

WATER QUALITY  
AND  
POLLUTION CONTROL  
IN MICHIGAN  
2018 SECTIONS 303(d), 305(b), AND 314  
INTEGRATED REPORT  
Draft Assessment Methodology

**WATER QUALITY AND POLLUTION CONTROL IN MICHIGAN 2018 SECTIONS 303(d), 305(b), AND 314 INTEGRATED REPORT (IR); DRAFT ASSESSMENT METHODOLOGY JUNE 2017.** The Michigan Department of Environmental Quality (MDEQ), Water Resources Division (WRD), is accepting written comments on the draft Assessment Methodology for the 2018 IR. Every two years, the WRD prepares and submits an IR to the United States Environmental Protection Agency to satisfy the requirements of Sections 303(d), 305(b), and 314 of the federal Clean Water Act. The IR describes the status of water quality in Michigan and includes a list of water bodies that are not attaining Michigan Water Quality Standards and require the establishment of pollutant Total Maximum Daily Loads. The Assessment Methodology includes a description of the data, information, and decision criteria that are used to determine whether Michigan's Water Quality Standards are attained. Written comments may be submitted to **Kevin Goodwin**, MDEQ, WRD, P.O. Box 30458, Lansing, Michigan 48909-7958, by **July 14, 2017**. Information Contact: **Kevin Goodwin**, 517-284-5552, [goodwink@michigan.gov](mailto:goodwink@michigan.gov).

## LIST OF ACRONYMS

ADB	Assessment Database (USEPA)
AMV	Aquatic Maximum Value
BCC	Bioaccumulative Chemicals of Concern
BPJ	Best Professional Judgment
CAZ	Critical Assessment Zone
CSO	Combined Sewer Overflow
CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
HCV	Human Cancer Value
HNV	Human Noncancer Value
HUC	Hydrologic Unit Codes
IR	Integrated Report
MCL	Maximum Contaminant Level
MDARD	Michigan Department of Agriculture and Rural Development
MDHHS	Michigan Department of Health and Human Services
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
mg/kg	Milligram per kilogram
NHD	National Hydrography Dataset
ng/L	Nanograms per liter
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NREPA	Natural Resources and Environmental Protection Act
P51	Procedure 51
PCB	Polychlorinated Biphenyl
SDWA	Safe Drinking Water Act
SSC	Site Specific Criteria
TMDL	Total Maximum Daily Load
TSI	Trophic Status Index
USEPA	United States Environmental Protection Agency
ug/L	Micrograms per liter
USFWS	United States Fish and Wildlife Service
WQS	Water Quality Standards

## **CHAPTER 4 ASSESSMENT METHODOLOGY**

### **4.1 Introduction**

Michigan's assessment methodology describes the data and information used to determine designated use support, explains how these data and information are used to determine designated use support for surface waters of the state, and describes how surface water resources are reported using five categories (fully supporting, partially supporting, not supporting, insufficient information, or not assessed, described in more detail in Section 4.11). Ultimately, this methodology describes the process used to develop several of the appendices and summary tables included in this IR to satisfy the requirements of Sections 305(b) and 303(d) of the federal CWA.

The internal coordination and review process used to generate Sections 305(b) and 303(d) lists is carried out by a team of MDEQ technical staff and managers with considerable knowledge of local watershed conditions/issues and expertise in aquatic biology, limnology, ecology, environmental engineering, chemistry, microbiology, and mammalian/aquatic toxicology.

### **4.2 Data and Information Used to Determine Designated Use Support**

The MDEQ considers readily available, adequately georeferenced, and quality checked data and information collected and submitted by the MDEQ, its grantees and contractors, other agencies, and the public (including volunteer monitoring groups). Sources of data and information, in part, include:

- The MDEQ's water quality monitoring program that includes eight interrelated elements: fish contaminants, water chemistry, sediment chemistry, biological integrity and physical habitat, wildlife contaminants, bathing beach monitoring, inland lakes monitoring, and stream flow (see Chapter 3).

As part of the MDEQ's water quality monitoring program, sites for biological integrity and water chemistry monitoring are selected using both targeted and probabilistic study designs. The probabilistic monitoring approach is used to address statewide and regional questions about water quality. Targeted monitoring is used to fulfill specific monitoring requests, assess known or potential problem areas or areas where more information is needed, achieve assessment coverage of a watershed, and provide information to support and evaluate the effectiveness of MDEQ water protection programs (e.g., NPDES, NPS, and Site Remediation). All site-specific data are considered to determine designated use support. Generally, the other types of monitoring are conducted using targeted study designs.

- Michigan's 2016 IR (Goodwin et al., 2016), which serves as a baseline for the 2018 IR and is modified using new data and information.
- Fish Consumption Advisories established by the Michigan Department of Health and Human Services (MDHHS).
- Dilution calculations, trend analyses, or predictive models for determining the physical, chemical, or biological integrity of surface water bodies.
- Reports of fish kills and chemical spills.

- Surface water quality monitoring data submitted by the general public or outside agencies. This information was solicited by the MDEQ in a notice on the MDEQ Web-based Calendar in the following publications: March 6, March 20, April 3, and April 17, 2017. Information was also solicited directly from governmental and non-governmental groups including the Michigan Department of Transportation, MDARD, MDNR, United States Forest Service, USFWS, USGS, USEPA, National Parks Service, Alliance for the Great Lakes, Michigan Tribal contacts, various Michigan Colleges and Universities, watershed organizations, private consulting firms, and industrial water users via e-mail on March 6, 2017. Data received from outside sources, and if and how they were used are summarized in Section 10.2.
- Public Water Supply taste and odor complaints as well as surface water, drinking water, and source water quality assessments conducted under Section 1453 of the federal Safe Drinking Water Act, enacted by Public Law 93-523, December 16, 1974, as amended, through August 6, 1996, being Title 42 of the United States Code (U.S.C.), Section 300j-13.
- Remedial investigation/feasibility studies to support Records of Decision under the Comprehensive Environmental Response, Compensation, and Liability Act, 1980 PL 96-510 or Part 201 of the NREPA.

To ensure adequate time for proper data analysis, the MDEQ applies a cutoff date for newly collected data considered for the IR (i.e., data that were not used for development of the 2016 IR). For the 2018 IR, unless otherwise noted below or in the methodology under each use, the MDEQ considered all new readily available and quality-checked water quality data and information collected by the MDEQ and its grantees/contractors within the two-year period immediately following the cutoff date considered for the 2016 IR. In other words, data collected during the period from January 1, 2015, to December 31, 2016, were considered for the 2018 IR. Data collected prior to January 1, 2015, that were unable to be used for the 2016 IR or that were helpful to understand conditions over a longer period of time given limited datasets were considered for the 2018 IR using the current assessment methodology.

A 7-year span of available data were used with Water Chemistry Monitoring Program (WCMP) data to capture multiple sampling events and provide better supporting information on conditions over time. WCMP data collected through 2015 were used for this IR. WCMP data collected in 2016 were not quality-checked in sufficient time to be broadly used for this IR. However, data collected in 2016 and after the December 31, 2016, cutoff date are occasionally considered for inclusion in the 2016 IR on a case-by-case basis as determined appropriate by the MDEQ. TMDL documents completed and approved by the USEPA through 2017 were used to prepare this IR. Water quality data collected since January 1, 2015, and submitted to the MDEQ by April 21, 2017, by other parties (e.g., in response to the data solicitation described in the above bulleted list, from the Michigan Clean Water Corps volunteer monitoring database, etc.) were evaluated according to this assessment methodology and potentially used to help prepare the 2018 IR.

The quality assurance/quality control requirements for water, sediment, and fish tissue chemistry and biological data collected by the MDEQ are described in the MDEQ's Quality Management Plan (MDEQ, 2005b). To ensure acceptable data quality, the MDEQ also requires all grantees or vendors receiving state or federal money for the purpose of conducting water quality monitoring to prepare and follow Quality Assurance Project Plans prior to sample collection (MDEQ, 2007). Other data, such as data submitted by outside agencies or the public, must satisfy the MDEQ's quality assurance/quality control requirements to be used to make designated use support determinations of supporting or not supporting, to change the designated use support, or to reassign water bodies to different categories. Data that do not fully satisfy the MDEQ's quality assurance/quality control requirements or data that are collected

and analyzed using techniques that are less rigorous than techniques used by the MDEQ to make designated use support determinations may be used to list a water body for further evaluation (i.e., as insufficient information).

Each dataset for a water body is evaluated to determine if the data are representative of existing conditions and of adequate quality to make designated use support decisions. Data may not be representative of existing conditions if land use, point sources, or hydrologic conditions were substantially changed since the point of last data collection. Data may not be of adequate quality if field or laboratory methods changed to address quality concerns subsequent to data collection. In addition, the quantity of data; duration, frequency, magnitude, and timing of WQS exceedances; analytical method sensitivity; and contextual information (e.g., naturally occurring, weather, and flow conditions, etc.) are considered to ensure the data are representative of critical conditions. Target sample sizes may be given in this assessment methodology to determine designated use support; however, these sample sizes are not applied as absolute rules. Generally, data that are collected to determine compliance with permitted activities, such as NPDES discharge data, are not used to determine designated use support; however, ambient data that are collected for this purpose will be considered.

Water body, assessment, or data types that are not specifically discussed in this assessment methodology (including uncommon data or unusual circumstances) are considered on a case-by-case basis and are evaluated consistent with WQS.

### **4.3 Determination of Designated Use Support**

At a minimum, all surface waters of the state are designated and protected for all of the following designated uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, and fish consumption (R 323.1100[1][a]-[g] of the Part 4 rules). In addition, all surface waters of the state are designated and protected for total body contact recreation from May 1 to October 1 (R 323.1100[2]). Specific rivers and inland lakes as well as all Great Lakes and specific Great Lakes connecting waters are designated and protected for coldwater fisheries (R 323.1100[4]-[7]). Several specific segments or areas of inland waters, Great Lakes, Great Lakes bays, and connecting channels are designated and protected as public water supply sources (R 323.1100[8]). The Part 4 rules form the basis for this assessment methodology.

