Rule Summary and Fiscal Analysis
Part A - General Questions

Rule Number: 901:13-1-19

Rule Type: Amendment

Rule Title/Tagline: Nutrient management planning requirements for watersheds in distress.

Agency Name: Department of Agriculture

Division:

Address: 8995 East Main Street Reynoldsburg OH 43068

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I. Rule Summary

1. **Is this a five year rule review?** Yes

    A. **What is the rule's five year review date?** 10/15/2018

2. **Is this rule the result of recent legislation?** No

3. **What statute is this rule being promulgated under?** 119.03

4. **What statute(s) grant rule writing authority?** 939.02

5. **What statute(s) does the rule implement or amplify?** 939.02

6. **What are the reasons for proposing the rule?**

    Due to the presence of harmful algae blooms (HABs), Ohio Environmental Protection Agency's 2018 Integrated Water Quality Report declared the Western Basin of Lake Erie "impaired", and amended its 2016 report to say the same. It has become clear that focusing solely on manure-based nutrient management plans for watersheds in distress limits the distress designation to only one type of agriculture nutrient source, and all agriculture-based nutrient sources should be considered. The Department views this rule package as the proper next step to help improve watersheds designated as "distressed".

7. **Summarize the rule's content, and if this is an amended rule, also summarize the rule's changes.**

   OAC 901:13-1-19 outlines the nutrient management planning requirements for watersheds in distress. The rule has been amended to require all owners, operators, or persons responsible for applying nutrients on more than fifty acres on an annual basis within a watershed in distress to develop a nutrient management plan in accordance with the rule. The rule outlines the information that must be included within the nutrient management plan. In addition, based on stakeholder comments, the rule has been amended to require the Department to conduct an audit of at least 5% of the attestations submitted to determine compliance regarding completion of nutrient management plans.

8. **Does the rule incorporate material by reference?** Yes

9. **If the rule incorporates material by reference and the agency claims the material is exempt pursuant to R.C. 121.71 to 121.76, please explain the basis for the exemption and how an individual can find the referenced material.**
   The rule incorporates a reference which is defined in OAC 901:13-1-01. The definition indicates how an individual may find the referenced material. Further, pursuant to section 121.76 of the Revised Code, the code sections incorporated into this rule are exempt from compliance with sections 121.71 to 121.74 of the Revised Code.

10. **If revising or re-filing the rule, please indicate the changes made in the revised or re-filed version of the rule.**

    Not Applicable

II. <u>Fiscal Analysis</u>

11. **As a result of this proposed rule, please estimate the increase / decrease in revenues or expenditures affecting this agency, or the state generally, in the current biennium or future years. If the proposed rule is likely to have a different fiscal effect in future years, please describe the expected difference and operation.**

    This will increase expenditures.

    $1,500,000.00

    The Department is required to audit 5% of the individuals whom have attested to a Nutrient Management Plan every year. As this is a new requirement, this will increase time for inspectors, including travel expenses. Pursuant to ORC 939.02, the rule now includes "nutrients" which will expand the regulated community to include row crop farmers and those who apply nutrients and/or manure to over fifty acres on an annual basis. Additionally, should new watersheds be declared as watersheds in distress, the departments costs would increase as a result of the time necessary to assist completion of the required nutrient management plans. Further, the inclusion of "nutrients" will result in increased inspections, investigations, and administrative actions which will increase expenditures for the department.

The Soil and Water Conservation Commission is considering a request to declare seven watersheds as distressed. These watershed cover twelve counties within Ohio. Should these watersheds be declared as distressed, the Department estimates that it will require one additional employee per county to complete the work necessary. These employees will be necessary to investigate complaints regarding inappropriate application of manure and nutrients, assist with the completion of necessary nutrient management plans, design systems to accommodate the storage of manure in compliance with comprehensive nutrient management plans, assist in civil and criminal investigations.

The approximate estimate of these costs is $1,500,000.00 annually. This figure will cover employees, their benefits, vehicle costs, and equipment.

12. What are the estimated costs of compliance for all persons and/or organizations directly affected by the rule?

The costs of compliance with these rules varies widely based on the size, scope, and location of the operation. There are a number of operations within Ohio who already have a nutrient management plan which would satisfy this rule. These operations would not incur any additional costs due to these changes. Further, there are operations which have a number of the components of a nutrient management plan but do not fully meet the requirements of a complete plan. These operations would have reduced costs in completing their requirements under these rules.

Members of the impacted business community which operate within a watershed in distress must develop and operate in conformance with a nutrient management plan that address the methods, amount, form, placement, cropping system and timing of all nutrient applications. Operations which apply manure and are required to obtain a CNMP could expect to occur costs of $55/hour for the development of this plan. Based on data provided to the Department by USDA NRCS, the cost of a CNMP could range from $2,400 to $12,100. The cost of the CNMP varies greatly and depends on the operation including size and complexity. Operations which do not apply manure would only be required to obtain a "simple" nutrient management plan. Costs for these plans on average range between $2,500 to $3,000 per plan, per producer. In an effort to assist the regulated community, USDA NRCS may have funds available to lower the cost of these plans. In addition, operations within a watershed in distress may be required to implement other practices such as installing filter strips onto their farmland, correcting and preventing erosion issues, and purchasing new equipment to comply with nutrient placement requirements.

The nutrient management plans must be in a form as outlined in paragraph (C) of rule 901:13-1-19. These forms include the Ohio nutrient management workbook, USDA NRCS comprehensive nutrient management plan (CNMP), or an equivalent document which has been approved by the Department. At a minimum, these plans must include soil tests, manure analysis (if applicable), planned application rates, field information, as well as other points of information outlined in rule.

Depending on the size and scope of the operations which are required to obtain a CNMP may have to install additional manure storage facilities. According to the USDA NRCS, each livestock facility on average would be expected to spend $80,000 for these "practices" over a ten-year period.

The impacted community must comply with the Natural Resources Conservation Service (NRCS) 590 standards contained in the Field Office Technical Guide.

All operations must attest to the completion of their nutrient management plan by the deadline established by the Director. The aforementioned plans must be updated every three years as well as conditions changed. Further, after a plan update is complete, the operators must re-attest to their plan.

Operations within a watershed in distress must compete and maintain operating records as outlined in paragraph (F) of rule OAC 901:13-1-19. This requires time for compliance as well as storage capabilities for five years of records.In order to comply with recordkeeping requirements, operators must spend time for compliance. Operators may have equipment which tracks and records all the necessary data however, this type of equipment is expensive and not required. Operators can accomplish the recordkeeping requirements manually and may store paper records or keep electronic copies.

Failure to comply with these rules may be subject to civil fines as outlined in OAC 901:13-1-99. Individuals who do commit a violation of these rules may be subject to civil fines in amounts from $250 to $10,000. The amount of the violation depends on the rule violated, the severity of the violation, and any history of non-compliance. Further, the quantified impact of corrective actions will depend entirely on the violation and the means to correct that violation.

13. **Does the rule increase local government costs? (If yes, you must complete an RSFA Part B).** Yes

14. **Does the rule regulate environmental protection? (If yes, you must complete an RSFA Part C).** Yes

III. Common Sense Initiative (CSI) Questions

15. **Was this rule filed with the Common Sense Initiative Office?** Yes

16. **Does this rule have an adverse impact on business?** Yes

    A. **Does this rule require a license, permit, or any other prior authorization to engage in or operate a line of business?** Yes

    The rule, as amended, requires all owners, operators, or persons responsible for applying nutrients on more than fifty acres on an annual basis within a watershed in distress to develop a nutrient management plan in accordance with the rule. Failure to have a nutrient management plan prior to applying manure or nutrients could result in a civil penalty being levied against you.

    B. **Does this rule impose a criminal penalty, a civil penalty, or another sanction, or create a cause of action, for failure to comply with its terms?** Yes

    Failure to comply with this rule could result in a civil penalty in accordance with OAC 901:13-1-99.

    C. **Does this rule require specific expenditures or the report of information as a condition of compliance?** Yes

    The rule requires all individuals required to have a nutrient management plan submit an attestation to the Department affirming that they have a completed nutrient management plan. Further, operating records must be kept and maintained however they do not need to be submitted as a condition of compliance.

Rule Summary and Fiscal Analysis
Part B - Local Governments Questions

1. Does the rule increase costs for:

A. Public School Districts	No
B. County Government	Yes
C. Township Government	No
D. City and Village Governments	No

2. Please estimate the total cost, in dollars, of compliance with the rule for the affected local government(s). If you cannot give a dollar cost, explain how the local government is financially impacted.

The Ohio Soil and Water Districts affected by the proposed amendments to this rule will be required to spend more time and resources in complying with this rule. No additional costs are directly required by these rules however, some SWCD's may wish to hire additional staff. If no additional staff is hired, the existing staff will need to accommodate these changes by spending less time participating in other projects.

3. Is this rule the result of a federal government requirement? No

A. If yes, does this rule do more than the federal government requires? *Not Applicable*

B. If yes, what are the costs, in dollars, to the local government for the regulation that exceeds the federal government requirement?

Not Applicable

4. Please provide an estimated cost of compliance for the proposed rule if it has an impact on the following:

A. Personnel Costs

As stated above, the local SWCD's will need to devote more personnel to these amendments. No additional costs are directly required by these rules however, some SWCD's may wish to hire additional staff. If no additional staff is hired, the existing staff will need to accommodate these changes by spending less time participating in other projects.

B. New Equipment or Other Capital Costs

Not applicable.

C. Operating Costs

Not applicable.

D. Any Indirect Central Service Costs

Not applicable.

E. Other Costs

SWCD's may experience other administrative costs for space and supplies.

5. Please explain how the local government(s) will be able to pay for the increased costs associated with the rule.

Allocated by the General Assembly, the Department has resources available that may be used in order to assist SWCD in compliance with this rule.

6. What will be the impact on economic development, if any, as the result of this rule?

Not applicable.

Rule Summary and Fiscal Analysis
Part C - Environmental Rule Questions

Pursuant to Am. Sub. H.B. 106 of the 121st General Assembly, prior to adopting a rule or an amendment to a rule dealing with environmental protection, or containing a component dealing with environmental protection, a state agency shall:

(1) Consult with organizations that represent political subdivisions, environmental interests, business interests, and other persons affected by the proposed rule or amendment.

(2) Consider documentation relevant to the need for, the environmental benefits or consequences of, other benefits of, and the technological feasibility of the proposed rule or rule amendment.

(3) Specifically identify whether the proposed rule or rule amendment is being adopted or amended to enable the state to obtain or maintain approval to administer and enforce a federal environmental law or to participate in a federal environmental program, whether the proposed rule or rule amendment is more stringent than its federal counterpart, and, if the proposed rule or rule amendment is more stringent, the rationale for not incorporating its federal counterpart.

(4) Include with the proposed rule or rule amendment and rule summary and fiscal analysis required to be filed with the Joint Committee on Agency Rule Review information relevant to the previously listed requirements.

(A) Were organizations that represent political subdivisions, environmental interests, business interests, and other persons affected by the proposed rule or amendment consulted? Yes

Please list each contact.

Organization Contact
Advocates for a Clean Lake Erie Mike Ferner
Alliance for the Great Lakes Crystal Davis
Black Swamp Rob Krain
Capitol Advocates Rob Eshenbaugh
Capitol Consulting Belinda Jones
CCAO Adam Schwiebert
CCAO Cheryl Subler
CJR Group Gary Smith
Ducks Unlimited Russ Terry
Environmental Defense Fund Karen Champan
Environmental Law & Policy Center Madeline Fleisher
Lake Erie Charter Boat Association Dave Spangler
Lake Erie Charter Boat Association Paul Pacholski
Lake Erie Foundation Matt Fisher
Lake Erie Foundation Matt Fisher

Lake Erie Improvement Jim Stoffer
National Wildlife Federation Gail Hesse
Ohio Agribusiness Assoc. Andrew allman
Ohio Agribusiness Assoc. Chris Henney
Ohio Beef Council/Ohio Cattlemen's Association Elizabeth Harsh
Ohio Corn & Wheat John Torres
Ohio Corn & Wheat Tadd Nicholson
Ohio Dairy Producers Scott Higgins
Ohio Ecological Food and Farm Association Amalie Lipstreu
Ohio Environmental Council Trent Dougherty
Ohio Environmental Stewardship Alliance Vickie Askins
Ohio Farm Bureau Adam Sharp
Ohio Farm Bureau Jack Irvin
Ohio Farm Bureau Larry Antosh
Ohio Farm Bureau Leah Curtis
Ohio Farm Bureau Roger High
Ohio Farm Bureau Tony Seegers
Ohio Farm Bureau Yvonne Lesicko
Ohio Farmers Union Joe Logan
Ohio Farmers Union Linda Borton
Ohio Federation of Soil and Water Conservation Districts Mindy Bankey
Ohio Forestry Association John Dorka
Ohio Municipal League Kent Scarlett
Ohio Pork Producers Council Bryan Humphreys
Ohio Poultry Association Jim Chakeres
Ohio Seed Improvement Assoc John Armstrong
Ohio Soil and Water Conservation Commission Tom Price
Ohio Soybean Council Kirk Merritt
Ohio State University Adam Ward
Ohio Township Association Heidi Fought
Ohio Turf Association Brian Laurent
Ohio Wine Producers Donniella Winchell
Ohio's Lake Erie Shores and Islands Larry Fletcher
Partners for Clean Streams Kris Patterson
Pheasants Forever Jim Inglis
The Nature Conservancy Jessica D'Ambrosio
The Nature Conservancy John Stark
The Nature Conservancy Sara Madenwald
The Nature Conservancy Tracy Freeman
The Ohio State University Peggy Hall
TMACOG Tim Brown
Ohio Soil and Water Conservation Commission Fred Cash

Ohio Soil and Water Conservation Commission Kate Bartter Arnold
Ohio Soil and Water Conservation Commission Bethany Gibson
Ohio Soil and Water Conservation Commission Bill Knapke
Ohio Soil and Water Conservation Commission Etta Reed
Ohio Soil and Water Conservation Commission Kent Stuckey
Grand St Marys Restoration Commission Tom Knapke

(B) Was documentation that is relevant to the need for, the environmental benefits or consequences of, other benefits of, and the technological feasibility of the proposed rule or amendment considered? Yes

Please list the information provided and attach a copy of each piece of documentation to this form. (A SUMMARY OR INDEX MAY BE ATTACHED IN LIEU OF THE ACTUAL DOCUMENTATION.)

USDA NRCS Field Office Techinical Guide which can be found by visiting: https://efotg.sc.egov.usda.gov/
USDA NRCS 590 Standards
Ohio EPA's 2018 Integrated Water Quality Monitoring Report
Distressed Watershed Designation Analysis Grand Lake St. Marys Watershed
Distressed Watershed Designation Analysis Selected Western Lake Erie Basin Watersheds

(C) Is the proposed rule or rule amendment being adopted or amended to enable the state to obtain or maintain approval to administer and enforce a federal environmental law or to participate in a federal environmental program? No

Is the proposed rule or rule amendment more stringent than its federal counterpart? *Not Applicable*

(D) If this is a rule amendment that is being adopted under a state statute that establishes standards with which the amendment is to comply, is the proposed rule amendment more stringent than the rule that it is proposing to amend? Yes

Please explain why?

Pursuant to the authority in ORC 939.02, the rule now includes "nutrients" which will expand the regulated community to include row crop farmers and those who apply nutrients and/or manure to over fifty acres on an annual basis. This will result in increased inspections, investigations, and administrative actions which will increase expenditures for the department.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

DEFINITION

Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

PURPOSE

- To budget, supply, and conserve nutrients for plant production.
- To minimize agricultural nonpoint source pollution of surface and groundwater resources.
- To properly utilize commercial fertilizer, manure and/or organic by-products as a plant nutrient resource or soil amendment.
- To protect air quality by reducing odors, nitrogen emissions (ammonia, oxides of nitrogen), and the formation of atmospheric particulates.
- To maintain or improve the physical, chemical, and biological condition of soil.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

CRITERIA

General Criteria Applicable to All Purposes

All Nutrients:

Plans for nutrient management are to comply with all applicable Federal, state, and local laws and regulations. A nutrient budget for nitrogen, phosphorus, and potassium must be developed that considers all potential sources of nutrients including, but not limited to, green manure, legumes, crop residues, compost, animal manure, organic by-products, biosolids, waste water, organic matter, soil biological activity, commercial fertilizer, and irrigation water.

For nutrient risk assessment policy and procedures see Title 190, General Manual (GM), Part 402, Nutrient Management, and Title 190, National Instruction (NI), Part 302, Nutrient Management Policy Implementation. The Nitrogen and Phosphorous Transport Risk Assessment Procedures is attached as Appendix I.

To avoid salt damage, the rate and placement of applied nitrogen and potassium in starter fertilizer must be consistent with the Tri-State Fertility Guide recommendations, or industry practice.

The NRCS-approved nutrient risk assessment for nitrogen must be completed on all sites unless the State NRCS, with the concurrence of State water quality control authorities, has determined specific conditions where nitrogen leaching is not a risk to water quality, including drinking water.

The Phosphorous Index Risk Assessment Procedure (P-Risk Index) or Soil Test Risk Assessment Procedure (STRAP) must be completed when:

- Soil Test Phosphorus (STP) levels exceed the maintenance limit in the Tri-State Fertility Guide (Extension Bulletin E-2567) for the planned crop and/or the planned phosphorus application rate exceeds recommended rates. (There is no agronomic reason to apply nutrients when soil tests are above the maintenance plateau level)

See Appendix I at the end of this standard for an explanation of the Ohio NRCS Risk Assessment Procedures.

A phosphorus risk assessment will not be required for fields that have a documented agronomic need for phosphorus based on soil test phosphorus (STP) level and the Tri-State Fertility Guide (Extension Bulletin E-2567) nutrient recommendations. On organic operations, the nutrient sources and management must be consistent with the USDA's National Organic Program and meet the requirements of this practice standard.

Areas contained within minimum application setbacks (e.g., sinkholes, wellheads, gullies, ditches, or surface inlets) must receive nutrients consistent with the setback restrictions. (See Table 4 Minimum Setback Distances for the Application of Manure and other Organic By-Products at the end of this standard for setback).

Applications of irrigation water must minimize the risk of nutrient loss to surface and groundwater.

Soil pH must be maintained in a range that enhances an adequate level for crop nutrient availability and utilization. Refer to the Tri-State Fertility Guide or the Ohio Agronomy Guide for guidance.

Commercial Fertilizer:

Enhanced efficiency fertilizers, used in the State must be defined by the Association of American Plant Food Control Officials (AAPFCO) and be accepted for use by the State fertilizer control official, or similar authority, with responsibility for verification of product guarantees, ingredients (by AAPFCO definition) and label claims.

To avoid salt damage, the rate and placement of applied nitrogen and potassium in starter fertilizer must be consistent with The Ohio State University guidelines, or industry practice recognized by the university.

Soil, Manure, and Tissue Sampling and Laboratory Analyses (Testing):

All Nutrients:

Nutrient planning must be based on current soil, manure, and (where used as supplemental information) tissue test results developed in accordance with The Ohio State University guidance, or industry practice, if recognized by the university.

Current soil tests are those that are no older than 3-4 years depending on the crop rotation and or intensity of the sampling. Shorter intervals may be appropriate if nutrient applications and crop yields are sufficiently variable to make nutrient status levels difficult to predict.

Soil samples for soil tests should represent 25 acres or less. Soil sampling depth for P and K shall be 6-8 inches. Under no till conditions pH should be tested at a depth of 4 inches or less.

For precision nutrient management plans, soil samples for soil tests should represent 12 acres or less for a zone management system and 6 acres or less for grid sampling. When a zone precision nutrient management plan is being developed, soil fertility, soil types, cropping history, and crop management practices should be taken into consideration when delineating the zones.

Soil tests taken soon after nutrient application may produce high (inaccurate) nutrient results.

The soil and tissue tests must include analyses pertinent to monitoring or amending the annual nutrient budget, e.g., pH, electrical conductivity (EC) and sodicity (where salts are a concern), soil organic matter, phosphorus, potassium, calcium, magnesium, and CEC and other nutrients where they are known to be crop limiting and test for nitrogen where applicable. Follow The Ohio State University guidelines regarding required sampling procedures and test methodology.

Soil samples shall be collected and prepared according to The Ohio State University guidance or standard industry practice. Soil test analyses shall be performed by laboratories that can provide the North Central Region 13 (NCR 13) method of testing. (NCR 13 specifies extraction methods appropriate for the Midwest conditions). Laboratories must successfully meet the requirements and performance standards of the North American Proficiency Testing Program-Performance Assessment Program (NAPT-PAP) under the auspices of the Soil Science Society of America (SSSA) and NRCS.

Manure:

Nutrient values of manure, organic by-products and biosolids must be determined prior to land application.

Manure, organic by-products and bio-solids analyses must include, at minimum, total nitrogen (N), ammonium N, nitrate N, total phosphorus (P) as P_2O_5, total potassium (K) as K_2O, and percent solids, or follow The Ohio State University guidance regarding required analyses.

The use of manure as a nutrient source is to be based on at least one annual analysis of the material in storage prior to application. Manure, organic by-products, and biosolids samples must be collected and analyzed as closely to land application as practical and at least annually from each separate storage facility. Manure samples should also be taken to account for operational changes (feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations. If no operational changes occur, less frequent manure testing is allowable where operations can document a stable level of nutrient concentrations for the preceding three consecutive years, unless federal, State, or local regulations require more frequent testing. Samples must be collected, prepared, stored, and shipped, following testing lab sampling requirements, The Ohio State University guidance or industry practice.

When planning for new or modified livestock operations manure nutrient values can be obtained from acceptable “book values” recognized by the NRCS (e.g., NRCS Agricultural Waste Management Field Handbook), the Ohio Livestock Manure Management Guide (Bulletin 604-06), or the Midwest Plan Service if manure from the existing operation is not available. Analyses from similar operations in the geographical area may be used if they accurately represent nutrient output storage and treatment methods of the proposed operation.

Manure testing analyses must be performed by laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program (MTLCP) under the auspices of the Minnesota Department of Agriculture, or other NRCS-approved program that considers laboratory performance and proficiency to assure accurate manure test results.

Nutrient Application Rates:

All Nutrients:

At a minimum, determination of nutrient application rate must be based on current soil test results, a cropping sequence, and realistic yield goals utilizing the recommendations from the Tri-State Fertility Guide. If nutrients from manure are applied in excess of agronomic need, an NRCS- approved nutrient risk assessments must be completed.

Realistic yield goals must be established based on a combination of the following… historical yield data (specific farm or county data if specific farm data is not available), soil productivity information, climatic conditions, nutrient test results, level of management, future management considerations, and local research results considering comparable production conditions as available. Applications of all sources of nutrients, including biosolids, starter fertilizers, or pop-up fertilizers must be accounted for in the nutrient budget.

Estimates of yield response must consider factors such as poor soil quality, drainage, pH, salinity, etc., before recommendations of adequate levels of nitrogen and/or phosphorus can be established.

For new crops or varieties, other land grant universities, industry- demonstrated yield, and nutrient utilization information may be used until The Ohio State University information is available.

