



MICHIGAN RAPID ASSESSMENT METHOD FOR WETLANDS

MiRAM Version 1.2

User's Manual



Draft for Field Testing

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1.0 INTRODUCTION

The regulation of wetlands under the federal and state environmental laws, e.g. under Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act (NREPA), has required the assessment of the function and quality of wetlands in order to determine whether to permit the destruction, alteration, or degradation of a wetland and to determine the appropriate level of mitigation that should be required. This type of assessment is different from the delineation of whether a particular location is a “wetland” at all, i.e. a “jurisdictional” wetland. Delineation attempts to draw a line around a location to call what lies within the line a “wetland” and subject to protection, and what lies outside the line, something else (typically nonwetland areas).

Assessment attempts to determine the ecological quality and the level of function of a particular wetland and to assign a rating level to that wetland.

A serious question in the development of such assessment tools is their sensitivity, i.e. their ability to distinguish between wetlands of differing quality and disturbance levels in order to properly categorize a site. The development and use of rapid assessment methods is not meant to replace more detailed quantitative measures of ecosystem function.

The numeric score obtained from the Michigan Rapid Assessment Method for Wetlands (MiRAM) is not, and should not be considered, an absolute number with intrinsic meaning. The numeric score should be considered in light of other available information [sentence needs reworked]. The numeric score does however allow for relative comparisons between wetlands to be made. Where MiRAM scores fall at the “break points” between wetland categories, for example, between Degraded/Low Quality and Degraded but Restorable, or Relatively Intact and Intact/High Quality, the MiRAM score, by itself, is not sensitive enough to distinguish between wetland type and other assessment techniques and professional judgment will need to be used in categorizing the wetland.

This User’s Manual is intended to explain the underlying scientific rationale for the MiRAM, to provide detailed explanatory notes for the different sections and scores of the MiRAM, and to aid in the consistent use of the MiRAM.

The focus of MiRAM is to highlight the requirements outlined in Part 303. Specifically, Section 30302, Legislative findings, and Section 30311, Criteria for determining unacceptable disruption to aquatic resources outline the requirements for determining wetland function and values. Specifically the legislative findings and the permit review criteria in Section 30311 focus on

1. flood and storm control
2. fish and wildlife habitat and food cycles
3. protection of subsurface water resources
4. pollution and erosion control and important function and values.
5. requires consideration of the recognized historic and cultural
6. scenic
7. ecological
8. recreational
9. size of the wetland
10. the remaining wetland in the general area
11. proximity to any waterway

These requirements are addressed in the metrics of MiRAM. Several requirements may be addressed in a single metric and each requirement may be addressed in more than one metric. Table 1 outlines each 303 criteria and the MiRAM metric that addresses the criteria.

Table 1. Wetland protection statute criteria and the MiRAM metric that addresses the criteria.

303 Criteria	MiRAM Metric
Flood and Storm Control	Average Buffer Width Intensity of Predominant Surrounding Land Use(s) Sources of Water Modifications to Natural Hydrologic Regime
Wildlife and Fish Habitat and Food Cycles	Average Buffer Width Intensity of Predominant Surrounding Land Use(s) Connectivity Duration of Inundation Habitat Development Habitat Alteration Vegetation Communities Horizontal Interspersion Coverage of Invasive Species Microtopography
Subsurface Water Resources	Intensity of Predominant Surrounding Land Use(s) Sources of Water Modifications of Natural Hydrologic Regime Substrate/Soil Disturbance
Pollution and Erosion Control	Average Buffer Width Intensity of Predominant Surrounding Land Use(s) Modifications of Natural Hydrologic Regime Substrate and Soil Disturbance Habitat Alteration
Scenic/Recreational	Scenic and Recreational Value
Ecological	All Items
Size of Wetland	Wetland Area
Remaining Wetland in General Area	Density of Wetlands
Proximity to any Waterway	Sources of water Connectivity

1.1 Michigan's Wetland Categorization Scheme

As with any attempt to differentiate wetlands based on some measure of "quality", there is considerable controversy over how such assessments should be performed and whether they should be performed at all. The MiRAM has been developed to provide a relatively fast and

easy method for determining the appropriate category of a particular wetland based on the 303 requirements.

Degraded/Low Quality Wetlands

Degraded/Low Quality wetlands are wetlands which support minimal wildlife habitat, and minimal hydrological and recreational functions, and as wetlands which do not provide critical habitat for threatened or endangered species or contain rare and imperiled, threatened or endangered species. In addition, Degraded/Low Quality wetlands are often hydrologically isolated, and have some or all of the following characteristics: low species diversity, no significant habitat or wildlife use, limited potential to achieve beneficial wetland functions, and/or a predominance of invasive or non-native species.

Examples of Degraded/Low Quality wetlands are those that have developed on excavated or mined lands or wetlands that are isolated from other surface waters and that are dominated by invasive plant species like narrow-leaved cattail (*Typha angustifolia*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinaceae*), buckthorn (*Rhamnus spp*), or giant reed (*Phragmites australis*). In other instances, Degraded/Low Quality wetlands may be wetlands which have been seriously degraded by human-caused disturbances such that the wetland's species diversity and functionality has been significantly compromised.

Degraded/Low Quality wetlands are often isolated emergent marshes dominated by cattails with little or no upland buffers located in active agricultural fields. Degraded/Low Quality forested, depressional wetlands are less common, if only for the fact that they often have had the trees removed at some time in the past, and therefore, definitionally, are no longer "forested". However, Degraded/Low Quality forested systems do exist. Typically, they have been disturbed by grazing activities, stormwater inputs, or other hydrologic modifications. A confounding factor for forested wetlands is that the canopy may be relatively mature and diverse because of the long-lived nature of most tree species. Such wetlands often have a "reasonable potential for restoration" such that they will be Degraded but Restorable.

Degraded but Restorable Wetlands

Degraded but Restorable wetlands are wetlands which are degraded but have a reasonable potential for reestablishing lost wetland functions. The Rater should expect to observe certain wetlands which are presently of somewhat lower quality than Relatively Intact wetlands (see below), but which could be restored [\[cite restoration papers\]](#). Professional judgment and other more detailed measures of biology and functions may be necessary when evaluating a wetland that is degraded but may have a reasonable potential for restoration. Being able to identify Degraded but Restorable wetlands allows for increased enhancement and restoration possibilities; it should not be used as a tool for authorizing further degradation. It should be stressed that this wetland category does not receive less protection than Relatively Intact wetlands or applications to impact these wetlands should be easier to obtain. The same avoidance, minimization, and mitigation standards that apply to Relatively Intact wetlands (see below) also apply to this category.

Relatively Intact Wetlands

Relatively Intact wetlands, constitute the broad category of "good" quality wetlands. They should be considered functioning, diverse, healthy water resources that have ecological integrity and human value. Some Relatively Intact wetlands have few impacts from human disturbance and can be considered to be naturally of moderate quality; others may have been Intact/High Quality wetlands in the past, but have been disturbed "down to" Relatively Intact status. These wetlands support moderate wildlife habitat or hydrological or recreational functions. They are

dominated by native species but are generally without the presence of rare and imperiled communities or habitat for rare, threatened or endangered species.

Intact/High Quality Wetlands

Wetlands that are assigned to Intact/High Quality have superior habitat, or superior hydrological or recreational functions. They are typified by high levels of diversity, a high proportion of native species, and/or high functional values. Intact/High Quality wetlands include wetlands which contain or provide habitat for threatened or endangered species, are high quality mature forested wetlands, intact Great Lakes coastal wetlands, or which are rare and imperiled communities.

It is important to stress that a wetland may be an Intact/High Quality wetland because it exhibits one or all of the above characteristics. For example, a forested wetland located in the flood plain of a river may exhibit “superior” hydrologic functions (e.g. flood retention, nutrient removal), but not contain mature trees or high levels of plant species diversity.

2.0 INTERPRETING THE RESULTS OF THE MIRAM

The MiRAM has been derived from the Ohio Rapid Assessment Method (Ohio EPA 2001), the Washington State Wetland Rating System (Washington DE 1993) and the Minnesota Routine Assessment Method (Minnesota Board of Water and Soil Resources 2006). This initial version of MiRAM relies heavily on format and content of the Ohio Rapid Assessment Method for Wetlands Version 5.0 (ORAM). In addition, MiRAM's method has been developed with the aid of a team of wetland experts with a diverse background in the protection, assessment, restoration, and management of Michigan's wetlands.

The content of the MiRAM modifies several aspects of ORAM to incorporate Michigan specific wetland habitats and characteristics as well as the legal basis for utilization of MiRAM in Michigan. Specifically, MiRAM Version 1.x focuses on the quality of wetland habitats and functions per the requirements of [Act 451 of 1994, Chapter 324, Part 303](#). While ORAM uses a scale consisting of three wetland quality categories, MiRAM expands this into four quality categories. The *Degraded but Restorable* wetland category was added to aid classification of those wetlands within Michigan that are not degraded beyond the scope of future practical and conceivable rehabilitation efforts. During the assessment, a wetland is assigned to a quality category, which is not intended to be controlling. It may be more appropriate to consider the categories as part of a continuum of wetland functions and values [on a scale from Degraded/Low Quality to Intact/High Quality](#).

Specifically, MiRAM should be used by persons familiar with Michigan specific habitats, delineation requirements, and legal requirements.

As previously discussed, rapid assessment methods are not a substitute for detailed studies of the biology and functions of wetlands. Every attempt has been made to reduce the "error-rate" of this method [by rigorous field testing and comparisons with IBI scores](#). Because of its [post-glacial topography, huge amount of Great Lakes shoreline, and large latitudinal differences within the state](#), Michigan has an extremely diverse array of wetland types. Therefore, the Rater should always evaluate the possibility that the method may have over or under scored the wetland being evaluated, especially when the wetland does not fit into the assumptions built into this method. In this regard, the Rater will do well to remember that nature does not read the *User's Manual*.

Given that the MiRAM is primarily a tool for determining a wetland's category, users should be especially cautious in applying the results of the method outside of this context.

2.1 Interpreting the Narrative Rating Answers.

The Narrative Rating is designed to incorporate elements of [Act 451 of 1994, Part 303 \(Wetlands Protection\)](#), legislative findings ([Section 30302](#)) and [the permit review criteria \(Section 30311\)](#) as well as to require the Rater to consult known information sources regarding the wetland. Depending on the question, there are three possible answers to the Narrative Rating: (1) the wetland is a Degraded/Low Quality wetland, (2) the wetland "should be evaluated for possible Intact/High Quality status", and (3) "the wetland is an Intact/High Quality wetland." Each of these "answers" presents separate interpretation issues.

The MiRAM Narrative Rating is based loosely on the ORAM Narrative Rating. However, modifications have been applied to the MiRAM Narrative Rating because Michigan has a more diverse array of wetland types. Some of the additions and omissions are explained below.

The ORAM question concerning significant bird breeding/concentration areas has been omitted from MiRAM Narrative Rating system because [\[why ??????\]](#).

The term “old growth” describes an ecological condition where forest vegetation is dominated by trees in the mature stages of their life cycle. Although considered a rare community in Michigan, old growth forested wetlands have similar ecological functions to the more-common mature forested wetland systems [cite DNR publication IC 4236 2001, etc.]. Therefore MiRAM handles them together within the same Narrative Rating question.

Immature and maturing forested wetlands are relatively abundant (compared to other wetland types) in Michigan and have been shown to often function as valuable ecological systems, even when somewhat degraded (CITE). Therefore, MiRAM uses a specific Narrative Rating question that applies specifically to these types of wetlands.

Several ORAM Narrative Rating questions pertain to Lake Erie coastal and estuarine wetlands. The MiRAM Narrative Rating contains similar questions. However, the phrase “Great Lakes” is substituted for “Lake Erie”.

Several ORAM questions pertain to specific types of rare wetland communities. Because so many rare wetland communities exist in Michigan [cite MNFI listing], the MiRAM Narrative Rating system does not inquire about each type individually as is done in ORAM, but instead covers all such rare communities within one Narrative Rating question. The Rater is required to review the published list [refer to new simplified key or give location in MNFI website] of Michigan’s rare wetland community types and determine if any are present within the wetland being assessed.

2.1.1 The Wetland is a Degraded/Low Quality Wetland

This is a possible answer to Question 4 of the Narrative Rating. If the Rater answers “yes” to this question, the wetland should be considered a Degraded/Low Quality wetland, unless the wetland scores above the Degraded/Low Quality threshold on the Quantitative Rating. In that case the Rater should reevaluate the category of the wetland using the narrative criteria and further evaluate the wetland using detailed assessments, including determining a wetland IBI score for that type of wetland.

2.1.2 The Wetland Should be Evaluated for Possible Intact/High Quality Status

This is a possible answer for Narrative Rating Questions 1, 6, 7b, 7e. For a wetland that should be evaluated for possible Intact/High Quality status, the Rater should (1) reevaluate the category of the wetland using the narrative criteria and (2) evaluate the category of the wetland using the Quantitative Rating. If the wetland is determined to be an Intact/High Quality wetland using either of these, it is an Intact/High Quality wetland. In addition, detailed biological or functional assessments may also be used to determine the wetland’s category, including determining a wetland specific IBI score.

2.1.3 The Wetland is an Intact/High Quality Wetland

This is a possible answer to Narrative Rating Questions 2, 3, 5, 7d. In this situation, the wetland should be considered an Intact/High Quality wetland unless the wetland scores in the Degraded/Low Quality range on the Quantitative Rating. In that case the Rater should reevaluate the category of the wetland using the narrative criteria and further evaluate the wetland using detailed biological or functional assessments, including determining the IBI score for that type of wetland.

2.2 Quantitative Rating

2.2.1 General Considerations for the Quantitative Score

This is a field-testing draft. Scoring calibration will be added in a later draft. In interpreting the score from the Quantitative Rating, the Rater will be referred to the most recent version of the companion document [MiRAM v.1.x Score Calibration](#). Some general considerations in interpreting the MiRAM score are discussed below.

The Rater is cautioned that the MiRAM scoring ranges and breakpoints may have been calibrated based on biological data obtained from wetlands of classes (vegetation, hydrogeomorphic) or regions different from the wetland being evaluated.

The MiRAM score ranges from 0 to 100. A 100 point scale provides several advantages: (1) it has a definite maximum, (2) it is a much more intuitive base 10 scale, and (3) it provides a greater range of scores, allowing for more visual “spread” when graphing the score versus quantitative biological data. Each “metric” in MiRAM version 1.x also has a definite maximum. This allows the entire score to be easily partitioned and allows for a relative weighting of importance attributed to each metric. It also allows the Rater to expressly understand any built-in assumptions or subjectivity and to better evaluate the method’s success and failure. Table 2 shows the maximum score possible for each [metric](#) and [submetric](#) as well as the percentage of the total score represented by each.

Unique legislative findings and rules exist to guide and control management decisions pertaining to Michigan’s wetlands. Although the development of MiRAM Quantitative Rating metrics has greatly benefited from the nearly decade of evolution and testing of Ohio EPA’s ORAM, all metrics used in the MiRAM Quantitative Rating System are also based on criteria listed in Part 303 of Michigan’s Natural Resources and Environmental Protection Act (Act 451 of 1994). Furthermore, all Quantitative Rating metrics are additionally backed by peer-reviewed, scientific literature.

Several metrics differ from those used in ORAM because of subtle differences between the legislative findings of Ohio and the legislative findings of Michigan. Specifically, Section 324.30311(g) states that the amount of remaining wetland in the general area is an important criteria in Michigan. Section 324.30311(e) recognizes recreational values that can potentially be provided by wetlands in Michigan. Therefore, these metrics (or submetrics) were included in the development of MiRAM’s Quantitative Rating system. Though utilized in ORAM, the submetric “Maximum Water Depth” was removed from the MiRAM Quantitative Rating because of a lack of legislative support in Part 303 and because of a relative deficiency of supporting scientific literature pertaining to that specific metric in Michigan wetlands.

Literature indicates that even very narrow (25 to 75 ft) buffers surrounding wetlands can provide at least some protection from anthropogenic activities in adjacent uplands (**CITE**). Thus, MiRAM’s Average Buffer Width metric (Metric 2a) differs somewhat from ORAM’s parallel metric.