Most designated uses have one or more types of assessment that may be used to determine support. For example, to determine support for the other indigenous aquatic life or wildlife designated use, biological or physical/chemical assessment (e.g., rapid bioassessment of the macroinvertebrate community or chemical analysis of water samples) may be used. The assessment types include biological, habitat, physical/chemical, toxicological, pathogen indicators, other public health indicators, and other aquatic life indicators (default types from the USEPA ADB). In addition, a variety of parameters may be considered for the same assessment type. For example, physical/chemical assessments to determine fish consumption designated use support may include analysis of mercury or PCB concentrations in the water column.

Michigan uses the principle of independent applicability when making a support determination for each designated use for each water body. If data for more than one parameter are available that are used to determine support for the same designated use, then each data type is evaluated independently to determine support for the designated use. If any one type of data indicates that the designated use is not supported, then generally, the water body is listed as not supporting that designated use. In some instances, data require reevaluation to resolve discrepancies. Some particular data types or situations may require consideration of multiple

data types in combination. If no data are available for any assessment methods, then a water body is considered not assessed.

A single parameter may be used to make support determinations for more than one designated use. For example, appropriate data for a water body may reveal that water column mercury concentrations exceed the wildlife value and human noncancer value (HNV) (nondrinking water) (R 323.1057); therefore, both the other indigenous aquatic life and wildlife, and fish consumption designated uses are not supported. The inclusion of a parameter under a specific designated use in this assessment methodology does not preclude the use of that parameter to make support determinations for a different designated use.

Though infrequent, when best professional judgment (BPJ) is used to make a designated use support determination, justification is documented in the designated use comment field in the ADB record.

Water bodies listed as having insufficient information will generally be revisited in the correct basin year as resources allow (Figure 3.1). Comments specific to the development of each assessment are also accessible via the MiSWIMS (<http://www.michigan.gov/miswims>) by selecting the 'Designated Use' layer under the Map Search, choosing the designated use of interest as well as the category(ies) of interest, then using the "I"dentify Tool to bring up information linked directly from the ADB.

#### **4.4 Designated Uses: Agriculture, Navigation, and Industrial Water Supply**

##### **4.4.1 Assessment Type: No Specific Indicator or Assessment Method**

The MDEQ does not conduct specific assessments to evaluate support of the agriculture, navigation, and industrial water supply designated uses. These uses are assumed to be supported unless there is site-specific information indicating otherwise. In a scenario where site-specific information is used, the information is evaluated on a case-by-case basis using BPJ.

#### **4.5 Designated Use: Warmwater Fishery and Coldwater Fishery**

All surface waters of the state are designated and protected for warmwater fishery. In addition, specific rivers and inland lakes as well as all Great Lakes and specific Great Lakes connecting waters are designated and protected for coldwater fishery per R 323.1100(4)-(7).

##### **4.5.1 Assessment Type: Physical/Chemical**

For the following parameters the ideal dataset for assessments will come from continuous data collection or similar frequent collection over a target time frame. Collecting data of a sufficient frequency over an appropriate duration is important to fully investigate fluctuations in parameter quality over time and during critical periods (e.g., predawn and midday dissolved oxygen monitoring to investigate diurnal swings).

###### **4.5.1.1 Dissolved Oxygen Concentration**

Support determinations using dissolved oxygen data will typically be based on continuous data collected over a time period (e.g., two weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Data should be collected with properly maintained equipment following the

manufacturer's guidelines. Current quality assurance/quality control (QA/QC) procedures should be followed. Consideration of environmental conditions (e.g., weather, sample collection time of day, etc.) is especially important when making designated use determinations using dissolved oxygen concentrations. In general, a decision of "not supporting" for dissolved oxygen will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative measurements (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1064 and R 323.1065, the site is listed as "not supporting." In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a two-week period), BPJ remains a factor in any case of support determinations using ambient dissolved oxygen for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a two-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

#### *4.5.1.2 Temperature*

Support determinations using temperature data will typically be based on continuous data collected over a time period (e.g., two weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Data should be collected with properly maintained equipment using manufacturer's guidelines. Current QA/QC procedures should be followed. Consideration of environmental conditions (e.g. weather, sample collection time of day) is especially important when making designated use determinations using temperature. In general, a decision of "not supporting" for temperature will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative measurements (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1069, R 323.1070, R 323.1072, R 323.1073, or R 323.1075, depending on water body type, the site is listed as "not supporting." In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a two-week period), BPJ remains a factor in any case of support determinations using ambient temperature for the warmwater and coldwater fishery designated uses. During periods of extreme ambient air temperatures, it is assumed that stream temperatures will also rise. In some cases, this alone may cause temperatures to exceed criteria. BPJ to list a waterbody will be used in these situations. Likewise, it is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a two-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

#### *4.5.1.3 Ammonia (un-ionized) Concentration*

Support determinations of chronic conditions using un-ionized ammonia data will typically be based on grab sample data collected over a time period (e.g., one week) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Consideration of other relevant parameters (e.g., temperature, pH, total ammonia) is especially important when calculating un-ionized ammonia concentration to make designated use determinations. In general, a decision of "not supporting" for un-ionized ammonia will be based on more than one exceedance of the monthly average

(chronic) WQS per R 323.1057 over the period of review (typically two years, see 4.2) following USEPA guidance (USEPA, 1999).

Support determinations of daily maximum (acute) conditions using un-ionized ammonia data will be based on following USEPA guidance; when comparing ambient water column data to Aquatic Maximum Values, more than one exceedance of the acute un-ionized ammonia WQS over the period of review will typically result in assessing the site as not supporting (USEPA, 1999).

In addition to the guidelines outlined above, BPJ remains a factor in any case of support determinations using un-ionized ammonia for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a two-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

#### *4.5.1.4 pH*

Support determinations using pH data will typically be based on continuous data collected over a time period (e.g., two weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as “insufficient information,” thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Data should be collected with properly maintained equipment using the manufacturer’s guidelines. Current QA/QC procedures should be followed. Consideration of environmental conditions (e.g., weather, sample collection time of day) is especially important when making designated use determinations using pH. In general, a decision of “not supporting” for pH will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative samples (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1053, the site is listed as “not supporting.” In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a two-week period), BPJ remains a factor in any case of support determinations using pH for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent that in using BPJ, a water body may be listed with a less rigorous set of data (e.g., the preferred continuous monitoring over a two-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

#### *4.5.1.5 Water Column Toxic Substance Concentrations*

To determine warmwater and coldwater fishery designated use support using toxic substances that are non-Bioaccumulative Chemicals of Concern (BCC), ambient water column chemical concentrations are compared to Aquatic Maximum Values and Final Chronic Values per R 323.1057 using Figures 4.1a and following the process described in 4.6.1.1.



## **4.5.2 Assessment Type: Biological**

### **4.5.2.1 Fish Community**

In addition to chemical and physical assessment types, Michigan uses rapid bioassessment of fish communities in wadeable streams and rivers [generally Procedure 51 (P51) (MDEQ, 1990)] to determine support for the warmwater fishery and coldwater fishery designated uses. Fish community biosurvey sites are generally selected using targeted study designs.

Rivers and streams with no site-specific fish community biosurvey results are considered not assessed unless other data are available to assess this use as described elsewhere in this Section (4.5).

Using P51, warmwater fish communities are scored with metrics that rate water bodies from excellent (+5 to +10) to poor (-10 to -5). Fish ratings from -4 to +4 are considered acceptable (Creal et al., 1996). Water bodies with warmwater fish communities rating acceptable or excellent using P51 are determined to support the warmwater fishery designated use. Fish communities collected from designated coldwater streams using P51 are determined to support the coldwater fishery designated use if the relative abundance of salmonids is equal to or greater than 1%. One bioassessment result is generally considered sufficient to make this determination.

Using P51, a determination of not supporting or, infrequently, insufficient information is made for water bodies that have metrics that rate the warmwater fish community poor, have coldwater fish communities with salmonid relative abundance of less than 1%, if fewer than 50 fish are collected, or if the relative abundance of fish with anomalies exceeds 2% (applies to both warmwater and coldwater fisheries). Generally, targeted biosurvey results should have sufficient supporting information available to determine survey representativeness and to list the water body as not supporting using one survey result. However, instances where other supporting information raise concerns over data quality and representativeness (e.g., a poor fish community result during high-water conditions or when equipment function was in question) may require the collection of additional information to determine data representativeness. In this case, a determination of insufficient information is made.

For fish communities that rate poor, current and past weather conditions, assessments of biological communities in adjacent stream or river segments, historic data, and the source and frequency of pollutant exposure are considered to determine if conditions are ongoing or temporary. If conditions are determined to be temporary, a water body may be listed as having insufficient information. For example, a water body with a temporarily poor biological community due to a short-term chemical spill may be listed as having insufficient information if remediation occurred and the community is expected to recover.

Fish community data for streams, rivers, and lakes collected using methods other than P51 are evaluated on a case-by-case basis. For example, fish community data collected as part of the MDNR Fisheries Division's Status and Trend monitoring can be evaluated based on community structure and compared to the definitions for coldwater and warmwater fishery Use as stated in R 323.1043 and R 323.1044. Additional factors considered in determining support of the fishery designated uses are the presence of indicator species such as cisco in coldwater lakes or walleye in warmwater lakes at densities sufficient to indicate waterbody support of a healthy food web that could maintain taxa of such trophic levels.

When evaluating this information, two biologists with fisheries experience independently assess fish community data relative to the definitions in the Rules and their assessments are subsequently compared. Assessments with agreement (e.g., both biologists rating the data as

'fully supporting' the fishery designated use) are used to assess the appropriate assessment unit as such. Assessments with disagreement (e.g., one biologist rating the data as 'fully supporting' while the other rates it as 'not supporting') result in discussions of the data and agreement reached or a rating as 'insufficient information' to generate additional data collection to fully assess the assessment unit in question.

