State of Michigan Wetland Monitoring and Assessment Strategy

Department of Environmental Quality
Water Resources Division

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Introduction

The *Michigan Wetland Monitoring and Assessment Strategy* was prepared by the Michigan Department of Environmental Quality's (MDEQ) Water Resources Division (WRD) as a supplement to the *Michigan Water Quality Monitoring Strategy*. Organization of this Wetland Monitoring and Assessment Strategy follows the United States Environmental Protection Agency (USEPA) document *Application of Elements of a State Water Monitoring and Assessment Program For Wetlands* (United States Environmental Protection Agency, 2006).

This document was adapted from the earlier 2009 version of the *Michigan Wetland Monitoring and Assessment Strategy.* Between 2009 and today, the MDEQ has continued to partner with universities and other agencies to finalize the development of protocols and sampling designs for all three levels of wetland monitoring outlined in the 2009 version of the strategy, as well as initiated implementation of all three levels of monitoring. The MDEQ has also made advancements in data management and analysis for wetland monitoring and assessment in Michigan.

Because efficient and effective procedures for the ongoing evaluation of wetland resources are continuing to be refined on both a state and national scale, this wetland assessment strategy document will continue to evolve in the future, as it has in the past. As this strategy outlines, Michigan has a solid framework for wetland monitoring at a landscape, rapid, and intensive assessment level, and ongoing statewide monitoring efforts implementing all of these techniques. The MDEQ intends to continue progress towards sustained, long-term statewide wetland monitoring, in coordination with our partners, as described in this strategy.

A. WETLAND MONITORING STRATEGY: A CONTEXT FOR WETLAND MONITORING AND ASSESSMENT IN MICHIGAN

Part 303, Wetland Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451 , as amended (NREPA), includes the following legislative findings regarding the importance of wetlands:

> Section 30302. (1) The legislature finds that:
>
> (a) Wetland conservation is a matter of state concern since a wetland of 1 county may be affected by acts on a river, lake, stream, or wetland of other counties.
>
> (b) A loss of a wetland may deprive the people of the state of some or all of the following benefits to be derived from the wetland:
>
> > (i) Flood and storm control by the hydrologic absorption and storage capacity of the wetland.
> >
> > (ii) Wildlife habitat by providing breeding, nesting, and feeding grounds and cover for many forms of wildlife, waterfowl, including migratory waterfowl, and rare, threatened, or endangered wildlife species.
> >
> > (iii) Protection of subsurface water resources and provision of valuable watersheds and recharging ground water supplies.
> >
> > (iv) Pollution treatment by serving as a biological and chemical oxidation basin.
> >
> > (v) Erosion control by serving as a sedimentation area and filtering basin, absorbing silt and organic matter.
> >
> > (vi) Sources of nutrients in water food cycles and nursery grounds and sanctuaries for fish.

The overarching goal of the MDEQ's Wetland Assessment and Monitoring Program is to address the success of the state in protecting, managing, and restoring Michigan's wetlands such that they will continue to provide the public benefits defined by the legislature in Part 303, Wetlands Protection, of the NREPA.

More specifically, the assessment and monitoring of Michigan's wetland resources is needed to provide information to address diverse program issues at a variety of scales, from the status and trends of statewide wetland acreage to the detailed evaluation of individual wetland sites. Wetlands are components of the waters of the state, and of the waters of the United States, and as such are protected under Michigan's surface water quality standards. Monitoring and assessment are needed to address periodic federal reporting requirements regarding the physical, chemical, and biological integrity of Michigan's wetlands.

Moreover, the evaluation of individual wetlands is an integral component of Michigan's regulatory program under Part 303 and Section 404 of the Clean Water Act, which also requires annual reporting on statewide regulatory impacts. And, on a different scale, land use planners are increasingly considering wetland functions, wetland quality, and restoration opportunities in watershed scale planning and in local nonpoint source control programs.

Responsibility for wetland monitoring and assessment: The MDEQ's WRD holds overall responsibility for monitoring and evaluation of Michigan's waters, as well as for development of and ensuring compliance with surface water quality standards. These broad functions are outlined in the Michigan Water Quality Monitoring Strategy.

The MDEQ's WRD is also responsible for administration of Michigan's Section 404 Permit Program, and for other aspects of wetland management. The WRD's Wetlands, Lakes, and Streams Unit (WLSU) has primary responsibility for development and implementation of a wetland-specific monitoring and assessment strategy.

Implementation of wetland monitoring and assessment activities is a team effort. The MDEQ works with many partner agencies and organizations on implementation of various components of this strategy. Many of these partners, including Central Michigan University (CMU) and Ducks Unlimited (DU), play a critical role in achieving the goals and objectives of wetland monitoring by assisting with development of sampling protocols, site selection, and executing the methods. We plan to continue partnering with these groups and others to advance wetland monitoring methods, implementation, and analysis.

Michigan's Wetland Monitoring and Assessment Strategy represents a multi-year effort; implementation of all aspects of this strategy will depend upon the commitment of both state and federal resources.

B. MONITORING OBJECTIVES

Michigan's overall Water Quality Monitoring Strategy defines four broad goals for the state's monitoring efforts:

- Assess the current status and condition of waters of the state and determine whether water quality standards are being met;
- Measure spatial and temporal water quality trends;
- Evaluate the effectiveness of water quality prevention and protection programs; and
- Identify new and emerging water quality problems.

The following objectives for monitoring and assessment of Michigan's wetlands speak to the broader goals outlined above, and are consistent with federal goal of determining whether national no net loss and net gain targets for wetlands are being achieved.

Objective 1: Complete an inventory of Michigan's wetland resources that provides both basic resource information and a baseline for evaluating gains and losses over time.

Objective 2: In order to support state and national no net loss and net gain goals for wetlands, cooperate in updating of National Wetland Inventory (NWI) maps for use in status and trends reporting.

Objective 3: Assess the effectiveness of Michigan's state-administered Section 404 Permit Program by tracking authorized wetland impacts and mitigation for those impacts, as well as documented unauthorized impacts and restoration measures.

Objective 4: Apply Landscape Level wetland assessment methods to support the protection, management, and restoration of wetlands on a watershed scale.

Objective 5: Evaluate individual wetland sites using the Michigan Rapid Assessment Method (MiRAM), to quickly assess wetland functions and values regardless of ecological type.

Objective 6: Use full scale biological assessment of wetlands for resource management purposes. Develop and document wetland Indices of Biological Integrity (IBI's) and related methods.

Objective 7: In cooperation with other public and private agencies and organizations, provide for the evaluation of Michigan's most outstanding wetland resources, especially Great Lakes coastal wetlands, by supporting the long-term monitoring of coastal wetlands through the Great Lakes Coastal Wetlands Consortium and similar cooperative efforts.

Objective 8: Assess statewide wetland quality by establishing a routine Wetland Monitoring Program that parallels other basin-wide water quality monitoring and includes the National Wetland Condition Assessment (NWCA).

C. DESIGN OF MONITORING AND ASSESSMENT PROGRAM ELEMENTS

General Framework The USEPA has suggested the following three-tiered framework for the assessment and monitoring of wetland resources (United States Environmental Protection Agency, 2006).

3-Tiered Technical Approach	Products/Applications
Level 1 – Landscape Assessment Use GIS and remote sensing to gain a landscape view of watershed and wetland condition. Typical assessment indicators include wetland coverage (NWI), land use, and land cover.	• Status and Trends • Targeting restoration and monitoring • Landscape condition assessment • Integrated Reporting CWA 305(b)/303(d)
Level 2 – Rapid Wetland Assessment Evaluate the general condition of individual wetlands using relatives simple field indicators. Assessment is often based on the characterization of stressors known to limit wetland functions, e.g. road crossings, tile drainage, ditching.	• 401/404 permit decisions • Integrated Reporting • Watershed Planning • Implementation monitoring of restoration projects
Level 3 – Intensive Site Assessment Produce quantitative data with known certainty on wetland condition within an assessment area, used to refine rapid wetland assessment methods and diagnose the causes of wetland degradation. Assessment is typically accomplished using IBI's or HGM.	• WQS development, including use designation • Integrated Reporting • Compensatory mitigation performance standards • Verify Levels 1 and 2 methods

Michigan's program is now implementing all three levels recommended by the USEPA's monitoring approach. This framework is useful to organize the variety of wetland assessment and monitoring activities that are proposed, under development, and being used in Michigan. In this section, the defined objectives for Michigan's wetland assessment and monitoring effort are organized within the USEPA's recommended Level 1,2,3 framework.

LEVEL 1 Wetland Assessment and Monitoring Methods and Activities: Landscape Scale

Objective 1: Complete an inventory of Michigan's wetland resources that provides both basic resource information and a baseline for evaluating gains and losses over time.