Develop nutrient draw-down strategies when the phosphorus risk assessment procedures indicate a very high risk of transport. In addition to not applying additional nutrients, draw-down strategies may include changing the rotation to crops having higher nutrient demands, removal of crop biomass (e.g. straw or hay), and utilizing harvested cover crops to remove nutrients from the system.

Lower-than-recommended nutrient application rates are permissible if the grower's objectives are met. Participation in an Adaptive Nutrient Management on-farm trial is a good way to help achieve yield goals while minimizing nutrient application.

Maximum Allowable Nutrient Application Rates:

The maximum allowable rate of nutrient application are to be determined based on the following:

Phosphate (P_2O_5), and potash (K_2O) application rates are to follow the recommended rates in the Tri-State Fertility Guide (Extension Bulletin E-2567. [See "Manure" section below in for livestock operations that produce more nutrients (manure) than can be utilized by crops]. Excess potash is not to be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages.

Nitrogen rates will be based on the economic threshold models developed by Purdue University or The Ohio State University. Adjust N rates for contributions from previous crops (legumes or forages), and soil organic matter.

Applications of phosphate (P_2O_5), and potash (K_2O) via fertilizer, manure, or other organic by-products can be made for multiple years of the rotation as long as

- no more than 500 Lbs/ac of potash (K_2O) are applied in any one year.
- no more than 250 Lbs/ac of (P_2O_5) are applied in any one year.

NOTE: In cases where liquid manure exceeds 60 Lbs P2O5 per 1000 gallons or solid manure exceeds 80 Lbs P_2O_5 per ton the P_2O_5 rates can be increased up to a maximum of 500 Lbs P_2O_5 /acre as long as nitrogen rates for the next crop are not exceeded nor the annual limit for K_2O of 500 Lbs/acre.

Commercial Fertilizer:

Planned nutrient application rates for phosphorus and potassium must not exceed the Tri-State Fertility Guide recommendations. Nitrogen rates will be based on the economic threshold models developed by Purdue University or The Ohio State University.

When applying fertilizer, the phosphorus application rate can account for multiple years in the crop rotation in one application. When such applications are made, the rate must not exceed:

- the acceptable phosphorus risk assessment criteria
- and no additional phosphorus may be applied until the crops in rotation have utilized the applied phosphorus. The exception is if the soil test phosphorus value falls within the buildup range of the Tri-State Fertility Guide.

Manure:

Application rates for manure are to be based on the most limiting factor of nutrient content, volume/weight limitation of the material.

When applying manure, the phosphorus application rate can account for multiple years in the crop rotation in one application. When such applications are made, the rate must not exceed:

- the acceptable phosphorus risk assessment criteria
- the recommended nitrogen application rate for the current crop.
- and no additional phosphorus may be applied until the crops in rotation have utilized the applied phosphorus. The exception is if the soil test phosphorus value falls within the buildup range of the Tri-State Fertility Guide.

Planned nutrient application rates for phosphorus and potassium should not exceed the Tri-State Fertility Guide recommendations. For livestock operations that produce more nutrients (manure) than can be utilized by crops and nutrient planned application rates exceed Tri-State Fertility Guide recommendations, an NRCS- approved nutrient risk assessment must be completed prior to nutrient application. Nutrient application beyond agronomic need should be viewed as a short term solution and other alternatives such as reducing nutrients in the manure and/or developing manure marketing strategies should be strongly considered.

For fields receiving manure, where phosphorus risk assessment results equate to:

LOW RISK:

Additional phosphorus can be applied at rates greater than crop requirement not to exceed the nitrogen requirement for the succeeding crop

MODERATE RISK:

Additional phosphorus may be applied at a phosphorus crop requirement rate for the planned crops in the rotation.

HIGH RISK:

Additional phosphorus may be applied at phosphorus crop removal rates if the following requirements are met:

- there is less than a 50% chance of rainfall of more than ½ inch within 24 hours.
- a long term soil phosphorus drawdown strategy has been implemented, and
- a site assessment for nutrients and soil loss has been conducted to determine if mitigation practices are required to protect water quality.

Any deviation from these high risk requirements must have the approval of the Chief of the NRCS.

Nitrogen rates will be based on the economic threshold models developed by Purdue University or The Ohio State University. Manure or organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass or not to exceed 150 lbs/acre of N, whichever is less.

Additional Criteria for Liquid Manure:
For liquid manure, the application rate is to be adjusted to the most limiting factor to avoid ponding, surface runoff, subsurface drainage (tile) discharge, the nutrient needs of the field, or the nitrogen or phosphorus risks for the field. The total application is not to exceed the field capacity of the upper 8 inches of soil. See Table 1. of this standard (Available Water Capacity (AWC) Practical Soil Moisture Interpretations for Various Soils Textures and Conditions to Determine Liquid Manure Volume Applications not to exceed AWC) to determine AWC and the amount (volume) that can be applied to reach the AWC. The actual application rate shall be adjusted during application to avoid ponding or runoff. Bare/Crusted soils may require some tillage to improve infiltration. See Table 3, of this standard, (Determining The Most Limiting Manure Application Rates) to determine the most limiting application rate factor base on the field condition and site limitations.

Additional Criteria for Nitrogen Application via Manure, Organic By-Products, and Biosolids (during Summer and Fall Periods):
On fields with a "High Nitrogen Leaching Potential" (rating more than 10) and with no growing crop, manure and other organic by-products application is to be limited to 50 Lbs/ac of Nitrogen (Ammonium N + 1/3 of the Organic N) calculated at the time of application from June to October 1st to limit nitrogen leaching. When a grass or legume cover crop is growing or established immediately after manure application, manure or other organic by-products can be applied prior to October 1st at the recommended Nitrogen rate for the next non-legume crop or the nitrogen removal rate for the next legume (maximum 150 Lbs/ac) crop.

Nutrient Sources:

All Nutrients:

Nutrient sources utilized must be compatible with the application timing, tillage and planting system, soil properties, crop, crop rotation, soil organic content, and local climate to minimize risk to the environment.

Nutrient Application Timing and Placement:

All Nutrients:

Timing and placement of all nutrients must correspond as closely as practical with plant nutrient uptake (utilization by crops or cover crops), and consider nutrient source, cropping system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment results.

Nutrients from any source must not be surface-applied if nutrient losses offsite are likely. This precludes spreading on:

- Frozen and/or snow-covered soils
  and not
- When the top 2 inches of soil are saturated from rainfall or snow melt.
- When there is a greater than 50% chance of rainfall of more than ½ inch within 24 hours.

Manure:

Where manure is to be spread on land not owned or controlled by the livestock producer, the nutrient management plan, as a minimum, shall document the amount of manure to be transferred and who will be responsible for the environmentally acceptable use of the manure.

Additional Criteria for Fields Prone to Flooding:
Agricultural manure is not to be land-applied on soils that are frequently flooded, as defined by the National Cooperative Soil Survey (or in the Flooding Frequency Soil List posted in Section II eFOTG), during the period when flooding is expected unless incorporated immediately.

Additional Criteria for Subsurface (tile) Drained Fields:
Fields or areas of fields that are subsurface (tile) drained require additional precautions. When liquid manure is applied to fields with subsurface drains, the liquid can follow soil macropores directly to the tile drains creating a surface water pollution hazard from direct tile discharge. A field is considered subsurface drained if 1/3 or more of the field is subsurface drained; however, even a field with one subsurface drainage line may present a risk of manure/wastewater movement to subsurface drains and cause a direct discharge. Research has shown that the higher the solids content of liquid manures (>4% solids), the less likely it is to move to subsurface drainage systems. To reduce the risk of nutrients getting into the tile:

1. Do not apply application rates (volume) that would exceed the lesser of the AWC in the upper 8 inches or ½ in per acre or approximately 13,500 gallons/acre per application.
2. Surface apply the liquid manure uniformly onto a growing crop or cover crop. If the field is not established in a growing cover crop or cover crop, prior to manure application:
    a. Use a vertical tillage tool that can disrupt/close (using horizontal fracturing) the preferential flow paths (worm holes, cracks, root channels) in the soil, or till the surface of the soil 3-5 inches deep to a condition that will absorb the liquid manure. The purpose is to have the surface soil act as a sponge to soak up the liquid manure and keep it out of preferential flow channels. This is especially important if shallow tile are present (< 2 feet deep). Any pre-application tillage should leave as much residue as possible on the soil surface. The adsorption of liquid manure by the soil in the root zone will minimize nitrogen loss and the manure/nutrient runoff potential. For perennial crops (hay or pasture), or continuous no till fields where tillage is not an option, all tile outlets from the application area are to be plugged prior to application. <u>This criteria may be waived if the producer can verify there is no prior history of manure discharge via subsurface drains. However, if there is a discharge the producer is liable for damages.</u>
    b. If injection is used, inject only deep enough to cover the manure with soil. Till the soil at least 3 inches below the depth of injection prior to application, or all tile outlets from the application area are to be plugged prior to application. <u>This criteria may be waived if the producer can verify there is no prior history of manure discharge via subsurface drains. However, if there is a discharge the producer is liable for damages.</u>
    c. In addition to tillage prior to surface liquid manure application or injection, install in-line tile flow control structures or inflatable tile plugs that can mechanically stop or regulate tile flow either prior to application, or have on site if needed to stop tile flow. Use caution not to back tile water where it may impair the functioning of an offsite subsurface drainage system. This criteria may be waived if the producer can verify there is no prior history of manure discharge via subsurface drains. However, if there is a discharge the producer is liable for damages.
    d. Apply at very low rates (.2” per acre) to reduce liquid manure movement to tiles.
3. Repair broken tile or blow holes prior to application.

Additional Criteria for Surface Drained Fields:
Fields or areas of fields that have systematic “surface drainage” systems (e.g. shallow surface drains spaced 100 – 200 feet apart – NRCS Practice Code 607). These "internal" surface drains are considered concentrated flow areas. However, if special precautions are taken, manure can be applied in the surface drains with minimal risk of surface runoff. THIS DOES NOT APPLY TO THE COLLECTOR SURFACE DRAINS (mains) OR DRAINS BORDERING THE FIELDS. The following special manure application techniques shall be used:

a. Limit LIQUID manure application rates to ½ in per acre or approximately 13,500 gallons/acre or less per application.
b. Surface apply the liquid manure uniformly onto a growing crop or cover crop.
c. If the field is not established in a growing crop or cover crop, till the surface at least 3 to 5 inches deep prior to liquid manure surface application. For SOLID manure incorporate within 24 hours. This can be done with a heavy disk, chisel plow, plow, field cultivator, AERWAY tool, or similar tool that can provide "full-width" soil disturbance to a depth of 3-5 inches.
d. For fields that have no subsurface (tile) drainage, the liquid manure can be injected directly with no prior tillage.

Additional Criteria for Highly Sloping Fields:
Organic nutrients should not be applied to cropland over 15% slope or to pastures/hayland over 20% slope unless one of the following precautions is taken:

a. Surface apply the liquid manure uniformly onto a growing crop or cover crop.
b. If there is not a growing crop or cover crop, immediate incorporate, band, or inject the manure on the contour, UNLESS the field has 80% ground cover (residue and/or canopy).
c. Applications are timed during periods of lower runoff and/or rainfall (Late May to Mid-October).
d. Apply low rates through split applications (separated by rainfall events). Apply no more than 10 wet tons/acre for solid manure/wastes; or 5000 gallons/acre for liquid manure/wastes.
e. The field is established in contour strips and utilizing a no-till cropping system.

Setback Distances:
No application of manure or organic by-products shall be made within a minimum distances shown in Table 4 Minimum Setback Distances for the Application of Manure and Other Organic By Products. These distances may need to be increased due to local conditions e.g. pond or lake used for a water supply or recreation area, or a stream that is already impaired by excess nutrients, etc. Setback distances from water and drainageways etc. is measured from the top of the edge of the bank at field level.

Emergency application of manure to frozen and /or snow covered soil:
If manure can be injected or immediately incorporated, the soil is not considered frozen for the intent of this criterion. Application on frozen and snow covered soil is not acceptable. Dry manure can be stockpiled using the Ohio NRCS Waste Transfer (Code 634) Manure Stockpiling Job Sheet. In an emergency, if liquid manure application becomes necessary on frozen or snow covered soils, only limited quantities of manure shall be applied to address manure storage limitations until non frozen soils are available for manure application. These situations need to be documented in the Comprehensive Nutrient Management Plan (CNMP) and in the producer records. If liquid manure application becomes necessary, applications are to be applied only if ALL the following criteria are met:

a. The rate of application shall not exceed the rates specified in Table 3 - Determining The Most Limiting Manure Application Rates for winter application.
b. Applications are to be made on land with at least 90% surface residue cover (cover crop, good quality hay or pasture field, all corn grain residue remaining after harvest, all wheat residue cover remaining after harvest).
c. Manure shall not be applied on more than 20 contiguous acres. Contiguous areas for application are to be separated by a break of at least 200 feet.

d. Apply manure to areas of the field with the lowest risk of nutrient transport such as areas furthest from streams, ditches, waterways, with the least amount of slop.
e. Increase the application setback distance to 200 feet “minimum” from all grassed waterways, surface drainage ditches, streams, surface inlets, water bodies. This distance may need to be further increased due to local conditions.
f. Additional winter application criteria for fields with significant slopes more than 6% (fields exceeding 6% are to be identified in the CNMP). Manure shall be applied in alternating strips 60 to 200 feet wide generally on the contour, or in the case of contour strips on the alternating strips.

Additional Criteria to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater

All Nutrients:

All the additional criteria will be met by developing the plan under Purdue Manure Management Planner (MMP) using the Ohio MMP Templates including.

(1) RUSLEII
(2) Nitrogen Leaching Index
(3) Phosphorus Risk Index

When there is a high risk of transport of nutrients, conservation practices must be coordinated to avoid, control, or trap manure and nutrients before they can leave the field by surface or subsurface drainage (e.g., tile). The number of applications and the application rates must also be considered to limit the transport of nutrients to tile. Erosion, runoff, and water management controls are to be installed, as needed, on fields where nutrients are applied. Sheet and rill erosion shall be managed within the tolerable soil loss for the field (using current NRCS Sheet and Rill Erosion Prediction Technology found in Section I, eFOTG, Ohio NRCS) and ephemeral and gully erosion shall meet minimum quality criteria state in Section III, eFOTG, Ohio – NRCS.

Nutrients must be applied with the right placement, in the right amount, at the right time, and from the right source to minimize nutrient losses to surface and groundwater. The following nutrient use efficiency strategies or technologies must be considered:

- slow and controlled release fertilizers
- nitrification and urease inhibitors
- enhanced efficiency fertilizers
- incorporation or injection
- timing and number of applications
- soil residual N testing
- coordinate nutrient applications with optimum crop nutrient uptake
- Corn Stalk Nitrate Test (CSNT for post-mortem nitrogen status evaluation), Pre-Sidedress Nitrate Test (PSNT), and Pre-Plant Soil Nitrate Test (PPSN)) and other residual N testing that can be used to predict nitrogen availability in the soil
- tissue testing, chlorophyll meters, and spectral analysis technologies
- other Ohio State University recommended technologies that improve nutrient use efficiency and minimize surface or groundwater resource concerns.

Additional Criteria Applicable to Properly Utilize Manure or Organic By-Products as a Plant Nutrient Source

Manure:

Crop production activities and nutrient use efficiency technologies must be coordinated to take advantage of mineralized plant-available nitrogen to minimize the potential for nitrogen losses due to denitrification or ammonia volatilization.

Additional Criteria to Protect Air Quality by Reducing Odors, Nitrogen Emissions and the Formation of Atmospheric Particulates

All Nutrients:

To address air quality concerns caused by odor, nitrogen, sulfur, and/or particulate emissions; the source, timing, amount, and placement of nutrients must be adjusted to minimize the negative impact of these emissions on the environment and human health. One or more of the following may be used:

- slow or controlled release fertilizers
- nitrification inhibitors
- urease inhibitors
- nutrient enhancement technologies
- incorporation
- injection
- stabilized nitrogen fertilizers
- residue and tillage management
- no-till or strip-till
- other technologies that minimize the impact of these emissions

Manure:

Do not apply poultry litter, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material offsite.

Ways to minimize the impact of odors of land-applied manure include:

- Making application at times when temperatures are cool and when wind direction is away from neighbors.
- If manure is spread on warm days, do so in the morning.
- On windy days, odors travel shorter distances before being mixed in the atmosphere to the point that odor is not detected.
- Do not spread on calm, humid days unless the field is isolated.
- Communicate with neighbors to plan applications that do not interfere with holidays or outdoor social functions.
- Injection or immediate incorporation will minimize odors.

Special Criteria for Manure Irrigation to Minimize Odors:

- o Use lower pressure nozzles (less than 80 psi) to reduce the aerosol effects of fine droplets.
- o Use low trajectory nozzles or drop nozzles to reduce drift.
- o Use "Pulse Irrigation Technology" to improve infiltration.

Additional Criteria to Improve or Maintain the Physical, Chemical, and Biological Condition of the Soil to Enhance Soil Quality for Crop Production and Environmental Protection

All Nutrients:

Incorporate cover crops into the rotation

Utilized reduced tillage systems such as no-tillage or strip tillage.

Time the application of nutrients to avoid periods when field activities will result in soil compaction or the creation of ruts.

In areas where salinity is a concern, select nutrient sources that minimize the buildup of soil salts.

Balance the Calcium to Magnesium ratio in the soil to flocculate clays, improve soil structure and increase water infiltration. If the soil pH needs to be raised this can be accomplished with the use of high calcium lime. If the soil pH does not need to be raised, this can be accomplished with gypsum. See The Ohio State University Extension Bulleting 945, Gypsum as an Agricultural Amendment and Amending Soils with Gypsum for more information. (References)

CONSIDERATIONS

All Nutrients:

Use a system of practices to sequester nutrients, increase soil organic matter, increase aggregate stability, reduce compaction, improve infiltration, and enhance soil biological activity to improve nutrient use efficiency.

These include:

- Precision Nutrient Management (590)
- Conservation Crop Rotation (328)
- Residue and Tillage Management (329, 345, or 346)
- Controlled Traffic Farming (720)
- Cover Crop (340)
- Critical Area Planting (342)
- Grassed Waterway (412)
- Filter Strips/Areas (393)
- Lake Erie CREP, Filter Recharge Areas (FSA CP1 and CP2)
- Diversion (362)
- Riparian Herbaceous Cover (390)
- Riparian Forest Buffer (391)
- Constructed Wetlands (656) / Wetland Restoration (657) / Wetland Creation (658)
- Drainage Water Management (554)
- Structure for Water Control (587)
- Bio-Reactors and Tile Discharge Filters
- Use of soil amendments, like lime and gypsum that promote active rooting at deeper depths and improve nutrient use efficiencies

Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere. Suggestions include:

a. Split applications of nitrogen to provide nutrients at the times of maximum crop utilization.
b. Greater nitrogen efficiency for crop production and reduced leaching potential can be obtained by applying the most of the recommended nitrogen rate for full season spring planted crops as a sidedress application.
c. Maintain adequate levels of potassium and a balance of all crop nutrients to optimize nutrient efficiencies including nitrogen

d. Avoiding winter nutrient application for spring seeded crops.
e. Band applications of phosphorus near the seed row.
f. Inject, band, broadcast on a growing crop or cover crop or incorporate nutrients with good erosion control practices to reduce surface runoff of nutrients, especially Phosphorus.
g. Applying nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques.
h. Research has shown that gypsum can help precipitate phosphorus instead of moving off of fields via surface and subsurface drainage water.

Use cover crops (i.e., wheat, rye, ryegrass, oats) to recycle nutrients, improve soil health and reduce soil erosion. It is critical to establish cover crops in the early fall to achieve the desired results.

Consider using nitrification inhibitors for early spring N applications especially on poorly and somewhat poorly drained soils.

Keep good field records of soil test results, yields achieved, and nutrients applied (time, form, rate, and method of application).

Perform periodic inspections of tile systems to repair blow holes, broken tile, and inlets.

On sites on which there are special environmental concerns, consider other sampling techniques. (For example: Soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant Soil Nitrate Test (PPSN) or soil surface sampling for phosphorus accumulation or pH changes.)

Use legume crops and cover crops to provide nitrogen through biological fixation and nutrient recycling.

Gypsum, when applied as a soil amendment, can precipitate soluble phosphorus and reduce phosphorus transport via surface or subsurface drainage.

Consider a balance of crop nutrients for maximum efficiency. For example: excessive levels of some nutrients can cause induced deficiencies of other nutrients, e.g., high soil test phosphorus levels can result in zinc deficiency in corn.

Workers should be protected from and avoid unnecessary contact with plant nutrient sources. Extra caution must be taken when handling anhydrous ammonia or when dealing with organic manure stored in unventilated enclosures.

Use adaptive nutrient management to improve nutrient use efficiency on farms as outlined in the NRCS' National Nutrient Policy in GM 190, Part 402, Nutrient Management.

Material generated from cleaning nutrient application equipment should be utilized in an environmentally safe manner. Excess material should be collected and stored for approved disposal method or field applied in an appropriate manner.

Nutrient containers should be recycled in compliance with State and local guidelines or regulations.

Manure:

Apply a minimum of 1-2 dry tons/acre/year of manure, organic by-products, or biosolids to supplement low biomass producing crops (soybeans, corn silage, canola, sunflowers, etc.) or enhance soil tilth after high biomass crops.

If injection is desired consider using straight points and spaced closer (< 30 inches, 10-15 inches would be better) to reduce the volume of liquid manure coming out of each knife point (or a disk type implement with a distribution manifold for even distribution across the swath). This helps to reduce the volume that can reach the preferential flow channels. If injection is used, it should only be deep enough to cover the manure with soil.

The pathogens and other pathogenic organisms may be contained in manure and should be utilized in a manner that minimizes their exposure to animals and humans.
It is preferable to apply manure on pastures and hayland soon after cutting or grazing before re-growth has occurred. Also, limit the application rate to avoid salt damage and/or coverage to the pasture and hayland.

When fields are not suited for manure application due to weather, crop, or soil conditions, field stock piling of manure may provide an option to move manure to fields for later application when the manure can be applied under more suitable and lower risk situations. Utilize the Ohio NRCS 634 Waste Transfer - Manure Stockpiling Job Sheet for further information.

The Ohio Livestock Waste Management Guide (OSU Bulletin 604); the Ohio Irrigation Guide; and OSU AEX 704 and 705; and EPA CAFO Rules on manure application provide additional guidelines and procedures for land application of animal manure.

A planned grazing system can substantially reduce manure to be mechanically handled and spread to reduce cost and environmental hazards.

Avoid applying lime stabilized biosolids on soils with a pH > 7.5.
.
Immediate incorporation of land applied manure, biosolids, or organic by-products.
If fields have a history of liquid manure entering the subsurface drainage system, the subsurface drainage outlets should be closed or plugged **prior** to application.

Avoid applications through surface waterways and by methods that would cause nutrients to be applied into ditches and streams through fringe particle spreading patterns.

Consider additional application setback distances from neighbors, environmentally sensitive areas, such as sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas.