#### **4.6 Designated Use: Other Indigenous Aquatic Life and Wildlife**

##### **4.6.1 Assessment Type: Physical/Chemical**

###### *4.6.1.1 Water Column Toxic Substance Concentrations*

To determine other indigenous aquatic life and wildlife designated use support using toxic substances, ambient water column chemical concentrations are compared to Wildlife, Aquatic Maximum, and Final Chronic Values per R 323.1057 using Figures 4.1a and b, as described below. Water chemistry monitoring sites are selected using both targeted and probabilistic study designs. All site-specific water column chemistry data that are determined to be representative of current conditions are used to determine other indigenous aquatic life and wildlife designated use support. Additionally, site-specific water column chemistry data for non-BCCs are also used to determine warmwater and coldwater fishery designated use support, as described in Section 4.5.1.5. and illustrated in Figure 4.1a, below.

A minimum of four data points in a year are generally used to assess toxic substances per USEPA guidance (USEPA, 2002). In rare instances, and particularly in the case of acute WQS, limited data (less than 4 data points) demonstrating exceedance of WQS may be used to assess a water body as not supporting; if so, the basis for these decisions will be reflected in the ADB. A seven-year window of the most recent quality assured data is used for WCMP information to capture two probabilistic monitoring events spaced 5-years apart.

Following USEPA guidance, when comparing ambient water column data to Final Chronic Values for non-BCCs, more than one exceedance of the WQS over the period of review (typically seven years in Michigan's review process) will typically result in assessing the site as not supporting, as illustrated in Figures 4.1a and 4.1b (USEPA, 2002). Similarly, to be reflective of the need to protect aquatic life against acute impacts, when comparing ambient water column data to Aquatic Maximum Values for BCCs and non-BCCs, one or more exceedance of the WQS over the period of review will typically result in assessing the site as not supporting, as illustrated in Figures 4.1a and b. For BCCs, comparisons of ambient water column data to Wildlife Values (the most sensitive chronic value) will be made using geometric means of available data as illustrated in Figure 4.1b. Geometric mean is chosen to help interpret the data when Wildlife Values are most sensitive because these criteria are based on long-term exposure of wildlife to surface water for drinking and consuming fish tissue. This is an analogous approach to that used when assessing human health protection as recommended per USEPA guidance (USEPA, 2002).

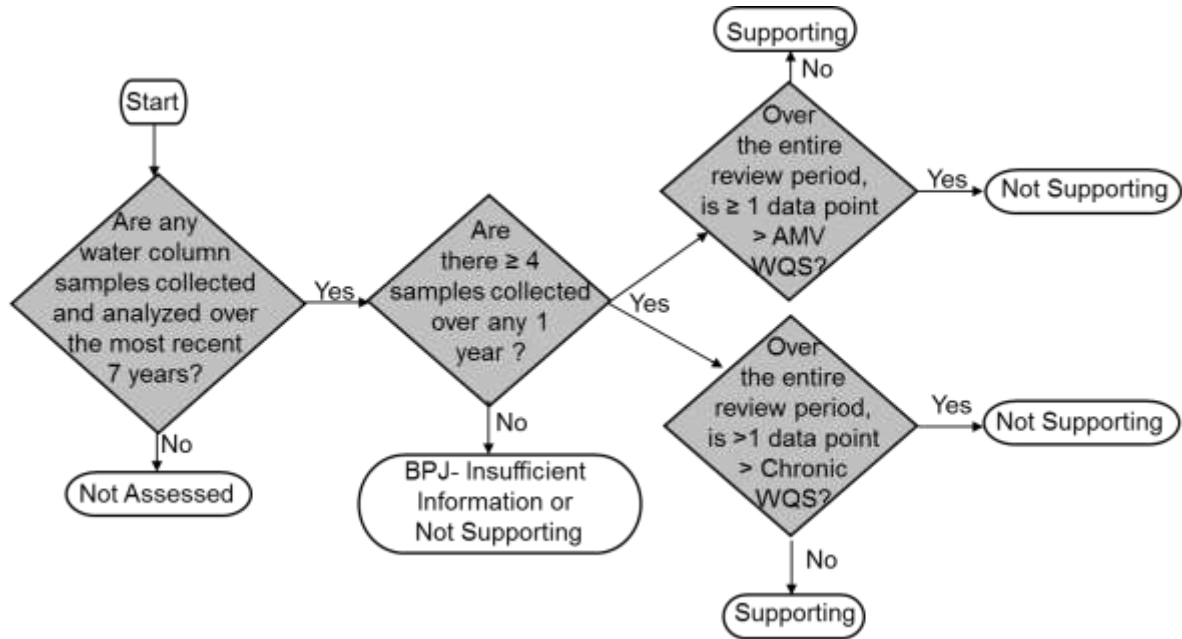


Figure 4.1a. Determination of other indigenous aquatic life and wildlife and warmwater/coldwater fishery designated uses support using water column toxic substance concentration for non-BCCs.

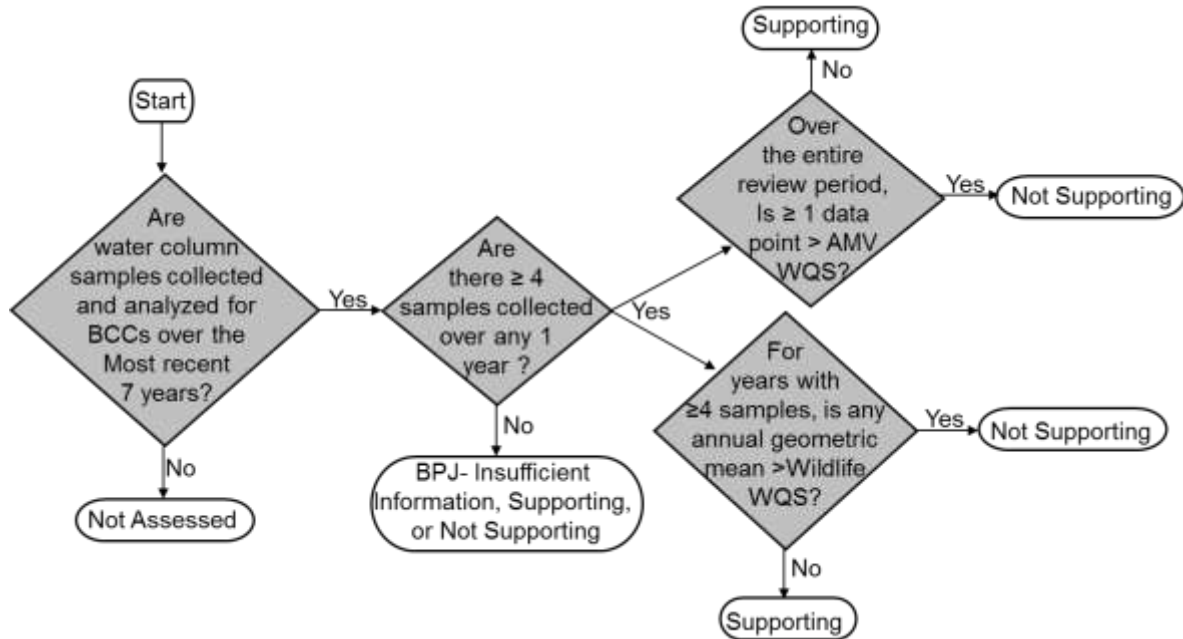


Figure 4.1b. Determination of other indigenous aquatic life and wildlife designated use support using water column toxic substance concentration for BCCs.

Site-Specific Aquatic Life Criteria (SSC) may be developed following Rule 323.1057(2)(r)(ii). If SSCs are developed, determination of designated use support status will be assessed following the processes in Figures 4.1a and b, as appropriate with water column data assessed against the corresponding SSC.

#### 4.6.1.2 Water Column Nutrient Concentrations

For all waters, ambient water column nutrient concentrations are used in conjunction with biological indicators to determine support of the other indigenous aquatic life and wildlife designated use in all surface waters per R 323.1060 using BPJ to interpret conditions related to this narrative standard. Samples collected during July through September, when the impacts due to nutrient expression are most likely to occur, are particularly important for making designated use support determinations. In addition, use support determinations will be influenced by excessive/nuisance algal and macrophyte growth (see Section 4.6.2.2.).

Nutrient concerns may generate the need to conduct additional studies on possible ecological effects, including indirect effects to dissolved oxygen concentrations that may impact the fish community. If so, the results of those studies may be used to assess the warmwater and coldwater fishery designated uses following Section 4.5.1.1 thereby linking nutrient impacts to those uses as well as depending on the monitoring outcome.

For inland lakes, Carlson's trophic status index (TSI) in conjunction with aquatic macrophyte surveys, are considered to determine designated use support. Individual TSI values are calculated using summer data for each trophic state indicator: summer secchi depth (transparency), total phosphorus concentration (epilimnetic), and chlorophyll *a* concentration (photic zone) (Table 4.1). An overall TSI is determined from the mean of the individual indicator TSI values to provide a way of reducing the effects of individual sampling and measurement errors, thus developing a more robust estimate of the index. Based on these index values the trophic status classification is determined as listed in Table 4.2 (Fuller and Taricska, 2012). Carlson's index may underestimate the trophic state of lakes dominated by macrophytes. Therefore, the relative abundance of submergent macrophytes, if available, is used to indicate more productive conditions than indicated by the TSI values. It is assumed that moderate and dense growths of macrophytes are indicative of mesotrophic and eutrophic conditions, respectively. Therefore, if Carlson's TSI indicate mesotrophic conditions, but dense macrophytes are present, the lakes will be classified eutrophic (MDNR, 1982).

Trophic state determinations for inland lakes in Michigan has typically used data collected during comparable late summer time frames with consistent sample collection methods [e.g., primarily MDEQ TMDL monitoring data, USGS Lake Water Quality Assessment data (Fuller and Taricska, 2012), or Cooperative Lake Monitoring Program volunteer data (<https://micorps.net/lake-monitoring/individual-lake-reports/>)]. However, data from other sources and gathered using somewhat different methods or time frames is not completely discounted and may be used to calculate TSI values at lakes where no other TSI information is available. For example, the use of data collected during the USEPA-sponsored National Lakes Assessments of 2007 and 2012, by Michigan tribes, the National Park Service, and potentially other sources (e.g., MDNR, Fisheries Division) data collected prior to 2013 is considered on a case-by-case basis. The total phosphorus and chlorophyll *a* samples collected during these efforts may deviate from the standard sampling methods used by the MDEQ at Michigan lakes to characterize TSI, but remains useful for assessments.