Background: Michigan had three primary baseline map sources of statewide wetland data – the NWI conducted by the United States Fish and Wildlife Service (USFWS) through interpretation of aerial photos and topographic data (1979, NWI), land cover data as mapped by the Michigan Resource Inventory System Michigan Department of Natural Resources, through interpretation of aerial photographs (1979, MIRIS), and hydric soils as mapped by the United States Department of Agriculture, Natural Resource Conservation Service (Hydric Soils). These layers were informative, but have limited usefulness separately. In addition, Part 303, Wetlands Protection, of the NREPA, mandates the inventory of wetland resources on a county by county basis:

> "The department shall make or cause to be made a preliminary inventory of all wetlands in this state on a county by county basis and file the inventory with the agricultural extension office, register of deeds, and county clerk."
>
> -Section 30321, of the NREPA

Methods: The MDEQ compiled information from each of the three primary sources to prepare county wetland inventories using geographic information system technology. In accordance with the Part 303 requirements, the MDEQ held a public hearing and distributed information regarding completion of the inventory for each county, prior to finalization. Once completed, hard copies of inventory maps were distributed to legislators and local government agencies, as required in statue.

The completed inventory maps were integrated into the public MDEQ Web site in an interactive Geographic Information System (GIS) Web Viewer called the Wetlands Map Viewer. This system allows users to search for their specific area of interest, and pull up the completed inventory maps and the most up-to-date wetland map information available, ensuring that all internal staff and public/private partners have access to the same comprehensive wetland datasets. The MDEQ also offers county level maps in pdf and printed form upon request.

Current status: The MDEQ's WRD completed and certified inventories for all counties on January 1, 2007, and this baseline information is being used for evaluating gains and losses over time. Inventory maps are currently available to the public on the MDEQ Web site in the Wetlands Map Viewer, and printed copies are available upon request.

Objective 2: In order to support state and national no net loss and net gain goals for wetlands, cooperate in updating of NWI maps for use in status and trends reporting.

Background: Both state and federal agencies recognize a goal of "no net loss" of wetland quantity and quality, in various publications. In order to assess progress towards this goal, Michigan uses the NWI to measure and evaluate wetland losses at a statewide scale. In addition, this information can be used

to analyze trends of wetland losses over time. These tools can also be used to set goals for wetland restoration, and to measure increases in wetlands due to successful restoration.

State Goals **-**

Michigan has no not loss and net gain goals for wetlands since 1990, prior to creation of the MDEQ when the Wetlands Program was administered by the Michigan Department of Natural Resources (MDNR). In particular, this goal states "The Corps of Engineers and the Michigan Department of Natural Resources hereby agree that the regulatory programs which they administer should not contribute to wetland losses, should encourage the expansion and enrichment of wetland resources, and that a short term goal of no net loss of wetlands by either acreage or function should be established for these programs. Distinct from this regulatory goal, the Director of the Michigan Department of Natural Resources and the Michigan Natural Resources Commission have adopted a goal of restoring 500,000 acres of wetlands by the year 2000 as an additional effort to regain critical wetland resources that have been lost historically."

These state goals were reinforced in MDNR's identified "Conservation Needs to Address Wetland Modification Threats," which states a need to "strengthen current regulations and enforcement to encourage no net loss of wetland resources and reduce the rate of loss of natural wetlands," and in Michigan's State Wetland Conservation Plan which contains goals for the achievement of a net gain of wetlands, including the restoration of 500,000 acres of wetlands (10 percent of historic losses).

National Goals **-**

In 1977, President Jimmy Carter signed Executive Order 11990 into law. This order offered the first legal protection of wetlands, and required the federal government to "take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands."

Then, in 1987, a national goal of "no net loss" of wetlands was recommended by The National Wetland Policy Forum, a workgroup convened by The Conservation Foundation at the request of the USEPA. The two-part recommended goal was stated as follows:

> Interim goal: To achieve no overall net loss of the nation's remaining wetlands base.
>
> Long-term goal: To increase the quantity and quality of the nation's wetland resource base.

This goal was adopted in policy set forth by President George H.W. Bush in 1989, and subsequently expanded upon by President William Clinton in the 1998 Clean Water Action Plan, with the specification of a net gain goal of 100,000 acres of wetlands each year. President George W. Bush affirmed the national "no net loss" goal in 2002, and in April 2004 announced a specific goal to create, improve, and protect at least three million wetland acres over the following five years in order to increase overall wetland acres and quality.

In 2009, President Barak Obama began the Great Lakes Restoration Initiative (GLRI). This effort is guided by the GLRI Action Plan, which was developed by a task force of 11 federal agencies, and which addresses five priority focus areas for this funding. In particular, focus area four addresses wetlands and wetland restoration:

Focus Area 4: Habitat and Wildlife Protection and Restoration — includes bringing wetlands and other habitat back to life, and the first comprehensive assessment of the entire 530,000 acres of Great Lakes coastal wetlands to target restoration and protection efforts using the best science.

The GLRI established federal funding to be awarded to various federal, state, local, or regional agencies, tribes, universities, and other groups addressing the focus priorities in the GLRI Action Plan.

In the USEPA Strategic Plan 2011-2015, the USEPA also outlines a goal to increase wetlands in Objective 2.2: Protect and Restore Watersheds and Aquatic Ecosystems:

"By 2015, working with partners, achieve a net increase of wetlands nationwide, with additional focus on coastal wetlands, and biological and functional measures and assessment of wetland condition (2004 baseline; 32,000 acres annual national wetland gain)."

Methods: The MDEQ is currently using two data sets for evaluating status and trends: NWI and pre-settlement vegetation maps. Original NWI maps for Michigan are based on photographs from 1978-1981. In 2006, the MDEQ began a partnership with DU to update NWI for Michigan. The MDEQ, in partnership with DU, has now completed NWI updates for the entire state of Michigan based on 1998 Color Infra-Red Leaf-off Imagery and 2005 Natural Color Leaf-on Imagery. The MDEQ plans to conduct periodic statewide updates of NWI in future years.

In 1995, the Michigan Natural Features Inventory completed a digital inventory estimating vegetation in Michigan prior to European settlement based on General Land Office (GLO) surveys of the state. The GLO surveys in Michigan were conducted between 1816 and 1856, prior to the logging era, and provide good information regarding the overall vegetation and topographic features, including wetlands, present on the landscape at that time. From this inventory, the MDEQ has created a pre-settlement wetland dataset. This mapped information is extremely useful in evaluating wetland trends on a landscape scale, and for planning wetland restoration activities.

Current status: The updated NWI has given the MDEQ the ability to assess statewide wetland changes over time, and has led to completion of the MDEQ technical report *Status and Trends of Michigan's Wetlands: Pre-European Settlement to 2005* (2014).

Future Efforts: The MDEQ plans to conduct periodic statewide updates of NWI, in future years, and subsequent updates to the status and trends technical report. In addition, the MDEQ plans to improve tracking of wetland restoration activities statewide using this and other information.

Objective 3: Assess the effectiveness of Michigan's state-administered Section 404 Permit Program by tracking authorized wetland impacts and mitigation for those impacts, as well as documented unauthorized impacts and restoration measures.

Background: Part 303, Wetlands Protection, of the NREPA, clearly recognizes the public benefits provided by wetlands, and an ongoing evaluation of the effectiveness of Michigan's regulatory program will be a primary component of the MDEQ's Wetland Monitoring and Assessment Strategy. In accordance with the USEPA's Section 404 State Program Regulations at 40 CFR § 233.52, the MDEQ's WRD reports annually on actions taken under Michigan's state administered 404 Program. This report includes assessment of wetland impacts on a statewide scale, including information regarding:

- The cumulative impact of the state's permit program on the integrity of the state regulated waters;
- The number and nature of individual and general permits issued, modified and denied; and
- The number of violations identified and number and nature of enforcement actions taken.

Methods: Currently, the MDEQ tracks regulatory actions in two databases: the Coastal and Inland Water Permit Information System (CIWPIS) and Compliance. These databases contain information from approximately the past 25 years, almost covering the time period since Michigan assumed the Clean Water Act Section 404 regulatory authority. The MDEQ uses regulatory data from CIWPIS and Compliance to evaluate the effectiveness of the Wetlands Permit and Enforcement Program, however these databases have significant limitations, particularly in spatial tracking.

- *CIWPIS:* Tracking of gains and losses is accomplished primarily through CIWPIS and associated mitigation and conservation easement databases. These systems provide for tracking of proposed and actual losses associated with regulated activities, long term protection of wetlands remaining on project sites that are protected by permanent conservation easements (held by the MDEQ); and replacement of impacted wetlands by compensatory mitigation. Because of the limitations of geospatial tracking in CIWPIS, location information for impacts is limited to one square mile accuracy.
- *Compliance - Complaint Tracking System:* Many of the enforcement actions taken each year arise from complaints received from the public. The WRD has developed a statewide complaint tracking system to improve access to information regarding complaints and violations and to facilitate regulatory compliance. Each complaint, whether received from the public or generated by MDEQ staff, is logged into this system.

  This database allows field staff to closely monitor complaints and track the status of ongoing enforcement actions (which may proceed over a period of months or years). It also allows law enforcement staff in the MDEQ and MDNR to coordinate with WRD staff and with each other. Moreover, the system provides valuable information to MDEQ management for decision-making and policy direction, by providing an overview of the Division's enforcement efforts and overall effectiveness.

Even though CIWPIS and Compliance are approximately 25 years old, they are a rich source of data on regulated water resource impacts since establishment of state water resource protection programs. Furthermore, data from CIWPIS and Compliance in the initial stages of being transferred to a new database and converted for use in a GIS environment. This step forward will allow a number of advancements in the methods the WRD uses to evaluate cumulative impacts under its Section 404 Program. Tracking of project sponsor (private, public, transportation, etc.), impacts to specific waterbodies over time, project type (fills, seawalls, dredging, etc.), in a spatial context will give the WRD new abilities to evaluate gains/losses, and program goals throughout the state.