Consider the potential problems from odors associated with the land application of animal manure or other organic by-products especially when applied near or upwind of residences.

Consider nitrogen volatilization losses associated with the land application of animal manure. Volatilization losses can become significant, if manure or other organic by-products are not immediately incorporated into the soil after application.

Where manure nutrients are produced in excess of farm needs, develop alternate manure management systems such as transporting to fields or farms needing additional nutrients or brokering the manure to others in need of the nutrients from the manure.

Consider ways to modify the chemical/physical properties of the manure such as adding amendments to the manure that flocculate phosphorus from the liquid faction and solid /liquid separators that will concentrate nutrients and reduce transportation costs.

Apply manure at a rate that will result in an “improving” Soil Conditioning Index (SCI) without exceeding acceptable risk of nitrogen or phosphorus loss.

Modify animal feed diets to reduce the nutrient content of manure following guidance contained in Conservation Practice Standard (CPS) Code 592, Feed Management.

Additional Considerations for Precision Nutrient Management:

Soil test information should be no older than 1 year when developing new plans.

Use soil tests, plant tissue analyses, and field observations to check for secondary plant nutrient deficiencies or toxicity that may impact plant growth or availability of the primary nutrients.

Use variable-rate nitrogen application based on expected crop yields, soil variability, soil nitrate or organic N supply levels, or plant tissue chlorophyll concentration.

Use variable-rate nitrogen, phosphorus, and potassium application rates based on site-specific variability in crop yield, soil characteristics, soil test values, and other soil productivity factors.

Develop site-specific yield maps using a yield monitoring system. Use the data to further diagnose low- and high- yield areas, or zones, and make the necessary management changes. See Title 190, Agronomy Technical Note (TN) 190.AGR.3, Precision Nutrient Management Planning.

Considerations to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater.

Use conservation practices that minimize runoff volume, reduce erosion, and increase infiltration, e.g., Filter Strips/Areas (393) and Filter Recharge Areas (FSA CP1 & 2) contour farming (330), or contour buffer strips (332). These practices can also reduce the loss of nitrates or soluble phosphorus.

Use application methods and timing strategies that reduce the risk of nutrient transport by ground and surface waters, such as:

- split applications of nitrogen to deliver nutrients during periods of maximum crop utilization,
- banded applications of nitrogen and/or phosphorus to improve nutrient availability,
- drainage water management to reduce nutrient discharge through drainage systems, and
- incorporation of surface-applied manure or organic by-products if precipitation capable of producing runoff or erosion is forecast within the time of planned application.
- Use the agricultural chemical storage facility conservation practice to protect air, soil, and water quality.
- Use bioreactors, tile discharge filters and multistage drainage strategies .
- Gypsum, when applied as a soil amendment, can precipitate soluble phosphorus and reduce phosphorus transport via surface or subsurface drainage.

Considerations to Protect Air Quality by Reducing Nitrogen and/or Particulate Emissions to the Atmosphere.

Avoid applying manure and other by-products upwind of inhabited areas.

Use high-efficiency irrigation technologies (e.g., reduced-pressure drop nozzles for center pivots) to reduce the potential for nutrient losses.

PLANS AND SPECIFICATIONS

1. Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment. The Purdue MMP software is the official software to be used to develop the nutrient management plan or CNMP. The Purdue MMP in conjunction with the Ohio MMP templates will generate a nutrient management plan with all the required components. For nutrient management plans that involve only commercial fertilizer additional plan formats are available in: Section I - Software and Plan Formats of the EFOTG - http://www.oh.nrcs.usda.gov/fotg/Ohio_eFOTG.htm . See references at the end of this standard for software to assist in planning and documenting specifications.

   The following components must be included in the nutrient management plan:

   - aerial site photograph(s)/imagery or site map(s), and a soil survey map of the site,
   - soil information including: soil type surface texture, pH, drainage class, permeability, available water capacity, depth to water table, restrictive features, and flooding and/or ponding frequency,
   - location of designated sensitive areas and the associated nutrient application restrictions and setbacks,
   - for manure applications, location of nearby residences, or other locations where humans may be present on a regular basis, and any identified meteorological (e.g., prevailing winds at different times of the year), or topographical influences that may affect the transport of odors to those locations,
   - results of approved risk assessment tools for nitrogen, phosphorus, and erosion losses,
   - documentation establishing that the application site presents low risk for phosphorus transport to local water when phosphorus is applied in excess of crop nutrient needs.
   - current and/or planned plant production sequence or crop rotation,
   - soil, water, compost, manure, organic by-product, and plant tissue sample analyses applicable to the plan,
   - when soil phosphorus levels are increasing, include a discussion of the risk associated with phosphorus accumulation and a proposed phosphorus draw-down strategy,
   - realistic yield goals for the crops,
   - complete nutrient budget for nitrogen, phosphorus, and potassium for the plant production sequence or crop rotation,
   - listing and quantification of all nutrient sources and form,
   - all enhanced efficiency fertilizer products that are planned for use,
   - in accordance with the Tri-State Fertility Guide or the nitrogen and phosphorus risk assessment tool(s), specify the recommended nutrient application source, timing, amount (except for precision/variable rate applications specify method used to determine rate), and placement of plant nutrients for each field or management unit, and
   - guidance for implementation, operation and maintenance, and recordkeeping.

If increases in soil phosphorus levels are expected (i.e., when N-based rates are used), the nutrient management plan must document:

- the soil phosphorus levels at which it is desirable to convert to phosphorus based planning,
- the potential plan for soil test phosphorus drawdown from the production and harvesting of crops, and
- management activities or techniques used to reduce the potential for phosphorus transport and loss
- for AFOs, a quantification of manure produced in excess of crop nutrient requirements, and
- a long-term strategy and proposed implementation timeline for reducing soil P to levels that protect water quality,

Additional Considerations for Precision Nutrient Management:

In addition, the following components must be included in a precision/variable rate nutrient management plan:

- Document the geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations.
- Document the nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.
- Document if a variable rate nutrient or soil amendment application was made.
- Provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all applications that resulted from use of the precision agriculture process for nutrient or soil amendment applications.
- Maintain the electronic records of the GIS data layers and nutrient applications for at least 5 years.

OPERATION AND MAINTENANCE

1. The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:
   a. Periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and revised with each soil test cycle.
   b. Protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
   c. Calibration of application equipment to ensure uniform distribution of material at planned rates. If custom applied, the applicator should provide appropriate records to owner.
   d. Documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.

2. Records shall be kept for a period of five years or longer <u>(heavy metals analyses for biosolids and associated application rates and locations are to be maintained permanently</u>) , and include when applicable:
   a. Quantity of manure produced, and its appropriate analysis.
   b. The last 3 soil test results.
   c. Dates, analysis, and amounts of manure that is land applied.
   d. The dates and amounts of manure removed from the system due to feeding, energy production, or export from the operation.
   e. Organic nutrients application methods.
   f. Crops grown and yields (both yield goals and measured yield).
   g. Other tests, such as determining the nutrient content of the harvested product.
   h. Calibration of application equipment (Refer to Ohio State University Fact Sheet AEX-707).
   i. A record of the soil moisture conditions and weather conditions (temperature and wind direction) at the time of application.
   j. Monitor fields during and after application for runoff or subsurface drainage discharge.

3. The operation and maintenance plan is to include the dates of periodic inspections and maintenance of equipment and facilities used in manure utilization. The plan should include what is to be inspected or maintained, and a general time frame for making necessary repairs.

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https://www.soils.org/publications/sssaj/abstracts/52/1/SS0520010175 (This publication shows the benefits of gypsum to improve rooting of crops into acid subsoils, thus improving nutrient uptake and reducing the need for more fertilizer inputs)

Appendix I

Nitrogen and Phosphorous Transport Risk Assessment Procedures

Introduction - Nitrogen and Phosphorous Transport - Risk Assessment Procedures

Nitrogen and Phosphorous are the two nutrients most often associated with the impairment of the quality of our groundwater and surface water. Nitrogen leaching out the root zone may enter a tile and be transported to surface water or it may leach to the groundwater. The EPA Drinking Water Maximum Contaminant Level (MCL) for Nitrates is 10 mg/L. Phosphorous leachate, or runoff entering the surface water may contribute to excessive algae growth which may cause low oxygen levels in surface water. This in turn may impair aquatic live and adversely effect the taste of the water.

To supply the needed nutrients to achieve realistic yield goals and minimize the transport of nitrogen and phosphorous to ground and surface water the Nitrogen and Phosphorous Risk Assessment Procedures have been developed.

The Nitrogen and Phosphorous Risk Assessment Procedures are designed to assist the planner and the producer to identify fields or areas of a field that have varying risks of nutrient transport and assist in the planning the land treatment and management to minimize nutrient transport and achieve production goals.

Nitrogen Leaching Risk Assessment

The Nitrogen Leaching Index evaluates a site's risk of nitrogen leaching out of the plant root zone into tile flow or to groundwater.

The Nitrogen Leaching Index classifies soils as having a high, medium, or low nitrogen leaching potential with relative index ratings from 0-10+ for their potential to leach nitrates below the root zone. The leaching potential is rated as high, medium, or low by combining the soil's hydrologic soil grouping (A, B, C, or D), the local county's annual rainfall, and the local county's season rainfall (Oct. 1 to March 1).

Phosphorous Transport Risk Assessments

Two phosphorous risk assessment options are available in Ohio for planners and producers to use to plan land treatment and management to minimize phosphorous transport and achieve production goals. The two options are (1) The Phosphorous Index and (2) the Soil Test Risk Assessment Procedure. It is the decision of the planner and the producer as to which method is most appropriate to meet the resource concerns and producer objectives.

(1) Phosphorous Index (P Index) Risk Assessment Procedure

The P Index is a procedure that combines well established factors that influence the transport of phosphorous to surface waters. Each of the factors is evaluated based on site specific data and weighted according to its overall effect on phosphorous transport. Each of the site subvalues are added together to establish an overall site rating of Low, Moderate, High, or Very High risk.

In most cases the use of the P Index will allow higher rates of phosphorous application than the Soil Test Risk Assessment Procedure. The use of the P Index should be viewed as a temporary measure until other alternatives can be developed to utilize excess phosphorous produced on the farm.

(2) Soil Test Risk Assessment Procedure

The Soil Test Risk Assessment Procedure establishes risk based on the soil test phosphorous level of the soil. As soil test phosphorous levels increase, water passing over the surface more easily absorbs phosphorous and transports it in the runoff. The Soil Test Risk Assessment Procedure establishes increasing levels of phosphorous application management as the soil test phosphorous levels increase. When soil test values for phosphorous reach Bray P1 of 150 ppm or more no additional phosphorous application is recommended.

The Soil Test Risk Assessment Procedure allows a more sustainable soil and water resource system because it establishes a maximum of 150 ppm Bray P1. By keeping soil test levels below 150 ppm Bray P1 the producer keeps more options open for future land use and treatment options. The use of the P Index, although it may allow additional phosphorous application in the short term, will require more restrictive land treatment and management in the future to minimize the risk of phosphorous transport.

Ohio - Nitrogen Leaching Assessment Procedure

Soils are classified as having a high, medium, or low nitrogen leaching potential with relative index ratings from 0-10+ for their potential to leach nitrates below the root zone. The leaching potential is rated as high, medium, or low by combining the soil's hydrologic soil grouping (A, B, C, or D), the local county's annual rainfall, and the local county's season rainfall (Oct. 1 to March 1).

To determine the soil's nitrogen leaching potential use the following procedure.

1st , determine the soils hydrological soil grouping (Found in Section II of the FOTG) - A, B, C, or D.

2nd , Refer to the Table (next page) - **Ohio (By County) Leaching Index Ratings for Soils by Hydrologic Groups (A, B, C, D)** for the respective county to determine the soils relative leaching index rating.

(a) Soils with a rating of 0-2 have a low potential to leach nitrates below the root zone.
(b) Soils with a rating of 3-10 have a medium potential to leach nitrates below the root zone.
(c) Soils with a rating of 10+ have a high potential to leach nitrates below the root zone.
(d) <u>All soils with systematic subsurface drains (tile) are rated high potential. A field is considered subsurface (tile) drained if 1/3 or more of the field is subsurface (tiled) drained.</u>

Ohio (By County) Leaching Index Ratings for Soils by Hydrologic Groups (A, B, C, D)

County	A	B	C	D	County	A	B	C	D
1. Adams	15	10	6	4	45. Licking	15	8	6	4
2. Allen	10	6	4	2	46. Logan	15	8	4	4
3. Ashland	15	8	4	4	47. Lorain	15	8	4	2
4. Ashtabula	15	10	4	4	48. Lucas	10	6	4	2
5. Athens	15	10	6	4	49. Madison	15	8	6	4
6. Auglaize	10	8	4	2	50. Mahoning	15	8	4	4
7. Belmont	15	10	6	4	51. Marion	15	8	4	4
8. Brown	15	10	6	4	52. Medina	15	8	4	4
9. Butler	15	10	6	4	53. Meigs	15	10	6	4
10. Carroll	15	8	4	4	54. Mercer	10	8	4	2
11. Champaign	15	8	4	4	55. Miami	15	8	4	4
12. Clark	15	8	6	4	56. Monroe	15	10	6	4
13. Clermont	15	10	6	4	57. Montgomery	15	10	6	4
14. Clinton	15	10	6	4	58. Morgan	15	8	6	4
15. Columbiana	15	8	4	4	59. Morrow	15	8	4	4
16. Coshocton	15	8	4	4	60. Muskingum	15	8	6	4
17. Crawford	15	8	4	2	61. Noble	15	8	6	4
18. Cuyahoga	15	8	4	4	62. Ottawa	10	6	4	2
19. Darke	15	8	4	4	63. Paulding	10	6	4	2
20. Defiance	10	6	4	2	64. Perry	15	8	6	4
21. Delaware	15	8	4	4	65. Pickaway	15	8	6	4
22. Erie	10	8	4	2	66. Pike	15	10	6	4
23. Fairfield	15	8	6	4	67. Portage	15	8	4	4
24. Fayette	15	10	6	4	68. Preble	15	10	6	4
25. Franklin	15	8	6	4	69. Putnam	10	6	4	2
26. Fulton	10	6	4	2	70. Richland	15	8	4	4
27. Gallia	15	10	6	4	71. Ross	15	10	6	4
28. Geauga	15	10	4	4	72. Sandusky	10	6	4	2
29. Greene	15	10	6	4	73. Scioto	15	10	6	4
30. Guernsey	15	8	6	4	74. Seneca	10	6	4	2
31. Hamilton	15	10	6	4	75. Shelby	15	8	4	4
32. Hancock	10	6	4	2	76. Stark	15	8	4	4
33. Hardin	10	8	4	2	77. Summit	15	8	4	4
34. Harrison	15	8	6	4	78. Trumbull	15	8	4	4
35. Henry	10	6	4	2	79. Tuscarawas	15	8	4	4
36. Highland	15	10	6	4	80. Union	15	8	4	4
37. Hocking	15	10	6	4	81. Van Wert	10	6	4	2
38. Holmes	15	8	4	4	82. Vinton	15	10	6	4
39. Huron	10	8	4	2	83. Warren	15	10	6	4
40. Jackson	15	10	6	4	84. Washington	15	10	6	4
41. Jefferson	15	8	6	4	85. Wayne	15	8	4	4
42. Knox	15	8	4	4	86. Williams	10	6	4	2
43. Lake	15	10	4	4	87. Wood	10	6	4	2
44. Lawrence	15	10	6	4	88. Wyandot	10	8	4	2

Phosphorous Index (P Index) Assessment Procedure

Purpose:

The P Index is a planning tool designed to help identify fields or areas of fields on a farm that have a higher or lower risk of phosphorous runoff from the application of commercial P fertilizers or from manure or other organic materials. Based on the risk assessment the appropriate land treatment and nutrient application treatments can be planned to minimize phosphorous transport from the site.

Procedure:

Use the P Index Assessment Procedure Worksheet to determine the site's overall P Index. Use the following guidance to determine each of the site's subvalues. The subvalues are added together to determine the overall site P Index. The worksheet can be photocopied as needed. A "Field Summary Worksheet" is also available with this procedure to record a series of site/field values for a given farm. It can be photocopied as needed.

1. **SOIL EROSION** – Sheet and rill erosion as measured by the most current version of the Revised Universal Soil Loss Equation (RUSLE) or Wind Erosion Prediction Procedure (where wind erosion is the primary concern) in Section I of the NRCS FOTG. Determine the predicted soil loss and multiply by (1) to determine the "soil loss" site subvalue.

2. **RUNOFF CLASS** – This represents the effect of the Hydrologic Soil Group (A, B, C, D) combined with the effect of slope. This factor represents the site's runoff vulnerability. Use the table below to determine the runoff class. The runoff class is the site's subvalue.

Runoff Class Matrix - Phosphorous Index Values

	Hydrologic Soil Group			
Slope Range	**A**	**B**	**C**	**D**
<1 %	0	1	3	6
1-3%	1	2	4	7
4-6%	2	3	5	8
7-10%	3	5	7	10
11-15%	4	6	9	12
>15%	6	8	11	15

3. **CONNECTIVITY TO WATER** – Defines the vulnerability of P to be transferred from the site to a perennial stream or water body. The more closely connected the runoff is from the field via concentrated flow (from a defined grassed waterway or surface drain) to a perennial stream or water body the higher the vulnerability of P transport. To determine the "connectivity to water" site subfactor ask the question: Does concentrated flow (via a defined waterway, tile inlet, or surface drain) leave the site? Read the value definitions to determine the site's "connectivity to water" subvalue.

4. **SOIL "P" TEST (BRAY-KURTZ P1)** – The soil test procedure using the Bray P1 extraction, or other extraction test calibrated to Bray P1, that provides an index of plant available P expressed in either ppm or lbs/ac (ppm X 2 = lbs/ac). Determine the Bray P1 value in PPM and multiply the PPM by (0.07) to determine the "soil P test site subvalue.

5. **FERTILIZER P2O5 APPLICATION RATE** - The amount of manufactured (commercial) phosphate fertilizer applied expressed in lbs/ac of P2O5. To determine the site's subvalue multiply the year's P fertilizer application rate by (0.05).

6. **FERTILIZER P2O5 APPLICATION METHOD** – Defines if the phosphate (P2O5) fertilizer is actually incorporated into the soil and the time interval between application and incorporation or if the fertilizer is applied over a given amount of crop residue. Incorporation is either through direct injection with the fertilizer application equipment or using a tillage tool operated a minimum of 3-4 inches deep to incorporate the P2O5 fertilizer. To determine the site's subvalue select the description that most closely describes the method of application. The value with that description is the site's subvalue.

7. **ORGANIC P2O5 APPLICATION RATE** - The amount of phosphate applied (expressed in lbs/ac of P2O5) from manure, sludge, or other bio-solids. To determine the site's subvalue multiply the year's P fertilizer application rate by (0.06).

8. **ORGANIC P2O5 APPLICATION METHOD** - Defines if the phosphate (P2O5) from the manure, sludge, or other bio-solids is actually incorporated into the soil, the time interval between application and incorporation, or if the manure/bio-solids are applied over a given amount of crop residue. Incorporation is either through direct injection with the application equipment or by using a tillage tool operated a minimum of 3-4 inches deep to incorporate the manure, sludge, or other bio-solids. To determine the site's subvalue select the description that most closely describes the method of application. The value with that description is the site's subvalue.

9. **FILTER STRIP** - Deduct 2 points if field runoff flows via sheet flow through a designed filter strip - minimum 33 feet wide. The filter strip must meet the NRCS FOTG Filter Strip (393) Standard criteria. It is critical that sheet flow crosses the filter strip, not concentrated flow, to credit a 2 point deduction.

Phosphorous Index Risk Assessment Procedure Worksheet

Site Characteristic	Phosphorous Vulnerability Values					Sub - Value
1.Soil Erosion	Soil Loss (Tons/Acre/Year) X 1.0					
2. Connectivity to Water. Does concentrated flow (via a defined waterway, tile inlet, or surface drain) leave the site?	NO, and the site is not adjacent to an intermittent or perennial stream. **Value = 0**	NO, but the site is adjacent to an intermittent or perennial stream. **Value = 4.0**	Yes, but the site is not adjacent to an intermittent or perennial stream. **Value = 8.0**	Yes, and the site is adjacent to and/or the concentrated flow outlets into an intermittent stream or through a tile inlet. **Value = 12.0**	Yes, and the site is adjacent to and/or the concentrated flow outlets into a perennial stream or through a tile inlet; OR Outlets to a pond or lake within 1 mile. **Value = 16.0**	
Runoff Class	See Runoff Class Matrix					
4. Soil Test Bray-Kurtz P1 PPM	Bray – Kurtz P1 (PPM) X (0.07)					
5. Fertilizer P2O5 Application Rate	Fertilizer P2O5 Applied (Lbs/Acre) X (0.05)					
6. Fertilizer P2O5 Application Method	0 Applied **Value = 0**	Immediate Incorporation Or Applied on 80% Cover **Value = 0.75**	Incorporation < 1 Week Or Applied on 50-80% Cover **Value = 1.5**	Incorporation > 1 Week & < 3 Months Or Applied on 30-49% Cover **Value = 3.0**	No Incorporation Or Incorporation > 3 Months Or Applied on < 30% Cover **Value = 6.0**	
7. Organic P2O5 Application Rate	Available - Manure / Biosolids P2O5 Applied (Lbs/Ac) X (0.06)					
8. Organic P2O5 Application Method	0 Applied **Value = 0**	Immediate Incorporation Or, Applied on 80% Cover **Value = 0.5**	Incorporation < 1 Week Or, Applied on 50-80% Cover **Value = 1.0**	Incorporation > 1 Week & < 3 Months Or, Applied on 30-49% Cover **Value = 2.0**	No Incorporation Or Incorporation > 3 Months Or , Applied on < 30% Cover **Value = 4.0**	
Filter Strip Factor (Deduct 2 points if field runoff flows through a designed filter strip - minimum 33 feet wide)						
Total Site Index Value						

P Index Field Summary

Name: **Farm:**

	Fields										
Site Characteristic											
1.Erosion (Value)											
2.Connectivity to Water (Value)											
3. Runoff Class (Value)											
4. STP (Value)											
5. P2O5 Fertilizer Rate (Value)											
6. P2O5 Fertilizer Method (Value)											
7. Manure Rate (Value)											
8.Manure Application Method (Value)											
9. Filter Strip (-2)											
Total Field Score											
Field Rating											

Field Vulnerability for Phosphorous Loss to Surface Water	
Phosphorous Index for Field	Generalized Interpretation of Phosphorous Index & Management
LOW **< 15**	LOW potential for P movement from the field. If farming practices are maintained at the current level there is a low probability of an adverse impact to surface waters from P loss. Manure or other bio-solids can be applied to meet the recommended nitrogen for the next grass crop or nitrogen removal of the next legume crop.
MEDIUM **15-30**	MEDIUM potential for P movement from the field. The chance of organic material and nutrients getting into surface water exists. Runoff reduction practices such as buffers, setbacks, lower manure/bio-solid rates, cover crops, and crop residue practices alone or in combination should be considered to reduce P loss impacts. Manure or other bio-solids can be applied to meet the recommended nitrogen for the next grass crop or nitrogen removal of the next legume crop. Applications of P at the crop removal rate should be considered.
HIGH **31-45**	HIGH potential for P movement from the field and for an adverse impact on surface waters unless remedial action is taken. Runoff reduction practices such as buffers, setbacks, lower manure/bio-solid rates, cover crops, and crop residue practices alone or in combination should be considered to reduce P loss impacts. Limit application of P to crop removal rates.
VERY HIGH **> 45**	VERY HIGH potential for P movement from the field and an adverse impact on surface water. Remedial action is required to reduce the risk of P loss. A complete soil and water conservation system is needed. Apply no additional P.