Inland lakes classified as oligotrophic, mesotrophic or eutrophic are generally determined to support the other indigenous aquatic life and wildlife designated use, unless other information exists regarding designated use impacts resulting from excess nutrients (e.g., persistent and significant algal blooms). Inland lakes that are classified as hypereutrophic, but without additional supporting information regarding nutrient expression, are generally listed as insufficient information with the goal of conducting additional, site specific, monitoring to confirm the trophic designation and whether impairments of the designated uses are realized

$TSI_{SD} = 60 - 14.40 \ln SD$	SD = Secchi depth transparency (m)
$TSI_{TP} = 4.15 + 14.42 \ln TP$	TP = total phosphorus concentration (ug/l)
$TSI_{CHL} = 30.6 + 9.81 \ln CHL$	CHL = chlorophyll a concentration (ug/l)

Trophic State	Carlson's TSI	TP (ug/l)	SD (m)	CHL (ug/l)
Oligotrophic	<38	<10	>4.6	<2.2
Mesotrophic	38-48	10-20	2.3-4.6	2.2-6
Eutrophic	49-61	21-50	0.9-2.2	6.1-22
Hypereutrophic	>61	>50	<0.9	>22

#### 4.6.1.3 Ammonia (un-ionized) Concentration

Support determinations of chronic and acute conditions using un-ionized ammonia data to assess the other indigenous aquatic life and wildlife designated use follow the processes found in Section 4.5.1.3.

#### 4.6.1.4 pH

Support determinations using pH data to assess the other indigenous aquatic life and wildlife designated use will follow the process found in Section 4.5.1.4.

#### 4.6.1.5 Physical Characteristics

R 323.1050 addresses the following physical characteristics of a water body: turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, and deposits. Michigan does not have specific assessment methods or numeric standards for these physical characteristics; therefore, BPJ (including visual observation) in conjunction with other assessment types (e.g., biological) is used to determine the other indigenous aquatic life and wildlife designated use support based on this narrative standard.

### 4.6.2 Assessment Type: Biological

#### 4.6.2.1 Macroinvertebrate Community

In addition to chemical and physical assessment types, Michigan uses rapid bioassessment of macroinvertebrate communities in wadeable streams and rivers (generally P51; MDEQ, 1990) to determine support for the other indigenous aquatic life and wildlife designated use. Using P51, macroinvertebrate communities are scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Macroinvertebrate ratings from -4 to +4 are considered acceptable (Creal et al., 1996). Biosurvey sites are selected using both targeted and probabilistic study designs. All biosurvey data are considered to determine other indigenous aquatic life and wildlife designated use support.

Rivers and streams with no site-specific macroinvertebrate community biosurvey results are considered not assessed unless other data are available to assess the use as described elsewhere in this Section (4.6).

Water bodies with macroinvertebrate communities rating acceptable or excellent (i.e., total P51 macroinvertebrate community score -4 to +9) are determined to support the other indigenous aquatic life and wildlife designated use. One bioassessment result is generally considered sufficient to make this determination.

A determination of not supporting or, infrequently, insufficient information is made for water bodies with macroinvertebrate communities rated poor (total P51 macroinvertebrate community score -5 to -9). Generally, targeted biosurvey results should have sufficient supporting information available to determine survey representativeness and to list the water body as not supporting using one survey result. For biological communities that rate poor, current and past weather conditions, relevant available historic data, assessments of biological communities in adjacent stream or river segments, and the source and frequency of pollutant exposure are considered to determine if conditions are ongoing or temporary (see Section 4.5.2.1). In all cases, the ADB reflects the information used to support the assessment decisions.

Macroinvertebrate data for wadeable streams and rivers collected using methods other than P51 are evaluated on a case-by-case basis. Similarly, biological integrity data regarding water bodies where P51 is not appropriate (e.g., wetlands, lakes, ephemeral streams, etc.) will be evaluated on a case-by-case basis using BPJ to assess community characteristics like taxa balance, diversity, and other indicators of system health and function.

Nonwadeable rivers are assessed using Michigan's Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers (MDEQ, 2013a). Using this nonwadeable procedure, macroinvertebrate communities are scored with metrics that rate water bodies from excellent to poor. Macroinvertebrate ratings from 76-100 are considered excellent, 50-75 good, 25-49 fair, and 0-24 are considered poor.

Nonwadeable rivers with macroinvertebrate communities rating excellent, acceptable, or fair (i.e., total macroinvertebrate community score  $\geq 25$ ) are determined to support the other indigenous aquatic life and wildlife designated use. One bioassessment result is generally considered sufficient to make this determination.

Similar to determinations made for wadeable streams and rivers, a determination of not supporting or insufficient information is made for nonwadeable rivers with macroinvertebrate communities rated poor (total macroinvertebrate community score 0-24) depending on the quality and amount of supporting contextual information available.

#### 4.6.2.2 *Bacteria, Algae, Macrophytes, and Fungi*

Site-specific visual observation of bacteria, algae, macrophytes, and fungi may be used to make a support determination for the other indigenous aquatic life and wildlife designated use. In addition, water column nutrient concentrations may also be used to support this determination (see Section 4.6.1.2).

A determination of not supporting will be made if excessive/nuisance growths of algae (particularly, *Cladophora*, *Rhizoclonium*, and cyanobacteria) or aquatic macrophytes are present. Although the determination of excessive, nuisance conditions is generally made using BPJ in accordance with narrative WQS, P51 offers the following guidance to make these determinations for streams:

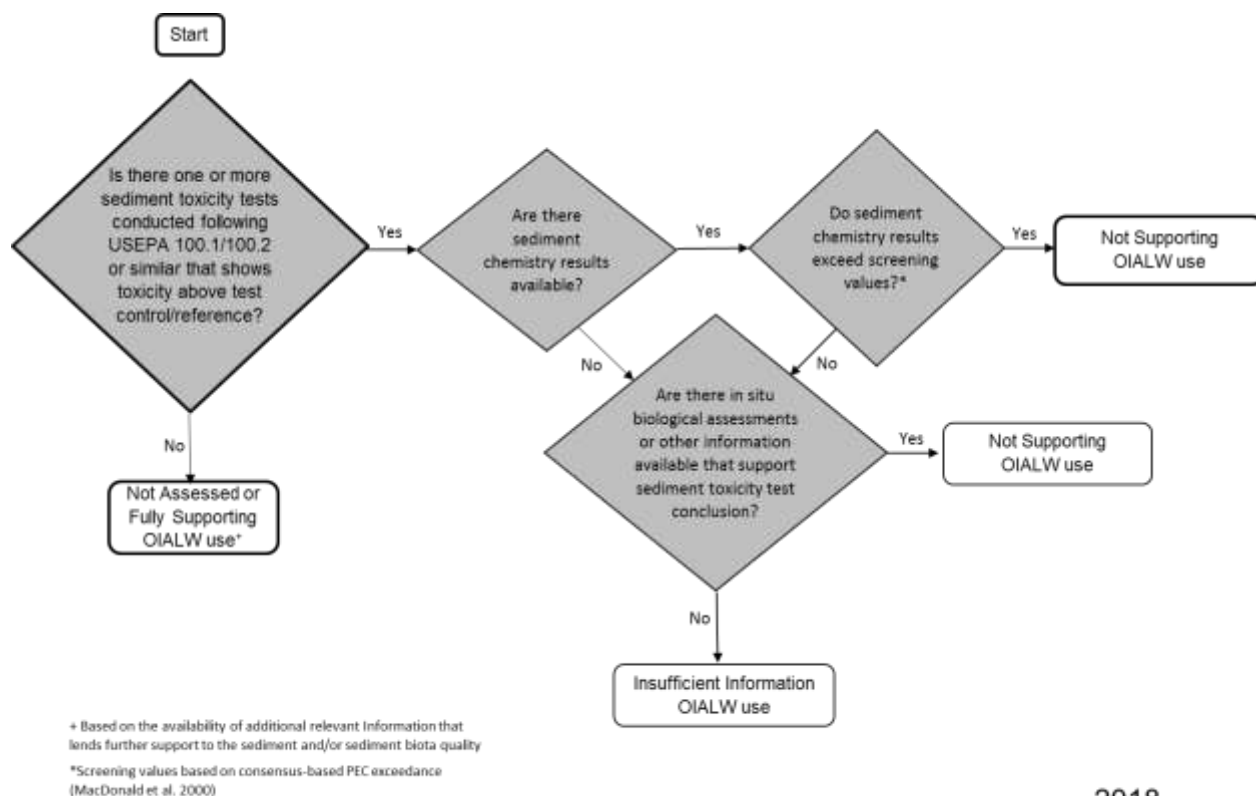
- *Cladophora* and/or *Rhizoclonium* greater than 10-inches long covering greater than 25% of a riffle.
- Rooted macrophytes present at densities that impair the designated uses of the water body.
- Presence of bacterial slimes.

For inland lakes and impoundments, chlorophyll *a* (used as a surrogate for algal biomass) is a component of the TSI calculation and is used quantitatively to determine the trophic state (see Section 4.6.1.2).

### 4.6.2.3 Sediment Toxicity

The results of sediment toxicity studies on freshwater invertebrates may be used in conjunction with supporting data from sediment chemistry analyses and/or additional site-specific information, to make support determinations for the other indigenous aquatic life and wildlife designated use. Sediment toxicity tests must be conducted following EPA methods 100.1 or 100.2, or a similar test, and must incorporate test acceptability requirements and other quality control steps (USEPA 2000). It is important from an assessment standpoint that the control-corrected sediment toxicity be further supported by additional information which lends confidence to the results and reduces the potential of making a listing decision based on possible laboratory error during the testing process. As such, sediment analyses, in-situ biological assessments, or other information in support of toxicity analyses results are necessary to make a full assessment determination following the process in Figure 4.2.

The determination of spatial area represented by toxicity tests will rely on associated information regarding sediment deposit mapping and other site-specific information that supports the likely extent of impacted areas.



2018

Figure 4.2. Determination of other indigenous aquatic life and wildlife designated use support using sediment toxicity.