Current Status: The MDEQ is currently working under a USEPA Wetlands Program Development Grant to develop a new, comprehensive database for tracking regulatory actions in a GIS-based format. This new database, to be called MiWaters, will allow the MDEQ to integrate existing databases (such as CIWPIS and Compliance), to efficiently process permit applications, enable electronic application filing, electronic filing of data, and system-provided compliance assistance.

Future Efforts: The ability to track individual and cumulative impacts, both spatially and temporally, in MiWaters, will significantly improve our ability to assess the effectiveness of Michigan's Section 404

Program, and help guide the regulatory program in the future. MiWaters will also provide capability for more detailed cumulative impact analysis at a regional or local scale. We anticipate completion of this new database in 2015.

Objective 4: Apply Landscape Level wetland assessment methods to support the protection, management, and restoration of wetlands on a watershed scale.

Background: Wetlands are an integral component of the aquatic resources of a watershed, and the status of these resources should be considered during the preparation and implementation of nonpoint source watershed management plans. Wetland protection, restoration, and enhancement should be significant components of watershed management programs.

To encourage the consideration of wetland resources in the planning process, staff of the MDEQ's WRD, participate in watershed planning projects, to incorporate wetland protection, management, and restoration goals. The primary tool the WRD uses in watershed planning projects is the Landscape Level Wetland Functional Assessment (LLWFA). This tool uses a variety of existing and historical data sources, in conjunction with wetland functional classification techniques, to evaluate the status and trends of wetlands within a watershed over time. This tool can identify portions of a watershed where wetland loss has resulted in the loss of specific functions, or where remaining wetlands are providing functional value in the watershed. This information can guide watershed management decisions, including wetland preservation and restoration decisions, on a local or regional scale.

Methods: Landscape Level Functional Wetland Assessment involves the completion of five primary tasks:

1. Spatial Data Collection and Integration

    - Collection and integration of all GIS spatial data for the watershed including NWI, National Hydrography Dataset (NHD), Digital Raster Graphic (DRG) topography and Digital Elevation Data (DEM), Soil Survey Geographic (SSURGO) Soil Surveys, National Aerial Photography Program (NAPP) 1988 imagery and National Agriculture Imagery Program (NAIP) 2005 and 2010 imagery, Michigan Center for Geographic Information (CGI) Framework Data, Michigan Natural Features Inventory (MNFI) Land Cover circa 1800, Darcy Groundwater Movement Model data, and the MNFI Biorarity Index.

2. Classification and Enhancement of NWI data with landscape position, landform, water flow path, and waterbody type (LLWW) descriptors

    - Classification of the NWI polygons using Hydrogeomorphic (HGM) LLWW Descriptors – Landscape position, Landform, Water Flow Path, and Waterbody type – according to the methodology outlined in USFWS publication "Dichotomous Keys and Mapping Codes for Wetland Landscape Position, Landform, Water Flow Path, and Waterbody Type Descriptors" (2003). The classification is manually completed for each polygon by a trained interpreter in accordance with the "Landscape Level Wetland Functional Assessment (LLWFA) Methodology Report" which was completed by the MDEQ and submitted to the USEPA as a final grant product in 2011.

    - Rivers, lakes, and ponds present in the NWI spatial data are classified in terms of waterbody type, and waterflow path.

3. Functional Correlations and Assessment

    - Correlating the HGM-coded NWI polygons with the functional correlations prepared by the MDEQ with input from an advisory council. Thirteen total functions are manually evaluated in this Watershed-based Preliminary Assessment of Wetland Functions (W-PAWF) approach: (1) Flood Water Storage, (2) Streamflow Maintenance, (3) Nutrient Transformation, (4) Sediment and Other Particulate Retention, (5) Shoreline Stabilization, (6) Fish Habitat, (7) Stream Shading, (8) Waterfowl and Waterbird Habitat, (9) Shorebird Habitat, (10) Interior Forest Bird Habitat, (11) Amphibian Habitat, (12) Conservation of Rare and Imperiled Wetlands and Species, (13) Ground Water Influence. Many of the criteria were initially developed by Ralph Tiner from the USFWS, while others were developed by the MDEQ in order to adapt this method to Michigan. The criteria were refined by an advisory group called the LLWFA Advisory Council, which was comprised of Michigan biologists, wetland specialists, and others to specifically focus on the characteristics of Michigan wetlands. Two new functions have recently been developed, and will be included in future assessments: (14) Carbon Sequestration, and (15) Pathogen Retention.

4. LLWFA Watershed Report

    - The wetland spatial data produced as a result of this work is used to develop printed maps highlighting wetlands of significance by function, as well as restoration areas, and basic mapping capability. Some of the maps provided to watershed groups include wetland extent circa Pre-European Settlement, wetland extent circa 2005, and predicted wetlands of significance for the 13 functions.

    - In addition, this spatial data is compiled into a customized GIS tool that presents the full set of information generated during the LLWW classification, functional correlations, and all source data used to complete the effort. This mapping tool allows for customized map creation utilizing aerial photography, hydrography, and any other relevant data to be overlain and utilized along with the wetland information. This free GIS product gives users the freedom to utilize the data for creation of maps intended for site specific application. Given the high cost of GIS software, and the expertise necessary to operate a comprehensive GIS, this particular piece of the LLWFA effort is a simple, valuable, and informative tool to local planning groups that are too often short of resources, monetary and otherwise.

    - A status and trends document contrasting Pre-European Settlement wetlands to 2005 wetlands is created for each watershed, along with a final statistical report which illustrates approximate functional loss, wetland loss, and general information on how the LLWFA work was completed.

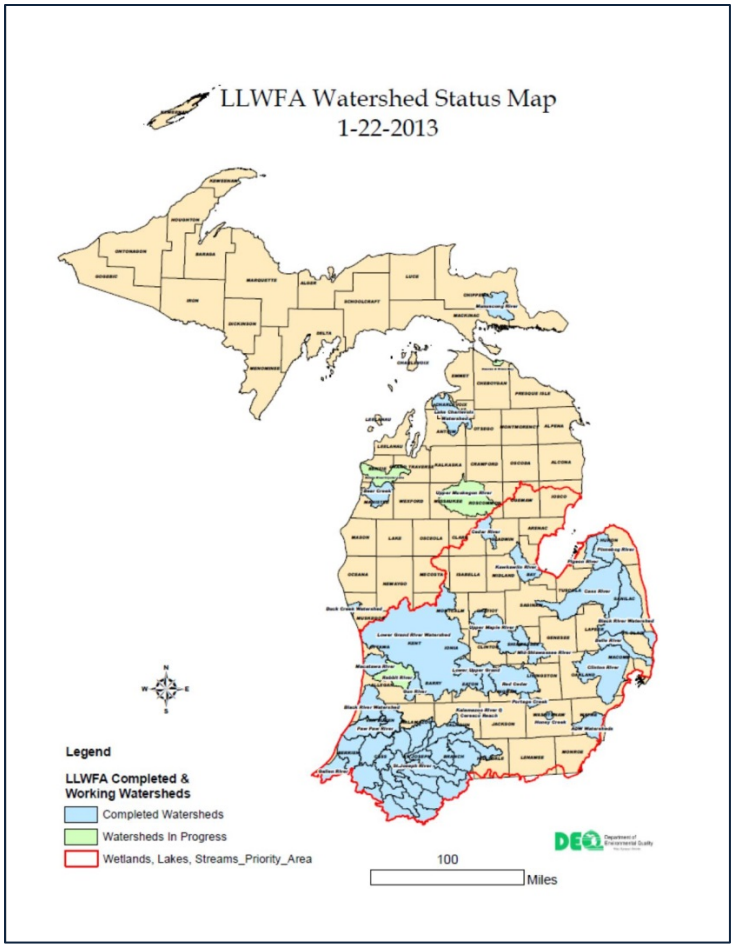
5. Training and Outreach

- Presentation of the LLWFA results to watershed groups and other interested organizations, as well as in-depth training given to stakeholders likely to utilize this type of tool for prioritizing wetland restoration/preservation. The training is especially helpful for development of a watershed management plan, as well as development of educational tools for local stakeholders on the functions and values of wetlands.

Current status: Initially, the LLWFA work was implemented through a partnership effort within the MDEQ'S WRD staff in the WLSU and the Nonpoint Source (NPS) Unit. When watershed management projects were given a grant through the NPS Program, the WLSU staff would work with the grantee to complete LLWFA in the target watershed, and provide the grantee with the report and GIS tool for use in development and implementation of the watershed management plan. This process was conducted on a watershed by watershed scale, and is ongoing at this time. In recent years, WRD staff have received USEPA Wetlands Program Development Grant funds to target other large and priority watersheds for LLWFA, particularly in regions where there are longstanding and enthusiastic stakeholder groups to engage in partnerships.

Future Efforts: The MDEQ will continue LLWFA through targeted stakeholder partnerships and coordination with the NPS Program, with a long-term goal of completing the LLWFA for the entire state of Michigan within approximately five years. The map below (Figure 1) shows the watersheds completed, and currently underway, at this time.