Many maximum point values assigned throughout MiRAM’s various submetrics differ slightly from those of ORAM, reflecting the geographic and ecological differences between Michigan and Ohio.

Table 2. Metrics in quantitative rating and the partitioning of the score.

Metric	Title	Submetric	Submetric Maximum	Metric Maximum	% of Total Score
1	Wetland Size and Distribution	<i>1a</i> Wetland Size	6	9	9%
		<i>1b</i> Wetland Remaining in Area	3		
2	Upland Buffers and Surrounding Land Use	<i>2a</i> Average Buffer Width	6	12	12%
		<i>2b</i> Intensity of Surrounding Land Use	6		
3	Hydrology	<i>3a</i> Sources of Water	10	26	26%
		<i>3b</i> Connectivity	4		
		<i>3c</i> Duration of Inundation or Saturation	4		
		<i>3d</i> Modifications to Natural Hydrologic Regime	8		
4	Habitat Alteration and Development	<i>4a</i> Substrate/Soil Disturbance	4	20	20%
		<i>4b</i> Habitat Development	7		
		<i>4c</i> Habitat Alteration	9		
5	Special Wetland Communities	<i>No Submetrics</i>	-10 to 10	10	10%
6	Vegetation, Interspersion, Microtopography	<i>6a</i> Wetland Vegetation Communities	21	20	20%
		<i>6b</i> Horizontal Community Interspersion	5		
		<i>6c</i> Presence of Invasive Species	-5 to 1		
		<i>6d</i> Microtopography	12		
7	Scenic and Recreational Benefits	<i>No Submetrics</i>	3	3	3%
			100	100%	
			Total Max Points		

2.2.2 Interpreting and Applying the Quantitative Score

The following decision rules should be used to interpret the score a wetland receives on the Quantitative Rating.

Wetlands that fall clearly within the scoring range for a wetland category.

Assuming the category has not been determined using the Narrative Rating, if the Quantitative Rating score is *within the scoring range* for a particular category, the wetland should be assigned to that category. For example, assume the scoring range for a Relatively Intact wetland is 35.0 to 59.9. The wetland receives a score of 43 on the quantitative rating; the wetland should be assigned to Relatively Intact. In all instances however, detailed functional or biological assessments can be used to clarify or change a categorization based solely on a MiRAM score.

Wetlands that fall within the scoring “gray zone” between categories

Assuming the category has not been determined using the Narrative Rating, if the quantitative rating score is *between the scoring ranges* for Degraded/Low Quality and Degraded but Restorable or Relatively Intact and Intact/High Quality i.e. is in the “gray zone” between categories, the Rater can do either of the following:

1. Assign the wetland to the *higher* of the two categories. For example, if the wetland is in the gray zone between Relatively Intact and Intact/High Quality, the Rater would assign the wetland to Intact/High Quality.
2. Assess the quality of the wetland using a nonrapid method, i.e. a detailed functional and/or biological assessment of the wetland and use this information in conjunction with any wetland indices of biotic integrity etc., to assign the wetland to a category.

2.3 Problem Situations and Reevaluation of MiRAM Categorization

Although it was designed to minimize such occurrences, in certain situations the MiRAM and the MiRAM score calibration may over or under categorize a particular wetland. Built into the MiRAM is the assumption that human disturbance degrades the biological integrity and functioning of wetland ecosystems. This assumption is sound and well supported by the literature (citations). However, in some instances a wetland may be degraded but still exhibit one or more moderate or superior functions, which could result in the wetland being under-categorized by the MiRAM. Conversely, it is possible that a wetland could be over-categorized by the MiRAM.

The narrative criteria for an Intact/High Quality wetland in Michigan states that “Wetlands assigned to Intact/High Quality category have superior habitat, or superior hydrological or recreational functions”. Thus a wetland only needs to exhibit superior functioning in one of these areas to be Intact/High Quality [does Michigan statute covers this?]. Thus, a wetland may be under-categorized using this method, but still exhibit one or more superior functions. For example, a wetland’s biotic communities may be degraded by human activities, but the wetland may still exhibit superior hydrologic functions because of its type, landscape position, size, local or regional significance, etc. In this circumstance, the narrative criteria for MiRAM is controlling and the under-categorization should be corrected.

2.4 Seasonality, Droughts and Floods

The Rater should be aware that the time of year in which a rapid assessment is performed may affect metric and submetric scores as well as the overall score for the wetland. The most reliable scores are obtained during the growing season: approximately April through October depending on where in the state the wetland is located. Although there are numerous seasonal factors which could affect the assessment, several bear consideration: In situations where categorization will be based solely on the wetland's quantitative score, the time of the year of the assessment should be evaluated to determine whether the score has been suppressed due to seasonal factors and whether the wetland has been under-categorized because of this.

1. Assessments should generally not be performed when there has been significant snowfall which obscures the wetland and its plant communities. If an assessment is performed during such a time, it should be re-scored after snowmelt.
2. Some riparian wetlands experience very deep flood events at various times during the year. Given the MiRAM's reliance on an evaluation of plant community quality, heterogeneity, sources of hydrology, etc., a follow up assessment may be necessary after the flood waters have receded.
3. Assessments performed in the winter or early spring will often find large areas of what appears to be open water but in actuality later in the growing season is really mudflat with obligate annuals, aquatic beds, or sedge meadow. This situation can occur at inland wetlands, in riparian contexts, and in coastal situations. In these circumstances, the Rater should make a notation on the rating forms that the open water may not be "open water" or the Rater may need to infer the community present during the growing season from plant stems or seed heads left over from the previous season.
4. Given their reliance on plant communities, Metric 6 and Submetric 4c may be underscored during winter, early spring, or late fall.
5. Metric 3 and its submetric questions may be underscored during drought years or during late summer drydowns typical of many inland depressional wetlands. During these periods, it is likely that secondary indicators of hydrology will need to be used to answer these questions. Areas of uncertainty should be noted on the scoring sheets.

A reassessment or confirmation of an assessment performed during a problem period can be required, especially in situations where categorization was based solely on the wetland's score and it is within a gray zone or just below a category breakpoint.

3.0 HOW TO USE THE MIRAM AND THIS USER'S MANUAL

The MiRAM consists of a series of questions found in the following forms:

- Background Information
- Scoring Boundary Worksheet
- Narrative Rating
- Quantitative Rating
- Wetland Categorization Worksheets

Each of these sets of questions emphasizes different aspects of the functions and values of wetlands in Michigan. *Failure to properly complete all questions may result in the incorrect assessment of the wetland.* For example, failure to properly complete the Narrative Rating will not allow the rater to determine whether the wetland is an Intact/High quality wetland because of the documented presence of a threatened or endangered species.

The underlying logic and purpose of the MiRAM is discussed briefly below. More detailed discussions of individual questions can be found in Sections 5.0, 6.0, and 7.0.

The “Background Information” incorporates basic information about the Rater, the location of the wetland, the wetland’s size, shape, and position in the landscape, and the information sources the Rater has used, e.g. USGS Maps, Wetland Inventory Maps, etc. In addition to estimating the size of the wetland, it is implicit in filling out the Background Information form that the Rater determines the “scoring boundaries” of the wetland being evaluated. This determination is discussed in detail in Section 5.0.

The “Scoring Boundary Worksheet” is designed to ensure that the Rater has properly decided what wetland or wetlands are being evaluated since incorrectly establishing the scoring boundaries can substantially change the result of the MiRAM evaluation.

The “Narrative Rating” consists of a series of eleven questions designed to determine whether a wetland is an Intact/High quality wetland or to alert the Rater that the wetland may be an Intact/High quality wetland. Intact/High Quality wetlands support “superior” wetland functions and values. They often provide habitat for threatened or endangered species or are wetlands of exceptional quality or rarity. Questions 1, 2, and 3 of the Narrative Rating portion of the MiRAM ask the Rater to consult the Michigan Department of Natural Resources, Wildlife Division, Natural Heritage Program staff and/or other readily available information sources to determine whether the wetland in question has the characteristics of an Intact/High Quality wetland. These questions are intended to be answered by “literature review” type activities that can be performed “in the office.”

Questions 5 through 7 of the Narrative Rating are also designed to determine whether a wetland is an Intact/High Quality wetland or to alert the Rater that the wetland may be an Intact/High Quality wetland. In addition, the Narrative Rating also allows the Rater to determine whether a wetland is a Degraded/Low Quality wetland. With regards to Intact/High Quality wetlands, these questions focus more on whether the wetland in question is a rare and/or imperiled natural community, e.g. lakeplain wet prairie, poor conifer swamp, prairie fen, etc., and also allows for the identification of particular types of wetlands which often have high levels of diversity, high native species richness, or high functional values.

It is very important to properly and thoroughly answer each of the questions in the Narrative Rating. These questions are designed to categorize certain wetlands as very low quality (Degraded/Low Quality) or as very high quality (Intact/High Quality). **Therefore, just completing the Quantitative Rating Questions gives an incomplete assessment.**

The Quantitative Rating consist of seven “metrics”; wetland size and density (metric 1), upland buffers and surrounding land use (metric 2), hydrology (metric 3), habitat (metric 4), special wetland communities (metric 5), vegetation, interspersion, and microtopography (metric 6), and scenic and recreational benefits (metric 7). The score is on a 100 point scale. **Interpreting the final score is discussed below in Section 2.0.** The questions are intended to act as surrogates for more direct and time-consuming measures of function. They are designed to ensure that wetlands that have moderate to high quality functions and habitats will be rated as Relatively Intact to Intact/High Quality, while highly degraded systems with minimal functions or habitats will be rated as Degraded/Low Quality or Degraded but Restorable wetlands.

The following sections (4.0, 5.0, 6.0, 7.0) contain detailed information for completing the MiRAM. These sections are organized in a linear fashion beginning with establishing the scoring boundaries and then working through each set of questions in turn.

It should be noted that significant portions of the MiRAM are flexible enough to be completed using available databases, inventory maps, and aerial photographs. However, an on site survey, during the growing season, is necessary to complete the MiRAM assessment.

The time necessary to evaluate a particular wetland will vary. For small wetlands, the Narrative and Quantitative Ratings may be able to be answered in a few minutes. For larger wetlands, or wetlands that are part of a complex of wetlands that must be scored together, it may take several hours to accurately evaluate the wetland. In many instances inventory maps and aerial photographs may be useful, in conjunction with the field survey, in answering some of the Quantitative Rating questions, e.g. connectivity to riparian, floodplain, or upland corridors, size of vegetation classes, etc.

The MiRAM is designed to be used by persons with a wide range of training and experience. It does not require the Rater to be an expert in field botany although it does require and assume an ability to identify the dominant plant species and knowledge of basic vegetation sampling techniques, e.g. the Rater should be familiar with the concept of “cover” and how to determine percent cover. The method also requires an ability to recognize high quality or unique wetlands (e.g. wet prairies and Great Lakes marshes), and a familiarity with the kinds of wetlands and the type and quality of the vegetation communities typically found in the areas of Michigan in which the rater is working. In addition, the rater should be aware of the fish and wildlife species that live and breed in wetlands, and be able to evaluate whether a wetland provides habitat for such species. In general, persons trained to delineate wetlands in accordance with the DEQ Wetland Identification Manual and the 1987 Corps of Engineers Delineation Manual should have the necessary basic skills to use the MiRAM.

4.0 BACKGROUND INFORMATION

Name of Rater

The name of the Rater(s) should be listed.

Date

The date of the on-site wetland assessment.

Affiliation

The Rater's affiliation should be listed, e.g. business name, governmental entity, etc.

Address

List address where the Rater can be contacted.

Phone Number

List the phone number where the Rater can be contacted.

e-mail address

List the e-mail address, if any, where the Rater can be contacted.

Name of Wetland

Include the name of the wetland if one exists. Alternatively, provide the name of the parcel, the owner's name, or any other descriptive title used to identify the wetland, e.g. Wetland located on the Smith tract, or Wetland B-1, etc.

Vegetation Communities

List all of the vegetation communities present within the wetland being evaluated following the USFWS Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979), e.g. palustrine scrub shrub, lacustrine emergent, etc.

Location of Wetland

Describe the location of the wetland with sufficient detail that someone unfamiliar with its location could find it by reference to USGS maps, County road maps, etc. If the property has a street address, include the street address. For example, "Wetland is located 0.3 miles northeast of the intersection of Highway 1 and Main Street in Pleasantville Township, Utopia County". Include a locational sketch to aid in locating the wetland.

Latitude/Longitude or UTM Coordinate

Include the wetland's latitude and longitude.

County, Township, Section, and Subsection

List the names of the county, township, section, and subsection where the wetland is located.

Sources of Information

The intent of this section is for the Rater to identify the sources of information used by the Rater to complete the forms, e.g. Hydrologic Unit Code, National Wetland Inventory, DEQ Wetland Inventory, USGS Topo Map(s), Soil Survey, etc.

Wetland Size

The estimated size of the wetland (acres) should be listed. In addition, the Rater should indicate how the size was estimated, e.g. visually, using a map, GIS, by a survey, etc. Refer to Section 5 for a more detailed discussion of estimating wetland size and scoring boundaries.

Site Sketch

A sketch of the wetland indicating its approximate shape, major vegetation classes and open water classes, relation to other surface waters, landmarks, and a north arrow should be included. A more detailed map of the wetland, if one is available, can be referred to here in place of a hand-drawn sketch.

Comments, Discussion of Problems

The Rater should include narrative discussing problem questions, uncertainties, or reasons for disagreeing with MiRAM results in this section.

Site Photographs

Color photographs that clearly show vegetation communities, hydrologic features, and any other pertinent site features should be provided and attached to the scoring sheets.

Final Score

The score from the Quantitative Rating should be written here.

Wetland Category

The wetland's category e.g. Intact/High Quality, as determined by the Rater, should be listed.

5.0 DETERMINING THE SCORING BOUNDARY OF A WETLAND

Most of this section is substantially similar to the Washington State Wetland Rating System, 2nd Edition, 1993, pages 12-14, 57-60 (Washington DE 1993). Credit for the concepts, format, and in some instances, text goes to the authors of that manual.

The initial step in completing the MiRAM is to identify the scoring boundaries of the wetland to be rated. In cases where the wetland delineation boundaries coincide with the scoring boundaries, the determination will be relatively easy. An example of this is a cattail marsh located at the edge of a farm field where the wetland delineation boundary and the scoring boundary will be the same area. However it may not be as easy to identify the boundaries of a wetland in a patchwork mosaic.

It is critical to establish a proper scoring boundary. Boundaries that are not correct can result in an over or under assessment of the wetland.

5.1 General Guidelines

Hydrology is the guiding criterion that should be used to establish scoring boundaries. Boundaries between contiguous or connected wetlands should be established where the volume, flow, source, or velocity of water moving through the wetland changes significantly. Areas with a high degree of hydrologic interaction should be scored as a single wetland. There are several general guidelines which should be used.

1. Identify the wetland area of interest. This may be the site of a proposed impact, a mitigation site, etc.
2. Identify the locations where there is physical evidence that the hydrology changes rapidly. Such evidence includes both natural and human-induced changes including constrictions caused by berms, roads, or dikes, points where the water velocity changes rapidly at rapids or falls, points where significant inflows occur at the confluence of rivers, or other factors that may restrict hydrologic interaction between the wetlands or parts of a single wetland.
3. Delineate the boundary of the wetland to be rated such that all areas of interest that are contiguous to and within the areas where the hydrology does not change significantly, i.e. areas that have a high degree of hydrologic interaction, are included within the scoring boundary.