Phosphorous Soil Test Risk Assessment Procedure

Nitrogen and Phosphorous Application Criteria for Manure, Organic By-Products, and Biosolids

Criteria Applicable to All Soil Test Levels:

1. Nitrogen application rates from manure, other organic by-products, or biosolids shall be based on Total Ammonium Nitrogen Content plus 1/3 of the Organic Nitrogen calculated at time of application when applied during the summer, fall, or winter for spring planted crops. When applied in the spring for spring planted crops the nitrogen application rate can be adjusted to apply the recommended nitrogen within the P2O5, K2O, and other limitations.
2. Nitrogen rates are not to exceed the succeeding crop's recommended Nitrogen for non-legume crops or the Nitrogen removal in the crop's biomass for legume crops.
3. All applications are based on current soil test results (not more than 3-5 years old).
4. No manufactured P2O5 applied above 40 ppm Bray P1 or equivalent test, unless recommended by appropriate industry standards or the land grant universities for specialty crops, vegetable crops, etc.

"P" Soil Test Level	Application Criteria
Bray P1 < 40 ppm (< 80 Lbs/Ac) OR Other Equivalents (e.g. Mehlich 3) ***LOW POTENTIAL***	**Recommended N or P2O5.** **Manure or other Organic By-Products can be applied to meet the succeeding crop's recommended NITROGEN requirements for non-legume crops or the NITROGEN removal for legume crops; OR the recommended P2O5 but not to exceed the NITROGEN needs of the succeeding crop.**
Bray P1 40-100 ppm (80 – 200 Lbs/Ac) OR Other Equivalents (e.g. Mehlich 3) ***MODERATE POTENTIAL***	**Recommended N or P2O5 Removal whichever is less.** The field shall have > 30% ground cover at the time of application or the manure or other organic by-products shall be incorporated within one week. The manure or other organic by-products can be applied to meet the succeeding crop's recommended NITROGEN requirements for non-legume crops or the NITROGEN removal for legume crops; OR P2O5 removal (annual or multiple year applications) whichever is less.
Bray P1 100-150 ppm (200-300 Lbs/Ac) OR Other Equivalents (e.g. Mehlich 3) ***HIGH POTENTIAL***	**Recommended N or P2O5 Removal whichever is less PLUS additional distance criteria from drainageway/water source or other sensitive area, OR Filter Strips.** Manure or other organic by-products can be applied to meet the succeeding crop's recommended NITROGEN requirements for non-legume crops or the NITROGEN removal for legume crops; OR P2O5 removal (annual or multiple year applications) whichever is less **IF:** 1. The field has > 50% ground cover at the time of application or the material is incorporated within 7 days on areas with < 50% cover. AND 2. Unless the manure or other organic by-products are incorporated within 24 hours, no manure or other organic by-products are to be applied within 100 feet of a drainageway, water source or other sensitive area; OR, the width of a vegetative filter strip (minimum width 33 feet) maintained adjacent to the drainageway, water source, or sensitive area.
Bray P1 > 150 ppm (> 300 Lbs/Ac) OR, Other Equivalents (e.g. Mehlich 3) *VERY HIGH POTENTIAL*	No additional P2O5 – Use P2O5 Draw-down Strategies

Table 1. Available Water Capacity (AWC) Practical Soil Moisture Interpretations for Various Soils Textures and Conditions to Determine Liquid Manure Volume Applications not to exceed AWC.

This table shall be used to determine the AWC at the time of application and the liquid volume in gallons that can be applied not to exceed the AWC. To determine the AWC in the upper 8 inches use a soil probe or similar device to evaluate the soil to a depth of 8 inches.

Available Moisture in the Soil	Sands and Loamy Sands	Sandy Loam and Fine Sandy Loam	Very Fine Sandy Loam, Loam, Silt Loam, Silty Clay Loam, Clay Loam, Sandy Clay Loam	Sandy Clay, Silty Clay, Clay
< 25% Soil Moisture Amount to Reach AWC	Dry, loose and single-grained; flows through fingers. 20,000 gallons/ac	Dry and loose; flows through fingers. 27,000 gallons/ac	Powdery dry; in some places slightly crusted but breaks down easily into powder. 40,000 gallons/ac	Hard, baked and cracked; has loose crumbs on surface in some places. 27,000 gallons/ac
25-50% or Less Soil Moisture Amount to Reach AWC	Appears to be dry; does not form a ball under pressure. 15,000 gallons/ac	Appears to be dry; does not form a ball under pressure. 20,000 gallons/ac	Somewhat crumbly but holds together under pressure. 30,000 gallons/ac	Somewhat pliable; balls under pressure. 20,000 gallons/ac
50 - 75 % Soil Moisture Amount to Reach AWC	Appears to be dry; does not form a ball under pressure. 10,000 gallons/ac	Balls under pressure but seldom holds together. 13,000 gallons/ac	Forms a ball under pressure; somewhat plastic; slicks slightly under pressure. 20,000 gallons/ac	Forms a ball; ribbons out between thumb and forefinger. 13,000 gallons/ac
75% to Field Capacity Amount to Reach AWC	Sticks together slightly; may form a weak ball under pressure. 5,000 gallons/ac	Forms a weak ball that breaks easily, does not stick. 7,000 gallons/ac	Forms ball; very pliable; slicks readily if relatively high in clay. 11,000 gallons/ac	Ribbons out between fingers easily; has a slick feeling. 7,000 gallons/ac
100% Field Capacity	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.
Above Field Capacity	Free water appears when soil is bounced in hand.	Free water is released with kneading.	Free water can be squeezed out.	Puddles: free water forms on surface

Table 2. APPLICATION RATES ON IDLED CROPLAND WITH A GROWING COVER, SET-ASIDE OR LAND IN GOVERNMENT PROGRAMS.

The following criteria shall be followed if land users desire to apply manure on idled cropland with a growing cover, set aside or on land in government programs (CRP, WRP, Other Government Easement Type Land).

1. Use the original soil test that was used to make the fertilizer determinations when the land went under set aside or obtain a new soil test if one is not available.
2. Obtain an analysis of the manure before application to determine nutrient content.
3. Manure may be applied up to the rates specified below based on the manure analysis and the soil test values for Bray P1 or equivalent.
4. FOR IDLED CROPLAND WITH A GROWING COVER, SET ASIDE LAND (CRP, ETC) WITH SOIL TEST VALUES LESS THAN A BRAY P1 OF 45 PPM OR EQUIVALENT. Manure may be applied on an ANNUAL BASIS not to exceed the most limiting of the N or P rates specified below:

	Phosphorus (P)	**Nitrogen (N)**
Bray P1 or equivalent Value Or Equivalent	Annual Application Rate (Lbs/Ac of P2O5) (Maximum of 10 years of Application)	Based on Available N at the Time of Application
< 5 ppm	105	125
5-10 ppm	90	125
10-15 ppm	80	125
15-20 ppm	70	125
20-25 ppm	55	125
25-45 ppm	50	125

5. FOR IDLED CROPLAND WITH A GROWING COVER, SET ASIDE LAND (CRP, ETC) WITH SOIL TEST VALUES BETWEEN 45 PPM AND 150 PPM BRAY P1 OR EQUIVALENT. Limit manure application to the most limiting of 50 Lbs/Ac of P2O5 or 125 Lbs/Ac of available N once during a 10 year period.

6. FOR IDLED CROPLAND WITH A GROWING COVER, SET ASIDE LAND (CRP, ETC) WITH SOIL TEST VALUES MORE THAN 150 PPM OR EQUIVALENT. No application of manure.

Table 3. Determining the Most Limiting Manure Application Rates

Select the Most Limiting Application Rate Based on the Following Criteria					
Field Situation & Time of Year	**Limiting Application Rate Criteria**				
	Nitrogen	**P2O5 4/**	**K2O**	**Tons/Ac Gallons/Ac**	**AWC Table**
Part 1. Subsurface Drained (Tiled) Fields					
(April - June) Subsurface Drained or High N Leaching Potential	**1/** Crop Needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	13,000 gal.	Upper 8"
(April - June) **Pasture > 20% or Cropland > 15%** Subsurfaced Drained or High N Leaching Potential	Crop Needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	**5/** 10 wet tons 5,000 gal. - unless contoured strips or incorporated immediately	Upper 8"
(July - Sept.) **No Growing Crop** Subsurface Drained or High N Leaching Potential	**2/** 50 lbs/ac as applied N	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	13,000 gal.	Upper 8"
(July - Sept.) **With a Growing Cover Crop** Subsurface Drained or High N Leaching Potential	**3/** Next year's crop needs as applied N	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	13,000 gal.	Upper 8"
(July - Sept.) **No Growing Crop** **Cropland > 15%** Subsurfaced Drained or High N Leaching Potential	**2/** 50 lbs/ac as applied N	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	**5/** 10 wet tons or, 13,000 gal.	Upper 8"
(Oct. - March) Subsurface Drained or High N Leaching Potential	**3/** Next year's crop needs as applied N	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	13,000 gal.	Upper 8"
(Oct. - March) **Pasture > 20% or Cropland > 15%** Subsurfaced Drained or High N Leaching Potential	**3/** Next year's crop needs as applied N	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	**5/** 10 wet tons 5,000 gal. - unless contoured strips or incorporated immediately	Upper 8"
Frozen or Snow Cover Subsurface Drained or High N Leaching Potential	**3/** Next year's crop needs as applied N	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	**5/** 10 wet tons < 50% Solids; 5 wet tons > 50% solids; Liquid Manure 5000 gallons/acre	

Select the Most Limiting Application Rate Based on the Following Criteria					
Field Situation & Time of Year	**Limiting Application Rate Criteria**				
	Nitrogen	**P2O5** 4/	**K2O**	**Tons/Ac Gallons/Ac**	**AWC Table**
Part 2. Fields NOT Subsurface Drained (Tiled)					
(April - June) Not Subsurface Drained	**1/** Crop Needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac		Upper 8"
(July - Sept.) Not Subsurface Drained	**1/** Crop Needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac		Upper 8"
(Oct. - March) Not Subsurface Drained	**1/** Crop Needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac		Upper 8"
(April - June) Not Subsurfaced Drained Pasture > 20% or Cropland > 15%	**1/** Crop Needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	**5/** 10 wet tons 5,000 gal. - unless contoured strips or incorporate immediately	Upper 8"
(July - Sept.) Not Subsurfaced Drained Pasture > 20% or Cropland > 15%	**1/** Crop Needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac		Upper 8"
Frozen or Snow Cover Not Subsurface Drained	**1/** Next year's crop needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	**5/** 10 wet tons < 50% Solids; 5 wet tons > 50% solids; Liquid Manure 5000 gallons/acre	
(Oct. - March) Not Subsurfaced Drained Pasture > 20% or Cropland > 15%	**1/** Crop Needs factoring N losses	Crop Needs or Crop Removal < 250 Lbs/ac	Crop Needs or Crop Removal < 500 Lbs/ac	**5/** 10 wet tons 5,000 gal. - unless contoured strips or incorporate immediately	Upper 8"

1/ Crop Needs factoring N losses - Maximum total nitrogen applied to meet the succeeding crop’s recommended NITROGEN requirements for non-legume crops or 150 lbs/ac NITROGEN for the succeeding legume crop. **Considers loss of N through application method and time of year.**

2/ 50 lbs/ac as applied N - Nitrogen application limited to 50 lbs/ac based on the addition of the NH4 or NH3 (ammonium/ammonia) content of the manure + 1/3 of the organic nitrogen content the manure as applied. **Considers no losses due to application method or time of year.**

3/ Next year's crop needs as applied N - Maximum total nitrogen applied to meet the succeeding crop’s recommended NITROGEN requirements for non-legume crops or 150 lbs/ac NITROGEN for the succeeding legume crop. **Considers no losses due to application method or time of year.**

4/ Under special conditions and criteria the rate of P2O5 application can be increased to 500 lbs./acre see (Nutrient Management Standard 590).

5/ Wet tons refers to the weight of the manure as it is applied – include solids and moisture weight.

Table 4
Minimum Setback Distances for the Application of Manure and Other Organic By Products 5/, 6/

Type of Sensitive - Setback Area	Setbacks Based on Methods of Manure Application		
	Surface Application	Winter Application Frozen or Snow Covered Soils 7/	Surface Incorporation W/I 24 Hours OR Direct Injection
Residences / Private Wells down slope from the application area.	100 ft.	200 ft.	100 ft.
- Sinkholes	300 ft.		100 ft.
- Pond or Lake	- 35ft. Vegetative Barrier 1/, with the remaining 100 ft. setback in non-vegetative Setback 2/	- 35ft. Vegetative Barrier 1/, with the remaining 200 ft. setback in non-vegetative Setback 2/	- 35ft. Vegetative Barrier 1/
- Streams - Ditches - Surface Inlets	- 35ft. Vegetative Barrier 1/, OR - 100 ft. setback in non-vegetative Setback, OR - 35 ft. in non-vegetative setback 3/	200 ft.	None
Grassed Waterway	35 ft.	200 ft.	None
Field Surface Drains	35 ft. 4/	200 ft.	None
Public Wells	300 ft.	300 ft.	100 ft.
Developed Springs	300 ft. upslope	300 ft. upslope	300 ft. upslope
Public Surface Drinking Water Intake	300 ft.	300 ft.	300 ft.

1/ Permanent vegetation consisting of grass, grass/legume mix, trees/shrubs, or trees/shrubs and grass/legumes. Measured from top of bank.
2/ Includes 100 ft. total setback. The setback must include a minimum of 35 ft. of vegetative cover from top of bank with the remainder of the 100 feet with no vegetative requirement. The setback is measured from the top of bank.
3/ Applies if the manure application area has at least 50% vegetation/residue cover at the time of application.

4/ No setback required for field surface drains if the Additional Criteria to Protect Water Quality, Item 5 is applied from this standard.

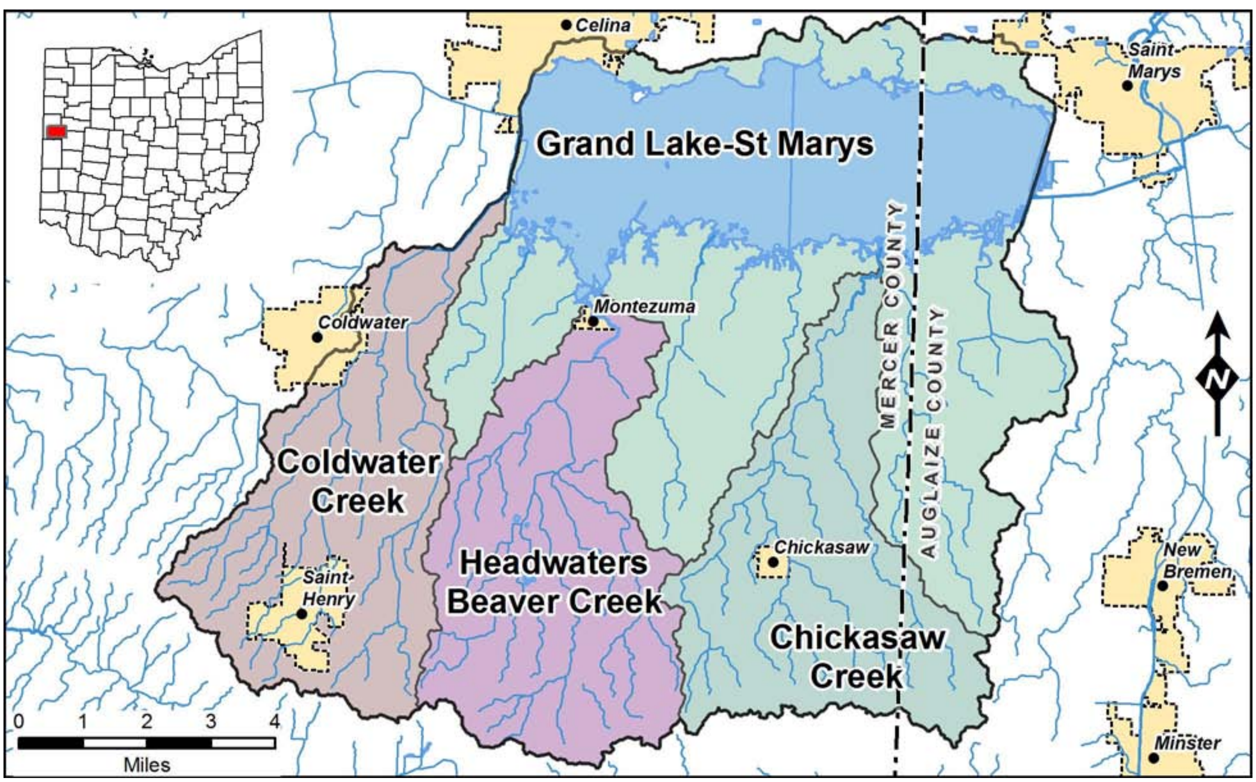
5/ CAFO's must follow the setbacks defined in the Ohio Department of Agriculture (ODA) rules regarding manure application. See **Table 5 – ODA Setbacks - Appendix A Table 1 of rule 901:10-1-14: Land Application Restrictions and Setbacks**
6/ Excludes sludge that is regulated by the Ohio Environmental Protection Agency (OEPA) and septage regulated by the Ohio Department of Health.

7/ See Additional Criteria to Protect Water Quality, Item 7, for the special manure application criteria on frozen and snow covered fields.

Distressed Watershed Designation Analysis Grand Lake St. Marys Watershed

Developed by the
Ohio Department of Natural Resources

Division of Soil and Water Resources
January 18, 2011



Introduction

This report provides information related to an analysis of whether Grand Lake St. Marys should be declared a "watershed in distress" as defined in Ohio Administrative Code (OAC) 1501:15-5-20(A) by the Chief of the Division of Soil and Water Resources. (A complete version of OAC 1501:15-5-20 is provided in Appendix A.) For such an analysis the chief may consider the six identified criteria as well as other relevant factors. These criteria and their role in the analysis, and other related situations, considerations or factors, are presented below.

This report was developed by staff of the Division of Soil and Water Resources and approved by the division chief for issuance to the general public, and submission to the Ohio Soil and Water Conservation Commission for its review and potential concurrence, as provided in OAC 1501:15-5-20(B).

The Division recognizes that there are many other sources of nutrients impacting the lake. However, this report focuses on the role of documented agricultural sources.

An overview of Grand Lake St. Marys (GLSM) and the watershed that drains to it is shown below with sub-watersheds identified.

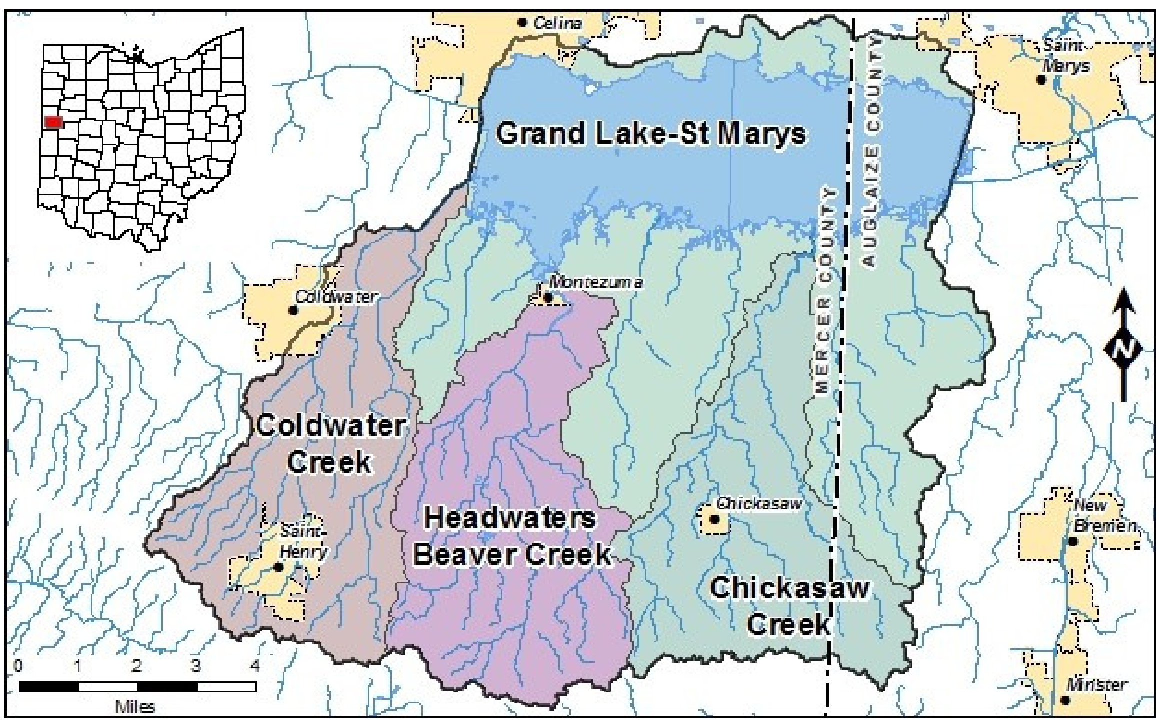


Figure 1 Grand Lake St. Marys with Sub-watersheds Identified

Executive Summary

Due to unprecedented harmful algal blooms and the release of related toxins occurring in Grand Lake St. Marys over the last two years, the Ohio DNR, Division of Soil and Water Resources, examined the need to declare Grand Lake St. Marys and its surrounding drainage area as a 'watershed in distress.' Consequently, Ohio DNR staff has conducted a thorough review of available data, field observations and scientific information for the Grand Lake St. Marys Watershed and compared the findings with criteria listed in Ohio Administrative Code 1501:15-5-20(A).

The first criterion in the regulations pertains to determinations by Ohio EPA as to the cause and sources of any watershed impairments and if those factors are related to nutrients from agricultural sources. The Ohio EPA lists the watershed as impaired by nutrients from agricultural sources in both of the following reports: the 2010 Integrated Water Quality Monitoring Report and the 2007 TMDL Report for Beaver Creek and Grand Lake St. Marys. Furthermore, manure generated by approximately 300 confined animal operations and applied to nearby crop fields is a major component of the nutrient load to the watershed.

Three other criteria relate to the threat or potential threat to use of the lake as a source of drinking water and recreation, and the threat to humans and wildlife, due to the presence of harmful algal blooms. Based upon water quality sampling of the lake and documented fishkills over the last two years, the watershed and specifically Grand Lake St. Marys itself has periodic algal and/or cyanobacterial blooms capable of producing toxins that are harmful to humans and wildlife. There is a reasonable chance that the watershed exhibits conditions that are a threat to a drinking water supply, public health and enjoyment of Grand Lake St. Marys as a recreational water body.