WRD staff is also engaging in discussions with federal agencies, including United States Geological Survey, and the National Oceanic and Atmospheric Administration (NOAA), on the feasibility of collecting high resolution topography data known as LiDAR. If LiDAR imagery becomes available for the whole state, WRD staff could drastically reduce the manual labor for this work by automating the LLWFA process. This would allow the WRD to complete LLWFA analysis for the entire state within approximately two years.



<u>Figure 1</u> shows the watersheds that have been completed, or are currently underway, for the Landscape Level Wetland Functional Assessment (LLWFA), as of January 22, 2013.

LEVEL 2 Wetland Assessment and Monitoring Methods and Activities: Rapid Wetland Assessment

Objective 5: Evaluate individual wetland sites using the MiRAM, to quickly assess wetland functions and values, regardless of ecological type.

Background: The MDEQ's WRD has developed the MiRAM for routine use in the evaluation of wetland sites. This method evaluates the extent to which a given site provides the public benefits, functions, and values, that are listed in Part 303, Wetlands Protection, of the NREPA. In developing the MiRAM, the MDEQ drew from other rapid assessment methods in use in the Great Lakes region, in particular the Ohio Rapid Assessment Method, as well as assessment procedures from Michigan (e.g. the *DNR Manual for Wetland Evaluation Techniques – Operational Draft [*circa 1980] and the *Floristic Quality Assessment: State of Michigan*). The MDEQ also relied on advice from a panel of expert advisors, including scientists who have developed IBIs for various wetland types in Michigan (see Level 3).

Development of MiRAM included the following tasks:

- Evaluation of existing assessment methods including those identified above as well as rapid assessment methods from other Great Lakes states and the country.
- Adaptation of existing wetland assessment methods into a draft procedure suitable for use in Michigan, guided by the findings of recent biological assessment studies in Michigan.
- Formation of a workgroup for discussion and review of draft methods consisting of researchers, WRD field staff, and other appropriate entities.
- Development of full documentation of the method, including a fully referenced handbook for regulatory staff, as well as reporting forms in a convenient format.
- Field testing of the draft method in wetland sites representing variations in wetland condition, comparing results with other methods; and revision as necessary.
- Training of WRD field staff followed by pilot use under typical regulatory conditions.
- Development of data storage methods.

The MiRAM method was developed and field tested between 2004 and 2009. WRD field staff was trained on MiRAM v1.3 during the 2008 and 2009 growing seasons. Some minor revisions were made after these trainings and the initial year of field use, prior to the finalization of MiRAM v2.0 in 2010.

The Wetland Advisory Council (WAC), formed in 2009 consisting of 21 stakeholder representatives, was charged with evaluating Michigan's Wetlands Program, including the potential use of MiRAM in the Michigan's regulatory program. After significant consideration and analysis, the WAC made recommendations on the appropriate use of MiRAM in the regulatory process, in the August 2012 Final Report:

> "The Council recommends that: 1) the MDEQ use Michigan Rapid Assessment Method (MiRAM), and other scientific methods for wetland monitoring, for evaluating potential preservation sites, and as one tool when there is a dispute regarding the benefits derived from a wetland (e.g., functions and values or quality of a wetland); 2) the MDEQ continues to develop MIRAM as a tool to be used by staff and consultants, and work with the MiRAM Development Committee to further calibrate the

method and provide future training; 3) MiRAM is used when a permit applicant requests its use as a potential tool to resolve a disagreement between MDEQ staff and a permit applicant or consultant; and 4) that the MDEQ establishes a database which documents the use of MiRAM on individual permit applications by staff and/or consultants and that such a database be shared with stakeholders as part of a program review before additional implementation."

Methods: The MiRAM includes the following metrics:

- *Wetland size*: acreage of the site and amount of wetland remaining in the area.
- *Upland buffers and surrounding land use*: intensity of surrounding land use; width of upland buffers.
- *Hydrology*: sources of water; connectivity; duration of inundation or saturation; modifications to natural hydrologic regime.
- *Habitat alteration or development*: substrate disturbance; habitat development; habitat alteration.
- *Special wetland communities*: identification of unusual ecological types.
- *Vegetation, Interspersion, Microtopography***:** wetland vegetation communities; horizontal community interspersion; presence of invasive species; microtopography.
- *Scenic and recreational benefits*: public benefits associated with wetlands.

Current Status:

Regulatory uses in preservation/mitigation, violations:

The MDEQ's WRD staff has been trained in MiRAM, and use MiRAM as one tool for helping to evaluate the functions and values provided by a wetland in regulatory reviews. The MiRAM is not performed on most sites, but is used when additional functional assessment of a site is necessary. Typically, MiRAM is used in the regulatory process on sites proposed for preservation as mitigation, or to assess wetlands involved in or adjacent to violations. The results of MiRAM in these instances can provide insight for MDEQ staff regarding the functions of the specific wetland, and can ensure a thorough review of the wetland size, buffer and surrounding land use, hydrology, habitat condition, community type, vegetation, structure, and scenic and historical benefits of the site. The MiRAM does not result in a regulatory decision, but may be used in conjunction with other pertinent information to inform a regulatory decision.

In addition, the regulated community and private wetland consultants are using MiRAM in some situations. When searching for high-quality and high-functioning wetlands for preservation or to prioritize for restoration, wetland consultants often use MiRAM. The results of these MiRAM assessments are sometimes, but not always, submitted to the WRD. To date, there has not been a MiRAM training offered for private wetland consultants, and as such there are many consultants who are not sufficiently trained in this method. The MDEQ's WRD hopes to offer a training in MiRAM at some point in the future, based on funding and MDEQ priorities.

Intensification – Coastal Wetlands:

Because MiRAM was designed and tested with a focus on inland wetlands, Michigan applied for and received a USEPA Wetlands Program Grant in 2010, to conduct an Intensification of the NWCA for coastal wetlands. This project allowed analysis of the functionality of MiRAM on coastal wetland sites by comparing results to the intense bio-assessment protocol results for Great Lakes coastal wetlands.

At the time field work began for this project, the NWCA protocols were not yet finalized, so the project implemented protocols for fish, invertebrates, vegetation, and water chemistry outlined in the Great Lakes Coastal Wetland Monitoring Plan (Great Lakes Coastal Wetland Consortium, 2008), which was developed by the Great Lakes Coastal Wetland Consortium. This project was conducted in partnership with CMU, with field sampling throughout the 2010, 2011, and 2012 field seasons. The results of this project provide an assessment of the functionality of MiRAM on Great Lakes Coastal Wetlands, as well as Level 2 monitoring results for 75 coastal wetlands along the Michigan coast of Lakes Michigan and Huron. The final report for this project was complete in 2013.

Future Efforts: The MDEQ plans to implement Level 2 monitoring using MiRAM, stratified by ecoregion and wetland type, on a five-year cycle, in order to assess the status and trends of wetland quality and function on a statewide scale. Michigan plans to conduct MiRAM at all sites sampled as part of the state-wide Level 3 Intensive Site Assessment, as well as the NWCA cycles, in order to build our database of MiRAM scores and to provide long-term data on the status and trends of Michigan's wetlands. In future years, Michigan will review and update to MiRAM, as appropriate.

The MiRAM results will provide a greater regional resolution of assessment results than the Landscape Level work, but will require significantly less staff time and fiscal resources to obtain data than the Level 3 Intensive Site Assessment. Long-term funding sources for this effort are still being sought, and may include federal and state grants, or Coastal Zone Management Program funding.

The MDEQ has developed a GIS-based database structure for storage and management of MiRAM monitoring results. The entry of MiRAM data into this system, as well as association of the data to specific sampling points in the GIS system, is ongoing at this time. The long-term plan for this system is integration into MiWaters and the online Wetlands Map Viewer, in order to provide relevant and accessible wetland monitoring information to MDEQ staff as well as the public and stakeholder groups.

Level 3 Wetland Assessment and Monitoring Methods and Activities:

Intensive Site Assessment

Objective 6: Use full scale biological assessment of wetlands for resource management purposes. Develop and document wetland IBIs and related methods.

Background: In Michigan, indicators have been developed primarily by staff from Michigan State University (MSU) and CMU, in cooperation with the state and federal resource agencies. Specifically, partnership and coordination over several years in the early 2000's led to development of the 2009 *Manual for Bioassessment of Great Lakes Coastal Marshes* (Uzarski, Burton, & Albert, 2009), which includes the IBIs for invertebrates, fish, and vegetation in Great Lakes Coastal Wetlands, and the 2009 manual *Ecology and Bioassessment of Michigan's Inland Wetlands* (Burton, Uzarski, & Albert, 2009), which includes the IBIs for invertebrates and vegetation in inland wetlands, by Dr. Donald Uzarski of CMU and Dr. Thomas Burton of MSU. CMU has also been a partner on development of a long-term wetland monitoring site selection plan, as well as assisted with statistical analysis of wetland monitoring results for various projects. Significant funding in support of development of these indicators was provided to Michigan through the USEPA State Wetland Grant Program.