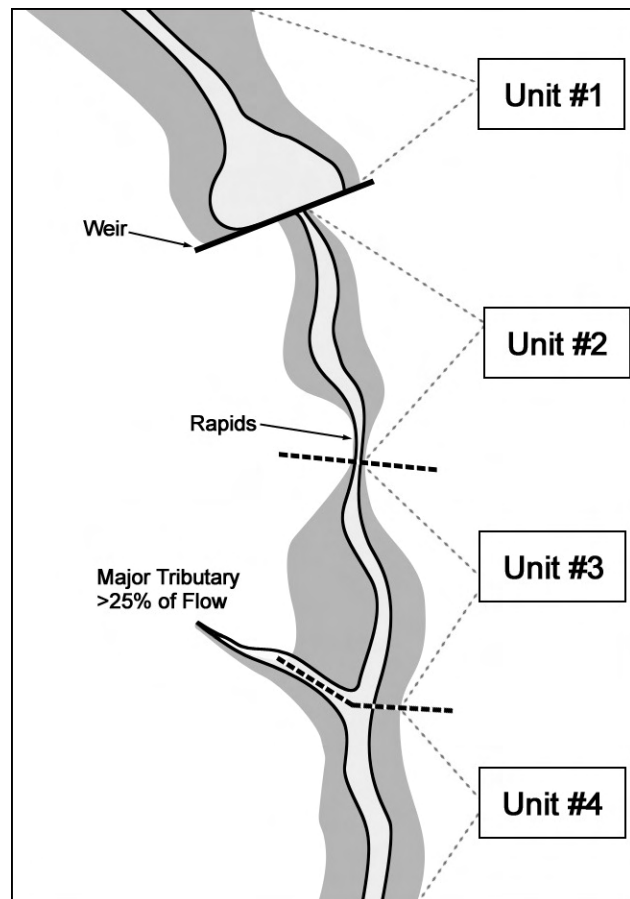


Figure 1. Boundaries for scoring units of contiguous wetlands along a stream corridor or floodplain. Adapted from Washington DE (p. 21, 2004).

4. Artificial boundaries, such as property lines, county borders, roads, railroad embankments, etc. should not be used to establish scoring boundaries unless they coincide with a change in the hydrologic regime. See additional discussion below.
5. Several dominant vegetation communities can be present in a single wetland. A predominately forested wetland may contain emergent or shrub communities along an edge or a wetland may have a high quality forested area adjacent to a degraded emergent area. It is generally not appropriate to treat these as separate wetlands and separately score them. The wetland should be scored per the scoring boundary, not on community type or disturbance level.
6. In areas that contain a mosaic or patchwork of wetlands, the minimum scoring boundaries can be enlarged to include the entire wetland complex.

Figure 1 shows how these guidelines would be used to establish scoring boundaries for a series of interconnected riparian wetlands. It is important to note that all of these wetlands are contiguous to each other, but are separated for scoring purposes by obvious breaks in the hydrology.

In certain instances, it may be difficult to establish the scoring boundary for the wetland being rated. These problem situations include wetlands that form a patchwork on the landscape, wetlands divided by artificial boundaries such as railroad embankments, roads, or property fences, wetlands that are contiguous with large areas of open water, streams, or rivers, and estuarine or coastal wetlands. These situations are discussed below; however, it is recommended that the assessor contact Michigan DEQ, Land and Water Management Division, if there are additional questions to clarify the appropriate scoring boundaries of a particular wetland.

5.2 Wetlands that Form a Patchwork on the Landscape

In situations where the wetland being scored is part of larger complex of wetlands, but separated by upland inclusions, the Rater should establish the scoring boundaries utilizing the following criteria and the Decision Table (Table 3).

Table 3. Decision table for determining whether to score wetland separately or as a patchwork.

Is the wetland less than 1 acre in size?	Yes Go to next question.	No Score wetlands separately.
Is the wetland part of a patchwork or mosaic of wetlands?	Yes Go to next question.	No Score wetland separately.
Are the wetlands in a patchwork less than 100 ft apart (on average)?	Yes Go to next question.	No Score wetland separately.
Does the total wetland area within the patchwork cover more than 50% of the patchwork?	Yes Score the entire patchwork as a single wetland.	No Score wetland separately.

If the area of wetlands is >50% total area and average distance between the wetlands is <100ft, then the scoring boundary is set around entire mosaic.

If the area of wetlands is <50% and average distance between wetlands is >100 ft, then scoring boundary is set around individual wetlands.

If the wetlands are small (<1 acre) and located in close proximity to each other, within the same forest, floodplain, soil mapping unit, etc., and are separated from each other by relatively narrow areas of non-wetland, then they should be scored as a single wetland.

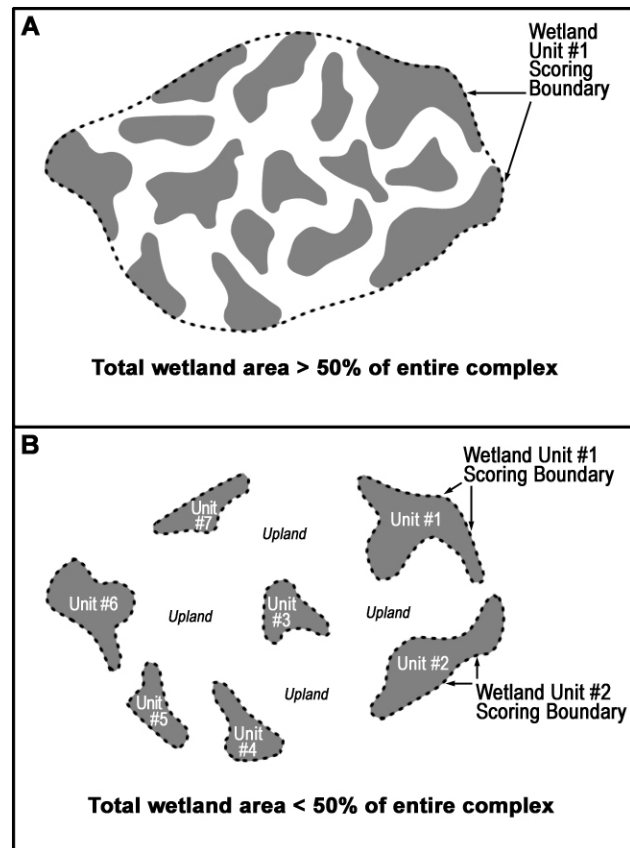


Figure 2. Establishing scoring boundaries for wetlands located in a patchwork or mosaic on the landscape. Wetland A scoring boundary is set around entire mosaic. Wetland B scoring boundary is set around individual wetlands. Adapted from Washington DE (p. 60 1993).

5.3 Wetlands Divided by Artificial Boundaries

Wetlands should be rated without regard to property boundaries or political jurisdictional boundaries.

Wetlands that are divided by artificial or natural physical barriers like roads, berms, dunes, etc. should generally be scored as a single wetland provided there is a hydrologic interaction between the wetland areas.

5.4 Wetlands Contiguous with an Area of Open Water

In some circumstances in Michigan, wetlands are contiguous to large and small areas of open water. Examples of this include wetlands contiguous to ponds, lakes, the Great Lakes, Lake St. Clair, or connecting waters. The assessor should determine the scoring boundary based on the following guidelines:

5.4.1 If the Area of Open Water is Less than or Equal to Five Acres in Size

If any part of a wetland is located contiguous to an area of open water that is less than or equal to five acres in size, the scoring boundary should include all of the wetlands and all areas of open water that are part of the water body. For example, in Figure 3, all of the wetlands and open water would be included as part of the same wetland scoring unit.

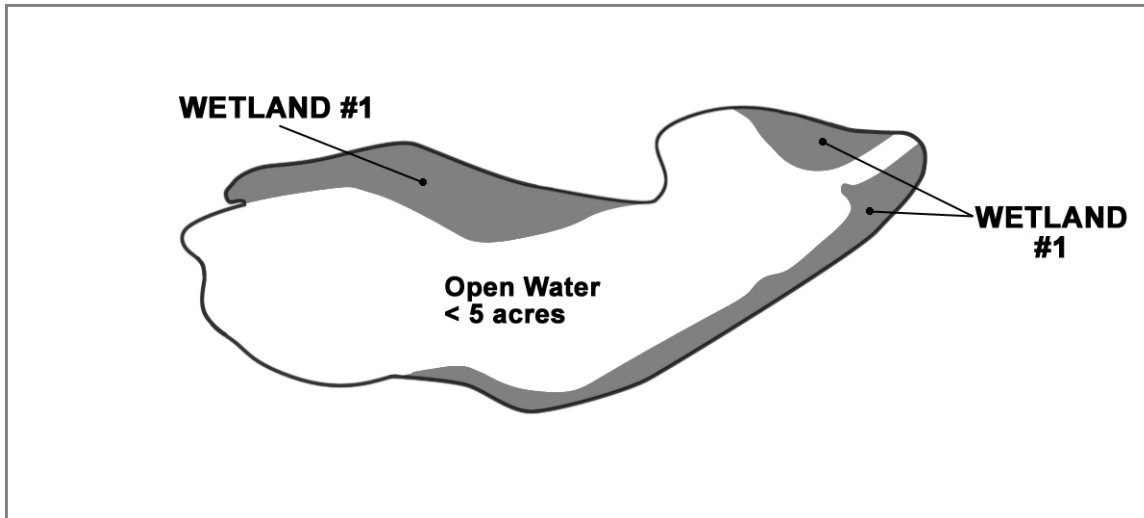


Figure 3. Scoring boundaries of wetlands contiguous to areas of open water <5 acres. In this scenario all the wetlands are scored as a single wetland unit. Adapted from Washington DE (p. 57, 1993).

5.4.2. If the Area of Open Water is Greater than Five Acres in Size

When the area of open water equals or is greater than five acres, vegetated wetlands throughout the lake are still considered to be part of the same scoring unit *unless they are greater than 500 feet apart from one another*. Figure 4 shows three separate wetland scoring units because the distance among wetlands is greater than 500 feet. The narrow channel bisecting Wetland Scoring Unit #3 is *not* sufficiently wide enough (< 500 feet) to separate Unit #3 into two distinct scoring units.

When determining the size of a wetland scoring unit use the parameters above and add a maximum of five acres of open water to the total area for that unit. If open water, aquatic beds, or mudflats are contiguous to the wetland, they should be included in the scoring boundary and the wetland unit should also score points for having these classes (Metric 6).

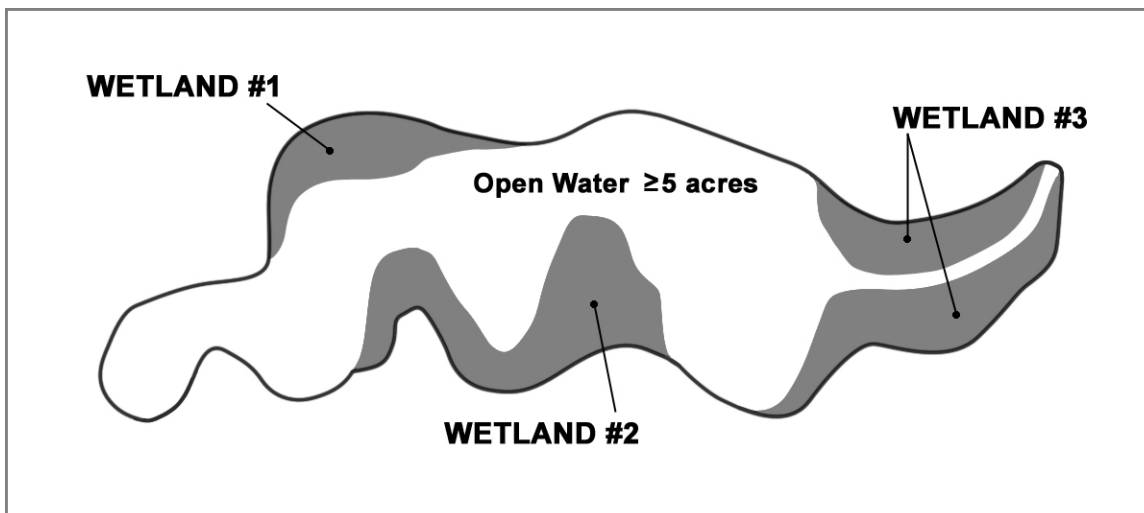


Figure 4. Scoring boundaries of wetlands contiguous to areas of open water ≥5 acres. In this scenario, there are three wetland scoring units because the distance among wetlands is greater than 500 feet. Adapted from Washington DE (p. 57, 1993).

5.5 Wetlands Contiguous to a Stream, River, Drain, or Ditch

Separate scoring boundaries for two or more wetlands that are contiguous to a stream, river, drain, or ditch should be established, if the wetlands are separated from each other by either 1) non-wetland corridors greater than 200 ft long, or 2) wetland corridors that are less than 50 ft wide (including the stream channel) at its widest point, and greater than 200 ft long. Wetlands that are located on opposite sides of a stream, river or ditch are scored together as a single wetland, unless the stream bed or its meander channel is greater than 200 ft wide on average. These situations are illustrated in Figure 5.

In Figure 5, separate scoring boundaries are established for Wetland #1 and Wetland #2 since more than 200 ft of non-wetland stream corridor separates them. The scoring boundary for Wetland #1 and #2 includes the wetlands located on both sides of the stream since the stream averages less than 200 ft. In contrast, separate scoring boundaries are established for Wetland #3 and Wetland #4, since Wetland #3 is less than 50 ft wide and more than 200 ft long. The dividing line between the scoring boundaries of Wetland #3 and #4 is set at the point where the wetland width abruptly changes (becomes wider).

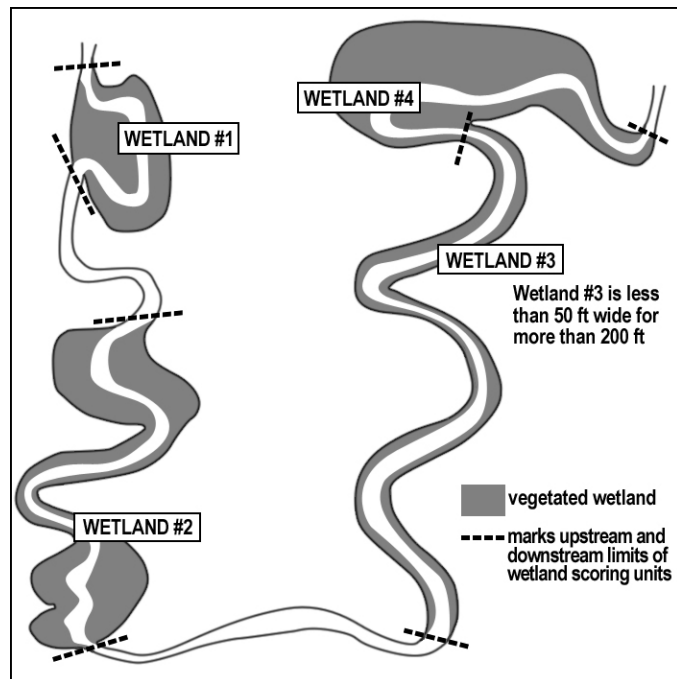


Figure 5. Scoring boundaries for wetlands contiguous to a stream or river. Adapted from Ohio EPA (p. 25, 2001).

5.6 Great Lakes Estuarine Wetlands

In Michigan, freshwater estuarine wetlands are located at the mouths of many of our rivers along the Great Lakes coastline. Some of Michigan's best examples are the drowned river mouths along the east coast of Lake Michigan (i.e. Pentwater Marsh). Estuarine wetlands are wetlands whose hydrology is strongly influenced by water from the Great Lakes as well as from the streams or rivers that enter them. Hence, they have characteristics of both types of systems.

In most instances, the guidelines for wetlands adjacent to areas of open water and the streams or rivers in Sections 5.4 and 5.5 should allow the assessor to appropriately establish the scoring boundary of estuarine wetlands.

5.7 Scoring Boundaries where only Part of a Wetland is Intact/High Quality

Large wetlands often contain areas that would be rated as Intact/High Quality wetlands because they contain features, such as rare and imperiled communities or other high quality features but the remainder of the wetland would be rated as Relatively Intact quality. In this situation, the wetland could be:

- 1) rated in its entirety as an Intact/High Quality wetland; or
- 2) be given a dual wetland rating as a Relatively Intact - Intact/High Quality wetland.