## 4.7 Designated Use: Partial Body Contact Recreation and Total Body Contact Recreation

The partial body contact recreation designated use applies to all water bodies the entire year- while the total body contact recreation designated use applies to all water bodies during May 1 to October 31.

## **4.7.1 Assessment Type: Pathogen Indicators**

### **4.7.1.1 *E. coli***

Michigan uses ambient *E. coli* concentration, and the presence of raw sewage discharges, to determine partial body contact and total body contact recreation designated use support using Rule 323.1062 and following Figures 4.3a and 4.3b, respectively. A minimum of 5 sampling events are needed to assess the partial and total body contact recreation designated uses using *E. coli* data. For the 30-day geometric mean total body contact WQS to be evaluated, the sampling events must be “representatively spread over a 30-day period” (Rule 323.1062). A sampling event is defined by Rule 323.1062 as “three or more samples taken during the same sampling event at representative locations within a defined sampling area.” Larger datasets (e.g., weekly over the total body contact season or over multiple years) should be used to their fullest extent when available to assure that changing conditions during the year or over multiple years are adequately represented; for example, assessments of bathing beaches for which the most recent two years of data indicate a shift in status (fully supporting to not supporting or vice versa), were expanded to use an additional year of data to increase confidence in changing conditions. A 10 percent exceedance threshold is targeted for making designated use determinations following USEPA guidance (USEPA, 2002). However, discretion may be used when considering a single violation and the magnitude of the exceedance under certain circumstances using small datasets (USEPA, 2002).

The representativeness of *E. coli* data is critical in assessing use attainment. It is important that the *E. coli* data used be spaced over time to represent a range of conditions rather than be clustered around a single event (e.g., single rain event or a single dry weather event). It is acceptable to sample during a critical 30-day period that may be driving *E. coli* concentrations (e.g., summer low flow, wet weather conditions) as long as they are distributed representatively over that time frame. Data used for reassessing an assessment unit previously listed as not supporting should, at a minimum, capture conditions that were reflected in the data used to make the initial assessment. For example, if wet weather events were captured as part of an initial dataset used to list an assessment unit as not supporting, it would be inappropriate to use only dry weather data to assess for delisting purposes. Additionally, when using more extensive datasets, the breadth of the data used is contingent on confidence that it represents conditions and variability typical of the water body being assessed.



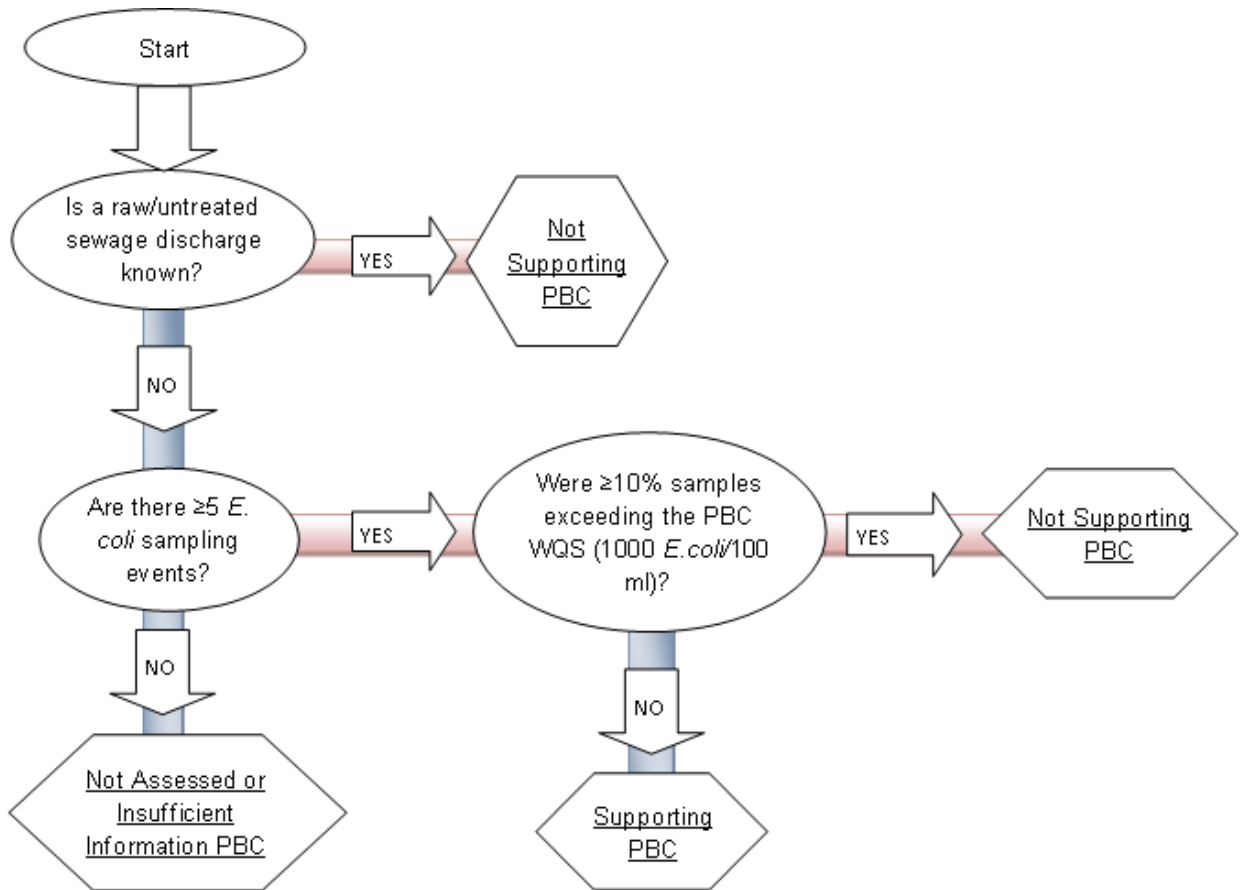


Figure 4.3a. Determination of partial body contact designated use support using ambient *E. coli* water column concentration. See Section 4.7.1.1 for additional details.

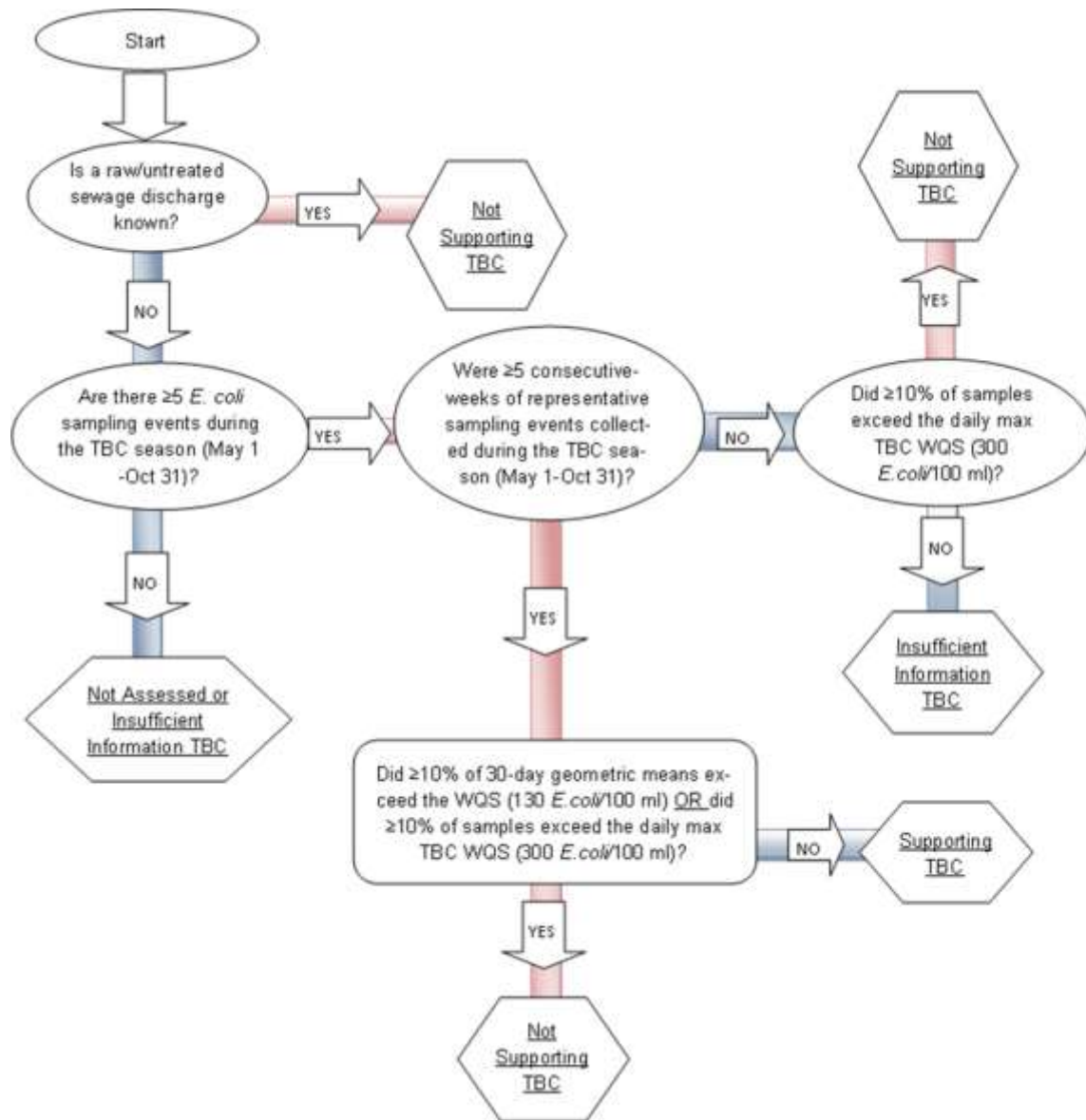


Figure 4.3b. Determination of total body contact designated use support using ambient *E. coli* water column concentration. See Section 4.7.1.1 for additional details.

## **4.7.2 Assessment Type: Physical/Chemical**

### **4.7.2.1 pH**

A determination of not supporting may be made in situations where the pH of surface water is such that direct human contact presents an opportunity for physical danger (e.g., contaminated groundwater venting from cement kiln dust disposal sites). Although infrequent, in such situations decision processes will be captured in relevant comment fields under affected Assessment Units within the ADB.