Methods: Development of bioassessment procedures requires thorough field characterization of a particular wetland ecosystem type, and identification of attributes that may be used to evaluate the biological integrity of each site. For example, the process for development of depressional wetland IBIs was summarized by MSU staff as follows:

> IBI development requires data on responses of attributes of wetland biota to specific disturbances or types of pollution. If these attributes change in a predictable manner along a gradient of increasing disturbance/pollution, they become useful as metrics in an IBI. In the first phases of this project, we collected data on potential biotic metrics from depressional forested wetlands experiencing a continuum of disturbance from reference conditions (undisturbed and unpolluted or systems with the least amount of disturbance/pollution possible in a region) to severely degraded conditions with known sources of disturbance/pollution. The ability to link sources and magnitude of pollution/disturbance to specific biotic responses is an integral part of IBI development. The overall objectives of this research are to collect basic data on plants, invertebrates, fish, and amphibians for subsets of reference and impacted wetlands in various ecoregions of the state and to use these data to develop bioassessment procedures.

Statewide biological indicators published in the *Great Lakes Coastal Wetland Monitoring Plan* (Great Lakes Coastal Wetland Consortium, 2008), developed by the Great Lakes Coastal Wetland Consortium in 2008:

- Invertebrate IBI for Great Lakes Coastal Wetlands
- Fish IBI for Great Lakes Coastal Wetlands
- Amphibian IBI for Great Lakes Coastal Wetlands
- Bird IBI for Great Lakes Coastal Wetlands
- Vegetation IBI for Great Lakes Coastal Wetlands

Statewide biological indicators which have been developed for Inland Wetlands:

- Invertebrate IBI for Inland Wetlands (provisional, 2009)
- Vegetation IBI for Inland Wetlands (provisional, 2009)

National chemical/physical/biological indicators for wetlands, used in the 2011 NWCA:

- Vegetation
- Soils
- Hydrology
- Algae
- Water quality
- Landscape/buffer

Current Status: In 2008, the *Great Lakes Coastal Wetland Monitoring Plan* (Great Lakes Coastal Wetland Consortium, 2008) finalized the protocols and methods for monitoring of coastal wetlands, as outlined above. The invertebrate and vegetation protocols for Michigan's inland wetlands, listed above, were outlined in the manual *Ecology and Bioassessment of Michigan's Inland Wetlands* (Burton, Uzarski, & Albert, 2009). In 2011, the NWCA finalized protocols and methods for use in all wetlands, as outlined above. As protocols are modified and refined for future field sampling years as part of the NWCA (2016, 2021, etc.), Michigan will update and implement the revised protocols.

Future Efforts: Over the next two years, the MDEQ will continue to collaborate with CMU and partners to improve the IBIs for inland wetlands, as well as evaluate and assess the effectiveness of the existing IBIs. The IBIs for coastal and inland wetlands will be updated as necessary, in the future. We will explore the application of monitoring results to inform regulatory decisions and other application of this information in Michigan's Wetlands Program. Michigan will also explore opportunities for identifying reference wetlands sites for long-term monitoring and research efforts.

Objective 7: In cooperation with other public and private agencies and organizations, provide for the evaluation of Michigan's most outstanding wetland resources, especially Great Lakes coastal wetlands, by supporting the long-term monitoring of coastal wetlands through the Great Lakes Coastal Wetlands Consortium and similar cooperative efforts.

Background: The Great Lakes Coastal Wetlands Consortium consisted of scientific and policy experts drawn from key U.S. and Canadian federal agencies, state and provincial agencies, non-governmental organizations, and other interest groups with responsibility for coastal wetlands monitoring. Approximately two dozen agencies, organizations and institutions were brought into the Consortium as Project Management Team members. In addition, other members were brought in to participate on small project teams, which addressed discrete project elements and pilot studies. The Great Lakes Coastal Wetlands Consortium was coordinated by staff at the Great Lakes Commission (GLC) in Ann Arbor, Michigan and funded by the USEPA Great Lakes National Program Office in Chicago, Illinois.

In order to design an implementable, long-term program to monitor Great Lakes coastal wetlands, indicators were developed to assess the condition of Great Lakes coastal wetlands. Indicators were selected through the State of the Lake Ecosystem Conference (SOLEC) process and further refined based on scientific investigation and pilot studies. Indicators were selected, field tested, and published by the GLC in the *Great Lakes Coastal Wetlands Monitoring Plan* (Great Lakes Coastal Wetland

Consortium, 2008). A classification and inventory of coastal wetland resources for the entire Great Lakes basin has also been completed.

In 2010, a large cooperative group of researchers, led by CMU and including 12 other universities and government agencies, from throughout the Great Lakes basin partnered to obtain a $10 million GLRI grant to fund five years (2011-2015) of coastal wetland monitoring, using the Great Lakes Coastal Wetlands Monitoring Plan indicators. This grant award also funded the development of a database which is being used to store the monitoring data for this project, basin-wide. The MDEQ is a partner on this project, responsible for coordinating and promoting education and outreach efforts to the other Great Lakes state, federal, and tribal agency wetland resource managers. The goal of this outreach is to ensure the monitoring results are accessible, useful, and meaningful to guide improved wetland resource management, throughout the Great Lakes.

Methods: Intensive, quantitative assessment of wetland condition typically requires the development of state or regional protocols. In the Great Lakes region, the *Great Lakes Coastal Wetland Monitoring Plan* (Great Lakes Coastal Wetland Consortium, 2008), outlines chemical/physical and biological indicators for monitoring of coastal wetlands. Specifically, indicators for water chemistry, vegetation, invertebrates, fish, amphibians, birds, and landscape based indicators are outlined in this document. For additional information on the Great Lakes Coastal Wetland Consortium and access to the *Great Lakes Coastal Wetland Monitoring Plan* (Great Lakes Coastal Wetland Consortium, 2008), refer to the following GLC Web site: glc.org/wetlands/final-report

Current Status: The GLRI funded cooperative effort to implement basin-wide Great Lakes coastal wetland monitoring, led by CMU, will be completed in 2015. The results from this large cooperative effort will be stored on a publicly accessible GIS-based database managed by CMU. Data will be downloadable to public agencies, such as state, federal, or tribal agencies, and viewable to the public and other groups. This project represents a large-scale effort to establish an ongoing coastal wetland monitoring program, across state and federal boundaries. For additional information on the GLRI-funded Great Lakes coastal wetland monitoring project, and access to the database, refer to the following Web site: www.greatlakeswetlands.org.

Future Efforts: Plans are underway to secure long-term funding to continue this Great Lakes coastal wetland monitoring effort beyond the 2015 project end date. The MDEQ will continue to partner on this effort, and promote the access and use of the monitoring results. We intend to explore expanded collaborative efforts with the partners on this project, as well as potential additional partners. To the extent that funding is available, it is our intent to support this effort, including the exploration of federal grants and other funding sources.

Objective 8: Assess statewide wetland quality by establishing a routine wetland monitoring program that parallels other basin-wide water quality monitoring and includes the NWCA.

Background: In 1997, the MDEQ finalized the first version of the state's surface water quality monitoring strategy, entitled *A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters.* This document established the four goals of the Surface Water Monitoring Program:

- Assess the current status and condition of individual waters of the state and determine whether standards are being met;
- Measure temporal and spatial trends in the quality of Michigan surface waters;
- Provide data to support MDEQ water quality protection programs and evaluate their effectiveness; and
- Detect new and emerging water quality problems.

This document outlined monitoring objectives and techniques for evaluation of Michigan's rivers, streams, inland lakes, and the Great Lakes. Wetlands were not specifically addressed in this document.

In 2005, the MDEQ updated the surface water monitoring strategy in the document *Michigan Water Quality Monitoring Strateg* . This strategy expanded and refined the objectives and techniques for monitoring Michigan's rivers, streams, inland lakes, and the Great Lakes. Again, wetlands monitoring was not included in this document.

The MDEQ initially completed the *Michigan Wetland Monitoring and Assessment Strategy* in January 2009, as a supplement to the *Michigan Water Quality Monitoring Strategy*. This document outlined objectives and goals for wetland monitoring at three levels, following the structure outlined in the USEPA document *Application of Elements of a State Wetland Monitoring and Assessment Program*.

In 2009, the MDEQ received a USEPA Wetland Program Development grant to update the *Michigan Wetland Monitoring and Assessment Strategy*, as well as to draft a report on the status and trends of Michigan's wetlands. This document, the 2014 update of the *Michigan Wetland Monitoring and Assessment Strategy*, was prepared using several products of past USEPA grants, specifically the final report for development of the LLWFA(2013), the final report for the development of MiRAM as well as the MiRAM User's Manual (2010), the wetland monitoring manuals prepared by CMU and MSU *Manual for Bioassessment of Great Lakes Coastal Marshes* (Uzarski, Burton, & Albert, 2009) and *Ecology and Bioassessment of Michigan's Inland Wetlands* (Burton, Uzarski, & Albert, 2009), and the Great Lakes Coastal Wetlands Consortium's *Great Lakes Coastal Wetlands Monitoring Plan (2008)*.

Between 2010 to 2012, the coastal wetland IBIs were used as part of the MDEQ's Intensification of the NWCA, which collected fish, invertebrate, water chemistry, and vegetation data, as well as a MiRAM score, for 75 Great Lakes coastal wetlands. CMU was the partner on this project, and collected and analyzed all of the IBI data for these sites, as well as conducted the statistical analyses for this data and the MiRAM scores.