Additional water quality sampling over the last two years of a key feeder tributary to Grand Lake St. Marys (Chickasaw Creek) and two other representative and comparable watersheds in northwest Ohio (Rock Creek and Lost Creek) indicates that total phosphorus, dissolved phosphorus and nitrate nitrogen concentrations in Chickasaw Creek are significantly higher than the other watersheds.

Based on the above information and analysis, the Grand Lake St. Marys Watershed is in distress as defined in OAC 1501:15-5-20(A).

Comparison to Six Identified Criteria

1. The watershed is listed as impaired by nutrients and/or sediment from agricultural sources as determined by the Director of the Environmental Protection Agency.

Ohio EPA's 2010 Integrated Water Quality Monitoring Report[1] characterizes the watershed draining to GLSM and lists information on four sub-watersheds (Coldwater Creek, Headwaters of Beaver Creek, Chickasaw Creek and direct drainage to GLSM). The Integrated Report, for all four sub-watersheds feeding the lake, lists nutrients (phosphorus and nitrate/nitrite) as leading causes of impairment. Similarly, in all four sub-watersheds, agricultural activities (e.g., confined animal feeding operations, non-irrigated crop production) are listed as leading sources of nutrients.

Ohio EPA's 2007 TMDL Report for Beaver Creek and Grand Lake St. Marys[2] (approved by USEPA) states the following in Section 4.3 discussing pollutant sources:

"Because pastureland and row crops are the dominant land cover in the watershed (approximately 90 percent of the watershed area when the surface area of Grand Lake St. Marys is not included; Table 2-2), many of the probable sources of impairment in this watershed are tied to agricultural practices."

and

"There are numerous small animal feeding operations (AFOs) and larger concentrated animal feeding operations (CAFOs) in this watershed that are also noted sources of nutrients and pathogens…while run-off from these operations' pastures, holding areas, and manure application fields can also be a significant nonpoint source. This is especially true in the absence of effective manure management plans and appropriately sized waste storage facilities."

2. The watershed or a portion of the watershed exhibits conditions that are a threat to public health based on information provided by the Ohio Department of Health or local health district.

In a letter dated January 5, 2011 from the Mercer County Celina City Health Department to the Chief of the Division of Soil and Water Resources, Ohio Department of Natural Resources, the Health Department Board concludes in a reference to the situation in 2010 at Grand lake St. Marys by stating in part:

> "The harmful algal bloom occurred as a result of high levels of nutrients feeding a specific type of bacteria (cyanobacteria). Cyanobacteria produce toxins that are deemed a threat to human health according to the World Health Organization. In the interest of health, the Mercer County-Celina City Health Department supports the need for the new regulations."

The letter in its entirety can be found in Appendix E.

3. Streams, lakes or other waterbodies within the watershed exhibit periodic evidence of algal and/or cyanobacterial blooms capable of producing toxins that are harmful to humans, domestic animals or wildlife.

GLSM has exhibited periodic algal blooms over a number of years. The pictures below demonstrate this for 2009 and 2010. 2010 presented algal blooms with unprecedented frequency and intensity.

Figure 2 Grand Lake St. Marys, Auglaize County, Photo by Ohio DNR, 2009

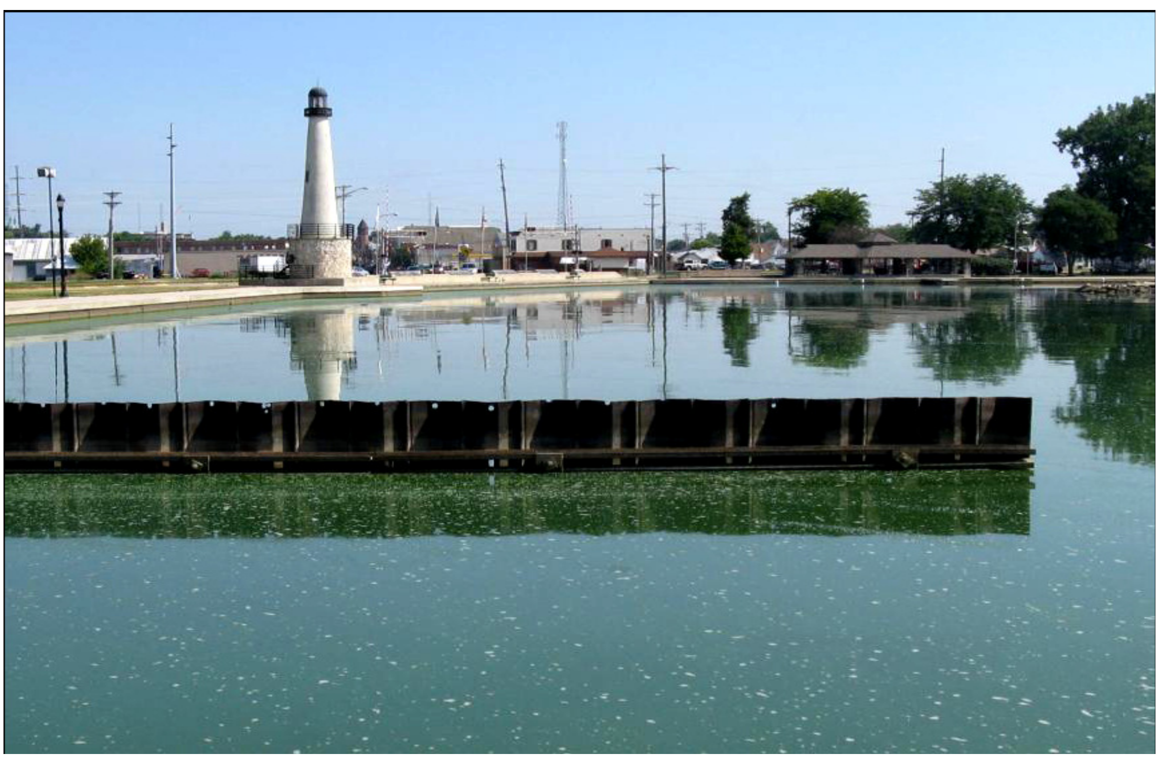


Figure 3 Grand Lake St. Marys, Mercer County, 2009, Photo by Ohio EPA

Figure 4 Grand Lake St. Marys, Mercer/Auglaize Counties, June 14, 2010, Photo by Ohio DNR

Figure 5 Grand Lake St. Marys, Auglaize County, June 14, 2010, Photo by Ohio EPA

Figure 6 Grand Lake St. Marys, Auglaize County, June 23, 2010, Photo by Ohio EPA

Figure 7 Grand Lake St. Marys, Auglaize County, July 12, 2010, Photo by Ohio EPA

Additional photos from 2009-2010 were provided by the Mercer Soil and Water Conservation District and they are presented in Appendix B. These algal blooms are capable of producing toxins that can be harmful to humans and animals.[3] The Ohio Department of Health website provides the following information: “Harmful algal blooms (HABs) can produce neurotoxins (which affect the nervous system) and hepatoxins (which affect the liver). These toxins can potentially impact the health of people who come into contact with water where HABs are present in high numbers. Sampling data listed on Ohio EPA's website[4] and reproduced in Appendix C indicate algal toxins detected in 2010 sampling include: microsystin, anatoxin-a, saxitoxin, and cylindrospermopsin. Ohio DNR reviewed data from 73 sampling days between January 7 and December 8, 2010 at four sampling locations around the lake (near the Celina drinking water intake, Camp Beach, East Beach and West Beach). Figure 8 shows the sampling locations. Microsystin was by far the most prevalent, showing above-detect levels for at least one of the sampling sites on 79% of the days when samples were taken, and ranging in value from 0.7 to >2000 ppb. Anatoxin was present 22% of the time, and both cylindrospermospin and saxitoxin were present 4% of the time.

Figure 8 Water Quality Sampling Locations, Grand Lake St. Marys, 2009 and 2010

Sampling was also conducted in 2009 but on a somewhat smaller scale (31 sampling days) and primarily for just microcystin.[4] Most samples were taken near the Celina water intake. (See data in Appendix C.) Microsystin was present in 100% of the samples and ranged in value from 2.6 to 70.3 ppb.

4. There is a threat to or presence of contaminants in public or private water supplies.

Grand Lake St. Marys is a public water supply for the City of Celina, Ohio (See Ohio Administrative Code (OAC) 3745-1-29). The Ohio Department of Health and the Ohio EPA both recognize a World Health Organization guideline for microsystin of 1 ppb for drinking water.[3,4] (No similar guidance exists for the other toxins produced by cyanobacteria.) During 2010 no tests[4] of finished water from the Celina municipal drinking water supply exceeded 1 ppb. Tests in Grand Lake St. Marys itself exceeded 1 ppb 45 times in 2010 and of these, values ranged from 1.1 to >2000 ppb.[4]

During 2009 testing, microsystin levels exceeded 1 ppb 100% of the time for in-lake testing.[4] During 2009, no tests[4] of finished water from the Celina municipal drinking water supply exceeded 1 ppb.

5. *There is a threat to or a presence of contaminants in a primary contact recreational water or bathing water as designated in OAC 3745-1.*

Grand Lake St. Marys is listed in regulation as a primary contact recreational water in OAC 3745-1-29. The Ohio Department of Health and the Ohio EPA both recognize a World Health Organization guideline for microsystin of 20 ppb for recreational waters.[3,4] Tests in Grand Lake St. Marys[4] itself exceeded 20 ppb eight times in 2010 and of these, values ranged from 25.2 to >2000 ppb.[6]

During 2009 testing, the 20 ppb guideline was exceeded 80% of the time and values ranged from 23.3 to 70.3 ppb.[6]

6. *Other unacceptable nuisance conditions exist including the depletion of dissolved oxygen in water that results in impacts to aquatic life.*

Several fish kills occurred in 2009/2010 due to the presence of harmful algal blooms. Two such fish kills on June 19 and 26, 2010 are documented in the ODNR Division of Wildlife Uniform Incident Reports presented in Appendix D. The following is an excerpt from an email communication from Ohio DNR Wildlife Officer Ryan Garrison on June 21, 2010, in reference to the June 19 fish kill, "The photos were taken on June 19, 2010 at 3:00 pm. The location is Southmoore Shores in Auglaize County. The Ammonia was > 10 ppm, DO – 0 ppm, and PH – 7. There was no sign of anything entering the water in this location. It appeared to be a natural fish kill from the blue/green algae bloom in the photos. The smell from the algae was pretty intense." [5] Two of the photos referred to above are shown below in Figure 9.

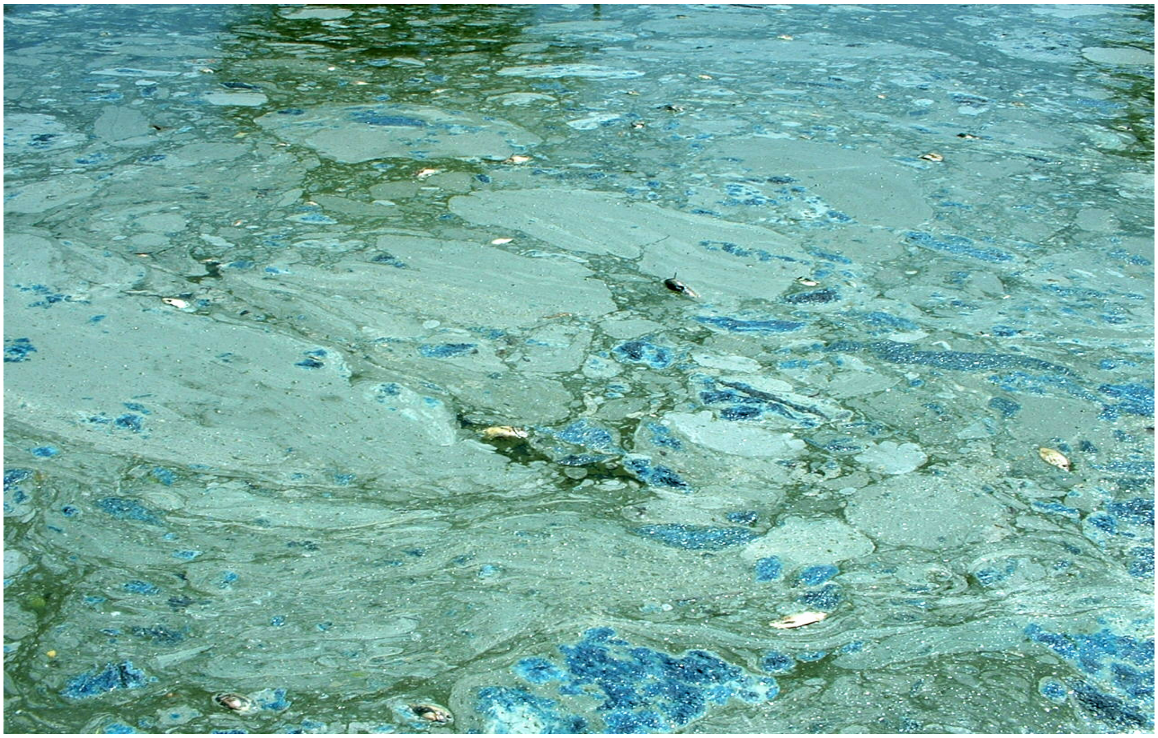


Figure 9 Photos Documenting a Fish Kill on June 19, 2010, Grand Lake St. Marys, Auglaize County, Photos by Ohio DNR

Analysis of Other Situations as Determined by the Chief Upon Consultation with other Federal, State and Local Agencies.

Heidelberg University recently analyzed water quality data for the time period between September 2008 and October 2009 for Chickasaw Creek (a main tributary to Grand Lake St.

Marys) and Lost creek and Rock Creek (two similar watersheds in northwest Ohio with significant agriculture land use). Observations on 289 days were compared.

According to the National Center for Water Quality Research at Heidelberg University study, “Analysis of Chickasaw Creek Concentrations and Loads, Water year 2009,” concentrations of nutrients were significantly higher in the Grand Lake St. Marys sub-watershed, Chickasaw Creek, than in Rock Creek and Lost Creek, two comparable streams in northwest Ohio.[6]

Total phosphorus concentrations within Chickasaw Creek exceeded the Ohio Environmental Protection Agency’s suggested draft standard of 0.1 mg/L on more than 80 percent of the sampling days (Figure 10). Rock Creek and Lost Creek recorded samples in excess of 0.1 mg/L 29.4% and 31.8% of the time, respectively.[6]

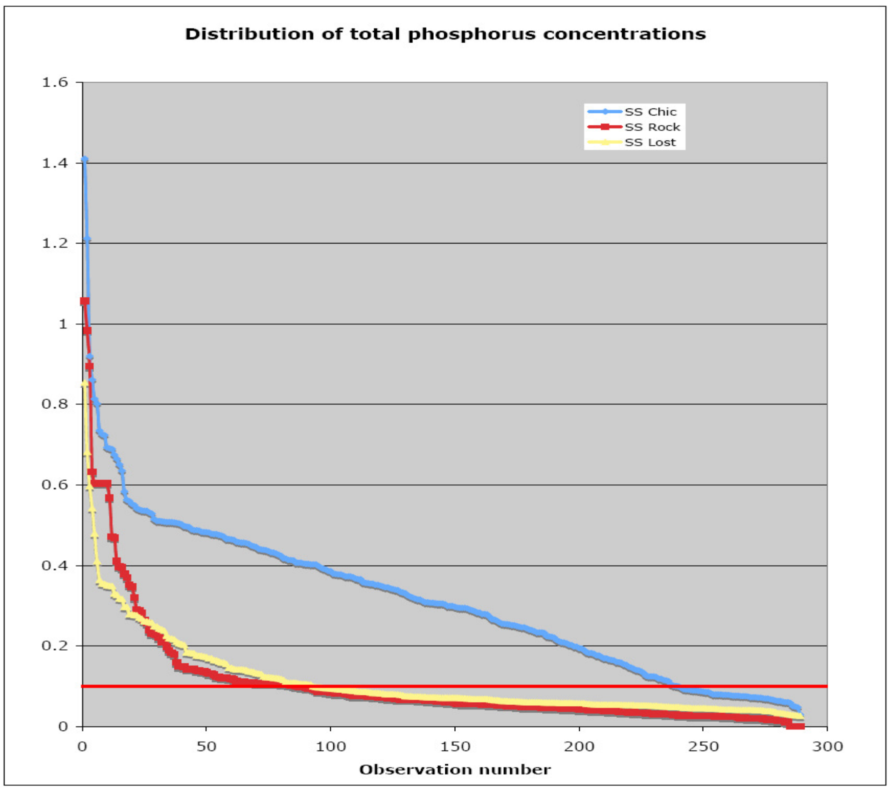


Figure 10 Distribution of Total Phosphorus Concentrations (mg/L), Sept. 2008 to Oct. 2009, for Representative Northwest Ohio Watersheds

Figure 11 shows the distribution for dissolved phosphorus and a similar trend with respect to Ohio EPA's draft standard.

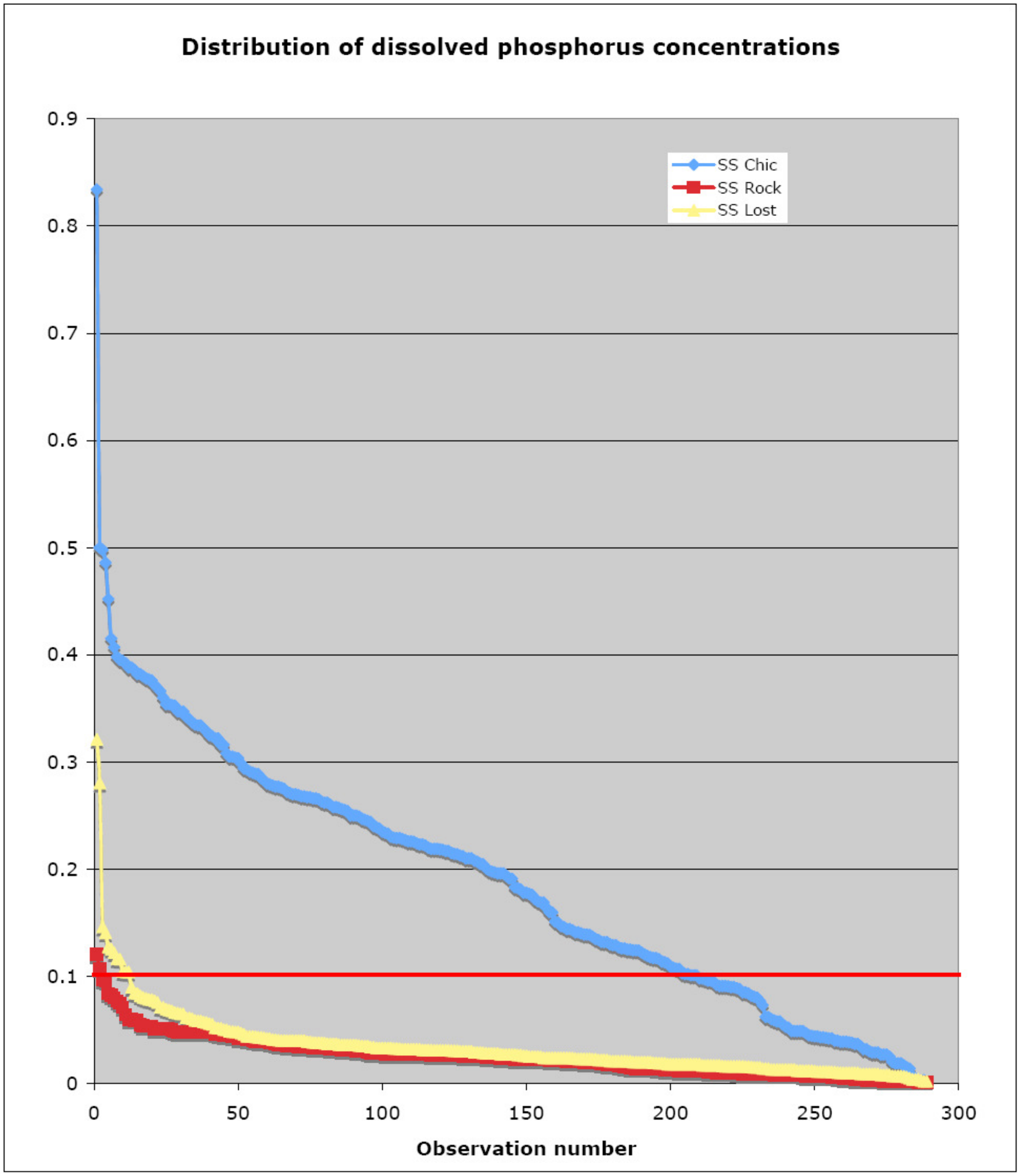
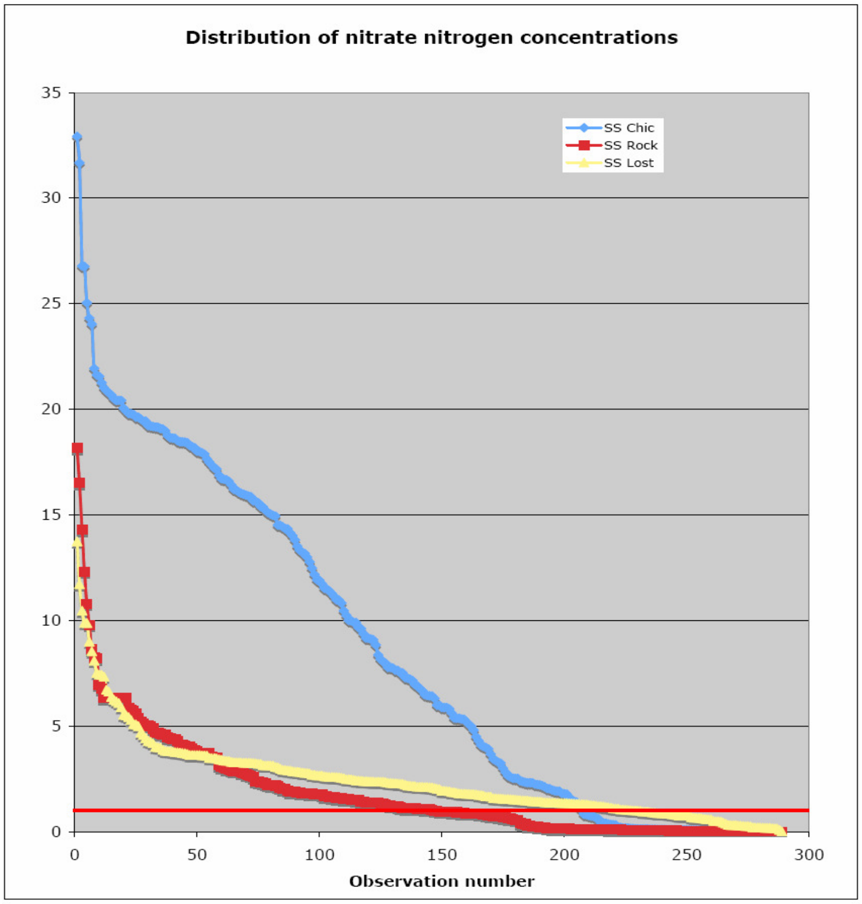


Figure 11 Distribution of Dissolved Phosphorus Concentrations (mg/L), Sept. 2008 to Oct. 2009, for Representative Northwest Ohio Watersheds

Nitrate nitrogen exceeded the draft standard for dissolved nitrogen of 1.0 mg/L on nearly 70% of the sampling days (Figure 12). The corresponding figures for Rock Creek and Lost Creek were 51% and 79% respectively.[6]



Distribution of nitrate nitrogen concentrations, sorted from highest to lowest.