## **4.8 Designated Use: Fish Consumption**

Michigan uses the concentration of BCCs (as listed in Table 5 of the Part 4 Rules) and other bioaccumulative substances (selenium and perfluorooctane sulfonate) in the water column, and fish consumption advisories issued by the MDHHS to determine fish consumption designated use support. A water body is considered to not support the fish consumption designated use if either the MDHHS has issued a site-specific fish consumption advisory for that water body or ambient water column concentrations exceed WQS, as described below.

### **4.8.1 Assessment Type: Physical/Chemical**

#### **4.8.1.1 Water Column and Fish Tissue Mercury Concentrations**

A fish consumption designated use decision based on ambient water column mercury concentrations is made by comparing mercury concentrations in the water with the HNV (nondrinking water) WQS (1.8 nanograms per liter [ng/L]) following the flow chart in Figure 4.4. In keeping with the assessment process spelled out in Section 4.6.1.1, geometric mean is chosen to help interpret the data when comparing to HNV because these criteria are based on long-term exposure to surface water for consuming fish tissue.

Michigan's fish tissue mercury value development method is similar to the USEPA's development method for the national fish tissue criterion (USEPA, 2001). Michigan's fish tissue mercury value (0.35 milligrams per kilogram [mg/kg]) was derived using the same exposure scenario used to derive Michigan's HNV (nondrinking water) WQS of 1.8 ng/L. Michigan's fish tissue value for mercury is the concentration that is not expected to pose a health concern to people consuming 15 grams or less of fish per day. This fish tissue value of 0.35 mg/kg for mercury is used as the decision point for making nonattainment listing decisions using the associated MDHHS advisory level, which encompasses that concentration. Therefore, the presence of MDHHS fish consumption advisories of two meals per month, or more restrictive, are used as a basis for a not supporting assessment. The two meal per month MDHHS advisory level based on mercury equates to tissue mercury concentrations in edible portions over a range (0.27-0.53 mg/kg wet weight), encompassing Michigan's fish tissue value for mercury (0.35 mg/kg wet weight).

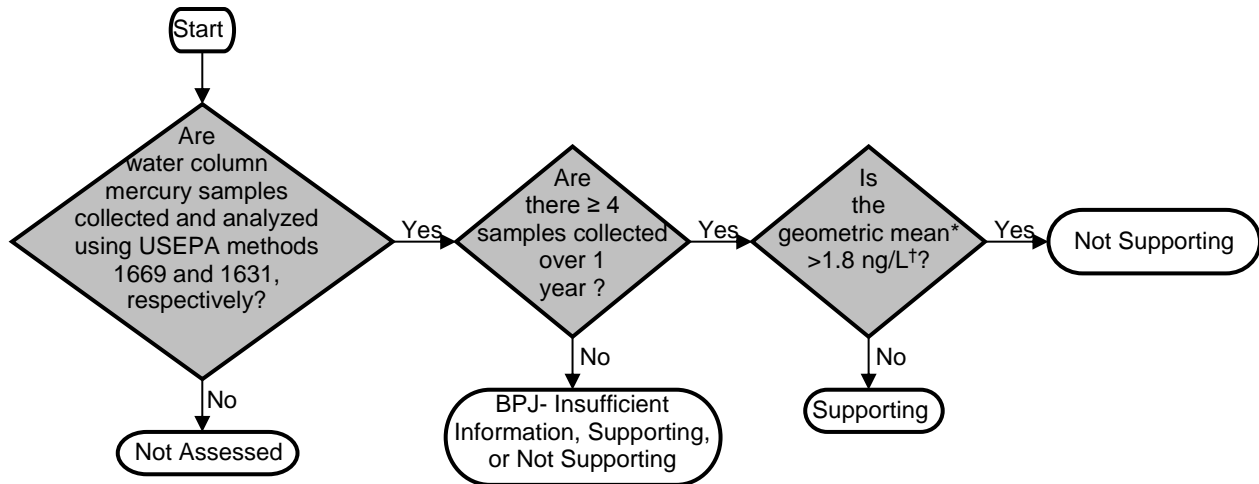


Figure 4.4. Determination of fish consumption designated use support using water column mercury concentration.

#### 4.8.1.2 Water Column PCB Concentration

To determine fish consumption designated use support for PCBs, the ambient water column PCB concentration is compared to the non-drinking water Human Cancer Value (HCV) (0.026 ng/L) (R 323.1057). PCB samples should be collected and analyzed according to protocols published by the USEPA (1997a and 1997b), with the exception that dissolved and particulate fractions are combined. For PCBs, a sample size of 1 is considered sufficient information to determine WQS nonattainment. This approach is justified by the existence of a large PCB dataset for the state as a whole, which shows virtually 100% exceedance of the HCV for total PCBs. If there are no appropriate PCB data, then a water body is considered not assessed. Water bodies with one or more ambient water column PCB sample results greater than the non-drinking water HCV are determined to not support the fish consumption designated use.

#### 4.8.1.3 Water Column BCCs Concentration other than Mercury and PCBs

To determine fish consumption designated use support for BCCs other than mercury and PCBs in the water column, ambient water column chemical concentrations are compared to the HNV and HCV for nondrinking water per R 323.1057 using Figure 4.1b (see Section 4.6.1.1).

### 4.8.2 Assessment Type: Other Public Health Indicators

The MDHHS bases their “Eat Safe Fish” Guidance (advisory) on fish tissue contaminant data collected as part of the Michigan Fish Contaminant Monitoring Program. The fish tissue value is not an ambient WQS; however, the MDEQ considers the use of the MDHHS advisory based on fish tissue data as appropriate for determining fish consumption designated use support. For example, a fish consumption advisory due to PCBs on a water body specific basis occurs when the upper 95% confidence limit on the mean total PCB concentration in fillet samples of any species exceeds 0.01 mg/Kg (wet weight). The MDHHS has developed advisory screening values for mercury, total PCBs, total DDT, dioxins, toxaphene, selenium, and perfluorooctane sulfonate. Information specific to the MDHHS fish consumption advisory issuance process can be found on the MDHHS [Web site \(http://www.michigan.gov/mdhhs/0,5885,7-339-71548\\_54783\\_54784\\_54785-170340--,00.html\)](http://www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785-170340--,00.html).

#### *4.8.2.1 Fish Consumption Advisories for Mercury*

As described in 4.8.1.1, the presence of MDHHS fish consumption advisories of two meals per month, or more restrictive, are used as a basis for a not supporting assessment.

#### *4.8.2.2 Fish Consumption Advisories for BCCs and other bioaccumulative substances other than Mercury*

For contaminants other than mercury, a water body is considered to not support the fish consumption designated use if the MDHHS has issued a site-specific fish consumption advisory for that water body recommending a consumption rate of 12 meals or less per month. The MDHHS bases their advisories on fish tissue contaminant data collected as part of the Michigan Fish Contaminant Monitoring Program. The fish tissue value is not an ambient WQS; however, the MDEQ considers the use of the MDHHS advisory listing based on fish tissue data as appropriate for determining fish consumption designated use support. For example, a fish consumption advisory due to PCBs on a water body specific basis occurs when the upper 95% confidence limit on the mean total PCB concentration in fillet samples of any species exceeds 0.01 mg/Kg (wet weight). Information specific to the MDHHS fish consumption advisory issuance process can be found on the MDHHS [Web site](http://www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785-170340--,00.html) ([http://www.michigan.gov/mdhhs/0,5885,7-339-71548\\_54783\\_54784\\_54785-170340--,00.html](http://www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785-170340--,00.html)). The MDHHS is developing advisory screening values for all fish contaminants.

### **4.9 Designated Use: Public Water Supply**

Several specific segments or areas of inland waters, Great Lakes, Great Lakes bays, and connecting channels are designated and protected as public water supply sources [R 323.1100(8)].

#### **4.9.1 Assessment Type: Physical/Chemical**

##### *4.9.1.1 Toxic Substances in Water Column*

Assessment of public water supply designated use support determination is problematic because the HNV and HCV for drinking water (surface WQS) calculations assumes exposure via the consumption of 2 liters of untreated water per day, but it also assumes exposure via the consumption of 15 grams of fish per day. The majority of human exposure to compounds that are shown to have a potential to bioaccumulate using this exposure scenario would be from the consumption of fish. In other words, based on the process used to develop the HNV and HCV WQS the relative human exposure to a BCC and many non-BCC toxics in surface waters via strictly water consumption is minimal. Currently, Michigan's Part 4 rules do not contain a methodology to derive human health values that protect humans solely for the consumption of two liters of untreated surface water per day. However, for compounds that do not have the potential to bioaccumulate (generally, a bioaccumulation factor of 1) the drinking water HNV and HCV WQS can be used directly to assess the public water supply designated use.

Conversely, for compounds where bioaccumulation has been demonstrated to be an important component in human exposure (generally, a bioaccumulation factor >1), a surrogate screening value will be used to assess the public water supply designated use. In these cases, the MCLs will be used to compare to water column data from an assessment standpoint. The MCLs are used by the MDEQ, Drinking Water Program, as the maximum permissible level of a

contaminant in water that is delivered to any user of a public water system. The MCLs are solely based on the consumption of two liters of water and do not include a fish consumption component in the calculation; because of this, it was decided that MCLs were reasonable to use as a screening value for water column comparison for toxics where bioaccumulation makes direct comparison to WQS inappropriate. Because the MCL is a standard applicable after treatment, an exceedance of an MCL will not be used as the basis for a nonattainment determination. Instead, the water body will be assessed as “Insufficient Information” indicating the need for further investigation and additional coordination with the MDEQ, Drinking Water Program, to complete a full assessment.

Data used for public water supply assessments should be reflective of conditions within the Critical Assessment Zone (CAZ) for Great Lakes intakes or in the upstream portion of 12-digit HUCs and any additional waters identified by the SDWA staff for inland intakes, as described in Section 4.10, for a particular intake. Similar to the assessment methods used in Section 4.6.1.1, and USEPA guidance, a minimum of four annual data points are generally used to assess toxic substances following Figure 4.5 (USEPA, 2002). The geometric mean of ambient water sample results from a CAZ will be compared to either the WQS or the MCL, as appropriate following the process in Figure 4.5. Geometric mean is chosen to help interpret the surface water data for WQS or MCL comparison because these levels are based on long-term exposure of humans to surface water for drinking. In rare instances, limited data (less than 4 data points) demonstrating extreme exceedance of WQS may be used to assess a water body as not supporting the Public Water Supply designated use; if so, the basis for these decisions will be reflected in the ADB.