Methods: Our long-term goal is to establish a consistent five-year cycle of Level 3 wetland monitoring projects, with random selection of wetland polygons stratified by ecoregion and wetland type. We plan to partner on development of a statistically robust sampling design so that wetland condition results can be analyzed statewide and by wetland type and region, and be compatible with the NWCA. This sampling design will include resampling sites throughout the monitoring cycle, to enable Michigan to explore trends analysis in the future. Monitoring will include collection of vegetation and invertebrate data from both inland and coastal wetlands, and fish and water chemistry data when possible. Monitoring will follow the protocols outlined in the 2009 manuals, developed by CMU and MSU. The MDEQ will conduct NWCA protocols for all wetlands sampled as part of the NWCA, and will evaluate the feasibility of implementing some or all of the NWCA protocols for NWCA Intensification sites.

Current Status: At this point, the MDEQ has developed a framework for all levels of wetland monitoring, but reliable and appropriate funding, and completion of this update of the *Michigan Wetland Monitoring and Assessment Strategy* have slowed progress towards consistent implementation of routine wetland monitoring. The monitoring efforts to date have been conducted through targeted grant projects, and through partnership with universities and other agencies.

In 2011, the USEPA conducted a national survey of wetland condition. The purpose of the survey was to produce a statistically valid report on biological condition and integrity of wetland resources on a regional and national level. Michigan partially participated in the 2011 NWCA by attending planning meetings, commenting on potential indicators, and participating in the survey by providing our soil scientist as one crew member of

the field team. The MDEQ also conducted an intensification study, which surveyed additional coastal wetlands in Michigan using Great Lakes Coastal Wetlands Monitoring Plan protocols, and the MiRAM.

The MDEQ continues to participate in the National Wetland Monitoring and Assessment Work Group (NWMAWG) bimonthly conference calls and/or webinars. In addition, the MDEQ continues to participate with internal coordination meetings with other surface water monitoring units working on stream and lake monitoring efforts, to engage in cross-training exercises, and coordinated monitoring efforts as appropriate.

Future Efforts*:* The MDEQ plans to implement Level 3 monitoring, using IBIs for coastal wetlands and inland wetlands and NWCA protocols as appropriate, in future monitoring efforts. The MDEQ will apply for USEPA WPD grants, and for any NWCA Intensification grants that may be available, in order to establish a statewide, five-year intensive Wetland Monitoring Program.

In addition, Michigan plans to incorporate monitoring of invasive species, in accordance with the *Aquatic Invasive Species State Management Plan* (Michigan Department of Environmental Quality, 2013), goals and objectives, as well as monitoring climate change indicators and impacts in wetlands in accordance with the *Climate Change Adaptation Plan for Coastal and Inland Wetlands in the State of Michigan* (Association of State Wetland Managers, 2012), when scientific-based protocols have been developed and tested by the academic community, or other state, federal, or regional agencies.

D. CORE AND SUPPLEMENTAL WETLAND QUALITY INDICATORS

The MDEQ will use a 3-tier approach with the methods and indicators outlined in our eight objectives to ensure that national and state goals for no net loss are met. State, regional, and federal no net loss/net gain goals for wetlands were reviewed under Objective 2. The net gain or loss of wetland quantity and quality is a primary indicator of the overall condition of the states wetland resources.

The USEPA Region 5, Water Division and Great Lakes National Program Office; the MDEQ; and resource agencies from the other Region 5 states have worked together to develop a set of shared Regional water *goals, milestones*, and associated environmental *indicators*. On December 11, 2001, each of these organizations signed a Joint Commitment to Achieve Shared Water Goals which documents our commitment to the goals.

Of the five water quality goals, one directly addresses wetland concerns:

> *Goal 5: The quantity and quality of critical aquatic habitat in Region 5, including wetlands, will be maintained or improved.*

Indicators of wetland quality have been developed, as described in a number of different components of this strategy, including:

> **IBIs**. Development of IBIs includes both definition of reference condition for the wetland type of interest, and development of a suite of indicators (the index) to provide a means of evaluating wetland condition in response to stressors.
> **Michigan Rapid Assessment Method for wetlands (MiRAM)**. Rapid Assessment also uses a suite of indicators to provide a "snapshot" of the condition of a particular wetland site, and its ability to provide the public benefits listed in Michigan's wetland law.
> **Great Lakes Coastal Wetlands Indicators.** Great Lakes Coastal Wetland monitoring incorporates the suite of indicators recommended by the Great Lakes Coastal Wetlands Consortium in the Great Lakes Coastal Wetland Monitoring Plan (Great Lakes Coastal Wetland Consortium, 2008) to contribute to this long term, basin-wide initiative.

<u>Future Needs</u>: Refinement of the framework for defining wetland condition on a statewide scale, taking into account information gathered through various levels of monitoring and assessment activities.

E. QUALITY ASSURANCE

The MDEQ has prepared a Quality Management Plan (QMP) which provides the framework for the MDEQ "to ensure that environmental programs and decisions are supported by data of the type and quality needed and expected for their intended use, and that decisions involving the design, construction, and operation of environmental technology are supported by appropriate quality assured engineered standards and practices."

MDEQ Quality Assurance Policy The MDEQ's QMP establishes the methods, policies, and procedures to ensure that environmental programs and decisions are supported for their intended use, and that the decisions involving the design, construction, and operation of environmental technology are supported by appropriate quality assured engineering standards and practices.

The MDEQ is committed to ensuring that all environmental data collected or used are of the type and quality needed to meet the intended use. The QMP outlines the process the MDEQ follows; it includes development and approval of a project-specific Quality Assurance Project Plan (QAPP) before monitoring can be implemented. This requirement applies regardless of funding source (state, private, federal), whether the monitoring is paid for with grant funds or provided as match. All pass-through grant contracts contain detailed work plans that require the development and approval of QAPPs and reflect state and federal quality system requirements.

For example, monitoring by MSU and Grand Valley State University during the development of wetland IBIs has proceeded under a QAPP approved by the USEPA. We will develop appropriate QAPPs for future efforts, as new monitoring protocols are developed, or for watershed or basin level monitoring, as appropriate.

F. DATA MANAGEMENT

Michigan manages data used for wetland monitoring through a variety of different databases and GIS systems, which store information on wetland type, location, habitat characteristics, as well as other information. Most of these databases were created for purposes other than wetland monitoring, prior to the establishment of Michigan's Wetland Monitoring and Assessment Program. Because of this, we continue to work on linking, and synchronizing information from all relevant databases as part of our program.

Wetland Inventory and Geographic Information: The MDEQ's WRD has developed Geographic GIS on wetland resources, and has dedicated considerable time developing an internet-based environment in which to share and distribute this information. County wetland inventories, Michigan's pre-settlement wetland inventory, potential wetland restoration areas, and similar information are now collectively housed in an online GIS system called 'Wetlands Map Viewer' (available on the MDEQ's Wetlands Web page www.michigan.gov/wetlands). Updates to NWI data, including trend analyses, will also be included in the MDEQ's Wetlands Web page. This advance will provide the regulated and non-regulated communities in Michigan an interactive tool for stakeholders to learn more about the changes in wetland resources, at whatever scale they are interested in. The trends data on a regional scale can provide guidance and focus to conservation and restoration groups, planning agencies, wildlife managers, and development groups.

Furthermore, completion of NWI updates through 2005 supported the 2013 status and trends analysis, documented in the report entitled *Status and Trends of Michigan's Wetlands: Pre-European Settlement to 2005*. This documents analysis of wetland status and trends in Michigan since pre-European settlement, and including the period during which Michigan's statewide and federal wetland regulations have been in effect. With the recent completion of this report, and the expansion of spatial tracking of regulatory gains and losses, the next step is the integration of both regulatory impacts and non-regulatory wetland monitoring and assessment activities in Michigan so that they are viewable in a single GIS-based database.

Regulatory Program: The MDEQ's WRD currently manages regulatory data through a number of linked databases. These include the following.

- *Coastal and Inland Water Permit Information System (CIWPIS)* - All applications for wetland permits are entered into this database. Information that is tracked includes the acreage of the wetland impact requested by the applicant; the acres of impact authorized by a permit if issued; and the acreage of mitigation required by permit conditions. If mitigation is required, links are established to the mitigation tracking system, which provides longer term tracking of mitigation activities, and to the conservation easement database.

  CIWPIS also provides for tracking of documents included in individual permit files, including on-site wetland assessments, NREPA documents, and wetland delineation reports. As of June 1, 2000, the public was provided access to information regarding the status of permit applications through the internet version CIWPIS.

- *Compliance Tracking System* – This is the primary database for tracking complaints and confirmed violations. Like CIWPIS, it tracks the acreage of wetland impact, and wetland acreage restored or provided as mitigation following a successful enforcement action.

- *Mitigation Tracking System* – Linked to CIWPIS, this secondary database compiles detailed information regarding mitigation sites, supporting both long term follow up of permit conditions and evaluation of the success of mitigation. Financial assurances to guarantee completion of mitigation projects are also tracked through this system. Some components of this database are still being refined.