Figure 12 Distribution of Nitrate Nitrogen Concentrations (mg/L), Sept. 2008 to Oct. 2009, for Representative Northwest Ohio Watersheds

Division of Soil and Water Resources staff, in consultation with the Mercer Soil and Water Conservation District, compiled the following watershed information for public education and outreach efforts in 2009 and 2010, based on field observations and animal inventory data from the National Agricultural Statistics Service.[7] The predominant land use (approximately 90%) in the Grand Lake St. Marys Watershed is affiliated with row crop and confined animal agriculture. Consequently, recycling the manure and nutrients from the approximately 300 animal operations into the surrounding row crop fields for livestock feed and other uses is essential to the overall nutrient balance in the watershed. Livestock numbers in the Mercer County portion of the watershed have grown tremendously over the last 40 years. See Figure13.

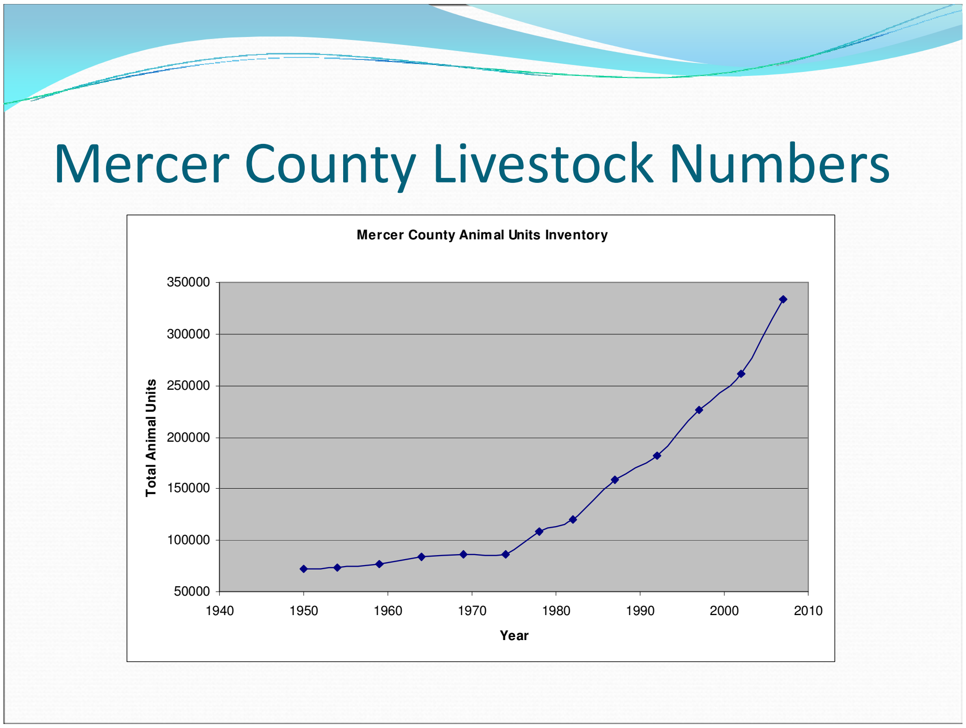


Figure 13 Livestock Numbers in Terms of Animal Units for Mercer County, 1950 to 2010

In Figure 14 the Mercer County information above was compared to animal inventory data for Putnam County (northwest Ohio) and Wayne County (northeastern Ohio) using the USDA's Nation Agricultural Statistics Service (NASS).[7] Specifically, the data for cattle, hogs and poultry layers was compared for the three agriculturally based counties for the period between 1987 and 2007.

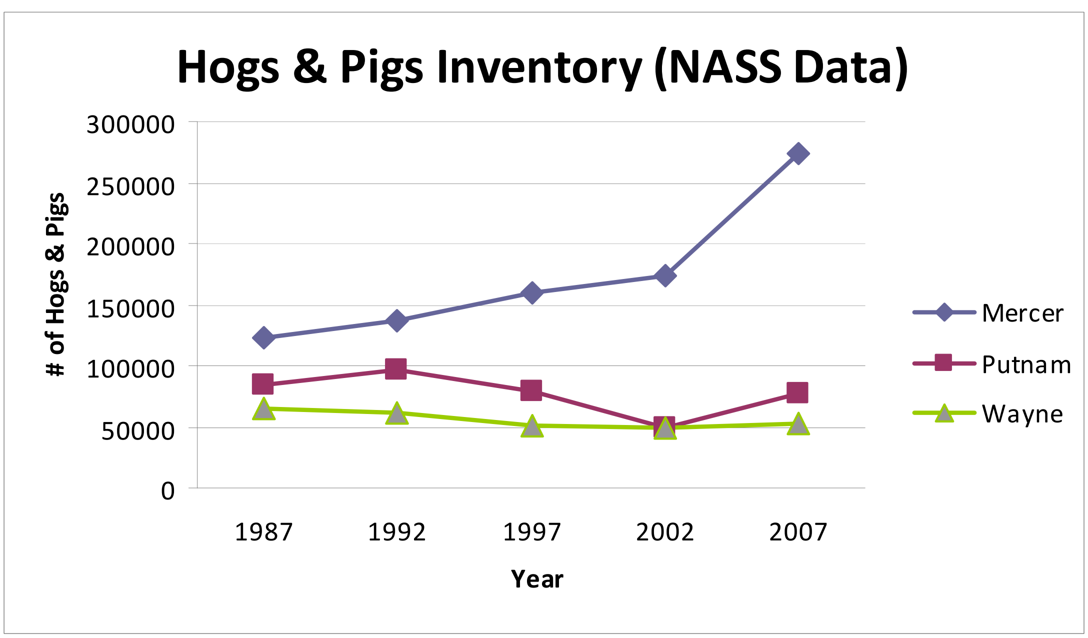
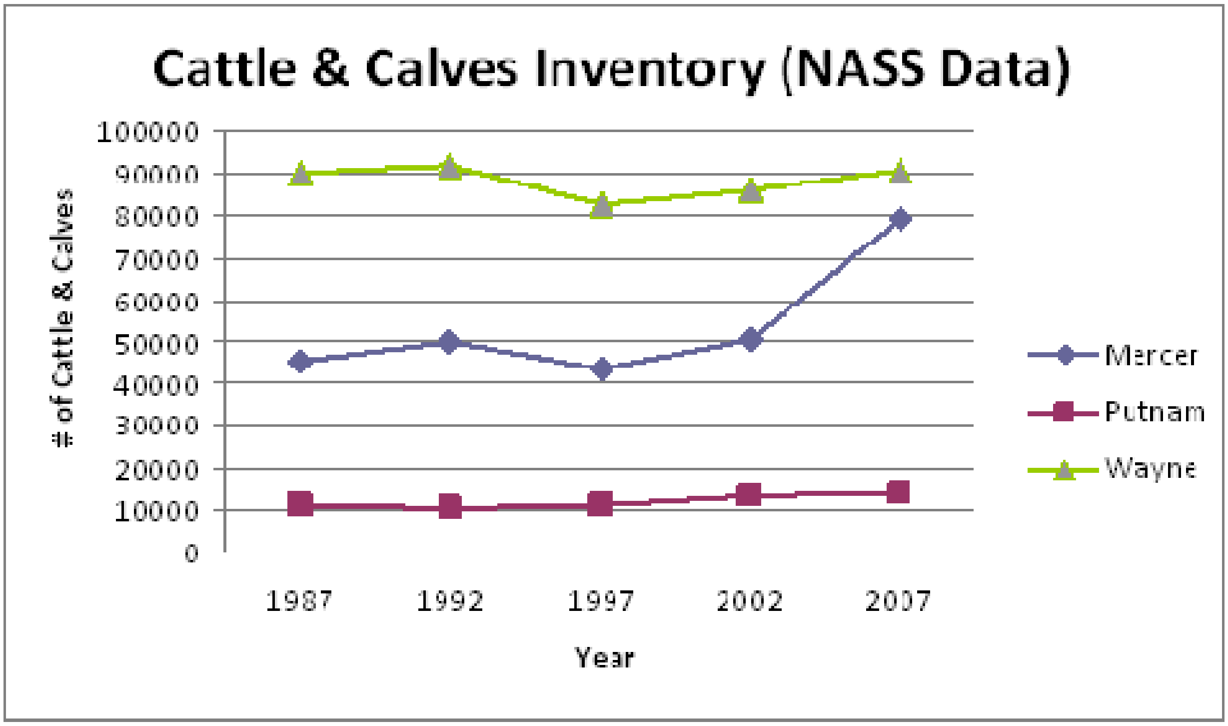


Figure 14 Comparison of Mercer County Livestock Data with Putnam and Wayne Counties, 1987 to 2007



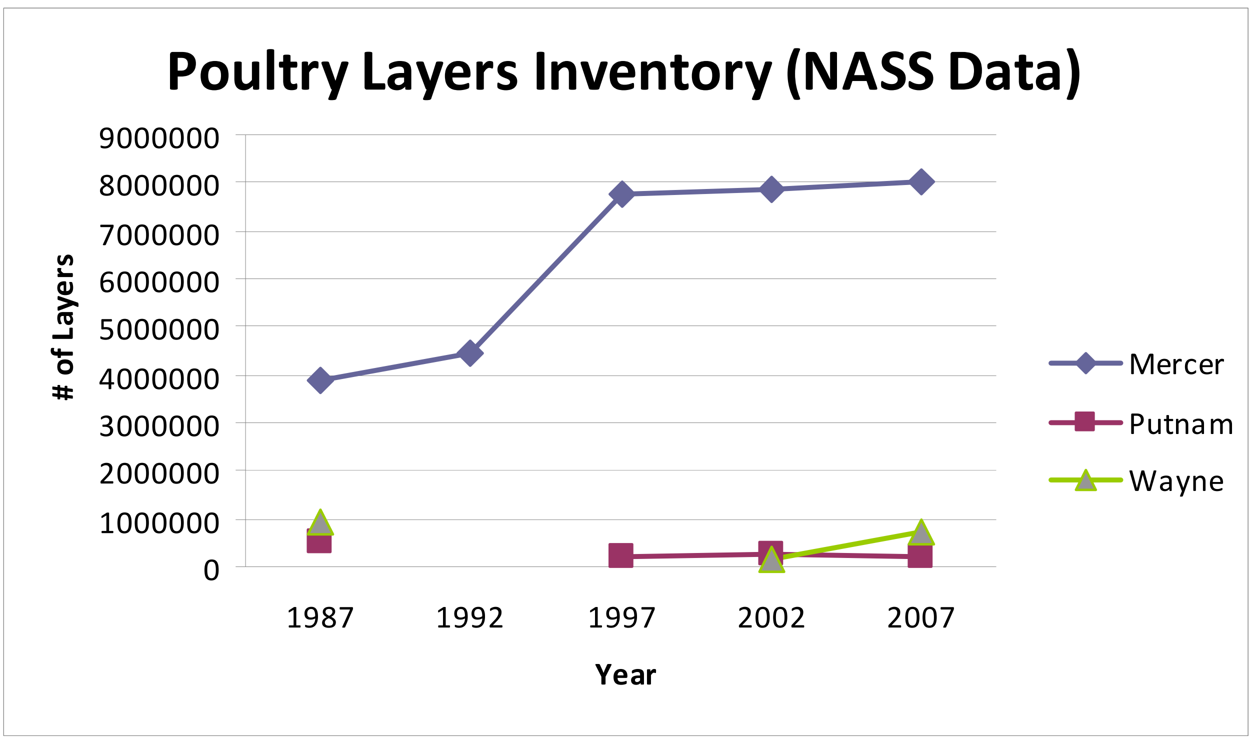


Figure 14 (cont.) Comparison of Mercer County Livestock Data with Putnam and Wayne Counties, 1987-2007

Conclusions

Ohio DNR staff has conducted a thorough review of available data, field observations and scientific information for the Grand Lake St. Marys Watershed and compared the findings with criteria for determining whether a watershed is in distress as provided in Ohio Administrative Code 1501:15-5-20(A).

The Ohio Environmental Protection Agency lists the watershed as impaired by nutrients from agricultural sources. Manure generated by high numbers of confined animals and applied to nearby crop fields is a major component of the nutrient load to the watershed.

There is a reasonable chance that the watershed exhibits conditions that are a threat to public health, a public drinking water source, and enjoyment of Grand Lake St. Marys as a recreational water body. Based upon water quality sampling of the lake and documented fishkills over the last two years, the watershed and specifically Grand lake St. Marys itself has periodic algal and/or cyanobacterial blooms capable of producing toxins that are harmful to humans and wildlife.

Additional water quality sampling over the last two years of a key feeder tributary to Grand Lake St. Marys (Chickasaw Creek) and two other representative watersheds in northwest Ohio (Rock Creek and Lost Creek) indicates that total phosphorus, dissolved phosphorus and nitrate nitrogen concentrations on Chickasaw Creek are significantly higher than the other watersheds.

Based on the above information and analysis, the Grand Lake St. Marys Watershed is in distress as defined in OAC 1501:15-5-20.

References

1. Ohio Environmental Protection Agency. (2010). Ohio Integrated Water Quality Monitoring and Assessment Report. Columbus, OH: author.

2. Ohio Environmental Protection Agency. (2007). Total Maximum Daily Loads for the Beaver Creek and Grand Lake St. Marys Watershed. Columbus, OH: author.

3. Ohio Department of Health. (2010). Harmful Algal Blooms Web Page. http://www.odhg.ohio.gov/features/odhfeatures/algalblooms.aspx.

4. Ohio Environmental Protection Agency (2010). Harmful Algal Blooms Web Page. http//www.epa.state.oh.us/dsw/HAB.aspx.

5. Ohio Department of Natural Resources. (June 21, 2010). Personal communiqué via email from Officer Ryan Garrison and Law Enforcement Administrator Ken Fitz.

6. National Center for Water Quality Research at Heidelberg University study. (2010). Analysis of Chickasaw Creek Concentrations and Loads, Water year 2009. Tiffin, OH: author.

7. United States Department of Agriculture. (2007). National Agricultural Statistics Service. Washington, D.C.: author.

Appendix A

Ohio Administrative Code

1501: 15-5-20 Designating Watersheds in Distress

(A) The chief may designate a watershed to be in distress, and thereby set requirements for the storage, handling and land application of manure; and/or the control of the erosion of sediment and substances attached thereto; and associated nutrient management plans for land and operations within the designated watershed boundaries. In evaluating a potential designation, the chief may consider whether:

1. The watershed is listed as impaired by nutrients and/or sediments from agricultural sources as determined by the Director of Environmental Protection and published in the Ohio Integrated Water Quality Monitoring and Assessment Report pursuant to Section 303(d) of the Federal Water Pollution Control Act or waters are identified as such in an approved Total Maximum Daily Load Report pursuant to OAC Rule 3745-2-12 as required by Section 303(d) of the Federal Water Pollution Control Act;
2. The watershed or a portion of the watershed exhibits conditions that are a threat to public health based on information provided by the Ohio Department of Health or local health district;
3. Streams, lakes, or other waterbodies within the watershed exhibit periodic evidence of algal and/or cyanobacterial blooms capable of producing toxins that are harmful to humans, domestic animals or wildlife;
4. There is a threat to, or presence of contaminants in public or private water supplies;
5. There is a threat to, or presence of contaminants in a primary contact recreational water or a bathing water as designated in OAC 3745-1;
6. Other unacceptable nuisance conditions exist including the depletion of dissolved oxygen in water that results in impacts to aquatic life;
7. Other situations as determined by the chief upon consultation with other federal, state and local agencies.

(B) Prior to proposing to designate a watershed in distress, the chief shall prepare and issue a report documenting the factors in the watershed relating to the items in paragraph (A).

(C) No designation of a watershed in distress shall be issued until the Ohio soil and water conservation commission consents by a majority vote to a proposed designation.

(D) The chief may remove the watershed in distress designation upon reasonable confirmation of a sustained recovery, restoration and mitigation of the factors leading to the original designation.

Appendix B

Additional photos relating to the 2009/2010 algal blooms on Grand Lake St. Mary provided by Mercer Soil and Water Conservation District.

Appendix B (cont.)

Additional photos relating to the 2009/2010 algal blooms on Grand Lake St. Mary provided by the Ohio Department of Natural Resources Division of Wildlife.

Appendix C

2009 and 2010 Grand Lake St. Marys Algal Toxin Sampling Data Provided by Ohio EPA

Grand Lake St. Marys Microcystin Toxin Sampling Data

Sample Collection Date	Sample Process Date	Collected By	Evaluated By	Finished Water	Near Intake (ppb)	Safety Island (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Its It Channel Scum/8" below surface (ppb)
5/18/09	5/21/09	OEPA	GreenWater Labs	Non Detect	82	59	48	72	56	-
6/02/09	6/3/09	OEPA	GreenWater Labs	Non Detect	68	73	59	55	67	-
6/11/09	6/11/09	ODNR	Celina-PWS	Non-Detect	28.9	72.2	28.9	25.5	62.7	-
6/15/09	6/16/09	ODNR	Celina-PWS	Non-Detect	23.3	14.4	16.7	14.4	13.9	-
6/22/09	6/24/09	ODNR	GreenWater Labs	-	66	-	-	55	-	-
6/22/09	6/24/09	ODNR	Celina-PWS	Non-Detect	15.5 and 26.2	-	-	32.7	-	-
6/30/09	7/6/089	ODNR	GreenWater Labs	-	-	-	61	47	56	-
6/30/09	7/1/09	ODNR	Celina-PWS	Non-Detect	8.0 and 9.5	13.8 and 12.9	9.2 and 7.1	9.5 and 7.8	10.0 and 6.0	14.0/24.4
7/13/09	7/15/09	ODNR	Celina-PWS	Non-Detect	53.7	26.1	26.5	45.0	37.0	-
7/22/09	7/22/09	Celina-PWS	Celina-PWS	Non-Detect	40.8	-	-	-	-	-
7/27/09	7/29/09	ODNR	Celina-PWS	Non-Detect	52.1	17.6	18.8	35.4	33.2	-
8/5/09	8/5/09	Celina-PWS	Celina-PWS	Non-Detect	37.1	-	-	-	-	-

***Note: As of August 13, 2009, the City of Celina PWS is using an ultrasonicator when processing raw lake water to ensure all microcystin toxin is released from algal cells to represent total microcystin toxin.**

Sample Collection Date	Sample Process Date	Collected By	Evaluated By	Finished Water	Near Intake (ppb)	Safety Island (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Its It Channel Scum/8" below surface (ppb)
8/11/09	*8/13/09 **See Note**	ODNR	Celina-PWS	Non-Detect	70.3	61.8	55.0	71.8	76.8	-
8/19/09	8/19/09	Celina-PWS	Celina-PWS	Non Detect	46.8	-	-	-	-	-
8/25/09	8/27/09	ODNR	Celina-PWS	Non-Detect	43.0	39.8	44.0	38.3	35.8	-
9/2/09	9/2/09	Celina-PWS	Celina-PWS	Non-Detect	55.5	-	-	-	-	-
9/8/09 9/9/09(intake)	9/9/09	Celina - PWS	Celina - PWS	Non-Detect	69.0	-	-	-	-	-
9/15/09	9/16/09	Celina - PWS	Celina - PWS	Non-Detect	61.7	-	-	-	-	-
9/23/09	9/23/09	Celina – PWS	Celina - PWS	Non-Detect	51.0	-	-	-	-	-
10/1/09	10/1/09	Celina - PWS	Celina-PWS	Non-Detect	42.3	-	-	-	-	-
10/8/09	10/08/09	Celina – PWS	Celina – PWS	Non-Detect	54.4	-	-	-	-	-
10/15/09	10/15/09	Celina-PWS	Celina - PWS	Non-Detect	58.8	-	-	-	-	-
10/21/09	10/22/09	Celina-PWS	Celina-PWS	Non-Detect	55.3	-	-	-	-	-
10/30/09	10/30/09	Celina-PWS	Celina-PWS	Non-Detect	23.7	-	-	-	-	-
11/5/09	11/5/09	Celina-PWS	Celina-PWS	Non-Detect	67.2	-	-	-	-	-
11/12/09	11/12/09	Celina-PWS	Celina-PWS	Non-Detect	23.5	-	-	-	-	-
11/19/09	11/19/09	Celina - PWS	Celina-PWS	Non-Detect	11.5	-	-	-	-	-
12/3/09	12/3/09	Celina-PWS	Celina-PWS	Non-Detect	5.2	-	-	-	-	-
12/10/09	12/10/09	Celina-PWS	Celina-PWS	Non-Detect	3.3	-	-	-	-	-
12/17/09	12/17/09	Celina-PWS	Celina-PWS	Non-Detect	9.5	-	-	-	-	-
12/23/09	12/23/09	Celina-PWS	Celina-PWS	Non-Detect	2.6	-	-	-	-	-

Sample Collection Date	Sample Process Date	Collected By	Evaluated By	Finished Water	Near Intake (ppb)	Safety Island (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Its It Channel Scum/8” below surface (ppb)
1/7/10	1/7/10	Celina-PWS	Celina-PWS	Non-Detect	4.4	-	-	-	-	-
1/13/10	1/14/10	Celina-PWS	Celina-PWS	Non-Detect	3.1	-	-	-	-	-
1/21/10	1/21/10	Celina-PWS	Celina-PWS	Non-Detect	3.7	-	-	-	-	-
1/28/10	1/28/10	Celina-PWS	Celina-PWS	Non-Detect	6.7	-	-	-	-	-
2/4/10	2/4/10	Celina-PWS	Celina-PWS	Non-Detect	4.5	-	-	-	-	-
2/11/10	2/11/10	Celina-PWS	Celina-PWS	Non-Detect	3.6	-	-	-	-	-
2/18/10	2/18/10	Celina-PWS	Celina-PWS	Non-Detect	8.6	-	-	-	-	-
2/25/10	2/25/10	Celina-PWS	Celina-PWS	Non-Detect	4.3	-	-	-	-	-
3/3/10	3/4/10	Celina-PWS	Celina-PWS	Non-Detect	2.3	-	-	-	-	-
3/11/10	3/11/10	Celina-PWS	Celina-PWS	Non-Detect	1.6	-	-	-	-	-
3/18/10	3/18/10	Celina-PWS	Celina-PWS	Non-Detect	2.4	-	-	-	-	-
3/24/10	3/25/10	Celina-PWS	Celina-PWS	Non-Detect	2.3	3.5	2.3	3.0	2.3	-
4/1/10	4/1/10	Celina-PWS	Celina-PWS	Non-Detect	1.5	-	-	-	-	-
4/8/10	4/8/10	Celina-PWS	Celina-PWS	Non-Detect	6.3	-	-	-	-	-
4/15/10	4/15/10	Celina – PWS	Celina - PWS	Non-Detect	9.2	-	-	-	-	-

<u>Water Quality Advisory Lifted At Grand Lake St. Marys</u>

Ohio EPA, Ohio Department of Natural Resources (ODNR) and Ohio Department of Health (ODH) are announcing that recent water quality sampling along the Grand Lake St. Mary’s beach area shows that levels of the previously detected algal toxin “microcystin” have fallen below the World Health Organization (WHO) provisional guideline for concern. Previously posted advisory signs will be removed from the beach areas until further notice. ODNR, in conjunction with the city of Celina, will begin bi-weekly sampling of Grand Lake St. Mary’s prior to Memorial Day weekend.