To assign a dual rating, the assessor will need to separate the Intact/High Quality wetland from the Relatively Intact wetland by establishing a scoring boundary between them. Depending on

the type of wetland and the physical circumstances at a particular site, a dual rating may not be possible. For example, where there is a strong degree of hydrological interaction between all areas and communities of a wetland, a dual rating would not be appropriate, even if parts of the wetland were of lower quality due to past disturbances.

Under the MiRAM, dual ratings are never acceptable for Intact/High Quality wetlands that are determined to be Intact/High Quality using the Narrative Rating. In no instance is Degraded/Low Quality - Relatively Intact or Degraded/Low Quality - Intact/High Quality dual rating appropriate in the MiRAM.

It is important to stress that in deciding whether a dual rating is appropriate, it will be necessary to demonstrate that the Intact/High Quality wetland will be protected from direct and indirect adverse impacts. If this cannot be demonstrated, then a dual rating is inappropriate and the entire wetland should be rated as an Intact/High Quality wetland. The use of a dual rating should be considered an exception rather than the rule in establishing scoring boundaries and assessing wetlands.

6.0 NARRATIVE RATING

The Narrative Rating consists of a series of eleven questions designed to determine whether a wetland is a Degraded/Low Quality or Intact/High Quality wetland or to alert the Rater that the wetland may be an Intact/High Quality wetland. Intact/High Quality wetlands support superior wetland functions and values and they often provide habitat for threatened or endangered species or are rare and imperiled wetland communities.

The first three questions ask the Rater to consult the U.S. Fish and Wildlife Service, the Michigan Department of Natural Resources, Natural Heritage Program, and/or other readily available information sources to determine whether the wetland in question has the characteristics of an Intact/High Quality wetland. These questions are intended to be answered by literature review type activities that can be performed in the office.

The remaining questions focus more on whether the wetland in question is of very poor quality, or a wetland of exceptional quality e.g. intact Great Lakes marsh, forested wetland, old growth forested wetland etc., and also allows for the identification of particular types of wetland which often have high levels of diversity, high native species richness, or high functional values. It is very important to properly and thoroughly answer each of the questions in the Narrative Rating. **Just completing the Quantitative Rating may give an incomplete answer as to the wetland's functions and values.**

6.1 Narrative Question 1: Critical Habitat

Question 1. Is the wetland in a township, section, or subsection of a United States Geological Survey 7.5 minute Quadrangle that has been designated by the U.S. Fish and Wildlife Service (USFWS) as critical habitat for any federally threatened or endangered plant or animal species?

For species listed as federally threatened and endangered, critical habitat is defined as the geographic area containing physical or biological features essential to the conservation of a listed species or as an area that may require special management considerations or protection. Currently in Michigan, critical habitat has been established for the Piping Plover (*Charadrius melodus*) and the Gray Wolf (*Canis lupus*). At the time of publication for this manual, a critical habitat plan has been drafted for the Hine's Emerald Dragonfly (*Somatochlora hineana*). Should the plan for the Hine's Emerald Dragonfly be finalized, it should be considered by the Rater in review of this question.

Online information pertaining to federally endangered, threatened, proposed and candidate species and information regarding critical habitat in Michigan can be found at the following USFWS web link: www.fws.gov/midwest/endangered/lists/state-mi.html . U.S. Fish and Wildlife Service personnel can be reached at:

U.S. Fish and Wildlife Service
2651 Coolidge Rd., Suite 101
East Lansing, MI 48823
(517) 351-2555

or

U.S. Fish and Wildlife Service
Division of Endangered Species
Bishop Henry Whipple Federal Building
1 Federal Drive, Fort Snelling, MN
55111-4056
(612) 713-5360

6.2 Narrative Question 2: State or Federal Threatened or Endangered Species

Question 2. Is the wetland known to contain an individual of, or documented occurrences of federal or state-listed threatened or endangered plant or animal species?

In order to properly answer this question, the Rater should, at a minimum, contact both the USFWS, for federally listed species, and the DNR for state listed species.

See previous section for USFWS contact information.

For information regarding state threatened or endangered species the Rater should utilize the Endangered Species Assessment, Michigan Department of Natural Resources, Wildlife Division - Natural Heritage Program website at www.mcgi.state.mi.us/esa . This site provides a preliminary evaluation of whether endangered, threatened, or special concern species, high quality natural communities, or other unique natural features have been known to occur at or near a site of interest. The purpose of this site is to provide a simplified and efficient assessment of rare species and other unique natural features at user identified locations.

Additional information about possible known occurrences within a project Town, Range, Section may be obtained by contacting:

Michigan Department of Natural Resources
Wildlife Division
Environmental Review
PO Box 30444, Lansing, MI 48909
(517) 373-9418

In addition, the Rater should consult any other published literature and accounts available which might indicate a threatened and endangered species has been observed at the wetland being evaluated.

Finally, Question 2 should be answered affirmatively, if the Rater, or other persons known to the Rater, actually observes a state or federal threatened or endangered species at the wetland.

6.3 Narrative Question 3: Rare and Imperiled Wetland Community Types

Question 3. Is the wetland on record with the DNR Natural Heritage Program and/or Michigan Natural Features Inventory as a rare or imperiled wetland community type and/or has the wetland been identified by the Rater, or other persons known to the Rater, to be a rare or imperiled natural community type as defined by Michigan Natural Features Inventory?

The Rater should review "Michigan's Natural Communities, Draft List and Descriptions, dated 4 March 2003" to determine if the community type is considered to be rare or imperiled. Rare or imperiled community types have a State Rank of S1, S2, or S3. It is advised that the Rater periodically review the Michigan Natural Features website <http://web4.msue.msu.edu/mnfi/> for information about and updates to the community abstracts.

In order to properly answer this question the Rater should also utilize the Michigan Department of Natural Resources, Wildlife Division website at www.mcgi.state.mi.us/esa/ . This site provides a preliminary evaluation of whether endangered, threatened, or special concern species, high quality natural communities, or other unique natural features have been known to occur at or near a site of interest. The purpose of this site is to provide a simplified and efficient assessment of rare species and other unique natural features at user identified locations.

Additional information about possible known occurrences of rare or imperiled communities within a project Town, Range, Section may be obtained by contacting:

Michigan Department of Natural Resources
Wildlife Division
Environmental Review
PO Box 30444, Lansing, MI 48909
(517) 373-9418

Finally, Question 3 should be answered affirmatively, if the Rater, or other persons known to the Rater, actually observes the presence of a rare and imperiled wetland community type.

6.4 Narrative Question 4: Degraded/Low Quality Wetlands

Question 4. Is the wetland less than 1 acre in size and non-contiguous as defined in Part 303 and either (1) comprised of vegetation that is dominated (greater than eighty percent areal cover) by invasive species listed in Table 4, or other invasive species, or (2) a stormwater pond that was excavated from upland and was primarily constructed for the treatment of stormwater in conjunction with a development project?

Table 4. Common invasive wetland plant species in Michigan.

common reed	<i>Phragmites australis</i>
purple loosestrife	<i>Lythrum salicaria</i>
reed canary grass	<i>Phalaris arundinacea</i>
glossy buckthorn	<i>Frangula alnus</i>

will add more...

Certain types of wetlands which are small, hydrologically isolated (non-contiguous), and dominated by invasive species will usually be considered Degraded/Low Quality wetlands. In addition, it is assumed that the loss of this type of wetland is able to be successfully mitigated. The key features of these wetlands are that they contain low biodiversity, are small in size, and that they are non-contiguous from all other surface waters.

6.5 Narrative Question 5: Old Growth and Mature Forested Wetlands

Question 5. Is the wetland a forested wetland and is the forest characterized by, but not limited to, the following characteristics: overstory canopy trees of great age (exceeding at least 50% of a projected maximum attainable age for a species); little or no evidence of human-caused understory disturbance during the past 80 to 100 years; an all-aged structure and multilayered canopies; aggregations of canopy trees interspersed with canopy gaps; and significant numbers of standing dead snags and downed logs.

The definition of an old growth or mature forest, as approved by the Natural Resources Commission on 12/8/94, is those that approximate the structure, composition, and functions of native forests. These native conditions generally include more large trees, canopy layers, standing snags, native species, and dead organic material, involve more complex ecological

processes, and undergo more gradual change than do young or intensively managed forests. Native forest conditions in Michigan also included ecologically important unforested openings, early successional stages, and extensive areas of catastrophic or frequent disturbance (Proposed Old Growth and Biodiversity Stewardship Planning Process and Draft Criteria for Michigan's State Forests and Other State Owned Lands, Michigan Department of Natural Resources, Feb. 8, 2001).

For purposes of this manual, the definition of an old growth or mature forest is those that approximate the structure, composition, and functions of native forests. These native conditions generally include more large trees, canopy layers, native species, and dead organic material. (DNR Forest, Mineral, and Fire Management Division 2001)

Very little "old-growth" forest, less than 1%, remains in Michigan and its surrounding states. The US Forest Service estimates that between 60,000 and 70,000 acres of "old growth" remains in Michigan, with most of the acreage in the Upper Peninsula. (DNR Forest, Mineral, and Fire Management Division 2001).

Thus, while the Rater should not expect to encounter old growth forests frequently, this situation should always be considered a possibility, especially in the Upper Peninsula or in any regions that had large areas of swamp forest prior to European settlement.

Question 5 can be answered in the affirmative based on the Rater's professional judgment after a site visit in which the wetland being evaluated appears to have many or all of the characteristics of an old-growth forest. The Rater is cautioned that often the wetland portion of the forest will only be a small area of the total forest. For example, simply counting the species and basal areas of the trees within the jurisdictional wetland boundary could lead to a conclusion that the "wetland" is not "old-growth forest." This is an erroneous conclusion; when faced with this or similar situations, the Rater should conclude that wetland is *part* of an old-growth forest. [Dave Price \(email sent 8/3\)](#)

Question 5 can also be safely answered in the negative when the Rater does not observe *any* large trees in the canopy, especially when the forest is clearly young second growth with most or all trees less than 18in DBH.

In borderline situations, or where the Rater wishes to quantitatively confirm his or her conclusion that the forest is or is not old growth, it is recommended that standard forest inventory methods be used (See e.g. Peet et al. 1998). In addition, the rater should obtain and review historic aerial photographs of the site to determine recent logging and disturbance history.

Table 5, reproduced from Parker (1989, p. 8) is included as an aid in determining what is or may be old-growth forest. – needs to be moved up

Table 5. Characteristics of mesic old-growth forests in the central hardwood forest region from published literature. From Parker (1989, p. 8).

Character	Range	Reference
tree species richness (# / forest)	20-40	See Parker (1989) for citations
herbaceous species (# / forest)	17-53	
breeding bird species richness (# / forest)	18-33	
tree density (stems > or = to 10 cm dbh ha ⁻¹)	161-427	
basal area (m ² ha ⁻¹)	25-35	
volume (1000 bd. ft. ha ⁻¹)	39-62	

mean age of overstory mortality (years)	135-210
maximum age of overstory mortality (years)	190-375
annual mortality (%)	0.6-0.9
deadwood on ground (megagram ha ⁻¹)	16-24
standing snags (stems > 10 cm dbh ha ⁻¹)	19-44
canopy distribution	random
mean canopy gap size (m ²)	50-374
canopy gaps (% of forest)	7-8

6.6 Narrative Question 6: Forested Wetlands

Question 6 Is the wetland partially or wholly contained within a forest? [Possibly add a definition.]

The Rater needs to look for trees.

6.7 Narrative Question 7: Great Lakes Coastal and Estuarine Wetlands

Question 7a. Is the wetland contiguous to one or more of the Great Lakes or Lake St. Clair, or one of the connecting waters (i.e. St. Mary's River, St. Clair River, and Detroit River) or is the area an estuarine wetland that is adjacent to of any of the above waterways and is accessible to fish?

Question 7b. Does the wetland's hydrology result from measures designed to prevent erosion and the loss of aquatic plants, i.e. the wetland is partially hydrologically restricted from the Great Lakes due to lakeward or landward dikes or other hydrological controls?

Question 7c. Are Great Lake water levels the wetland's primary hydrological influence, i.e. the wetland is hydrologically unrestricted (no lakeward or upland border alterations), or can the wetland be characterized an "estuarine" wetland with lake and river influenced hydrology? These include sandbar deposition wetlands, estuarine wetlands, or river mouth wetlands.

Question 7d. Does the wetland have a predominance of native species within its vegetation communities, although non-native or disturbance tolerant native species can also be present?

Question 7e. Does the wetland have a predominance of non-native or disturbance tolerant native plant species within its vegetation communities?

Estimates of overall wetland loss along the Great Lakes shoreline range from 30 to 50 percent (Citations). In Saginaw Bay, Lake St. Clair and western Lake Erie, comparison of historic maps to present aerial photos shows even greater level of loss. These 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. Coastal wetlands with unrestricted hydrology provide numerous benefits including flood control, shoreline protection, nutrient-cycle control, sediment retention, fish spawning and nursery grounds, and water fowl habitat (citation).

Albert (2003) defines coastal wetlands as wetlands that occur along the Great Lakes shoreline proper and in portions of tributary rivers and streams that are directly affected by Great lakes

water regimes. These wetlands form a transition between the Great Lakes and adjacent terrestrial uplands and are influenced by both. Though multiple environmental factors are at work in structuring these systems, the most important factors appear to be the aquatic environment, shoreline configuration, water level fluctuation, bedrock geology, climate, and human land use. These factors – some regional, some local – create the context for Great Lakes coastal wetlands and provide a broad classification framework for understanding their diversity, distribution and species composition.

Coastal or estuarine wetlands with unrestricted hydrology and a predominance of native plant species are a valuable resource (cite). Question 7 presents the Rater with a series of either/or statements to first determine if the wetland is potentially a Great Lakes coastal or estuarine wetland (Question 7a). Questions 7b through 7e are designed to sort a Great Lakes coastal or estuarine wetland based on its hydrological connectedness to a Great Lake and the invasiveness/disturbance tolerance of its predominant species. A wetlands that has an unrestricted hydrological connection to the Great Lakes and that has relatively few disturbance tolerant species is categorized as Intact/High Quality. A wetland that is hydrologically restricted or has a predominance of disturbance tolerant species should be further evaluated to determine possible Intact/High Quality status.

7.0 QUANTITATIVE RATING

7.1 Metric 1: Wetland Size and Distribution

Historically, the state of Michigan had many large wetlands and wetland complexes, e.g. the St. Johns Marsh, Dead Stream Swamp, Great Black Swamp, and Remy Chandler Marsh, although this is not to say that many small wetlands did not exist presettlement. Many of these larger systems have been destroyed or fragmented into relict wetlands of a few acres in size. Where large, contiguous wetlands or wetland complexes exist, they often represent the best of what remains in the state.

7.1.1 Question 1a: Wetland Size

Metric 1 asks the Rater, in part, to estimate the size of the wetland. See Section 5 of this manual for guidance on determining scoring boundaries. The question uses size classes that increase in increments that are relatively easy to visualize. Additional points are assigned to large wetlands versus small. It is expected that the requirements to delineate wetlands for state and federal jurisdictional purposes will make this a relatively easy question to answer. However, in situations where precise areal estimates are not available, wetland size can be visually estimated, so long as the Rater is confident that the estimate places the wetland in the appropriate size class.

7.1.2 Question 1b: Wetland Remaining in the General Area

The density of wetlands in the general area will determine the benefit each provides downstream. Chow et al. (1988) found wetlands reduce flood peaks up to 75 percent compared to rolling topography when they occupy only 20 percent of the total basin. When wetland densities in the subwatershed exceed 20 percent total cover, the flood storage benefits of additional wetlands rapidly decrease. [this is directly from MnRAM] [base flow reduction?]

This question asks the Rater to determine the total percentage of area occupied by wetlands within a 2 mile radius from the center of the wetland being assessed. A higher score is assigned to wetlands that occur in areas where the total wetland coverage is less than 20 percent of the total area. [add citations to backup]

7.2 Metric 2: Upland Buffers and Surrounding Land Use

Wetlands are areas transitional between upland and aquatic environments. Like many natural systems, both terrestrial and aquatic, they are sensitive to human disturbances, both direct and indirect. Nutrient enrichment or eutrophication from stormwater inputs, urban runoff, or agricultural runoff can degrade wetlands just as these disturbances can degrade streams and lakes.