- *Easement Tracking Database* – Also linked to CIWPIS and to the mitigation tracking system, this is a secondary database to ensure proper recording of conservation easements offered during the permit process, and to provide a long term record for real estate purposes of conservation easements obtained by the MDEQ. At this time, most conservation easements are provided to protect wetland mitigation sites (5,480 acres to date), or to protect those wetlands that are avoided on a particular site during the permit process (20,720 acres to date). The MDEQ currently holds 1,732 easements over more than 26,200 acres of wetland and integral habitat in Michigan.

- *MiWaters* - As mentioned earlier in this document, the MDEQ is currently working to develop a new, comprehensive database for tracking regulatory actions in a GIS-based format. This new database, to be called MiWaters, will allow the MDEQ to integrate the existing databases (including CIWPIS, Compliance, Mitigation, Conservation Easements, etc.), to efficiently track regulatory actions on individual and cumulative impacts, both spatially and temporally. This new database will significantly improve our ability to monitor and assess impacts through Michigan's Section 404 Regulatory Program. MiWaters is planned for release in 2015.

Wetland Monitoring: In the last year, the MDEQ's WRD has developed a pilot GIS-based wetland monitoring database. This system tracks the results of Level 2 and Level 3 wetland monitoring efforts conducted by the MDEQ and partners, since 2010. The layer identifies the monitoring site as a coordinate point. These points are located within wetland polygons associated with the NWI 2005 Update for Michigan, but the acreage assessed differs based on the level of monitoring conducted and the project specific goals. Given the overlay of data that can be achieved in a GIS system, multiple monitoring efforts can be tracked in the same location, providing a comprehensive picture over time of the ecological health of the resource being studied. At this time, the points in this database are categorized by wetland monitoring project. A subset of the wetland monitoring projects Michigan has conducted so far include MiRAM and Intense Wetland Monitoring at the same site, while others only included one or the other type of monitoring. With color-coded categorization of the different monitoring efforts, users can see at a glance where we have Level 2 and/or Level 3 data, and can turn different layers on and off to focus on a specific project or type of data.

Furthermore, every monitoring site point includes the wetland monitoring data and summary of the results within the attributes table. This information is quickly viewed in ArcGIS, or can be queried and exported for detailed analysis of the results.

We are continuing to enter monitoring data into this database, and to make improvements to the functionality of the system for use by MDEQ staff as a tool to improve regulatory decision-making, review of proposed wetland mitigation and restoration sites, and as a prioritization tool for wetland preservation. In the future, we intend to incorporate parts of this wetland monitoring database into our online Wetland Map Viewer tool, for access and use by various stakeholders and the general public.

Landscape Level Assessment: Up to this point, landscape level assessments have been managed and stored with other geographic data layers, in the MDEQ's internal geographic inventory collection, and

the data has also been shared with the sponsors of the watershed project. Currently, MDEQ is working on a project, through another USEPA Wetlands Program Development Grant, to create a GIS-based database and online viewer for storing and sharing landscape level assessment information. This database and viewer are planned for completion in 2015.

Other Collaborative Projects: Plans for data management will be an integral part of cooperative efforts such as the Great Lakes Coastal Wetland Monitoring project. For example, the GLRI funding supported the development and maintenance of a database for compilation of the basin-wide coastal wetland data being collected as part of that effort. The long-term future funding and technical support for the database are still being finalized, at this time, but will likely be administered through CMU the project lead. Michigan, as well as the other Great Lakes states has an interest in the long-term funding and support for this database to ensure that it is accessible and useful for the state and federal resource management agencies with oversight of these coastal resources. However, until the long-term funding and technical support for this coordinated database are established, the MDEQ will plan to store any data collected by the MDEQ internally as well.

G. DATA ANALYSIS/ASSESSMENT

The MDEQ uses various methods and data forms for analysis and assessment of data, based on the type of wetland monitoring and goals of the project. The methods, procedures, and data forms are documented in technical reports and published literature, as specified below.

Wetland Inventory and Geographic Information: Analysis methodology used for using geographic information in evaluating status and trends of Michigan's wetlands is included in the report *Status and Trends of Michigan's Wetlands: Pre-European Settlement to 2005* (2014).

Regulatory Program: Data that is collected through specific regulatory actions provides information regarding the impacts associated with Michigan's Section 404 Permit Program. The MDEQ uses the United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (1987), the Mid-West Regional Supplement and Northeast and Northcentral Regional Supplement, and associated data forms for delineation and identification of wetlands. In addition, the current regulatory tracking databases, CIWPIS and Compliance, record information on location, impact type, waterbody, etc., but have limited ability to query certain information like individual wetland types, etc. So far, the MDEQ has used CIWPIS and Compliance to analyze cumulative impacts by querying authorized impacts by type, waterbody type, location, etc., and reported this work to the USEPA in 2013 in a final grant report. However, the migration of the regulatory impacts data to a GIS based format in the new MiWaters database will significantly improve analysis in the future. These impacts are also summarized annually in a report provided to the USEPA in accordance with Section 404 Program requirements.

Wetland Monitoring: Statewide Level 2 wetland monitoring efforts follow the assessment and analysis methodologies documented in the Michigan Rapid Assessment Method (MiRAM) 2.1 User's Manual, available on the MDEQ Web site at www.mi.gov/wetlands, and use the official MiRAM 2.1 Rating Form. For inland wetlands, statewide Level 3 wetland monitoring efforts follow the assessment and analysis methodologies detailed in the "Invertebrate IBI for Inland Wetlands (provisional, 2009)," the "Vegetation IBI for Inland Wetlands (provisional, 2009)," and the "2011 National Wetland Condition Assessment Field Operations Manual," and the associated data forms as appropriate. For Great Lakes coastal wetlands, statewide Level 3 wetland monitoring efforts follow the assessment and analysis methodologies in the *Great Lakes Coastal Wetland Monitoring and Assessment Plan* (2008).

Landscape Level Assessment: LLWFA are being carried out in priority watersheds, with the goal of eventually completing an enhanced NWI evaluation statewide. These assessments are conducted following the "Landscape Level Wetland Functional Assessment (LLWFA) Methodology Report" which was completed by the MDEQ and submitted to USEPA as a final grant product in 2011 and available on the MDEQ Web site.

Other Collaborative Projects: The collaborative Great Lakes Coastal Wetland Monitoring Project, currently underway through GLRI funding, follows the assessment and analysis methods outlined in the *Great Lakes Coastal Wetland Monitoring and Assessment Plan* (2008).

Future needs: Data collected during the initial years of wetland monitoring will be used in part to establish reference condition for Michigan's wetland types. With broader monitoring data, it will be possible to refine monitoring datasheets, scoring, and other aspects of the methods to improve consistency among samplers and to more accurately reflect wetland condition.

H. REPORTING

Michigan reports on wetland monitoring and assessment activities through different means, based upon the type of monitoring and assessment and the specific project goals.

Wetland Inventory and Geographic Information: Final county wetland inventory maps, Michigan's pre-settlement wetland inventory, potential wetland restoration areas, and similar information are now collectively housed in the online GIS system, Wetlands Map Viewer (available on the MDEQ Wetlands Web page www.michigan.gov/wetlands). The final county wetland inventory maps were also provided to all state Legislators, and to the county register of deeds, the county clerk, and the agricultural extension offices as required by state law.

The NWI Map updates will be integrated into the USFWS NWI map set.
The 2014 report entitled *Status and Trends of Michigan's Wetlands: Pre-European Settlement to 2005*, is an evaluation of the changes in wetland quantity and type in Michigan, from prior to European settlement through the present. This report includes analysis of wetland trends between the 1970s and today, the period during which the federal and Michigan's statewide wetland regulations have been in effect.

Regulatory Program - Section 404 Program Reporting: The MDEQ is required to provide an annual report to the USEPA under the state Section 404 Program Regulations (40 CFR §233.52), including the following information:

- An assessment of the cumulative impacts of the state's 404 Permit Program on the integrity of the state's regulated waters;
- A summary of the number and nature of individual and general permits issued, modified, or denied during the year, and permits not yet processed;
- A summary of the number and nature of violations or suspected violations identified and the nature of enforcement actions taken;
- An estimate of the extent of total impact to state regulated waters from individual and general permits;
- The number of acres of each of the categories of state regulated waters (lakes, streams, and wetlands) that were impacted by dredge or fill material during the year (by either authorized or known unauthorized activities) in excess of one surface acre per project;
- A summary of any significant changes in program operations or procedures; and
- Other information of particular concern or interest.

Reporting on the status and trends of wetlands in Michigan will be incorporated into the annual Section 404 Program report. In accordance with the USEPA State Wetlands Program guidelines, the annual 404 Program Reports are also available to the public.

Wetland Monitoring - Integrated Reporting: The MDEQ is responsible for biennial integrated reporting under Sections 305(b), 303(d), and 314 of the Clean Water Act. The Wetlands Program staff assists in preparation of the specific information for wetlands, using information from all levels of wetland monitoring and assessment activities. A summary of additional and expanded water quality data for wetlands will be included in these reports, as the monitoring and assessment results become available, and analysis is completed.

Landscape Level Assessment: The MDEQ submits an annual 319 Program report to the USEPA which lists the number of Landscape Level Assessments completed by watershed, through coordination with the 319 Program, and also identifies any funded grant proposals which use the Landscape Level Assessment to prioritize wetland restoration or protection projects. In addition, the MDEQ reports Landscape Level Assessments completed through the USEPA's Wetlands Program Development grants in final grant products. As stated earlier, the MDEQ is currently working to create a GIS-based database and online viewer for storing and sharing landscape level assessment information. This database and viewer, planned for completion in 2015, will provide agencies, stakeholders, and the public access to the landscape level assessments online, in a faster and easier manner than has previously been used.