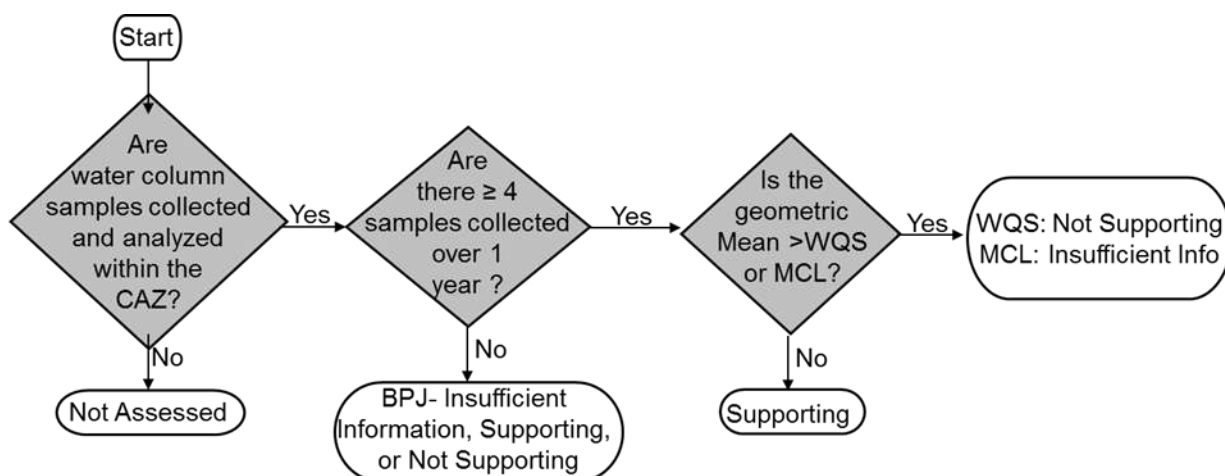


Figure 4.5. Determination of the Public Water Supply designated use support using WQS or MCLs.

#### 4.9.1.2 Chlorides

Designated use support determination using chlorides data is made on a case-by-case basis where one or more representative monthly average calculations can be made and compared to R 323.1051(2). With consistent ambient monitoring data (e.g., ambient drinking water intake data) the WQS will be considered not supporting the Public Water Supply designated use if more than 10 percent of samples during the period of review exceed the applicable WQS.

#### 4.9.1.3 Taste and Odor

To determine public water supply designated use support, site-specific complaints of taste and odor causing substances in community source waters are considered on a case-by-case basis.

#### 4.9.1.4 *Nitrates*

Elevated nitrates in drinking water source water can lead to acute health concerns, particularly in infants. The nitrate WQS and MCL are both 10 mg/L to be protective of methemoglobinemia in infants. Nitrate data used for Public Water Supply assessments should be reflective of conditions within the Critical Assessment Zone (CAZ) or inland 12-digit HUC and relevant additional waters, as described in Section 4.10, for a particular intake. Similar to the assessment methods used in Section 4.6.1.1, a minimum of four annual data points are generally used to assess nitrate conditions in surface waters as supporting the Public Water Supply designated use. However, due to the acute nature of the health impacts, one or more exceedances of the 10 mg/L WQS will lead a not supporting assessment.

In rare instances, limited data (less than 4 data points) demonstrating extreme exceedance of WQS may be used to assess a water body as not supporting the Public Water Supply designated use; if so, the basis for these decisions will be reflected in the ADB.

#### 4.9.1.5 *Total Microcystins*

The relationship between microcystins and their environmental drivers is complicated and not well understood. From a Public Water Supply assessment standpoint in Michigan, the understanding of expectations for natural background concentrations, the susceptibility of surface water drinking water intakes to microcystins, and expectations for conventional treatment efficacy need to be more fully explored. Although the presence of microcystins in source water may necessitate additional treatment from a SDWA program standpoint, the link between that need and the presence of total microcystins in source water that indicates something unnatural and caused by a pollutant may not be clear in many cases.

The USEPA developed health advisory (HA) levels for total microcystins in finished drinking water in 2015. While non-regulatory, these HA levels serve as guidance and provide concentrations at or below which adverse health effects are not anticipated over a 10-day duration. Two HA levels were developed, one (1.6 ug/L) for school-age children through adults and one (0.3 ug/L) for pre-school age children under six years old. Practically speaking, the more conservative HA level of 0.3 ug/L offers a level at which the entire population is protected. These HA levels are important in providing meaningful targets for SDWA programs from a treatment perspective.

The presence of microcystins in drinking source water, while treatable, often presents the need for water treatment facilities to upgrade from conventional treatment to address a source water quality problem. The detection of microcystins in raw intake water above the HA level indicates that, without additional treatment, the source water body may not provide suitable potable water. However, the ability to differentiate between possibly naturally occurring occasional total microcystins from those caused or exacerbated by pollutants, differentiates between possible assessments for the PWS use from a surface water standpoint. It should be noted that the designated use assessment has no bearing on the decisions made in the SDWMA program regarding the need to provide additional treatment to protect human consumption.

There are no cyanotoxin water quality criteria for the protection of the public water supply designated use. However, the Public Water Supply designated use may be assessed with a combination of total microcystins monitoring data in raw source water and information on the condition of that water body in the vicinity of the intake related to nutrient inputs and other indications of source water quality issues (e.g. documented blooms of algae or cyanobacteria, observed scums, elevated chlorophyll-a). To assess the public water supply designated use total microcystins data should be gathered monthly, at a minimum, during the growth season (June through September).

In cases where two or more total microcystins results in surface water exceed the more conservative HA level of 0.3 ug/L in a 3-year period and are supported by documented eutrophication and nuisance nutrient conditions in the same 3-year period (see Section 4.6.2.2) that are likely causative, an assessment of Not Supporting the use may be made. Exceedance of the HA level must be at least 30 days apart to reflect cyanotoxin events that are either repeating frequently, or substantial in duration.

In rare circumstances, best professional judgement may be used to assess a water for the Public Water Supply designated use based on different 'weight of evidence' scenarios. However, the presence of total microcystins alone, particularly with limited monitoring data, will typically result in an assessment of Insufficient Information until additional support linking those concentrations to conditions related to human impacts on the water body.

#### **4.10 Assessment Units and Determination of Geographic Extent**

Michigan uses the NHD coding scheme (1:24,000 resolution) to georeference water bodies when generating the Sections 305(b) and 303(d) lists. As a base assessment unit, Michigan uses 12-digit HUCs (Appendix A). The geographic extent of a designated use support determination for each water body is made on a case-by-case basis. The 12-digit HUC base assessment unit is used as a default when listing streams and rivers to facilitate record keeping and mapping. Each 12-digit HUC base assessment unit may be split into multiple assessment units if site-specific information supports a smaller assessment unit (e.g., contextual information such as land use, known areas of contamination, point source pollution location, specific fish consumption advisory geographic information, barriers such as dams that restrict fish migration, etc.). An assessment unit may consist of all water bodies in a 12-digit HUC (as a maximum) or specific stream segments or lakes in a 12-digit HUC.

Beyond using the 12-digit HUC as a base assessment unit, contextual information is considered when making a determination of the geographic extent that data collection points represent. For example, if a macroinvertebrate community survey conducted in the lower reach of a branch of a river indicates support of the other indigenous aquatic life and wildlife designated use and a second survey conducted farther upstream (several 12-digit HUCs upstream) in the same river branch also indicates designated use support, then contextual information may be considered to make a determination that the spanned river miles also support the designated use. In this example, contextual information may include similar physical habitat, similar land use, absence of point sources, absence of contaminated sites, etc. Similarly, if an intensive riverine *E. coli* monitoring is conducted, the results from that study may be applied to adjacent assessment units if supported by additional information like land use and more reduced *E. coli* grab sampling data. In other words, if contextual information indicates that it is appropriate, data collected from an assessment unit may be used to make designated use determinations for surrounding water body segments in different assessment units that lack data.



For the public water supply designated use in inland intakes, the geographic extent of the assessment unit is generally the upstream portion of the 12-digit HUC in which the intake is located and may include additional waters identified by site-specific input by SDWA program staff.

For public water supply intakes that are located in the Great Lakes or connecting channels, a concept of a CAZ around each intake was developed based on a Sensitivity Factor calculated for each intake. The two attributes used to develop the Sensitivity Factor are the water depth above the intake structure and the perpendicular distance from shore or length of the intake pipeline. Other factors such as localized flow patterns, thermal effects, wind effects, lake bottom characteristics, benthic nepheloid layers, etc., may be used to complete the sensitivity analysis. A radius for the CAZ, ranging from 3,000 feet for the most sensitive intakes to 1,000 feet for the least sensitive intakes, is assigned based on the Sensitivity Factor. A shape with this radius is then drawn around the intake to illustrate the CAZ. If the CAZ intersects the shoreline, then the geographic extent of the assessment unit is determined on a case-by-case basis as the most influential 12-digit HUCs that are along the shoreline within the CAZ. For intakes that are located in open waters of the Great Lakes where the CAZ does not intersect the shoreline, the geographic extent of the assessment unit is 1.5 square miles.

Ultra low-level PCB monitoring conducted by the MDEQ indicates that PCB concentrations exceed the HCV WQS (0.026 ng/L) in all waters sampled. Based on these results, all river miles in the individual watersheds sampled for PCBs are listed as not supporting the fish consumption designated use for PCBs in the water column.

The geographic extent of some beaches is not currently available. In these instances, a geographic extent of 0.2 shoreline miles was used as a default value.

Streams and rivers are listed in terms of miles. Wetlands are listed in terms of acres. Generally, inland lakes are listed in their entirety as acres, and Great Lakes and bays are listed in terms of square miles, except for Great Lake and inland lake beaches, which are listed in terms of shoreline miles for pathogen concerns.