The questions in Metric 2 reflect the fact that wetlands with “buffer” zones between the wetland and human land uses are often less disturbed than wetlands without such buffers. Conversely, wetlands that are located in places where human land use is more intensive are often subject to greater degrees of disturbance. However, it is important to stress that merely because a wetland is located in an area with intensive human land uses does not mean that it is or will become degraded.

7.2.1 Question 2a: Average Buffer Width

For the purposes of this question, “buffer” means non-anthropogenic landscape features which have the capability of protecting the biological, physical, and/or chemical integrity of the wetland from effects of human activity. Larger buffer zones may also provide multipurpose habitat for a variety of wildlife species. Typically, a buffer could be forested or shrubby margin, prairie,

streams or lakes, old fields, and in certain instances more managed landscapes like meadows or hay fields. Intensive human land uses should not be counted as buffers. These include active agricultural row cropping, fenced or unfenced pastures, paved areas, housing developments, golf courses, mowed or highly managed parkland, mining or construction sites, etc. A comprehensive list is not proposed in this manual. The key concept is whether the buffer area, whatever it is, *functions* to protect the wetland from degradation.

In order to calculate the average buffer width (ABW), estimate the width of buffer on each side of the wetland to a maximum of 150ft and divide by the number of sides, e.g. the average buffer width of a wetland with buffers of 710ft, 150ft, 0ft and 0ft would be calculated as follows: $ABW = (150 + 150 + 0 + 0) / 4 = 75$. See Figure 6. The wetland in Figure 6 would score 4 points for Question 2a. A wetland with buffers greater than 150ft on all sides would have an ABW ≥ 150 ft and would score 6 points.

This procedure works well with smaller wetlands. For very large wetlands or wetlands with unusual shapes there may be multiple “sides” and it may be difficult to measure, determine, or obtain access to all of the sides of the wetland. In this situation, the Rater may consider this question to provide a buffer continuum from very narrow to wide and assign the points associated with the most appropriate category.

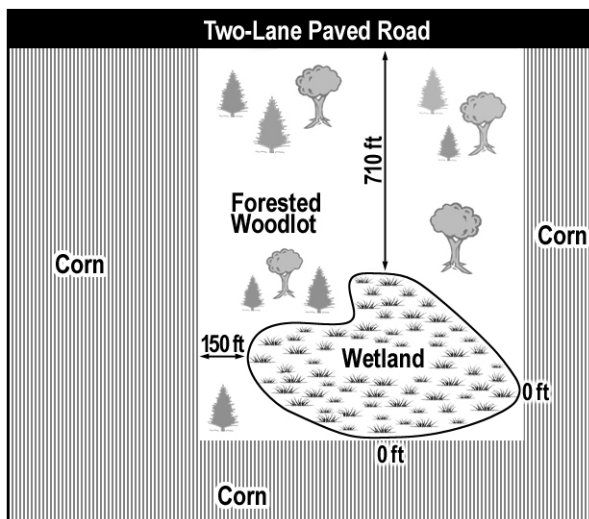


Figure 6. Hypothetical wetland example for estimating average buffer width.

7.2.2 Question 2b: Intensity of Predominant Surrounding Land Use(s)

In order to answer this question, the Rater should evaluate the intensity of the predominant land uses in the areas outside the wetland and beyond the wetland’s buffer zone, i.e. more than 150ft if the wetland has buffers greater than 150ft on all sides. The questions form a continuum from most intensive to least intensive land uses. In many instances, the Rater will need to select two adjacent categories and average the score. This question asks the Rater to generally characterize the type of land uses that are most common in the immediate vicinity of the wetland. Several examples are offered to aid in answering this question.

Example 1. Wetland is a deep (3ft), largely unvegetated (except for the canopy trees above it) vernal pool, located entirely within a large, contiguous patch of second growth forest. Upland forest extends from 325 to 1000ft on all sides of the wetland. Outside of the forest, the land use is agricultural row cropping. Score: “the wetland is entirely surrounded by second growth forest and should receive a score of 6.

Example 2. The wetland is deep, largely unvegetated (except for the canopy trees above it) vernal pool, located *at the edge* of a large, contiguous patch of second growth forest. Outside of the forest, the land use is agricultural row cropping. The boundary of hydric soils extends from the current wetland edge into the agricultural field. Score: the Rater should select both “very low” (6) and “high” (1) and average the scores, $(6+1)/2=3.5$.

Example 3. The wetland is a vegetatively diverse emergent marsh located in the floodplain of a State Scenic River. A mature forested, riparian corridor is adjacent to one side of the wetland; on the other side is a fenced pasture (Note: both sides of the river have a forested, riparian corridor). Score: the Rater should select both “very low” and “moderately high”, and average the scores, $(6+2)/2=4$.

Example 4. The wetland is an isolated, depressionnal cattail marsh. On one side, the wetland has no buffer and is immediately adjacent to active row cropping. On the other three sides, the wetland is surrounded by a new fallow field. Score: the Rater should select both “moderately high” (2) and “high” (1), and average the scores, $(2+1)/2=1.5$.

Example 5. The wetland is a depressionnal buttonbush swamp with forested margins. The wetland is bisected by a small, paved township road. The wetland has mature to young second growth forest on one side, a “shrubby” old field (probably > 10 years old) on 2 sides, and is hydrologically connected to another buttonbush swamp on the fourth side but is separated from this other wetland by a 20 to 50 meter wide upland forested area. Score: the Rater should select both “very low” and “low” and average the scores, $(6+4)/2=5$.

7.3 Metric 3: Hydrology

“Hydrology is probably the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland process.” (Mitsch and Gosselink, 1996, p.55). Thus, 30% of the total points possible in the MiRAM Quantitative Rating are awarded in Metric 3. This metric asks the Rater to evaluate the wetland’s water budget, hydroperiod, the hydrologic connectivity of the wetland to other surface waters, and finally, the degree to which the wetland’s hydrology has been altered by human disturbances.

The functions and values of a particular wetland’s hydrology and position in the landscape are addressed both implicitly and explicitly in these questions. The Rater should be familiar with the definitions, criteria and methods of the *MDEQ Wetland Delineation Manual* and the *Corps of Engineers Wetlands Delineation Manual* (U.W. ACOE 1987, hereafter the *Corps Manual*) for determining whether a particular area has wetland hydrology. In addition, the Rater’s answers to Questions 3a, 3b, and 3c can often be based on the same information and indicators of wetland hydrology discussed in the MDEQ and the Corps Manuals.

7.3.1 Question 3a: Sources of Water

This question relates to a wetland’s water budget. It also reflects that wetlands with certain types of water sources, or multiple water sources, e.g. high pH groundwater or perennial surface water connections, can be very high quality wetlands or can have high functions and values. This question asks the Rater to check all of the following water sources that are part of the wetland’s hydrologic budget:

- Groundwater (2 points)
- Precipitation (1 point)
- Seasonal/intermittent surface water (2 points)
- Perennial surface water (lake or stream) (5 points)

The applicability of each of these options is discussed in detail below.

7.3.1.1 Groundwater

Although many wetlands may receive inputs from the water table as part of their annual water budget, this question should not be scored unless the Rater can observe seeps or other signs that groundwater is a source of water, or unless the Rater has more detailed water budget data

available that confirms a net input of groundwater to the wetland. It is often expensive and time-intensive to obtain more detailed information on a wetland's subsurface hydrology. Therefore, it is not expected that the Rater obtain such information in order to complete this portion of MiRAM. **“Groundwater” should not be scored without observable or documentary evidence. However, if the Rater suspects but does not observe sufficient evidence of groundwater inputs, this should be noted on the scoring forms for further investigation, especially if the wetland’s category might change.**

Because of this, the Rater should be aware that wetlands can be underscored if groundwater inputs are not readily observable or the Rater evaluates the wetland at a time of year when the wetland is a net exporter of water to local groundwater. However, Michigan DEQ believes the MiRAM will be robust enough that wetlands will score highly in other portions of the Quantitative Rating such that they will be appropriately categorized. If the Rater suspects but does not have evidence to support scoring the wetland for “other groundwater”, this should be noted on the scoring sheets or comments section and revisited if the loss of these points affects a categorization decision.

As with high pH groundwater, other groundwater can be inferred by observing seeps or rivulets flowing into the wetland or by observing plant species associated with groundwater, e.g. skunk cabbage (*Symplocarpus foetidus*), sweet flag (*Acorus calamus*), species typically associated with fens, various Cyperaceae species, etc. Other circumstantial factors which can be used to infer whether “other groundwater” is present are whether what otherwise appears to be an isolated wetland remains inundated or saturated through late summer and fall, and the clarity or oxygen content of the water.

7.3.1.2 Precipitation

At a minimum, every wetland evaluated under the MiRAM receives at least 1 point since all wetlands receive precipitation as a hydrologic input.

7.3.1.3 Seasonal Surface Water

Many wetlands receive a substantial portion of their annual hydrologic input from seasonal or semiseasonal flooding from nearby streams or rivers. Wetlands located in the headwater areas of watersheds or which have their own small watersheds, often receive intermittent surface water inputs via definable small channels that flow into the wetland after a substantial rain event. Note, that this type of surface water input should be distinguished from seasonal or semiseasonal flood events and should be scored under the precipitation category.

In order to award points for “seasonal” surface water, the Rater should observe a definable channel, tributary, stream, etc. whereby surface water flows into the wetland **[always ?]**. Seasonal surface water, e.g. from spring flooding of a river or stream, can be inferred using the indicators of hydrology outlined in the *MDEQ Wetland Delineation Manual* and *Corps Manual*, e.g. recorded data, drift lines, sediment deposits, etc. The Rater *does not* need to actually observe surface water flowing into the wetland at the time the rating is being performed. The use of secondary indicators, as outlined in the *MDEQ Wetland Delineation Manual* and *Corps Manual* is necessary and expected.

7.3.1.4 Perennial Surface Water (Lake or Stream)

A wetland has a “perennial surface water” connection to a lake or stream if there is a permanent or nearly permanent surface water connection between the wetland and the lake or stream such that the wetland’s hydrology is completely or significantly dominated by water from the stream or lake. The qualifier “significantly” is used since some wetlands can have other water sources, in addition to the connection to the stream or lake, which also are important. For example, a wetland that forms on the margins of a kettle lake can have a perennial surface water

connection to the lake, and can also receive high pH ground water. Both water sources are significant to the wetland's overall hydrology.

7.3.2 Question 3b: Connectivity

Question 3b awards points for a wetland's position in the landscape and awards additional points if a wetland is located in a flood plain, is located between a stream or lake and a human land use, is part of a riparian or upland corridor, or is part of a wetland or upland (e.g. forest or prairie) complex. Fennessy et al. (1998b) found strong positive correlations between a wetland's proximity to other wetlands and a wetland's "quality". Wetlands that are located in 100 year flood plains or that are in a position to intercept contaminated water before it reaches a stream or lake have functions that are valued by human society. Wetlands located in riparian or upland corridors, or that are part of larger natural systems, e.g. large, contiguous patches of forest are important components of watersheds and regional ecosystems.

100 Year Flood Plain

A flood plain is the relatively level land next to a stream or river channel that is periodically submerged by flood waters. It is composed of alluvium deposited by the present stream or river when it floods. Where they are available, the Rater can use flood insurance rate maps (FIRMs) and flood boundary and floodway maps published by FEMA. These maps cover over 99 percent of the flood-prone communities in the United States and can be obtained at no cost from the FEMA Flood Map Distribution Center in Baltimore, Maryland. Guidance on using FIRMs is provided in the FEMA publication entitled *How to Read a Flood Insurance Rate Map* (REMA, 1980).

Wetland is located between a stream/lake and other human use

This question asks the Rater to determine whether the wetland is located between a surface water and a different adjacent land use, such that run-off from the adjacent land use could flow through the wetland before it discharges into the surface water. "Different adjacent land uses" include agricultural, commercial, industrial, mining, or residential uses.

Wetland is part of a wetland or upland complex

Both this and the next question ask whether the wetland is in physical proximity to, or a part of other nearby wetland or upland natural areas. The difference is whether the area the wetland is connected to is "long and narrow" like a river, or more "squarish", like a large, contiguous forest or woodlot. If the latter is the case, this question applies; if the former, the next question applies. In some instances, both may apply where a wetland is located in a riparian corridor but is adjacent to a large wetland or upland complex. In this case, the wetland should be scored for both.

Wetland is part of a riparian/upland corridor

The term "corridor" has its common meaning and should be understood differently from the term "complex" used in the preceding question. Riparian corridors are typically areas within the flood plain of rivers or streams that are often forested, however, a mix of natural and human land uses is possible. The key concept for deciding to score this and the preceding question is whether the wetland is connected to other natural areas such that organisms can move between or through the systems. Upland corridors can be as narrow as a vegetated fence row along a farm field, which eventually connects to a woodlot, forest, or riparian corridor.

7.3.3 Question 3c: Duration of Standing Water/Saturation

Duration of standing water/soil saturation often correlates well with use of the wetland as breeding or migratory habitat, e.g. breeding pools for salamanders and other amphibians. There is some redundancy between this question and Question 3b (connectivity). This question will often be difficult to answer if the wetland is only visited once in the late summer or fall. The use of secondary indicators, as outlined in the *MDEQ Wetland Delineation Manual* and *Corps Manual* is necessary and expected in order to properly answer this question. The scoring categories correspond approximately to Zones II, III, and IV of Table 5 of the *Corps Manual*, with Zone IV being subdivided into seasonally inundated and seasonally saturated. The Rater does *not* need to actually observe the wetland during the wettest time of the year in order to award the points for this question.

7.3.4 Question 3d: Modifications to Natural Hydrologic Regime

This question asks the Rater to evaluate the “intactness” of, or lack of disturbance to, the natural hydrologic regime of the type of wetland that is being evaluated. Given that hydrology is one of the fundamental determinants of wetland function, and disturbances to hydrology one of the main sources of degradation to wetlands, this question represents 10% of the total possible points awardable under the Quantitative Rating.

It is very important to stress that this question does not discriminate between wetlands with different types of hydrologic regimes, e.g. between a forested seep wetland located on a flood plain with seasonal inundation and a bog with precipitation and minor amounts of surface run-off from a small watershed. Rather, it asks the Rater to evaluate the “intactness” of the hydrologic regime attributable to *that* type of wetland, with “type” referring to the wetland’s hydrogeomorphic class or vegetation community class, or both. In the example above, both the forested seep wetland and the leatherleaf bog can score the maximum points (10) if there are no apparent modifications to the natural hydrologic regime.

In order to properly answer this question, the Rater should check all possible disturbances to the wetland’s hydrology that are observed by the Rater. These disturbances, located in or near the wetland, could include ditches, tiles, dikes, weirs, stormwater inputs, including urban and/or agricultural run-off, nonstormwater point source discharge, filling, grading, road beds, railroad tracks, dredging, and other hydrologic disturbances to the wetland.

All available information, field visits, aerial photos, maps, etc. can be used to identify a possible ongoing or past hydrologic disturbance. It is important to stress that this is a list of *possible* disturbances to the wetland’s natural hydrology. The Rater must then evaluate whether the activity *actually* disturbed the wetland’s hydrology (see examples below).

Once the Rater has listed all possible past and ongoing disturbances, the Rater must determine whether any of the observed disturbances caused more than trivial alterations to the natural hydrologic regime, or have occurred so far in the past that current hydrology should be considered to be “natural.” The possible scoring categories are listed below:

- No modifications. There are no modifications or no modifications that are apparent.
- Recovered. The wetland appears to have recovered from past modifications which altered the wetland’s natural hydrologic regime.
- Recovering. The wetland appears to be in the process of recovering from past modifications which altered the wetland’s natural hydrologic regime.

- Recent or no recovery. The modifications have occurred recently, and/or the wetland has not recovered from past modifications, and/or the modifications are ongoing.

Instances where the Rater believes that a wetland falls between two categories, or where the Rater is uncertain as to which category is appropriate, it is appropriate to select both categories and average the scores. The labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a hydrologic disturbance continuum, from very high to very low or no disturbance.