Other Collaborative Efforts: The collaborative Great Lakes Coastal Wetland Monitoring Project is being conducted using GLRI funding, submits semi-annual progress reports to the USEPA, as required by the grant agreement. In addition, the preliminary project results, including sites sampled, and flora and fauna identified, are currently displayed on the online publically-accessible GIS-based database www.greatlakeswetlands.org.

Future needs: *The* MDEQ plans to establish a process for reporting on the statewide condition of wetlands in Michigan, incorporating information from all tiers of wetland monitoring – thus far, the reports have been on an individual project level, with a focus on one tier of monitoring effort. Reporting processes will be further developed by the wetland monitoring staff, as the statewide wetlands monitoring five-year cycle and funding sources are solidified.

I. PROGRAMMATIC EVALUATION

Evaluation of Michigan's Wetland Monitoring and Assessment Program: The MDEQ will review and update this Wetlands Monitoring and Assessment Strategy every five years, to evaluate progress towards achieving our objectives, and to consider expansion or addition of our goals and objectives. The wetland monitoring staff will continue to work with technical advisory partners to evaluate developing monitoring efforts, and to coordinate among MDEQ divisions, among state agencies, and with regional and federal wetland monitoring programs. In addition, the MDEQ will continue to coordinate both internally and with partners to evaluate, refine, and expand monitoring sampling methods, as appropriate. The MDEQ will also continue to participate in the National Wetland Monitoring and Assessment Work Group conference calls and meetings, to keep apprised of wetland monitoring advancements nationally and in other states.

Regulatory Program - Evaluation of Michigan's Section 404 Program: The MDEQ provides an annual report to the USEPA under the State Section 404 Program Regulations (40 CFR §233.52). Through development of this report, MDEQ conducts annual evaluation of the Section 404 Program, including assessment of the cumulative impacts of the state's permit program on the integrity of the state's regulated waters; summary of the number and nature of individual and general permits issued, modified, or denied during the year, and permits not yet processed; summary of the number and nature of violations or suspected violations identified and the nature of enforcement actions taken; estimate of the extent of total impact to state regulated waters from individual and general permits; number of acres of each of the categories of state regulated waters (lakes, streams, and wetlands) that were impacted by dredge or fill material during the year (by either authorized or known unauthorized activities) in excess of one surface acre per project; summary of any significant changes in program operations or procedures; and other information of particular concern or interest.

The USEPA may also audit Michigan's Section 404 Program to ensure consistency with federal program requirements. In 2008, the USEPA completed a comprehensive review of the state of Michigan's Section 404 Permitting Program. The findings of this review identified certain changes needed in order to maintain consistency with the federal program, including some administrative actions, amendments to the Administrative Rules, statutory amendments, and an update of the Section 404 Program Memorandum of Agreement between the MDEQ and the USEPA.

The USEPA indicated that this review was conducted for a number of reasons, including that there have been a number of changes to the relevant federal and state statutes and regulations since Michigan assumed the program in 1984, such as publication of Final Section 404 State Program Regulations in the Federal Register, numerous changes to the Corps of Engineers Nationwide Permit Program, adoption of a Federal Wetland Delineation manual, and changes in the scope of federal jurisdiction as a result of legal challenges. In addition, a body of state of Michigan judicial and administrative opinions relevant to permitting under the Section 404 Program has developed.

In 2009, legislative changes to the wetlands statute in Michigan created the WAC, for the purpose of evaluating Michigan's Wetlands Program and providing recommendations for improvement to the Governor, the Legislature and the MDEQ. The WAC consisted of 21 members representing a wide range of interests including regulated entities, citizen organizations, governmental agencies, academia, and the general public. The WAC Final Report was released on August 15, 2012, and outlined recommendations for improvements to Michigan's Wetlands Program including methods for streamlining processes, improving coordination, improvements to decision-making methods, long-term funding for the program, modifications to permit categories, actions to promote and improve wetland mitigation and banking, and evaluation of certain permit criteria.

J. GENERAL SUPPORT AND INFRASTURCTURE PLANNING

The MDEQ has a strong, well-established Wetlands Program. Statewide wetland regulations took effect in 1980, and the state assumed administration of the federal Section 404 Program in 1984. As the regulatory program has provided a focal point for wetland protection and management efforts, other elements of Michigan's Wetlands Program were often initiated in part to support regulatory efforts. For example, wetland inventories are a requirement of the state wetland protection part, but the cooperative efforts to update NWI maps and to provide status and trends information were a natural outgrowth of this basic inventory program. Likewise, MiRAM was developed primarily to replace an outdated rapid assessment method that was developed in the early 1980's during initial implementation of the state regulatory program, however, MiRAM has been primarily useful in statewide wetland monitoring efforts.

Many existing program areas supported by the MDEQ, have provided important resources for Michigan's Wetland Monitoring and Assessment Program, including:

- Updating of NWI maps by DU, supported with funding from both the USEPA and the Coastal Management Program, with the associated status and trends analysis detailed in the report Status and Trends of Michigan's Wetlands: Pre-European Settlement to 2005.
- Use of NWI Enhancement to complete landscape level assessment of wetland function by watershed, with financial support from the USEPA's State Wetlands Program and 319 Nonpoint Source Program. Partners include a number of local watershed planning agencies.
- Development of potential wetland restoration maps and priority wetland preservation maps for 319 Watershed Projects and for Great Lakes Areas of Concern, with partial funding from the USEPA's State Wetlands Program Grants, the 319 NPS Program, and the GLC.
- Development of the MiRAM, with support from the USEPA's State Wetlands Program Development Grants, and with technical input from a wide array of partnering agencies and organizations. CMU, in particular, played a key role supporting the drafting and field testing of the assessment method.
- Development of many of the IBIs for Michigan wetlands under the leadership of research staff from MSU and CMU, in cooperation with Michigan Natural Features Inventory.
- Participation in the Great Lakes Coastal Wetland Consortium and the ongoing Great Lakes Coastal Wetland Monitoring project, led by CMU and in partnership with 13 other basin-wide university and agency partners, with funding support from the USEPA's Great Lakes National Program Office, GLRI funding, and other sources.
- Participation in the NWCA, and continued future participation in this and similar national wetland monitoring efforts, with funding from the USEPA.

Sustained development of Michigan's wetland monitoring and assessment efforts will require continued and enhanced cooperation among a number of existing programs and partners, as reflected in this strategy, as well as ongoing participation in the National Aquatic Resource Surveys, particularly the NWCA, and the National Wetland Monitoring and Assessment Work Group.

<u>Future Needs</u>: To make progress on monitoring and assessment of Michigan's wetland resources, we will need funding for various aspects of this strategy, in accordance with our objectives, including:

- Acquisition of High Resolution Topograpy Data (LiDAR- Light Detection and Ranging) statewide to facilitate the modeling of depressional wetland systems, hydrology, and vegetative communities (Objectives 2 and 4)

- Acquisition of High Resolution Multispectral Imagery collected in the spring or fall (leaf-off) to assist with identification of seasonally flooded wetlands, forested wetlands, and drier-end wetlands (Objectives 2 and 4)
- Refinement and improvements to our regulatory and monitoring program databases (Objective 3)
- Completion of LLWFA for the remaining watersheds in Michigan (Objective 4)
- Conducting widespread rapid assessment of Michigan's wetlands using MiRAM in conjunction with implementation of the five-year cycle of wetland intensive site monitoring, using the selection design stratified by ecoregion and wetland type (Objective 5)
- Refinement and updates of the MiRAM database and GIS layer (Objective 5)
- Improve and refine IBIs for inland and coastal wetlands (Objective 6)
- Identification of reference sites for Michigan (Objective 6)
- Initiate and conduct monitoring of Michigan's most outstanding wetland resources (Objective 7)
- Intensification of the NWCA for Michigan, and establishment of a five-year wetland monitoring cycle (Objective 8)
- Identification of methods for incorporation of invasive species and climate change monitoring into the State of Michigan Wetland Monitoring and Assessment Strategy (Objective 8)

The identification of sustainable long-term infrastructure, staffing, and funding are essential to full implementation of this strategy.

K. REFERENCES

Association of State Wetland Managers. (2012). *White Paper: Climate Change Adaptation Plan for Coastal and Inland Wetlands in the State of Michigan.*

Burton, T. M., Uzarski, D. G., & Albert, D. A. (2009). Ecology and Bioassessment of Michigan's Inland Wetlands.

Great Lakes Coastal Wetland Consortium. (2008). *Great Lakes Coastal Wetland Monitoring Plan.*

Michigan Department of Environmental Quality. (2013). *Michigan's Aquatic Invasive Species State Management Plan 2013 Update.*

United States Environmental Protection Agency. (2003). *Elements of a State Water Monitoring and Assessment Program.*

United States Environmental Protection Agency. (2006). *Application of Elements of a State Wetland Monitoring and Assessment Program.*

Uzarski, D. G., Burton, T. M., & Albert, D. A. (2009). A Manual for Bioassessment of Great Lakes Coastal Marshes.