Explaining the Difference in Data

Question: Is the finished water from the Celina Public Water Supply (PWS) free of microcystin toxin?

Answer: Yes. Data we received so far (as of June 30, 2009) from Celina PWS and GreenWater Labs indicates there is no microcystin toxin in the Celina PWS finished water.

Question: Why are the data for the other sample points different from the Celina and GreenWater Laboratories?

Answer: There is no national standardized procedure for analyzing microcystin toxin. The Celina PWS and GreenWater Laboratories are using different procedures for analyzing the level of microcystin toxin in Grand Lake St. Marys. The procedure currently used by the Celina PWS is good for preliminary screening of lake waters, and for evaluating finished drinking water. However, the procedure used by Celina does not calculate total microcystin concentration as the process does not release all the toxin from all the algal cells. Therefore, lower microcystin toxin levels reported by Celina do not mean there are less toxins in the lake or that the lake water quality is improving. When this issue arose, Celina was the only Ohio lab we were aware of that could perform this type of analysis quickly. Celina's analysis of these samples are especially helpful to ensuring that the finished drinking water remains safe for consumption.

Ohio EPA was also able to use GreenWater Laboratories in Florida to analyze raw water and finished drinking water samples with a more conservative method of analysis that reports total microcystin toxin. GreenWater Laboratory uses a procedure with special equipment that releases all the toxin from all algal cells resulting in higher toxin readings. It is important to know total microcystin toxin to determine the risk of recreational exposure. That is why the Ohio EPA sometimes sends samples to GreenWater Laboratories for analysis and uses GreenWater Laboratory results for public notification of recreational risks by posting Water Quality Advisories.

Ohio EPA is working with both labs to provide the best analysis possible. Advisories are based on the best information available and are conservative on the side of protecting public health.

***Note: As of August 13, 2009, the City of Celina PWS is using an ultrasonicator when processing raw lake water to ensure all microcystin toxin is released from algal cells to represent total microcystin toxin**

World Health Organization Provisional Guidelines for Microcystin Toxin:

Recreational Contact = 20 ppb (moderate risk)
Public Drinking Water = 1 ppb
ppb = parts per billion

2010 Grand Lake St. Marys Algal Toxin Sampling Data
Ohio EPA, Division of Surface Water
ppb = parts per billion

World Health Organization Provisional Guidelines for Microcystin Toxin:

- Recreational Contact = 20 ppb (upper end of moderate risk range)
- Public Drinking Water = 1 ppb

There are no national standards or benchmarks for Anatoxin-a, Cylindrospermopsin or Saxitoxin. Ohio Harmful Algae Bloom Websites:

- Ohio Environmental Protection Agency – www.epa.ohio.gov/dsw/HAB.aspx and www.epa.ohio.gov/pic/glsm_algae.aspx
- Ohio Department of Natural Resources – www.ohiodnr.com/tabid/22957/Default.aspx
- Ohio Department of Health – www.odh.ohio.gov/features/odhfeatures/algalblooms.aspx

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
12/8/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	1.1	-	-	-	-	-	-	-	-
11/24/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	2.9	-	-	-	-	-	-	-	-
11/17/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	3.7	-	-	-	-	-	-	-	-
11/11/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	1.7	-	-	-	-	-	-	-	-
11/2/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	6.7		-	-	-	-	-	-	-
10/27/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	4.9	-	-	-	-	-	-	-	-
10/25/10	Ohio EPA / Green Water	Anatoxin-a	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	8.1	2.1	2.1	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
10/20/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	0.7	-	-	-	-	-	-	-	-
10/18/10	Ohio EPA / Green Water	Anatoxin-a	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
	Ohio EPA / Ohio EPA	Microcystins	-	-	2.6	2.4	2.2	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
10/13/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	3.7	-	-	-	-	-	-	-	-
10/12/10	Ohio EPA / Green Water	Anatoxin-a	-	-	Non-detect	0.05-0.1	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	3.3	2.1	4.6	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
10/7/10	Ohio EPA / Ohio EPA	Microcystins	-	-	-	-	-	-	-	-	3.6/2.0/1.5	-
	Celina-PWS / Celina-PWS	Microcystins	Non-detect	3.9	-	-	-	-	-	-	-	-
10/4/10	Ohio EPA / Green Water	Anatoxin-a	-	-	0.05-0.1	0.05-0.1	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	6.5	4.9	5.0	-	-	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
9/28/10	Ohio EPA / Green Water	Anatoxin-a	-	-	Non-detect	0.05-0.1	0.05-0.1	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	6.2	7.2	7.5	-	-	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-

9/20/10	Ohio EPA / Green Water	Anatoxin-a	-	-	0.1	0.1	0.1	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	5.6	4.9	3.8	-	-	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
9/17/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	5.3	-	-	-	-	-	-	-	-
9/15/10	Ohio EPA/ Ohio EPA	Microcystins	-	-	-	-	-	-	-	-	3.6/2.6/2.5	-
9/13/10	Ohio EPA/ Ohio EPA	Anatoxin-a	-	-	0.1	0.1	0.1	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	4.0	7.2	5.0	-	-	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
9/9/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	3.0	-	-	-	-	-	-	-	-
9/7/10	Ohio EPA / Ohio EPA	Anatoxin-a	-	-	0.1	0.05-0.1	0.1	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	3.4	3.4	2.7	-	-	-	-	-
	Ohio EPA / Green Water	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
9/1/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	1.5	-	-	-	-	-	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
8/30/10	Ohio EPA / Green Water	Anatoxin-a	-	-	0.2	0.1	0.3	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	7.5	3.3	1.5	-	-	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-

8/24/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	6.1	-	-	-	-	-	-	-	-
8/23/10	Ohio EPA / Green Water	Anatoxin-a	-	-	0.2	0.2	0.3	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	4.5	2.6	3.9	-	-	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
8/19/10	Ohio EPA-NWDO / Green Water	Anatoxin-a	-	-	-	-	-	-	-	-	Non-detect / - / -	-
	Ohio EPA-NWDO / Ohio EPA	Cylindro-spermopsin	-	-	-	-	-	-	-	-	Non-detect / - / -	-
	Ohio EPA / Ohio EPA	Microcystins	-	-	-	-	-	-	-	-	2.5 / 1.8 / 4.4	-
	Ohio EPA-NWDO / Ohio EPA	Saxitoxin	-	-	-	-	-	-	-	-	Non-detect / - / -	-
8/17/10	Ohio EPA / Green Water	Anatoxin-a	-	-	0.5	0.4	0.6	-	-	-	-	-
	Ohio EPA / Ohio EPA	Cylindro-spermopsin	-	-	Non-detect	0.062	Non-detect	-	Non-detect	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
	Ohio EPA / Ohio EPA	Microcystins	-	-	6.7	14	6.7	-	4.1	-	-	-
	Ohio EPA / Ohio EPA	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	Non-detect	-	-	-
8/18/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	0.7	-	-	-	-	-	-	-	-
8/8/10	USGS / Green Water	Anatoxin-a	-	-	6	10	6	-	-	-	-	-
	USGS / Green Water Labs	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	USGS / Celina-PWS	Microcystins	Non-detect	2.5	3.2 (biomass) 3.1 (water)	2.2 (biomass) 2.9 (water)	20.2 (biomass) 3.5 (water)	-	-	-	-	-
	USGS / Green Water Labs	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
8/4/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	5.1	-	-	-	-	-	-	-	-
8/2/10	USGS / Green Water Labs	Anatoxin-a	-	-	3	15	10	-	-	-	-	-
	USGS / Green Water Labs	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	USGS / Celina-PWS	Microcystins	-	-	18.5 (biomass) 3.2 (water)	35.5 (biomass) 3.5 (water)	81.0 (biomass) 9.1 (water)	-	-	-	-	-
	USGS / Green Water Labs	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
7/27/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	7.8	-	-	-	-	-	-	-	-
7/26/10	Ohio EPA / Green Water Labs	Anatoxin-a	-	-	0.8	1.2	0.9	-	-	-	-	-
	Ohio EPA / Green Water Labs	Cylindro-spermopsin	-	-	-	-	-	-	-	-	-	-
	Ohio EPA / Celina-PWS	Microcystins	-	-	1.2	2.0	2.5	-	-	-	-	-
	Ohio EPA / Green Water Labs	Saxitoxin	-	-	-	-	-	-	-	-	-	-
7/25/10	USGS / Celina-PWS	Microcystins	-	-	5.3 (scum) 14.4 (water)	27.5 (scum) 0.8 (water)	416 (scum) 4.2 (water)	-	-	-	-	-
7/23/10	Ohio DNR / Green Water Labs	Anatoxin-a	-	-	-	-	-	-	-	-	-	6
	Ohio DNR / Green Water Labs	Cylindro-spermopsin	-	-	-	-	-	-	-	-	-	Non-detect
	Ohio DNR / Celina-PWS	Microcystins	-	-	-	-	-	-	-	-	-	Non-detect
	Ohio DNR / Green Water Labs	Saxitoxin	-	-	-	-	-	-	-	-	-	Non-detect
7/20/10	Ohio EPA / Green Water Labs	Anatoxin-a	Non-detect	2.0	-	-	-	-	-	-	-	-
	Ohio EPA / Green Water Labs	Cylindro-spermopsin	Non-detect	Non-detect	-	-	-	-	-	-	-	-
	Celina-PWS / Celina-PWS	Microcystins	Non-detect	2.6	-	-	-	-	-	-	-	-

	Ohio EPA / Green Water Labs	Saxitoxin	Non-detect	Non-detect	-	-	-	-	-	-	-	-
7/19/10	Ohio EPA / Green Water Labs	Anatoxin-a	-	-	3.0	4.0	4.0	-	-	-	-	-
	Ohio EPA / Green Water Labs	Cylindro-spermopsin	-	-	0.7	Non-detect	Non-detect	-	-	-	-	-
	USGS / Celina-PWS	Microcystins	-	-	150 (scum) 13.5 (water)	55 (scum) 19.7 (water)	105 (scum) 26.0 (water)	-	-	-	-	-
	Ohio EPA / Green Water Labs	Saxitoxin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
7/15/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	25.2	-	-	-	-	-		-	-
7/12/10	Ohio EPA / Green Water Labs	Anatoxin-a	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Green Water Labs	Cylindro-spermopsin	-	-	Non-detect	Non-detect	<5.0	-	-	-	-	-
	USGS / Celina-PWS	Microcystins	-	-	>2,000	>2,000	>2,000	-	-		-	-
	Ohio EPA / Green Water Labs	Saxitoxin	-	-	0.05	0.07	0.09	-	-	-	-	-
7/7/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	7.6	-	-	-	-	-	-	-	-
7/6/10	Ohio EPA / Green Water Labs	Anatoxin-a	-	-	Non-detect	0.1	0.02	-	-	-	-	-
	Ohio EPA / Green Water Labs	Cylindro-spermopsin	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
	Ohio EPA / Green Water Labs	Saxitoxin	-	-	0.03	0.03	Non-detect	-	-	-	-	-
7/5/10	USGS / Celina-PWS	Microcystins	-	-	>250	>250	>250	-	-	-	-	-
6/30/10	Celina-PWS / Celina-PWS	Microcystins	-	5.7	-	-	-	-	-	-	-	-
6/29/10	Ohio EPA / Green Water Labs	Anatoxin-a	Non-detect	Non-detect	-	-	-	-	-	-	-	-
	Ohio EPA / Green Water Labs	Cylindro-spermopsin	Non-detect	Non-detect	-	-	-	-	-	-	-	-
	Ohio EPA / Celina-PWS	Microcystins	Non-detect	>250	-	-	-	-	-	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
	Ohio EPA / Green Water Labs	Saxitoxin	Non-detect	Non-detect	-	-	-	-	-	-	-	-
6/28/10	USGS / Celina-PWS	Microcystins	-	-	12.4	9.2	>50	-	-	-	-	-
6/23/10	Ohio EPA / Green Water Labs	Anatoxin-a	-	-	-	-	Non-detect	-	-	Non-detect	-	-
	Ohio EPA / Green Water Labs	Cylindro-spermopsin	-	-	-	-	9.0	-	-	0.1	-	-
	Ohio EPA / Celina-PWS	Microcystins	-	-	-	-	-	-	-	>250 (scum)	-	-
	Celina-PWS / Celina-PWS	Microcystins	Non-detect	4.7	-	-	-	-	-	-	-	-
	USGS / Celina-PWS	Microcystins	-	-	0.5	1.1	0.7	-	-	-	-	-
	Ohio EPA / Green Water Labs	Saxitoxin	-	-	-	-	0.03	-	-	Non-detect	-	-
6/17/10	Celina-PWS / Green Water Labs	Anatoxin-a	Non-detect	Non-detect	-	-	-	-	-	-	-	-
	Celina-PWS / Green Water Labs	Cylindro-spermopsin	Non-detect	Non-detect	-	-	-	-	-	-	-	-
	Celina-PWS / Celina-PWS	Microcystins	Non-detect	0.5	-	-	-	-	-	-	-	-
	Celina-PWS / Green Water Labs	Saxitoxin	Non-detect	Non-detect	-	-	-	-	-	-	-	-
6/16/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	-	-	-	-	-	-	-	-	-
6/14/10							See Bloom Response Sampling Table below					
	USGS / Celina-PWS	Microcystins	-	-	Non-detect	Non-detect	Non-detect	-	-	-	-	-
6/10/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	0.1	-	-	-	-	-	-	-	-
6/3/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	0.4	-	-	-	-	-	-	-	-
6/2/10	Ohio DNR / Celina-PWS	Microcystins	-	-	0.4	0.4	0.5	-	-	-	-	-
5/27/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	0.6	-	-	-	-	-	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
5/20/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	-	-	-	-	-	-	-	-	-
5/18/10	Ohio DNR / Celina-PWS	Microcystins	-	0.6	0.7	0.8	0.8	-	-	-	-	-
5/13/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	1.1	-	-	-	-	-	-	-	-
5/6/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	Non-detect	-	-	-	-	-	-	-	-
4/29/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	0.9	-	-	-	-	-	-	-	-
4/22/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	3.5	-	-	-	-	-	-	-	-
4/15/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	9.2	-	-	-	-	-	-	-	-
4/8/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	6.3	-	-	-	-	-	-	-	-
4/1/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	1.5	-	-	-	-	-	-	-	-
3/24/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	2.3	2.3	3.0	2.3	3.5	-	-	-	-
3/18/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	2.4	-	-	-	-	-	-	-	-
3/11/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	1.6	-	-	-	-	-	-	-	-
3/3/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	2.3	-	-	-	-	-	-	-	-
2/25/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	4.3	-	-	-	-	-	-	-	-
2/18/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	8.6	-	-	-	-	-	-	-	-
2/11/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	3.6	-	-	-	-	-	-	-	-
2/4/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	4.5	-	-	-	-	-	-	-	-

Sample Collection Date	Collected By / Analyzed By	Toxin Tested	Finished Water (ppb)	Near Intake (ppb)	Camp Beach (ppb)	East Beach (ppb)	West Beach (ppb)	Safety Island (ppb)	Pizza Hut Dock (ppb)	Ohio DNR Ramp (ppb)	L-1 / L-2 / L-3 * (ppb)	Red Algae Bloom Center of Lake (ppb)
1/28/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	6.7	-	-	-	-	-	-	-	-
1/21/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	3.7	-	-	-	-	-	-	-	-
1/13/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	3.1	-	-	-	-	-	-	-	-
1/7/10	Celina-PWS / Celina-PWS	Microcystins	Non-detect	4.4	-	-	-	-	-	-	-	-

L-1, L-2 and L-3 are three sampling stations near the center of the lake.

Microcyctin – Bloom Response Sampling

Sample Collection Date	Collected By / Evaluated By	Toxin Tested	SE Center Lake (ppb)	Big Chick Beach (ppb)	St. Marys Boat Club Ramp (ppb)	Pizza Hut Dock (ppb)	Windy Point (ppb)	Montezuma Boat Ramp (ppb)
6/14/10	Ohio EPA / Celina-PWS	Microcystins	Non-detect	9.3	5.4	12.9	Non-detect	Non-detect

Analysis of the Microcystins samples taken from a large blue-green algae bloom on Grand Lake St. Marys on 6/14/10 shows Microcystins was not detected in several samples and ranged between 3.3 ppb and 12.9 ppb in four sampling locations.

All of these numbers are below the World Health Organization's guideline for recreational contact concerns. However, the current algae bloom is *Aphanizomenon gracile*, a different species than the *Planktothrix* that was dominant in the summer of 2009. Cyanobacteria (blue-green algae) are capable of producing a variety of toxins. Because different algae have been identified in recent samples, Ohio EPA is conducting further analysis to determine if public health concerns exist.

Appendix D

Ohio DNR Division of Wildlife Incident Reports

ADMINISTRATIVE

AGENCY NAME
ODNR - Wildlife

CALL NUMBER | *GEOCODE

TOD
TOA
TOC

☐ INCIDENT (NON-CRIMINAL)
☐ OFFENSE
☐ SUPPLEMENT

OHIO UNIFORM INCIDENT REPORT

*INCIDENT NUMBER

*CLEARANCES

A ☐	Death of Suspect	G ☐	Arrest – Juvenile
B ☐	Prosecution Declined	H ☐	Warrant Issued
C ☐	Extradition Denied	I ☐	Invest. Pending
D ☐	Victim Refused to Coop.	J ☐	Closed
E ☐	Juvenile/No Custody	K ☐	Unfounded
F ☐	Arrest - Adult	U ☐	Unknown

*CLEARANCE DATE | CLEARED BY:

*REPORT DATE/TIME				*INCIDENT OCCURRED FROM				*INCIDENT OCCURRED TO			
MONTH	DAY	YEAR	TIME	MONTH	DAY	YEAR	TIME	MONTH	DAY	YEAR	TIME
06	27	2010	08:55	06	26	2010	12:30				

INCIDENT LOCATION (Street, Apt., City, State, Zip)

OFFENSE

*OFFENSE	*OFFENSE CODE	*A/C	F/M & DEGREE	*HATE/BIAS	*LARCENY	* TYPE CRIMINAL ACTIVITY
1.	1.					1. ____ 2. ____ 3. ____
2.	2.					1. ____ 2. ____ 3. ____
3.	3.					1. ____ 2. ____ 3. ____
4.	4.					1. ____ 2. ____ 3. ____
5.	5.					1. ____ 2. ____ 3. ____

(Enter up to three for each offense)
B- BUYING/RECEIVING
C- CULTIVATING/MFG./PUB.
D- DISTRIBUTING/SELLING
E- EXPLOITING CHILDREN
O- OPER/PROPOTING/ASSIST
P- POSSESSING/CONCEALING
T- TRANSP/TRANSMITTING
U- USING/CONSUMING
G- OTHER GANG ACTIVITY
J- JUVENILE GANG ACTIVITY
N- NO GANG ACTIVITY

*LOCATION OF OFFENSE (Enter up to two)

1. ________ 2. ________

RESIDENTIAL STRUCTURE
01 Single Family Home
02 Multiple Dwelling
03 Residential Facility
04 Other Residential
05 Garage/Shed

PUBLIC ACCESS BLDGS.
06 Transit Facility
07 Government Office
08 School
09 College
10 Church
11 Hospital
12 Jail/Prison
13 Parking Garage
14 Other Public Access Buildings

COMMERCIAL LOCATIONS
15 Auto Shop
16 Financial Institution
17 Barber/Beauty Shop
18 Hotel/Motel
19 Dry Cleaners/Laundry
20 Professional Office
21 Doctor's Office
22 Other Business Office
23 Amusement Center
24 Rental Storage Facility
25 Other Commercial Service Loc.