It is very important to stress that the Rater may check one or several of these possible disturbances, yet still determine that disturbances did not alter the natural hydrologic regime. If the Rater does not observe any alterations, or determines that the alterations have made trivial changes to the natural hydrology, then the maximum points should be assigned. If the alterations have caused more than trivial changes, a score of 1, 4 or 6, or an intermediate score of 2.5 or 5 (if 1 and 4 or 4 and 6 are both selected) should be assigned. If the Rater is unsure whether the alterations were more than trivial or did not occur so far in the past that the current conditions are “natural,” 6 and 8 should both be selected and a score of 7 assigned.

Example 1. The wetland is a complex of marshes, aquatic beds, fens and forested seep wetlands located around the perimeter of a natural kettle lake. In the 1930’s, portions of the wetland were filled and dredged to develop a private beach/picnic/campground area. A dike with a weir was installed to deepen the lake by several feet. The private beach is still in use throughout the growing season. Approximately, 37 acres of high quality wetlands remain. *Score:* the past disturbances did not seriously impact this groundwater-driven wetland system, although a considerable amount of wetland was probably flooded when the lake level was raised but the system appears to have recovered from this disturbance. “Recovered” should be checked and the wetland receives a score of 6.

Example 2. The wetland is a 10-acre depressional, buttonbush swamp with areas of forested wetland with closed canopy on one side. No significant outflows are observed although a small, shallow ditch from an abandoned farm field is observed. A small, asphalt-paved township road cuts off the forested area from the buttonbush swamp. A small culvert connects the two wetlands. The road was installed more than 25 years ago. *Score:* select both “no modifications apparent” and “recovered” since it is unclear whether the alterations disturbed the natural hydrologic regime at all, or whether the wetland has recovered from the disturbances. The wetland receives a score of “7” for this question.

Example 3. The wetland is a 6-acre predominately emergent marsh with a strong shrub/sapling component. Small amounts of fill were placed to construct a pole barn 600 feet from the wetland’s edge. *Score:* select “no modifications apparent” and assign a score of “8” since the filling activity did not affect the wetland’s natural hydrology.

Example 4. The wetland is a forested wetland with shallow (<8in deep) pools located in an isolated woodlot. Surrounding farm fields have been ditched and tiled and are actively farmed and the county soil map shows large areas of hydric soils extending through portions of the woodlot into the surrounding farm fields. The remaining wetland areas appear to be at the local topographic low. A feeder ditch passes along one side of the woodlot. The herbaceous layer appears degraded and over-run by poison ivy (*Toxicodendron radicans*). *Score:* select both “recovering” and “recent or no recovery” (average of 2.5 points) since it appears that the

ditching and tiling has and is diverting water from this remnant wetland but it is unclear whether the wetland has not recovered or is in the process of recovering from this hydrologic modification.

Example 5. Wetland is a seasonally-flooded, forested wetland on the flood plain of a warmwater habitat creek. The wetland abuts a wooded ridge and is located at the side of a former pasture. The understory is regularly mowed and woody debris removed by the owner. Some selective cutting has also occurred. *Score:* “no modifications apparent” (8 points) since the disturbances, while substantial, have not affected the wetland’s natural hydrology (but see Metric 4, Habitat Alteration).

Example 6. Wetland is a remnant forested, depressional wetland that was avoided during development of a large commercial, residential development, but is now completely landlocked by streets, stores and apartment housing. The wetland has old field vegetation around its margins but has a diverse canopy and herbaceous vegetation within its boundaries. It is suspected that the surrounding development has increased the surface flows into the wetland, although no stormsewers directly discharge into the wetland. *Score:* since it is unclear whether the development has actually affected the wetland’s natural hydrologic regime, although it seems likely that there has been *some* type of disturbance, the Rater decides to view the scores as points on a hydrologic disturbance continuum and selects both “no modifications apparent” and “recovered” and assigns a score of “7.”

Example 7. The wetland is a 5-acre depressional forested wetland located in a mature forest of 24 acres. The wetland has a diverse sedge flora. The forest is located on a large 98-acre plot of undeveloped land located within a heavily urbanized suburb. *Score:* the Rater should check “no modifications apparent” (8 points) since the natural hydrologic regime has not been disturbed by the surrounding urbanization.

7.4 Metric 4: Habitat Alteration and Development

While hydrology may be the single most important determinant for the establishment and maintenance of specific types of wetlands and wetland processes, there is a range of other factors and activities which affect wetland quality and cause disturbances to wetlands that are unrelated to hydrology. These metric attempts to evaluate these things under the rubric “habitat alteration.”

In many instances, items checked as possible hydrologic disturbances in Question 3d will be instead alterations to a wetland’s habitat or disruptions in its development (successional state). In other instances, a disturbance may be appropriately considered under both Metric 3 and Metric 4. In any case, the Rater should carefully consider what is the actual proximate (direct) cause of the disturbance to the wetland.

7.4.1 Question 4a: Substrate/Soil Disturbance

This question asks the Rater to evaluate general physical disturbances to the soil and surface substrates of the wetland. The continuum of recovery or disturbance seen in Question 3d is also used here with disturbance ranging from recent to none:

The Rater should check the most appropriate category to describe the present state of the wetland. In instances where the Rater believes that a wetland falls between two categories, or where the Rater is uncertain as to which category is appropriate, it is expected and highly appropriate to select both categories and average the score. Note also that the labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a disturbance continuum, from very high to very low or no disturbance.

Examples of substrate/soil disturbance include filling and grading, plowing, grazing (hooves), vehicle use (motorbikes, off-road vehicles, construction vehicles), sedimentation, dredging, and other mechanical disturbances to the surface substrates or soils.

7.4.2 Question 4b: Habitat Development

This question asks the Rater to assign an overall qualitative rating of how well-developed the wetland is in comparison to other ecologically or hydrogeomorphically similar wetlands. More than most questions, this question presumes the Rater has a good sense of the types of wetlands and the range in quality of those wetlands typical of the region, watershed, or state. Again, a scoring continuum is presented from poor to excellent. Uncertainties in assigning a wetland to a particular category should be resolved by selecting two of the most appropriate categories and averaging the score.

- Excellent. Wetland appears to represent the best of its type or class.
- Good. Wetland appears to be a good example of its type or class but because of past or present disturbances, successional state, etc. is not excellent.
- Fair. Wetland appears to be a fair to good example of its type or class.
- Poor. Wetland appears to not be a good example of its type or class because of past or present disturbances, successional state, etc.

7.4.3 Question 4c: Habitat Alteration

This question is directly analogous to Question 3d, except that it asks the Rater to evaluate the “intactness” of, or lack of disturbance to, the natural habitat of the type of wetland that is being evaluated. Again, it is very important to stress that this question does not discriminate between wetlands with different types of habitat, e.g. between a forested vernal pool and a flood plain forested wetland. This question asks the rater to evaluate the “intactness” of the habitat attributable to *that type of wetland*. In the example above, both the vernal pool and flood plain forest can score the maximum points (9) if there are no, or no apparent, modifications to the natural habitat.

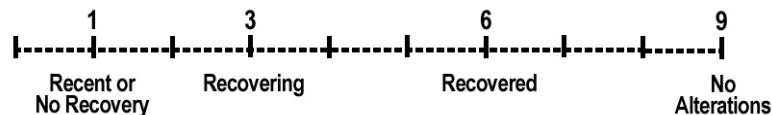
In order to properly answer this question, the Rater should check all possible alterations to the wetland’s habitat that are observed by the Rater. These could include, but are not limited to, mowing, grazing (cattle, sheep, pigs), clearcutting, selective cutting, woody debris removal, toxic pollutants, shrub/sapling removal, herbaceous/aquatic bed removal, sedimentation, dredging, farming, and nutrient enrichment.

All available information, field visits, aerial photos, maps, etc. can be used to identify possible ongoing or past habitat alterations. It is important to stress that this is a list of *possible* alterations to the wetland’s habitat. The Rater must then evaluate whether the activity actually disturbed the habitat (see examples below).

Once the Rater has listed all possible past and ongoing disturbances, the Rater must determine whether any of the observed disturbances caused more than trivial alterations to the natural habitat, or have occurred so far in the past that current conditions should be considered to be “natural.” The possible scoring categories range from no apparent alteration to recent or no recovery.

In instances where the Rater believes that a wetland falls between two categories, or where the Rater is uncertain as to which category is appropriate, it is appropriate to select both categories

and average the scores. The labels on the scoring categories are intended to be descriptive but not controlling. In some instances, it may be more appropriate to consider the scoring categories as fixed locations on a habitat disturbance continuum, from very high to very low or no disturbance.



It is very important to stress that the Rater may check one or several of these possible disturbances, yet still determine that disturbances did not alter the natural habitat of the wetland. If the Rater does not observe any alterations, or determines that the alterations have made trivial changes to the natural habitat, then the maximum points should be assigned. If the alterations have caused more than trivial changes, a score of 1, 3 or 6, or an intermediate score of 2 or 4.5 (if 1 and 3 or 3 and 6 are both selected) should be assigned. If the Rater is unsure whether the alterations were more than trivial or did not occur so far in the past that the current conditions are “natural”, then 6 and 9 should both be selected and a score of 7.5 assigned.

Example 1. The wetland is a large 247-acre fen/marsh/wet prairie, located between end moraines and receiving artesian ground water as its predominate source of hydrology. The wetland is a relict of a much larger wetland complex that existed presettlement. In the 1950s, peat mining occurred throughout the wetland. Adjacent wetland areas were ditched and tilled and are now actively farmed. The wetland is now largely vegetated with narrow-leaved cattail (*Typha angustifolia*), although small areas of fen vegetation are maintained by removing cattails through cutting or spraying. *Score:* the peat mining was a substantial disturbance to the wetland’s natural vegetation from which the wetland may either have not recovered from or be in the process of recovering from. The Rater selects both “recovering” and “recent or no recovery” to resolve this uncertainty and assigns a score of “2”.

Example 2. The wetland is a 3.7-acre formerly forested/buttonbush swamp wetland in which most of the trees were removed to incorporate the wetland into a golf course as a water hazard. The wetland also received large amounts of sediment during golf course construction. The wetland now supports a diverse emergent marsh community along with a richly vegetated forested/buttonbush community along one side. *Score:* “recovering” is checked (3 points) since the clear cutting has changed the vegetative community and “reset” the successional “clock” of a part of the wetland but a forested/buttonbush swamp component remains relatively intact.

Example 3. The wetland is a 7.5-acre forested wetland which was heavily grazed by cattle no more than 5 years ago. The wetland is near a large 1000-acre mature second growth forest with other forested wetlands that were fenced off from the pasture. The wetland has few tree seedlings or saplings and no shrubs, although a relatively diverse herbaceous (sedges and grasses) community is now present. *Score:* the wetland appears to be recovering from the heavy grazing. The Rater assigns a score of “3” to this wetland.

Example 4. The wetland is a 5-acre depressional forested wetland located in a mature forest of 25 acres. The wetland has a diverse sedge flora. The forest is located on a large 100-acre plot of undeveloped land located within a heavily urbanized suburb. Surrounding the forest are other wetlands, some of which have been clear cut, mowed, or partially filled. *Score:* the Rater should check “no alterations apparent” (9 points) since the forested wetland does not appear to be disturbed even though the surrounding area is heavily urbanized.

Example 5. Wetland is an emergent marsh dominated by bulrush (*Scripus atrovirens*) and reed canary grass (*Phalaris arundinacea*) surrounding a kettle lake. Much of the wetland and surrounding upland areas was farmed until 15 years ago, when the groundwater-fed kettle lake was allowed to revert to a natural state. The surrounding hillsides can be characterized as young “old-field.” Carp, bullheads and green sunfish are abundant in the lake itself. *Score:* the Rater considers selecting both “recovering” and “recent or no recovery”, but ultimately decides that the system as a whole is in the process of recovering from these past disturbances. A score of “3” is assigned.

Example 6. Wetland is a forested, depressional wetland with a rich herbaceous community with several rare or endangered plant species. As recently as 15 years ago, the wetland and adjacent upland forests were selectively cut. The canopy of the forest has largely reestablished itself. *Score:* the wetland has “recovered” from this disturbance and a score of “6” is assigned.

7.5 Metric 5: Special Wetland Communities

This metric assigns or deducts up to 10 additional points to the types of wetlands and circumstances addressed in the Narrative Rating Questions. *No wetland can ever receive more than 10 points for this metric* even if multiple categories are applicable, e.g. the wetland is an old growth forest (10 points) with the documented occurrence of an endangered species (10 points) for a total of 20 points; even in this situation, the score for Metric 5 would still be only 10 points.

If the Rater answers “yes” to the questions 2, 3, 5, 7d in the Narrative Rating, the Rater should check the appropriate scoring category(ies) in Metric 5. Refer to Section 6.0 for guidance in determining whether one of these choices is applicable.

7.6 Metric 6: Vegetation, Interspersion, and Microtopography

Vascular plants are an easily observable component of most wetland communities. Increases and decreases in the diversity, horizontal and vertical complexity, and abundance of plant species are well correlated with disturbances to wetlands. See Fennessy et al. 1998a and 1998b; Mack et al. 2000. Also included in this metric are physical habitat attributes like standing dead trees, hummocks, and coarse woody debris because these are ultimately plant-produced attributes.

7.6.1 Question 6a: Wetland Vegetation Communities

This question asks the Rater to identify all of the plant communities present within the wetland being evaluated. Six communities are identified: aquatic bed, emergent, shrub, forested, mudflat, and open water (with mudflats and open water being notable for their overall *lack* of vegetation). To be counted towards the score, a vegetation community must cover a minimum contiguous area within the wetland. This area is set at 0.25 acres.

Importantly, when evaluating the presence or absence of a plant community, the Rater must consider simultaneously its horizontal and vertical distribution. For example, a typical Michigan marsh will often have horizontally dispersed zones of vegetation: emergent to aquatic bed to open water. However, vegetation communities can also be vertically stratified: a forested wetland may have a “forest community” composed of trees, with buttonbush (a shrub class) and a rich sedge herbaceous layer (an emergent class).

The definitions for the vegetation classes listed in the MiRAM are largely based on the vegetation classification scheme outlined in Cowardin et al. (1979).

7.6.1.1 Aquatic Bed Class

The “aquatic bed” vegetation community includes wetlands or areas of wetlands dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.

The most common types of plants found in aquatic bed habitats in Michigan are pondweed (*Potamogeton* spp.), water-milfoil (*Myriophyllum* spp.), coontail (*Ceratophyllum* spp.), and pond lilies (*Nymphaea* spp. and *Nuphar* spp.). Floating aquatic species like duckweed (*Lemna* spp.) are excluded from the definition of “aquatic bed” for the purposes of MiRAM, although Cowardin et al. (1979) includes them in their classification.

In most instances, aquatic beds will occur as a distinct zone or ring in the wetland; however, occasionally aquatic beds can occur as an “understory” below shrubs or trees. For example, yellow water crowfoot (*Ranunculus flabellaris*) often grows in rich beds in inundated pools of forested wetlands and buttonbush swamps. In this situation, the Rater should consider the aquatic bed community to be present even though it occurs under a “canopy” of shrubs or trees.

7.6.1.2 Emergent Class

The “emergent” vegetation community includes wetlands or areas of wetlands dominated by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants.

Emergent wetlands can maintain the same appearance in areas with relatively stable hydrology or can change appearance if water levels fluctuate strongly or in drought years. Common names for emergent communities include marsh, wet meadow, wet prairie, sedge meadow, fens, prairie pothole, and bluejoint slough.