#### **4.11 Assessment Unit Assignment to Categories**

After support determinations for all designated uses and geographic extent decisions are made for an assessment unit, categories are assigned using a multiple category system. The following categories and subcategories are used:

Category 1: All designated uses are supported, no use is threatened.

Category 2: Available data and/or information indicate that some, but not all of the designated uses are supported.

Category 3: There is insufficient available data and/or information to make a designated use support determination.

Category 4: Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed.

Category 4a: A TMDL to address the impairment-causing pollutant has

been approved or established by the USEPA.

Category 4b: Other approved pollution control mechanisms are in place and are reasonably expected to result in attainment of the designated use within a practical time frame.

Category 4c: Impairment is not caused by a pollutant (e.g., impairment is due to lack of flow or stream channelization).

Category 5: Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed.

An assessment unit is considered threatened and is placed in Categories 4 or 5 when water quality data analysis demonstrates a declining trend that is expected to cause that water body to not attain WQS by the next listing cycle (2018). An assessment unit is not attaining WQS when any designated use is not supported (i.e., Category 4 or 5). Assessment units placed in Category 5 form the basis for the Section 303(d) list and the TMDL development schedule (see Chapter 9 for additional information regarding TMDLs).

A statewide TMDL has been developed for PCBs and is currently under review by the USEPA. It is anticipated that, upon approval of the TMDL, future assessments involving PCB data determined to be atmospheric in source (vs. an otherwise locally controllable source from legacy contamination or point-source conditions) will be assigned to Category 4a based on the existence of the approved statewide PCB TMDL. More information on this process is described in the statewide PCB TMDL.

A few instances exist where the MDEQ has determined that assessment units do not support one or more designated uses, but other appropriate pollution control mechanisms are in place. These assessment units are placed in Category 4b. As described above, the pollution control mechanism for a Category 4b water body is expected to result in the attainment of the designated use within a practical timeframe. Considerations to determine if a pollution control mechanism is appropriate to place a water body in Category 4b include, but are not limited to: the scale of the project (e.g., geographic extent affected, duration, etc.) and the anticipated level of impact on water quality. The MDEQ works closely with the USEPA to develop any new listings in Category 4b.

Assessment methodologies used for streams and rivers are also used for channelized streams, when appropriate, including rapid bioassessment of macroinvertebrate and fish communities according to the five-year rotating watershed cycle.

An assessment unit is listed in Category 4c when sufficient water quality data and information are available to determine all of the following:

- A specific designated use is not supported (e.g., the other indigenous aquatic life and wildlife designated use is not supported based on a P51 poor macroinvertebrate community rating).
- The cause of the designated use nonattainment is due to something other than a pollutant (e.g., channel maintenance activity or beaver dam).
- No pollutant would cause the designated use nonattainment if the above cause did not occur.

Assessment units are only placed in Category 4c when MDEQ monitoring staff determines (using P51 or other appropriate techniques) that sufficient water quality data and information are available to clearly indicate that the Category 4c listing requirements explained in the preceding paragraph fully apply.

Key factors considered by MDEQ monitoring staff to help differentiate whether pollutants or other causes are responsible for the observed nonattainment include: water/sediment chemistry and microbiological data when such data are available for the assessment unit, riparian land use characteristics, and P51 habitat metric scores, particularly those for the epifaunal substrate/available cover, embeddedness, sediment deposition, channel alteration, channel sinuosity, bank stability, bank vegetative protection, and riparian vegetative zone width metrics.

It should be noted that the MDEQ recognizes sediment to be a pollutant. If MDEQ aquatic biologists determine that a pollutant (including riparian sediment) is responsible for an assessment unit not supporting a designated use, then that assessment unit is listed in Category 5. Additionally, if channel modification activities in an upstream assessment unit result in sedimentation problems in a downstream assessment unit to a point which causes a designated use to not be supported, then that downstream assessment unit is listed in Category 5.

Michigan uses a multiple category system; therefore, placement of an assessment unit in Category 4c based on a determination that a designated use is not supported and the cause is not a pollutant does not preclude placement of that assessment unit in Category 5 (or any other category) based on a designated use support determination for a different designated use.

Assessment units that do not support a designated use due to multiple causes may be listed in multiple categories for that designated use. For example, an assessment unit may have a TMDL completed for sedimentation; therefore, the assessment unit is listed in Category 4a for the other indigenous aquatic life and wildlife designated use. The same assessment unit may have a mercury TMDL scheduled but not yet completed; therefore, the assessment unit is also listed in Category 5 for the other indigenous aquatic life and wildlife designated use (see Table 4.3, Assessment Unit 10). In this case, the assessment unit is reported in both Categories 4a and 5 for the other indigenous aquatic life and wildlife designated use.

The following example (Table 4.3) adapted from USEPA guidance, illustrates Michigan's use of a multiple category system.

Table 4.3. Examples of assessment unit assignment to categories using a multiple category system with three designated uses. S = Supporting, NS = Not Supporting, - = Not Assessed, ? = Insufficient Information, / = Designated use does not apply to assessment unit. In designated use support summary tables (e.g., Tables 5.2, 5.3, 6.2, 7.2, and 8.1) Category 3 is reported as two subcategories: Insufficient Information and Not Assessed.

	Designated use A	Designated use B	Designated use C	Assigned Categories
Assessment Unit 1	S	S	S	1
Assessment Unit 2	NS	NS	NS	5
Assessment Unit 3	S	S	-	2, 3
Assessment Unit 4	S	S	?	2, 3
Assessment Unit 5	S	-	?	2, 3
Assessment Unit 6	S	NS (nonpollutant)	S	2, 4c
Assessment Unit 7	S	?	NS	2, 3, 5
Assessment Unit 8	S	NS (nonpollutant)	/	2, 4c, 3*
Assessment Unit 9	-	NS (TMDL approved)	NS	3, 4a, 5
Assessment Unit 10	-	NS (TMDL approved) NS	-	3, 4a, 5

\* Currently designated uses that do not apply to an assessment unit are assigned not assessed in the ADB (e.g., coldwater fishery).

Justification for designated use support determination for each assessment unit is contained in the ADB. A comprehensive list of designated use support determinations is provided in Appendix B.

#### 4.12 Impairment Cause and Source

When a determination is made that a designated use is not supported (i.e., an assessment unit is placed in Category 4 or 5), the cause and source of impairment are identified. Generally, the cause of impairment is the parameter(s) used to determine that the designated use is not supported unless a biological indicator is used. The source of impairment is determined using supporting contextual information and BPJ.

In addition, sediment toxic substance concentration data may be used to support other assessment types to make support determinations for the other indigenous aquatic life and wildlife, fish consumption, or other designated uses. Sediment data are collected from water bodies when there is direct knowledge or reasonable expectation of heavy metal or organic chemical contamination at levels that may impair biological communities by direct toxicity or cause fish consumption problems. Contaminated sediments may be listed as the source of impairment when sediment pollutant concentrations exceed screening concentrations (MacDonald et al., 2000; Jones and Gerard, 1999; and Ontario Ministry of the Environment, 1993) or when sediment toxicity test results demonstrate excessive toxicity.

#### 4.13 Delisting Category 5 Assessment Units

Assessment units are removed from the Section 303(d) list (i.e., moved from Category 5 to another category) by the MDEQ using representative data and the current assessment methodology. Data analysis used to remove an assessment unit from the Section 303(d) list must be at least as rigorous a data analysis as was originally used to list the water body.

Specific instances that justify the removal of assessment units from Category 5 include:

- A TMDL has been developed for all pollutants and approved by the USEPA (assessment unit is placed in Category 4a).
- A corrective, remediation action plan has been approved to be implemented or the problem source(s) has been removed, thereby, eliminating the need for a TMDL (assessment unit is placed in Category 4b or when water quality is reevaluated and it is determined that the designated use is supported, the assessment unit is placed in Category 2 or Category 1).
- The source of impairment for the initial designated use support determination was an untreated CSO and updated information reveals that the untreated CSO has been eliminated or control plan elements have been implemented in a legally binding document that includes a schedule for elimination of the untreated discharge but data are not yet available to document restoration (assessment unit is placed in Category 3 unless the corrective action program has not yet been completed, then it is placed in Category 4b).
- Reassessment of the assessment unit using updated monitoring data or information, techniques, or WQS, indicates that the water body now supports the designated use (assessment unit is placed in Category 1 or Category 2), or that additional monitoring or information is needed to determine whether the designated use is supported (assessment unit is placed in Category 3). For example, a water body may be moved from Category 5 to Category 3 if one year of new data indicated designated use support, but additional monitoring is needed to ensure continued designated use support.
- Reexamination of the monitoring data or information used to make the initial designated use support determination reveals that the decision was either incorrect or inconsistent with the current assessment methodology.
- Reassessment of a water body indicates that the cause of impairment is not a pollutant (assessment unit is placed in Category 4c).
- The assessment unit is determined to be within Indian Country, as defined in 18 U.S.C., Section 1151. These water bodies are not considered waters of the state of Michigan, and therefore, are not appropriate to include on the Section 303(d) list.

#### **4.14 Assessment Methodology Changes**

In addition to the minor edits and clarification changes made to update the 2016 assessment methodology for the 2018 IR, the following updates were made under the noted Sections:

**4.2 & 4.6.1.1:** Expansion of the data window used for WCMP program data to 7 years to potentially capture 2 cycles of data within a review period thereby providing better supporting information on conditions over time. Revisions were made to Figures 4.3a and b to reflect this change.

**4.6.2.3:** *Sediment toxicity methodology* was added as an indicator to make support determinations for the Other Indigenous Aquatic Life and Wildlife designated use based on

sediment toxicity data in combination with other supporting information, in part following past comments received from the public.

**4.9.1.4:** Nitrates was added as an indicator to the Public Water Supply designated use to clarify the methodology that has been used for this parameter and in response to comments received from the USEPA.

**4.9.1.5:** Total Microcystins was added as an indicator to the Public Water Supply designated use based on comments received from, and coordination with, SDWA staff within the MDEQ's Office of Drinking Water and Municipal Assistance Division.