In Michigan, with exception of the Great Lakes coastal and estuarine wetlands, most emergent communities are classified as “palustrine” emergent wetlands. Cowardin et al. (1979) distinguishes between persistent and nonpersistent emergent communities but this distinction is not critical for the purposes of the MiRAM. The most common types of plants found in emergent wetland include cattails (*Typha* spp.), sedge family plants (*Carex* spp., *Scripus* spp., *Eleocharis* spp., *Cyperus* spp. etc.), bur-reeds (*Sparganium* spp.), rushes (*Juncus* spp.), grass family plants (*Glyceria* spp., *Phalaris arundinacea*, *Phragmites australis*, *Leersia* spp., *Poa palustris*, *Calamagrostis* spp., etc.), and many broad-leaved persistent and nonpersistent dicots (e.g. *Lythrum* spp., *Lysimachia* spp., *Rumex verticillatus*, *Polygonum* spp., *Peltandra virginica*, *Pontederia cordata*, *Sagittaria* spp., *Lycopus* spp., *Bidens* spp., *Impatiens* spp., *Iris* spp., *Mimulus* spp., *Verbena hastata*, *Boehmeria cylindrica*, *Asclepias incarnata*).

In most instances, emergent communities will occur as distinct zones or rings in the wetland; however, an emergent community can also be found as an “understory” below shrubs or trees. For example, some forested wetlands in Michigan can have very rich, diverse herbaceous communities also. In this situation, the Rater should consider the emergent community to be present even though it occurs under a “canopy” of shrubs or trees.

7.6.1.3 Shrub Class

The “shrub” vegetation community includes wetlands or areas of wetlands dominated by woody vegetation less than 20 ft tall. The plant species include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions. Shrub wetlands may

represent a successional stage leading to forested wetland or they may be relatively stable plant communities (Anderson 1982). Outside of shrub dominated bogs and fens, scrub-shrub wetlands in Michigan may contain or be dominated by buttonbush (*Cephalanthus occidentalis*), alder (*Alnus* spp.), *Viburnum* spp., buckthorn (*Rhamnus* spp.), willows (*Salix* spp.), dogwoods (*Cornus* spp.), *Spirea* spp., blueberries (*Vaccinium* spp.), winterberry *Ilex verticillata*, and swamp rose (*Rosa palustris*).

7.6.1.4 Forested Class

The “forested” vegetation community includes wetlands or areas of wetlands characterized by woody vegetation greater than 20 ft or taller. Forested wetlands have an overstory of trees and often contain an understory of young trees and shrubs and an herbaceous layer, although the young tree/shrub and herbaceous layers can be largely missing from some types of forested wetlands.

In some parts of Michigan, forested wetlands were probably the most common type of wetland, e.g. the former Great Black Swamp. Forested wetlands are also common in flood plains where they form a mosaic with upland riparian forests. Finally, both vegetated and unvegetated depressional forested wetlands are common in Michigan. Unvegetated forested wetlands are defined as “vernal pools” while vegetated forested wetlands typically have a rich herbaceous layer with multiple *Carex* spp. and monocot and dicot forbs.

The most commonly observed canopy trees in Michigan forested wetlands are probably silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), and green/red ash (*Fraxinus pennsylvanica*). Other Michigan wetland tree species include swamp white oak (*Quercus bicolor*), pin oak (*Q. palustris*), red maple (*Acer rubrum*), black ash (*Fraxinus nigra*), black willow (*Salix nigra*), yellow birch (*Betula allegheniensis*), tamarack (*Larix laricina*), and white cedar (*Thuja occidentalis*). Several upland-rated trees such as white pine (*Pinus strobus*), hemlock (*Tsuga canadensis*), and basswood (*Tilia americana*) are also known to occur in forested wetlands.

7.6.1.5 Mudflat Class

The “mudflat” class is generally equivalent to the “unconsolidated bottom/mud” class/subclass (PUB₃) described in Cowardin et al. (1979). Although not commonly found in inland wetlands, it is a very frequent component of Great Lakes coastal wetlands. The mudflat class includes wetlands or areas of wetlands characterized by exposed or shallowly inundated substrates of unconsolidated particles of silt and clay, although coarser sediments or organic material may be intermixed, with vegetative cover less than 30%. If vegetation is present it will often be limited to annual plants, e.g. some smartweeds (*Polygonum* spp.), flatsedges (*Cyperus* spp.) and other annual hydrophytes, which can become established in years when the mudflat dries down enough to trigger germination of these plants from the seed bank. Upland pioneer species and weed species, e.g. barnyard grass (*Echinochloa crusgalli*) or cocklebur (*Xanthium chinense*), can also become established during these times.

7.6.1.6 Open Water Class

The “open water” class is equivalent to the “open water - unknown bottom” class in Cowardin et al. (1979). “Open water” can occur in both inland and coastal wetlands and includes areas of wetlands that are 1) inundated, 2) unvegetated (no emergent or aquatic bed vegetation), and 3) “open”, i.e. there is no “canopy” of any type of vegetation: “open water” does not, by definition, occur under a canopy of shrubs or trees.

7.6.1.7 Other Classes Not Listed

Although it is expected that the classes described above will be sufficient to characterize most if not all Michigan wetlands, the Rater may be faced with a wetland or portion of a wetland that does not fit within one of these communities. In this situation, it is recommended that the classification outlined in Cowardin et al. (1979), *Classification of Wetlands and Deepwater Habitats of the United States*, or Anderson (1982), be used to determine an appropriate classification of the wetland. The Rater should clearly document the reasons for using the new class. The class should then be scored using the cover scale (see below).

7.6.2 Question 6a Continued: Assigning Points to Communities Using “Cover Scale”

It is very important for the Rater to evaluate the quality of the vegetation communities present at a site. Each community present should be scored in relation to the other vegetation communities found in the wetland. Use the Tables 6 and 7 to score each community.

“Low”, “moderate”, and “high” quality vegetation communities presume the Rater has knowledge of the types and range in quality of the vegetation communities found in wetlands in the region where the wetland is located, such that the Rater can place a particular community on a relative scale of quality. Table 6 provides narrative descriptions of vegetation community quality.

For mudflat and open water classes an alternative quality scale is used based on the size of these classes. See Table 8.

Table 6. Quality guidelines for vegetation community cover scale. Use this table to develop a quality rating (e.g. low/moderate/high) for each vegetation community in 6a. Then see Table 2 to determine point scores for each vegetation community.

Narrative	Description
Low:	Low species diversity and/or a predominance of non-native or disturbance tolerant native species.
Moderate:	Native species are the dominant component of the vegetation, although non-native or disturbance tolerant native species can also be present, and species diversity is moderate to moderately high, but generally without the presence of rare, threatened, or endangered species.
High:	A predominance of native species, with non-native species absent or virtually absent, and high species diversity and sometimes, but not always, the presence of rare, threatened or endangered species.

Table 7. Vegetation community cover scale (coverage and quality). Use quality guidelines from Table 1 to develop a score for each vegetation community in 6a.

Cover Scale	Description
0 pt.	The vegetation community is either, a) absent from wetland, OR b) comprises less than 0.25 acres of contiguous area within the wetland
1 pt.	The vegetation community is present and either, a) only comprises a small part of the wetland's vegetation and is of moderate quality, OR b) if it comprises a significant part of the wetland's vegetation, this community is of low quality
2 pt.	The vegetation community is present and either, a) comprises a significant part of the wetland's vegetation and is of moderate quality, OR b) the vegetation community comprises a small part of the wetland's vegetation but is of high quality
3 pt.	The vegetation community comprises a significant part, or more, of the wetland's vegetation and is of high quality

Table 8. Non-vegetated (mudflat or open water) community cover scale.

Use this table to develop a score for existent non-vegetated communities of submetric 6a.

Mudflat or Open Water Quality	Narrative Description
0 pt.	Absent: < 0.25 acres
1 pt.	Low: 0.25 to < 2.5 acres
2 pt.	Moderate: 2.5 to < 10 acres
3 pt.	High: 10 acres or more

The following guidelines are presented for when and how to assign a score to a vegetation community.

7.6.2.1 Assigning a “0” Score

All classification schemes are artificial to greater or lesser extent and impose arbitrary thresholds. Thus, it is likely that most wetlands have *some* element of *most* of the vegetation communities described above. Emergent marshes often have a wooded fringe that is located on hydric soils and within the jurisdictional boundary of the wetland. Unvegetated forested wetlands often have small amounts of buttonbush growing under a closed canopy, or have small amounts of emergent wetland vegetation or mesic woodland herbs growing on logs or the bases of trees. However, for the purposes of this method, in order for a vegetation community to be considered “present” in the wetland, the community must cover a minimum contiguous area of 0.25 acres, unless the wetland itself is less than 0.25 acres in size, in which case the Rater will need to select the single most characteristic class. This minimum area is equivalent to an area with the dimensions 35 x 35 yards.

Some qualifications and explanations for what constitutes the “minimum contiguous area” may be helpful.

1. With regard to the herbaceous vegetation that comprises emergent and aquatic bed communities, the community may have areas of bare ground, small areas of open water, or somewhat sparse stem or tussock density. Some forested wetlands have diverse herbaceous emergent communities that are characterized by scattered tussocks growing throughout the wetland or in wide or narrow zones around the shallower perimeter areas of the wetland. The Rater should “sum up” all the parts of this entire community, including open areas between tussocks or stems, when determining whether it meets the minimum size.
2. If the forested vegetation area is no more than a thin band of 1 or 2 trees around some or all of the perimeter, a score of 0 should be assigned. Conversely, many emergent marshes and buttonbush swamps grade into a clearly forested community with a closed canopy and a rather abrupt change occurs in understory vegetation, either in a zone around the perimeter or on one or several sides, especially when upland forest is nearby. In this situation a forested community should be considered to be present and a score of 1, 2, or 3 assigned.
3. Scrub-shrub and emergent communities can often be densely intermingled: however, it is equally common for emergent marshes to have one or several buttonbush, willow, or dogwood plants scattered here or there. The coverage of these scattered individuals should not be “summed up” to meet the size threshold. The Rater should be able to observe one to three large patches of shrubs or small trees which together are equal or greater than 0.25 acres.

4. Mudflats and open water classes do not occur under any type of “canopy.” Thus, a vernal pool never has an open water class, or a mudflat class after the pool dries down by late summer.

7.6.2.2 Assigning a “1” Score

In assigning a score of “1” to a vegetation community that is determined to be present, the Rater must find one of the following:

1. The vegetation community only comprises a *small part* of the wetland’s *entire* vegetation and is of moderate quality, or
2. The vegetation community comprises a *significant part* of the wetland’s vegetation, and this community is of *low quality*.

The Rater is asked to compare the relative contribution of the vegetation community to all of the vegetation communities that make up this wetland. If the relative contribution is small, than a “1” is appropriately assigned to this community even if it is of moderate quality (if it is of high quality, a “2” should be assigned. See the next section. Alternatively, if the relative contribution is significant, but the community is of low quality, the Rater can also assign a “1”.

If neither of the choices above apply, the Rater must consider assigning at least a “2” to the community.

Example 1. The wetland is a 9.88-acre high quality emergent marsh. Areas of buttonbush and swamp loosestrife are present with surface area of 1.2 to 2.5 acres. The south edge of the wetland abuts a young second growth forest and a forested wetland community 0.5 acres has developed at this margin. *Score:* The forested wetland community receives a score of “1” since it only comprises a small part of the wetland’s entire vegetation. Conversely, the emergent marsh will receive a score of “2” or higher.

Example 2. Portions of a forested flood plain wetland have been clear cut and partially filled. Sedimentation from a nearby construction site has resulted in an emergent community dominated by narrow-leaved cattail and *Phragmites australis*. The emergent community is approximately 30% of the area of mapped hydric soils. *Score:* The emergent community receives a score of “1” because it is of low quality, even though it comprises a significant part of the wetland’s present vegetation. Note: the remaining forested component will likely receive a score of 2 or more.

7.6.2.3 Assigning a “2” Score

In assigning a score of “2” to a vegetation community that is determined to be present, the Rater must find one of the following:

1. The vegetation community comprises a *significant part* of the wetland’s vegetation and is of *moderate* quality, or
2. The vegetation community comprises a *small part* of the wetland’s vegetation but is of *high* quality.

“Significance” is understood as whether the community is an ecologically significant part of the entire wetland. In some instances, however, just considering the physical size of a community may go a long way to deciding what the ecological significance of the community is. For example, if 16 acres of a 17-acre marsh is an “emergent” vegetation community, and 1.25 acres is relatively narrow (65 -130 ft wide), moderate quality, forested wetland community in one

corner, the forested component probably does not comprise a significant part of the wetland's vegetation (and the Rater should reconsider assigning a "1" to the forested community).

Alternatively, if the relative contribution is small, but the community is of high quality, the Rater should assign a "2" to the vegetation community.

If a wetland vegetation community appears to be high quantity and high quality, the Rater should consider assigning a "3" to the community.

Example 1. The wetland is a 17-acre wetland located in the flood plain of a low-gradient river that floods one to several times yearly. Approximately 7.4 acres is buttonbush, 2.5 acres open water, and 7.4 acres is second-growth forested with silver maple and green ash. The forested portions of the wetland lie around the central area of buttonbush and open water. A diverse, sedge-dominated herbaceous community (*Carex muskingumensis*, *C. grayii*, *C. lacustris*, *C. lupulina*, *C. typhina*) is present under portions of the forested wetland; annual and perennial emergents (*Polygonum persicaria*, *P. hydropiperoides*, and *Iris versicolor*) and a floating aquatic herb (*Proserpinaca palustris*) are present in the margins of the buttonbush/open water area. *Score:* four communities are present in this wetland: forested, open water, emergent, and scrub-shrub (The aquatic bed species is not present over a sufficient area to count as a separate community). The forested wetland is of moderate quality given the moderate species diversity and age of the forest and should receive a score of 2 points. The emergent and buttonbush (scrub-shrub) community appear to be high quality and would receive a score of 3 (refer to discussion in next section of when to assign a score of 3). Referring to Table 8, the open water is determined to be low quality based on its size and therefore receives only 1 point.

Example 2. The wetland is a 6.2-acre forested wetland ringing a central 0.75-acre area dominated by buttonbush. On two sides a rare sedge is present growing in tussocks in areas more shallowly inundated (0.6 acres in area) under a mixed canopy of green ash, silver maple, and American elm; other wetland and mesic forest herbs grow intermixed with the tussocks or on downed logs and tree bases. *Score:* herbaceous community counts as an "emergent" class and receives a score of two as a "high quality" community present in small amounts. Forested community is present in moderate quality in large amounts and receives a score of "2"; the scrub-shrub community is present in moderate quality in small amounts and receives a score of "1".

7.6.2.4 Assigning a "3" Score

In assigning a score of "3" to a vegetation community that is determined to be present, the Rater must find that the vegetation community is:

1. of high quality, and
2. comprises a significant part, or more, of the wetland's vegetation.

Example 1. Wetland is an intact 6.2-acre relict wet prairie that is part of a 37-acre oak savannah. The wetland is dominated by bluejoint grass (*Calamagrostis stricta*), lake sedge (*Carex lacustris*), and tussock sedge (*Carex stricta*) and has a diverse assemblage of prairie forbs. The wetland also has a small area (0.75 acres) of open water dominated by mermaid weed (*Proserpinaca palustris*) and water primrose (*Ludwigia palustris*). The emergent community is of high quality and comprises a significant amount of the wetland's vegetation and scores a "3"; the aquatic bed community is of moderate quality but is only a small part of the wetland's vegetation and scores a "1".

Example 2. Wetland is a 3.7-acre, high quality floating-leaved marsh surrounded by a 17-acre buttonbush/swamp rose shrub swamp located on the flood plain of a low-gradient stream.

Areas of young second growth swamp forest (< 5 acres) exist at the margins of the wetland. Lake cress (*Azorella lacustris*) is present in the marsh. The aquatic bed community and scrub-shrub communities receive a score of “3”; the swamp forest community receives a score of “1”.

7.6.3 Question 6b: Horizontal (Plan View) Community Interspersion

In order to properly answer this question, the Rater must evaluate the wetland from a “plan view,” i.e. as if the Rater was hovering above the wetland in the air and looking down upon it. Figure 7 is provided as an aid in evaluating the degree of horizontal interspersion.

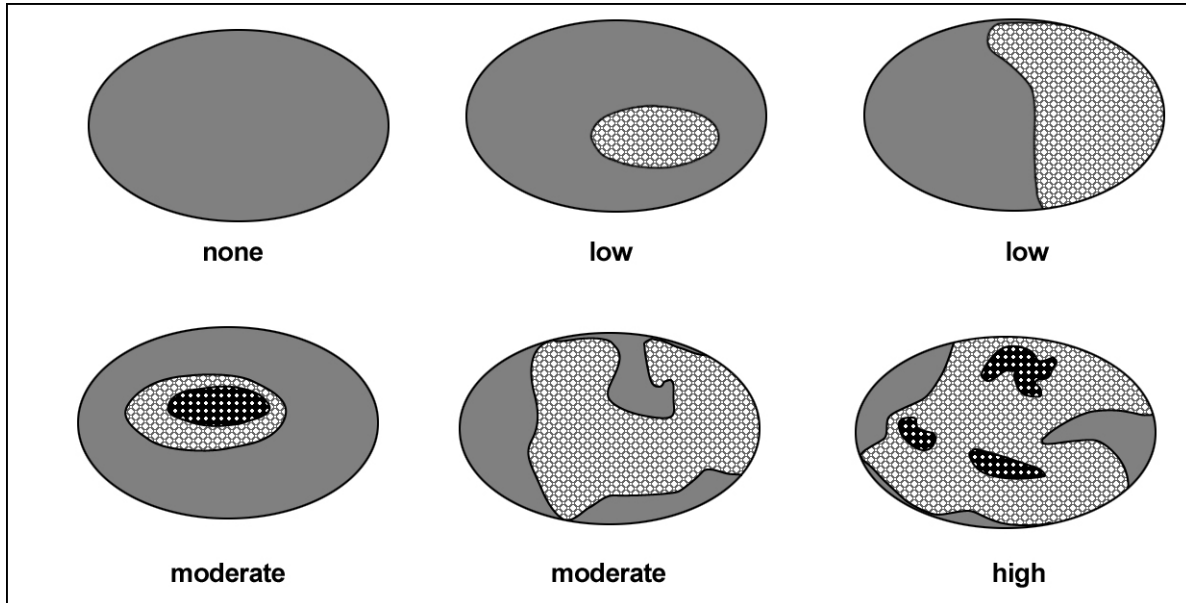


Figure 7. Hypothetical wetlands for estimating degree of interspersion.

The Rater can select from the following categories of interspersion:

- High (5 points). Wetland has a high degree of plan view interspersion.
- Moderate (3 points). Wetland has a moderated degree of plan view interspersion.
- Low (1 point). Wetland has a low degree of plan view interspersion.
- None (0 points). Wetland has no plan view interspersion.

7.6.4 Question 6c: Coverage of Invasive Plant Species

Recall that in Metric 5, a “-10” point deduction is assigned to hydrologically isolated wetlands that have >80% cover of invasive species. However, other types of wetlands can be invaded by these species and many wetlands have coverages of less than 80% for these species. This question requires the Rater to deduct points for the presence of invasive plant species or to add a point if these species are absent from the wetland being rated. See Table 4 for a list of common invasive species found in Michigan wetlands.

7.6.5 Question 6d: Microtopography

This final question in Metric 6 asks the Rater to evaluate various plant-derived microtopographic habitat features often present in wetlands and determine whether the wetland provides breeding pools for amphibians. A cover scale of 0 to 3 points, similar to that used in Question 6a, is used to rate both the quantity and quality of habitat features present in the wetland.

The features to be evaluated are:

- vegetated hummocks/tussocks
- coarse woody debris > 6in
- standing dead trees > 10in
- amphibian breeding pools

The Rater should check all of the microtopographic features that are present in the wetland and then assign an appropriate cover score of 0, 1, 2, or 3. See Table 9.

Table 9. Microtopography cover scale. Use this table to determine microtopographic habitat quality scores for submetric 6d.

Microtopographic Habitat Quality	Description
0 pt.	Feature is absent or functionally absent from the wetland.
1 pt.	Feature is present in the wetland in very small amounts or if more common, of low quality.
2 pts.	Feature is present in moderate amounts, but not of highest quality, or in small amounts of highest quality.
3 pts.	Present in moderate or greater amounts and of highest quality.

7.7 Metric 7: Scenic and Recreational Benefits

Wetlands provide valuable open space for visual and recreational enjoyment. Rare, threatened, and endangered plant and animal species can be found in some of the wetlands around the state providing added interest for naturalists to enjoy these areas. Bird watching, hiking, plant viewing, along with introspection, quiet reflection, and the opportunity to experience wilderness are just a few of the benefits provided by wetlands.

Accessibility of the wetland is key to its aesthetic or recreational appreciation. Wetlands located on lands in public ownership inherently will provide open accessibility. Wetlands occurring on lands within a conservation easement provide some certainty that the wetlands will not be subject to impact pressures. Proximity to population centers may increase a wetlands perceived importance. However, proximity to population centers and locations in public areas may have associated noise and/or pollution factors that could degrade the aesthetic and educational functional level. A population center is a city, town, or village within easy driving distance of the site.

The Rater should determine the wetlands proximity to a population center and use personal observation to assess wetland usage. The Rater may also rely on the observations of other persons know to the Rater to determine usage of the wetlands. In addition, the Rater should

consult any published literature and accounts available which might indicate public usage of the wetlands.

Bloomfield Township Wetland Inventory

Site ID: S1-W3

Wetland Type(s): PSS w/PFO and PEM Date: 4-Apr-07
 Area (acres): 58.59 Rater(s): JWB / AAB

Comments:

Large wetland complex - primarily PSS w/ some PFO and PEM components. Likely groundwater fed due to creek, topo, and presence of skunk cabbage

61

MiRAM Score

Final Category			
Degraded / Low Quality	Degraded but Restorable / Moderate Quality	Relatively Intact / Moderately High Quality	Intact / High Quality

This MiRAM form was completed through a combination of field evaluations primarily from public right-of-ways, aerial photo interpretation, and Base Maps compiled from various GIS data sources for purposes of assisting the Township in planning decisions. The condition of wetlands as indicated is not intended to be an actual wetland assessment or delineation and should be evaluated on a site specific basis. Bloomfield Township assumes no responsibility for errors that arise from the use of this data.



9 **9**
max 9 subtotal

Metric 1: Wetland Area Size and Distribution (9 points max)

1a. Wetland Size

Select one size class. Assign score.

- 6 >50 acres (6 pts)
- 25 to <50 acres (5 pts)
- 10 to <25 acres (4 pts)
- 3 to <10 acres (3 pts)
- 0.3 to <3 acres (2 pts)
- 0.1 to <0.3 acres (1 pt)
- <0.1 acres (0 pt)

6

1b. Wetland Remaining in General Area

Select one matrix class and assign score.

Measure 2-mile radius from the center of the wetland.

- 3 0 to 20% of surrounding 2-mile radius is wetland (3 pts)
- >20 to 80% of surrounding 2-mile radius is wetland (2 pts)
- >80% of surrounding 2-mile radius is wetland (1 pt)

3

Large wetland complex - primarily PSS w/ some PFO and PEM components. Likely groundwater fed due to creek, topo, and presence of skunk cabbage

7 **16**
max 12 subtotal

Metric 2: Upland Buffers and Surrounding Land Use (12 points max)

2a. Average Buffer Width (ABW) around Wetland Perimeter

Select only one and assign score (do not average).

- Wide: Buffers average 50 feet or more (6)
- 4 Medium: Buffers average 25 to <50 feet (4)
- Narrow: Buffers average 10 to <25 feet (2)
- Very Narrow: Buffers average less than 10 feet (0)

4

2b. Intensity of Surrounding Land Use

Select one (or select two and average the scores).

- Very Low: Second growth or older forest, prairie, savannah, or wildlife area, etc. (6)
- Low: Old field (greater than 10 years), shrubland, young second growth forest, etc. (4)
- 3 Mod. High: Residential, fenced pasture, park, conservation tillage, new fallow field (2)
- High: Urban, industrial, open pasture, row cropping, mining, and construction (1)

3

20 **36**
max 26 subtotal

Metric 3: Hydrology (26 points max)

3a. Sources of Water

Score all that apply.

- 2 Groundwater (2)
- 1 Precipitation (1)
- Seasonal Intermittent Surface Water (2)
- 5 Perennial Surface Water (Lake or Stream) (5)

8

3c. Duration of Inundation/Saturation

Select one (or select two and average the scores).

- Semipermanently to Permanently Inundated (4)
- Regularly Inundated (3)
- 2 Seasonally Inundated to Saturated (2)
- Seasonally Saturated in Upper 12 inches (1)

2 2

3d. Modifications to Natural Hydrologic Regime

Select one (or select two and average the scores).

- No Modifications Apparent (8)
- 6 Recovered (6)
- Recovering (4)
- Recent or No Recovery (1)

6 6

3b. Connectivity

Score all that apply.

- 1 100 Year Floodplain (1)
- 1 Between Stream/Lake and Other Human Use (1)
- 1 Part of Wetland/Upland (e.g. Forest, Prairie) Complex (1)
- 1 Part of Riparian/Upland Corridor (1)

4

Use this checklist with submetric 3d. Check (✓) all modifications observed.

- Ditch(es)
- Tile(s)
- Dike(s)
- Weir(s)
- Stormwater Inputs
- Channelization
- Point Source Discharge(s) (non-stormwater)
- Filling/Grading
- Road Bed(s) / Railroad Bed(s)
- Dredging
- Beaver Dam(s)
- Other _____

15 **51**
max 20 subtotal

Metric 4: Habitat Alteration and Development (20 points max)

4a. Substrate / Soil Disturbance

Select one (or select two and average them).

- 4 No Substrate/Soil Disturbance Apparent (4)
- Recovered (3)
- Recovering (2)
- Recent or No Recovery (1)

4 4

4b. Habitat Development

Select only one and assign score.

- Excellent (7)
- 5 Good (5)
- Fair (3)
- Poor (1)

5

4c. Habitat Alteration

Select one (or select two and average)

- No Alterations Apparent (9)
- 6 Recovered (6)
- Recovering (3)
- Recent or No Recovery (1)

6 6

Use this checklist with submetric 4c. Check (✓) all habitat alterations observed.

<input type="checkbox"/> Mowing	<input type="checkbox"/> Toxic Pollutants	<input type="checkbox"/> Farming
<input type="checkbox"/> Grazing	<input type="checkbox"/> Shrub/Sapling Removal	<input checked="" type="checkbox"/> Nutrient Enrichment, e.g. nuisance algae
<input type="checkbox"/> Clearcutting	<input type="checkbox"/> Herbaceous/Aquatic Bed Removal	<input type="checkbox"/> Other _____
<input type="checkbox"/> Selective Cutting	<input checked="" type="checkbox"/> Sedimentation	<input type="checkbox"/> Other _____
<input type="checkbox"/> Woody Debris Removal	<input type="checkbox"/> Dredging	

Metric 5: Special Wetlands (10 points max)

- Score all that apply.
- Critical Habitat (10)
 - Occurrence of State and/or Fed. Threatened/Endangered Species (10)
 - Rare and Imperiled Natural Community Type (10)
 - Part of an Old Growth Forest (10)

- Score all that apply
- Part of a Forested Wetland (5)
 - Great Lakes Coastal Wetland, Unrestricted Hydrology (10)
 - Hydrologically Isolated Wetland and >80% Invasives (-10)

Metric 6: Vegetation, Interspersion, Microtopography (20 points max)

6a. Wetland Communities

See tables below and score all present using scale of 0 to 3 points.

Vegetation Communities (see Tables 1 and 2)

- Aquatic bed
- 1 Emergent
- 2 Shrub
- 1 Forested

Non-Vegetation Communities (see Table 3)

- Mudflat
- Open water
- Other

Low:	Low spp. diversity and/or predominance of non-native or disturbance tolerant native spp.
Mod:	Native spp. are a dominant component of the vegetation, although non-native and/or disturbance tolerant native spp can also be present, and spp diversity moderate to moderately high, but generally w/o presence of special concern, threatened, or endangere
High:	Predominance of native spp. with non-native spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of special concern, threatened, or endangered spp.

0 pt	Absent or comprises 0.25 acres contiguous area.
1 pt	Present and comprises small part of wetland's vegetation and is of moderate quality OR comprises a significant part, but is low quality.
2 pts	Present and comprises significant part of wetland's vegetation and is of moderate quality OR comprises a small part, but is high quality.
3 pts	Present and comprises significant part or more of wetland's vegetation and is of high quality.

0 pt	Absent: <0.25 acres
1 pt	Low: 0.25 to 2.5 acres
2 pts	Moderate: 2.5 to 10 acres
3 pts	High: 10 acres or more

6b. Horizontal (plan view) Interspersion

Select only one (see Figure 1).

- High (5)
- 3 Moderate (3)
- Low (1)
- None (0)

6c. Coverage of Invasive Plants

Add or deduct points for coverage.

- Extensive: >75% Cover (-5)
- Moderate: 25% to 75% Cover (-3)
- 1 Sparse: 5% to 25% Cover (-1)
- Nearly Absent: <5% Cover (0)
- Absent: 0% Cover (1)

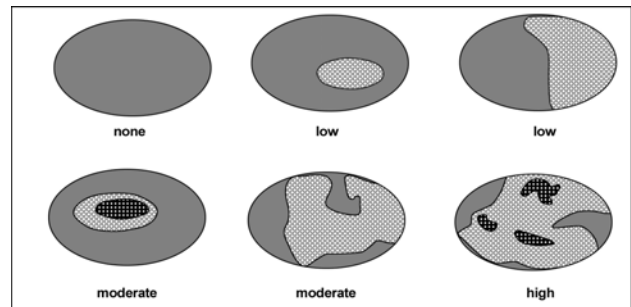


Figure 1. Hypothetical wetlands for estimating degree of interspersion.

6d. Microtopography (see Table 4)

Score all present using scale of 0 to 3 points.

- Vegetative Hummocks/Tussocks
- 2 Coarse Woody Debris >6 inches DBH
- 1 Standing Dead Trees >10 inches DBH
- 1 Amphibian Breeding Pools

0 pt	Absent
1 pt	Present in very small amounts or if more common, of marginal quality
2 pts	Present in moderate amounts, but not of highest quality OR in small amounts of highest quality
3 pts	Present in moderate or greater amounts and of highest quality

Metric 7: Proximity and Accessibility to the Public (3 points max)

Score all that apply.

- All or any part of the wetland in public or conservation ownership (1).
- The general public has access to the wetland (1).
- Wetland and immediately adjacent area used for recreational activities (1).

MiRAM Summary Worksheet

MiRAM Summary Worksheet					
Narrative Rating	Question 1.	Critical Habitat	YES	NO	If yes, Intact/High Quality
	Question 2.	Threatened or Endangered Species	YES	NO	If yes, Intact/High Quality
	Question 3.	Rare and Imperiled Wetland Community	YES	NO	If yes, Intact/High Quality
	Question 4.	Low Quality Wetlands	YES	NO	If yes, Low Quality
	Question 5.	Old Growth Forest	YES	NO	If yes, Intact/High Quality
	Question 6.	Forested Wetland	YES	NO	If yes, evaluate for Intact/High Quality
	Question 7b.	Great Lakes wetlands – Restricted Hydrology	YES	NO	If yes, evaluate for Intact/High Quality
	Question 7d.	Great Lakes Wetlands – Unrestricted Hydrology with Predominance of Native/ Disturbance intolerant Plants	YES	NO	If yes, Intact/High Quality
	Question 7e.	Great Lakes Wetlands – Unrestricted Hydrology with Predominance of Disturbance Tolerant Plants	YES	NO	If yes, evaluate for Intact/High Quality
Quantitative Rating				score	
	Metric 1. Size			9	
	Metric 2. Buffers and Surrounding Land Use			7	
	Metric 3. Hydrology			20	
	Metric 4. Habitat			15	
	Metric 5. Special Wetland Communities			0	
	Metric 6. Plant communities, Interspersion, Microtopography			10	
	Metric 7. Public Access			0	
	TOTAL SCORE Consult most recent score calibration report at: www.michigan.gov/deqwetlands to determine the wetland's quality based on its quantitative score.			61	