RETAIL
26 Bar
27 Buy/Sell/Trade Shop
28 Restaurant
29 Gas Station
30 Auto Sales Lot
31 Jewelry Store
32 Clothing Store
33 Drugstore
34 Liquor Store
35 Shopping Mall
36 Sporting Goods
37 Grocery/Supermarket
38 Variety/Convenience
39 Department Store
40 Other Retail Store

41 Factory/Mill/Plant
42 Other Building

OUTSIDE
43 Yard
44 Construction Site
45 Lake/Waterway
46 Field/Woods
47 Street
48 Parking Lot
49 Park/Playground
50 Cemetery
51 Public Transit Vehicle
52 Other Outside Location

77 Other

*SUSPECTED OF USING
A ☐ ALCOHOL
D ☐ DRUGS
C ☐ COMPUTER EQUIPMENT
N ☐ NOT APPLICABLE

*TYPE WEAPON/FORCE USED
1. ________ 2. ________ 3. ________

*METHOD OF ENTRY
1 ☐ FORCE
2 ☐ NO FORCE
*NO. PREMISES ENTERED

*METHOD OF ENTRY – MOTOR VEHICLE THEFT
01 ☐ Motor Running/Keys in Car
02 ☐ Unlocked
03 ☐ Duplicate Key Used
04 ☐ Window Broken
05 ☐ Towed
06 ☐ Hot Wire
07 ☐ Slim Jim/Coat Hanger
08 ☐ Tumblers Removed
09 ☐ Column Peeled
10 ☐ Ignition Peeled

*METHOD OF ENTRY – BURGLARY/B&E

ENTRY		EXIT	ENTRY		EXIT	ENTRY		EXIT
1 ☐	BASEMENT	☐	1 ☐	DOOR	☐	1 ☐	FRONT	☐
2 ☐	1^{ST} FLOOR	☐	2 ☐	WINDOW	☐	2 ☐	SIDE	☐
3 ☐	2^{ND} FLOOR	☐	3 ☐	GARAGE	☐	3 ☐	REAR	☐
4 ☐	OTHER	☐	4 ☐	SKYLIGHT	☐	4 ☐	ROOF	☐
			5 ☐	OTHER	☐	5 ☐	OTHER	☐

METHODS OF OPERATION

VICTIM

*NO. | *TOTAL VICTIMS | *VICTIM TYPE: I ☐ INDIVIDUAL, B ☐ BUSINESS, F ☐ FINANCIAL INSTITUTION, G ☐ GOVERNMENT, P ☐ POLICE OFFICER (IN THE LINE OF DUTY), R ☐ RELIGIOUS ORGANIZATION, S ☐ SOCIETY, U ☐ UNKNOWN, O ☐ OTHER

NAME (Last, First, Middle)

ADDRESS (Street, Apt., City, State, Zip) | PHONE

EMPLOYER NAME AND ADDRESS (Street, Apt., City, State, Zip) | PHONE

*AGE/ D.O.B. | *SEX | *RACE ☐ B ☐ A ☐ W ☐ I ☐ U | HGT | WGT | HAIR | EYES

OCCUPATION | SSN | *RESIDENT STATUS 1 ☐ RESIDENT 2 ☐ TOURIST 3 ☐ MILITARY 4 ☐ STUDENT 5 ☐ OTHER U ☐ UNKNOWN

*VICTIM INJURED? ☐ Y ☐ N | IF INJURED, DESCRIBE INJURIES:

*AGG. ASSAULT/ HOMICIDE CIRC. | *LEOKA INFORMATION: TYPE OF ACT, ASSIGN. TYPE, ORI – OTHER | *VICTIM/SUSPECT RELATIONSHIP 0. ____ 1. ____ 2. ____ 3. ____ 4. ____ 5. ____ | *VICTIM/OFFENSE LINK

INCIDENT NUMBER

My signature verifies that the information on this report is accurate and true

DATE________________

REPORTING OFFICER	BADGE NO.	DATE
Ryan Garrison	1591	
APPROVING OFFICER	BADGE NO.	DATE

FOLLOW-UP? ☐ Y ☐ N | If yes, follow-up Assignment:

ADDITIONAL SUPPLEMENTS: ☐ VICTIM/WITNESS ☐ SUSPECT/ARRESTEE ☐ PROPERTY ☐ NARRATIVE ☐ STATEMENTS ☐ OTHER | FORM RECEIVED BY: ☐ INVESTIGATION ☐ INTELLIGENCE ☐ RECORDS | SPECIAL COPIES

09/2004

INCIDENT REPORT – PART 2

INCIDENT NUMBER

VICTIM | OFFENSE | INCIDENT DATE AND TIME 06 26 2010

REPORTEE

NO. | NAME (Last, First, Middle) | AGE/ D.O.B. | SSN

ADDRESS (Street, Apt., City, State, Zip) | PHONE

EMPLOYER NAME AND ADDRESS (Street, Apt., City, State, Zip) | PHONE

STATEMENTS OBTAINED ☐ Y ☐ N TYPE ☐ WRITTEN ☐ ORAL ☐ TAPED ☐ OTHER

VEHICLE

CHECK CATEGORIES ☐ STOLEN ☐ RECOVERED ☐ IMPOUNDED ☐ RECEIVED ☐ SUSPECT'S VEHICLE ☐ VICTIM'S VEHICLE ☐ UNAUTHORIZED USE ☐ ABANDONED

NO. | ☐ DAMAGE TO VEHICLE ☐ THEFT FROM VEHICLE | LIC | LIS | LIY | LIT | VIN/OAN | *VALUE

VYR | VMA | VMO | VST | VCO TOP BOTTOM | VEHICLE LOCKED ☐ Y ☐ N | KEYS IN VEHICLE ☐ Y ☐ N | HOLD VEHICLE ☐ Y ☐ N | RELEASE CONTENTS ☐ Y ☐ N

VEHICLE ASSOC. W/ SUSPECT NO. | VEHICLE ASSOC. W/ VICTIM NO. | VEHICLE TOWED? ☐ Y ☐ N | TOWED BY | OWNERSHIP VERIFIED BY: ☐ TAG RECEIPT ☐ BILL OF SALE ☐ TITLE ☐ OTHER:

STOLEN MOTOR VEHICLE ONLY | NO. STOLEN | AREA STOLEN ☐ BUSINESS | ☐ RESID. ☐ RURAL | ADDITIONAL DESCRIPTION

AUTO INSURER NAME (Company) ADDRESS (Street, Apt., City, State, Zip) | PHONE

MOTOR VEHICLE RECOVERY ONLY | NO. RECOVERED | DATE REC. | STOLEN IN YOUR JURISDICTION ☐ Y ☐ N WHERE RECOVERED?

PROPERTY

*TYPE PROPERTY LOSS/ETC. (enter codes below) 1 NONE 2 BURNED 3 COUNTERFEITED/FORGED 4 DESTROYED/DAMAGED/VANDALIZED 5 STOLEN/ETC. 6 SEIZED 7 RECOVERED U UNKNOWN P PHOTO E EVIDENCE | TOTAL VALUE $0.00

*LOSS CODE | QUANTITY | DESCRIPTION | *PROP CODE | *VALUE
VICT. NO. | VEH NO. | MAKE/BRAND | MODEL | DATE RECOVERED
SERIAL NUMBER | NCIC NUMBER | OTHER NUMBER

*LOSS CODE | QUANTITY | DESCRIPTION | *PROP CODE | *VALUE
VICT. NO. | VEH NO. | MAKE/BRAND | MODEL | DATE RECOVERED
SERIAL NUMBER | NCIC NUMBER | OTHER NUMBER

*LOSS CODE | QUANTITY | DESCRIPTION | *PROP CODE | *VALUE
VICT. NO. | VEH NO. | MAKE/BRAND | MODEL | DATE RECOVERED
SERIAL NUMBER | NCIC NUMBER | OTHER NUMBER

*LOSS CODE | QUANTITY | DESCRIPTION | *PROP CODE | *VALUE
VICT. NO. | VEH NO. | MAKE/BRAND | MODEL | DATE RECOVERED
SERIAL NUMBER | NCIC NUMBER | OTHER NUMBER

PROPERTY CODES:

EXCHANGE MEDIUMS
01 Money
02 Credit/Debit Card
03 Negotiable Instruments
04 Other Exchange Mediums

DOCUMENTS
05 Non-Negotiable Instruments
06 Personal Papers
07 Other Documents

VALUABLES
08 Jewelry/Precious Metals
09 Art Objects, Antiques
10 Other Valuables

PERSONAL EFFECTS
11 Clothing/Furs
12 Purses/Handbags/Wallets
13 Other Personal Effects

HOUSEHOLD ITEMS
14 Household Items

EQUIPMENT
15 Drug/Narcotic Equip.
16 Gambling Equipment
17 Computer Hardware/Soft.
18 Office Equipment
19 Stereo TV Equip.
20 Recordings-Audio Visual
21 Sports Equipment
22 Photographic Equipment
23 Farm Equipment
24 Heavy Construction/Industrial
25 Building Supplies-Const.
26 Tools
27 Vehicle Parts/Accessories
28 School Supplies
29 Other Equipment

CONSUMABLE ITEMS
30 Alcohol
31 Drugs/Narcotics
32 Consumable Goods

ANIMALS
33 Livestock
34 Household Pets

VEHICLES
35 Aircraft
36 Automobiles
37 Bicycles
38 Buses
39 Trucks
40 Trailers
41 Watercraft
42 Recreational Vehicle
43 Other Motor Vehicle

WEAPONS
44 Firearms
45 Other Weapons

STRUCTURES
46 Single Occupancy
47 Other Dwellings
48 Commercial/Business
49 Indus./Mfg.
50 Public/Community
51 Storage
52 Other Structure

OTHER
53 Merchandise
54 Other Property
55 Pending Inventory

NARRATIVE

On June 26, 2010, I received a call of fishing dying in Grand Lake St. Marys. The caller advised the fish were in the water to the east of Lake Acres Dr. I arrived on the scene at 12:23 pm. I observed several fish at the surface gasping for air along the shore to the east of Lake Acres Dr.. The residential homes had sandy beaches in front of their property next to the water. There were hundreds of channel catfish swimming up onto and out of the water on the beach areas. There were also sunfish, crappies, freshwater drum, and largemouth bass dead and in distress. Grand Lake St. Marys has been experiencing large algae bloom and low DO for over a week. There have been several other fish kills around the lake. I didn't observe any visible pollutant in the water. The fish kill and fish gasping for air appeared to be a result of low DO associated with the algae bloom.

OHIO UNIFORM INCIDENT REPORT

ADMINISTRATIVE

AGENCY NAME: ODNR - Wildlife
*INCIDENT NUMBER:
CALL NUMBER: | *GEOCODE:
TOD:
TOA:
TOC:

☑ INCIDENT (NON-CRIMINAL)
☐ OFFENSE
☐ SUPPLEMENT

*CLEARANCES

A ☐	Death of Suspect	G ☐	Arrest – Juvenile
B ☐	Prosecution Declined	H ☐	Warrant Issued
C ☐	Extradition Denied	I ☐	Invest. Pending
D ☐	Victim Refused to Coop.	J ☐	Closed
E ☐	Juvenile/No Custody	K ☐	Unfounded
F ☐	Arrest - Adult	U ☐	Unknown

*CLEARANCE DATE: | CLEARED BY:

*REPORT DATE/TIME MONTH	DAY	YEAR	TIME	*INCIDENT OCCURRED FROM MONTH	DAY	YEAR	TIME	*INCIDENT OCCURRED TO MONTH	DAY	YEAR	TIME
06	22	2010	14:42	06	19	2010	14:59				

INCIDENT LOCATION (Street, Apt., City, State, Zip)

OFFENSE

*OFFENSE	*OFFENSE CODE	*A/C	F/M & DEGREE	*HATE/BIAS	*LARCENY	* TYPE CRIMINAL ACTIVITY
1.	1.					1. ____ 2. ____ 3. ____
2.	2.					1. ____ 2. ____ 3. ____
3.	3.					1. ____ 2. ____ 3. ____
4.	4.					1. ____ 2. ____ 3. ____
5.	5.					1. ____ 2. ____ 3. ____

(Enter up to three for each offense)
B- BUYING/RECEIVING
C- CULTIVATING/MFG./PUB.
D- DISTRIBUTING/SELLING
E- EXPLOITING CHILDREN
O- OPER/PROPOTING/ASSIST.
P- POSSESSING/CONCEALING
T- TRANSP/TRANSMITTING
U- USING/CONSUMING
G- OTHER GANG ACTIVITY
J- JUVENILE GANG ACTIVITY
N- NO GANG ACTIVITY

*LOCATION OF OFFENSE (Enter up to two)

1. ________ 2. ________

RESIDENTIAL STRUCTURE
01 Single Family Home
02 Multiple Dwelling
03 Residential Facility
04 Other Residential
05 Garage/Shed

PUBLIC ACCESS BLDGS.
06 Transit Facility
07 Government Office
08 School
09 College
10 Church
11 Hospital
12 Jail/Prison
13 Parking Garage
14 Other Public Access Buildings

COMMERCIAL LOCATIONS
15 Auto Shop
16 Financial Institution
17 Barber/Beauty Shop
18 Hotel/Motel
19 Dry Cleaners/Laundry
20 Professional Office
21 Doctor's Office
22 Other Business Office
23 Amusement Center
24 Rental Storage Facility
25 Other Commercial Service Loc.

RETAIL
26 Bar
27 Buy/Sell/Trade Shop
28 Restaurant
29 Gas Station
30 Auto Sales Lot
31 Jewelry Store
32 Clothing Store
33 Drugstore
34 Liquor Store
35 Shopping Mall
36 Sporting Goods
37 Grocery/Supermarket
38 Variety/Convenience
39 Department Store
40 Other Retail Store
41 Factory/Mill/Plant
42 Other Building

OUTSIDE
43 Yard
44 Construction Site
45 Lake/Waterway
46 Field/Woods
47 Street
48 Parking Lot
49 Park/Playground
50 Cemetery
51 Public Transit Vehicle
52 Other Outside Location
77 Other

*SUSPECTED OF USING
A ☐ ALCOHOL
D ☐ DRUGS
C ☐ COMPUTER EQUIPMENT
N ☐ NOT APPLICABLE

*TYPE WEAPON/FORCE USED
1. ________ 2. ________ 3. ________

*METHOD OF ENTRY
1 ☐ FORCE
2 ☐ NO FORCE

*NO. PREMISES ENTERED

*METHOD OF ENTRY – MOTOR VEHICLE THEFT
01 ☐ Motor Running/Keys in Car
02 ☐ Unlocked
03 ☐ Duplicate Key Used
04 ☐ Window Broken
05 ☐ Towed
06 ☐ Hot Wire
07 ☐ Slim Jim/Coat Hanger
08 ☐ Tumblers Removed
09 ☐ Column Peeled
10 ☐ Ignition Peeled

*METHOD OF ENTRY – BURGLARY/B&E

ENTRY		EXIT	ENTRY		EXIT	ENTRY		EXIT
1 ☐	BASEMENT	☐	1 ☐	DOOR	☐	1 ☐	FRONT	☐
2 ☐	1^{ST} FLOOR	☐	2 ☐	WINDOW	☐	2 ☐	SIDE	☐
3 ☐	2^{ND} FLOOR	☐	3 ☐	GARAGE	☐	3 ☐	REAR	☐
4 ☐	OTHER	☐	4 ☐	SKYLIGHT	☐	4 ☐	ROOF	☐
			5 ☐	OTHER	☐	5 ☐	OTHER	☐

METHODS OF OPERATION

VICTIM

*NO. | *TOTAL VICTIMS | *VICTIM TYPE: I ☐ INDIVIDUAL B ☐ BUSINESS F ☐ FINANCIAL INSTITUTION G ☐ GOVERNMENT P ☐ POLICE OFFICER (IN THE LINE OF DUTY) R ☐ RELIGIOUS ORGANIZATION S ☐ SOCIETY U ☐ UNKNOWN O ☐ OTHER

NAME (Last, First, Middle)
ADDRESS (Street, Apt., City, State, Zip) | PHONE
EMPLOYER NAME AND ADDRESS (Street, Apt., City, State, Zip) | PHONE
*AGE/ D.O.B. | *SEX | *RACE ☐ W ☐ B ☐ I ☐ A ☐ U | HGT | WGT | HAIR | EYES
OCCUPATION | SSN | *RESIDENT STATUS: 1 ☐ RESIDENT 2 ☐ TOURIST 3 ☐ MILITARY 4 ☐ STUDENT 5 ☐ OTHER U ☐ UNKNOWN
*VICTIM INJURED? ☐ Y ☐ N | IF INJURED, DESCRIBE INJURIES:
*AGG. ASSAULT/ HOMICIDE CIRC. | *LEOKA INFORMATION: TYPE OF ACT. | ASSIGN. TYPE | ORI – OTHER | *VICTIM/SUSPECT RELATIONSHIP: 0. ____ 1. ____ 2. ____ 3. ____ 4. ____ 5. ____ | *VICTIM/OFFENSE LINK

INCIDENT NUMBER

My signature verifies that the information on this report is accurate and true

DATE________________

REPORTING OFFICER: Ryan Garrison | BADGE NO.: 1591 | DATE
APPROVING OFFICER | BADGE NO. | DATE
FOLLOW- UP? ☐ Y ☑ N | If yes, follow-up Assignment:
ADDITIONAL SUPPLEMENTS: ☐ VICTIM/WITNESS ☐ SUSPECT/ARRESTEE ☐ PROPERTY ☐ NARRATIVE ☐ STATEMENTS ☐ OTHER | FORM RECEIVED BY: ☐ INVESTIGATION ☐ INTELLIGENCE ☐ RECORDS | SPECIAL COPIES

8/9/2004

INCIDENT REPORT – PART 2

INCIDENT NUMBER	
VICTIM	OFFENSE
INCIDENT DATE AND TIME	06 19 2010

REPORTEE

NO. | NAME (Last, First, Middle) | AGE/ D.O.B. | SSN

ADDRESS (Street, Apt., City, State, Zip) | PHONE

EMPLOYER NAME AND ADDRESS (Street, Apt., City, State, Zip) | PHONE

STATEMENTS OBTAINED ☐ Y ☐ N TYPE: ☐ WRITTEN ☐ ORAL ☐ TAPED ☐ OTHER

VEHICLE

CHECK CATEGORIES ☐ STOLEN ☐ RECOVERED ☐ IMPOUNDED ☐ RECEIVED ☐ SUSPECT'S VEHICLE ☐ VICTIM'S VEHICLE ☐ UNAUTHORIZED USE ☐ ABANDONED

NO. | ☐ DAMAGE TO VEHICLE ☐ THEFT FROM VEHICLE | LIC | LIS | LIY | LIT | VIN/OAN | *VALUE

VYR | VMA | VMO | VST | VCO TOP BOTTOM | VEHICLE LOCKED ☐ Y ☐ N | KEYS IN VEHICLE ☐ Y ☐ N | HOLD VEHICLE ☐ Y ☐ N | RELEASE CONTENTS ☐ Y ☐ N

VEHICLE ASSOC. W/ SUSPECT NO. | VEHICLE ASSOC. W/ VICTIM NO. | VEHICLE TOWED? ☐ Y ☐ N | TOWED BY | OWNERSHIP VERIFIED BY: ☐ TAG RECEIPT ☐ BILL OF SALE ☐ TITLE ☐ OTHER

STOLEN MOTOR VEHICLE ONLY | NO. STOLEN | AREA STOLEN ☐ BUSINESS | ☐ RESID. ☐ RURAL | ADDITIONAL DESCRIPTION

AUTO INSURER NAME (Company) ADDRESS (Street, Apt., City, State, Zip) | PHONE

MOTOR VEHICLE RECOVERY ONLY | NO. RECOVERED | DATE REC. | STOLEN IN YOUR JURISDICTION ☐ Y ☐ N WHERE RECOVERED?

PROPERTY

*TYPE PROPERTY LOSS/ETC. (enter codes below) 1 NONE 2 BURNED 3 COUNTERFEITED/FORGED 4 DESTROYED/DAMAGED/VANDALIZED 5 STOLEN/ETC. 6 SEIZED 7 RECOVERED U UNKNOWN P PHOTO E EVIDENCE | TOTAL VALUE $0.00

*LOSS CODE | QUANTITY | DESCRIPTION | *PROP CODE | *VALUE

VICT. NO. | VEH NO. | MAKE/BRAND | MODEL | DATE RECOVERED

SERIAL NUMBER | NCIC NUMBER | OTHER NUMBER

*LOSS CODE | QUANTITY | DESCRIPTION | *PROP CODE | *VALUE

VICT. NO. | VEH NO. | MAKE/BRAND | MODEL | DATE RECOVERED

SERIAL NUMBER | NCIC NUMBER | OTHER NUMBER

*LOSS CODE | QUANTITY | DESCRIPTION | *PROP CODE | *VALUE

VICT. NO. | VEH NO. | MAKE/BRAND | MODEL | DATE RECOVERED

SERIAL NUMBER | NCIC NUMBER | OTHER NUMBER

*LOSS CODE | QUANTITY | DESCRIPTION | *PROP CODE | *VALUE

VICT. NO. | VEH NO. | MAKE/BRAND | MODEL | DATE RECOVERED

SERIAL NUMBER | NCIC NUMBER | OTHER NUMBER

PROPERTY CODES:

EXCHANGE MEDIUMS
01 Money
02 Credit/Debit Card
03 Negotiable Instruments
04 Other Exchange Mediums

DOCUMENTS
05 Non-Negotiable Instruments
06 Personal Papers
07 Other Documents

VALUABLES
08 Jewelry/Precious Metals
09 Art Objects, Antiques
10 Other Valuables

PERSONAL EFFECTS
11 Clothing/Furs
12 Purses/Handbags/Wallets
13 Other Personal Effects

HOUSEHOLD ITEMS
14 Household Items

EQUIPMENT
15 Drug/Narcotic Equip.
16 Gambling Equipment
17 Computer Hardware/Soft.
18 Office Equipment
19 Stereo TV Equip.
20 Recordings-Audio Visual
21 Sports Equipment
22 Photographic Equipment
23 Farm Equipment
24 Heavy Construction/Industrial
25 Building Supplies-Const.
26 Tools
27 Vehicle Parts/Accessories
28 School Supplies
29 Other Equipment

CONSUMABLE ITEMS
30 Alcohol
31 Drugs/Narcotics
32 Consumable Goods

ANIMALS
33 Livestock
34 Household Pets

VEHICLES
35 Aircraft
36 Automobiles
37 Bicycles
38 Buses
39 Trucks
40 Trailers
41 Watercraft
42 Recreational Vehicle
43 Other Motor Vehicle

WEAPONS
44 Firearms
45 Other Weapons

STRUCTURES
46 Single Occupancy
47 Other Dwellings
48 Commercial/Business
49 Indus./Mfg.
50 Public/Community
51 Storage
52 Other Structure

OTHER
53 Merchandise
54 Other Property
55 Pending Inventory

NARRATIVE

On June 19, 2010, at approximately 2:30pm, I received a complaint of a fish kill in Grand Lake St. Marys. The caller advised that the kill occurred in Auglaize County at Southmoor Shores near Causeway Dr. I arrived on the scene at 2:59pm. The channel to the west of Causeway Dr. appeared blue in color. The water color was blue, green, and brown in areas. The water had thick foam like substance on the surface. There was a strong odor present. I observed a fair amount of dead fish in the channel. There was bluegill, crappie, channel catfish, shad, and crap visible from the bank. I conducted a field test of the water at 3:05pm. The water tested: > 10 ppm ammonia, 0 ppm DO, and PH - 7. The area of water was a man made dead end channel of the lake. There wasn't any water movement except from the wind swirling. There was no evidence of any pollutant entering the water. It appeared that the blue/green algae was dying and causing the ammonia levels to rise and the dissolved oxygen levels to drop. It appeared to be a natural fish kill.

Appendix E

MERCER COUNTY
CELINA CITY
Health Department
PREVENT • PROMOTE • PROTECT

January 5, 2011

Ohio Department of Natural Resources
Division of Soil & Water Resources
David Hanselmann, Chief
2045 Morse Rd.
Building B-3
Columbus, OH 43229-6605

Dear Mr. Hanselmann:

The Mercer County – Celina City Board of Health would like to offer a comment to the Ohio Department of Natural Resources regarding the newly adopted law relating to designating watersheds in distress, found in Ohio Revised Code 1501: 15-5-20.

The Harmful Algal Bloom which took place in Grand Lake St. Marys during the spring and summer of 2010 brought to the forefront of attention the ramifications of numerous, combined conditions originating within the watershed. These conditions were years in the making, but have progressed to a point at which action is necessary now to reduce their impact. The conditions were created from a variety of sources, but the largest source has been identified as agricultural, as documented in past studies such as the EPA's TMDL (total maximum daily load) study. The regulations that Ohio Department of Natural Resources have established to provide a framework of managing nutrients from agricultural sources are a good step toward the reduction of impact from this sector. The Harmful Algal Bloom occurred as a result of high levels of nutrients feeding a specific type of bacteria (cyanobacteria). Cyanobacteria produces toxins that are deemed a threat to human health according to the World Health Organization. In the interest of health, the Mercer County – Celina City Health Department supports the need of the new regulations.

Thank you for your time in considering our comment. Best wishes with the implementation of the new regulations.

Respectfully,

220 W. LIVINGSTON ST. – B152. CELINA, OHIO 45822.
Work (419) 586-3251 Fax (419) 586-2583 Email: healthdept@mccchd.org
AN EQUAL OPPORTUNITY EMPLOYER

Distressed Watershed Designation Analysis Selected Western Lake Erie Basin Watersheds

Developed by the
Ohio Department of Agriculture

Division of Soil and Water Conservation
July 19, 2018

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Introduction

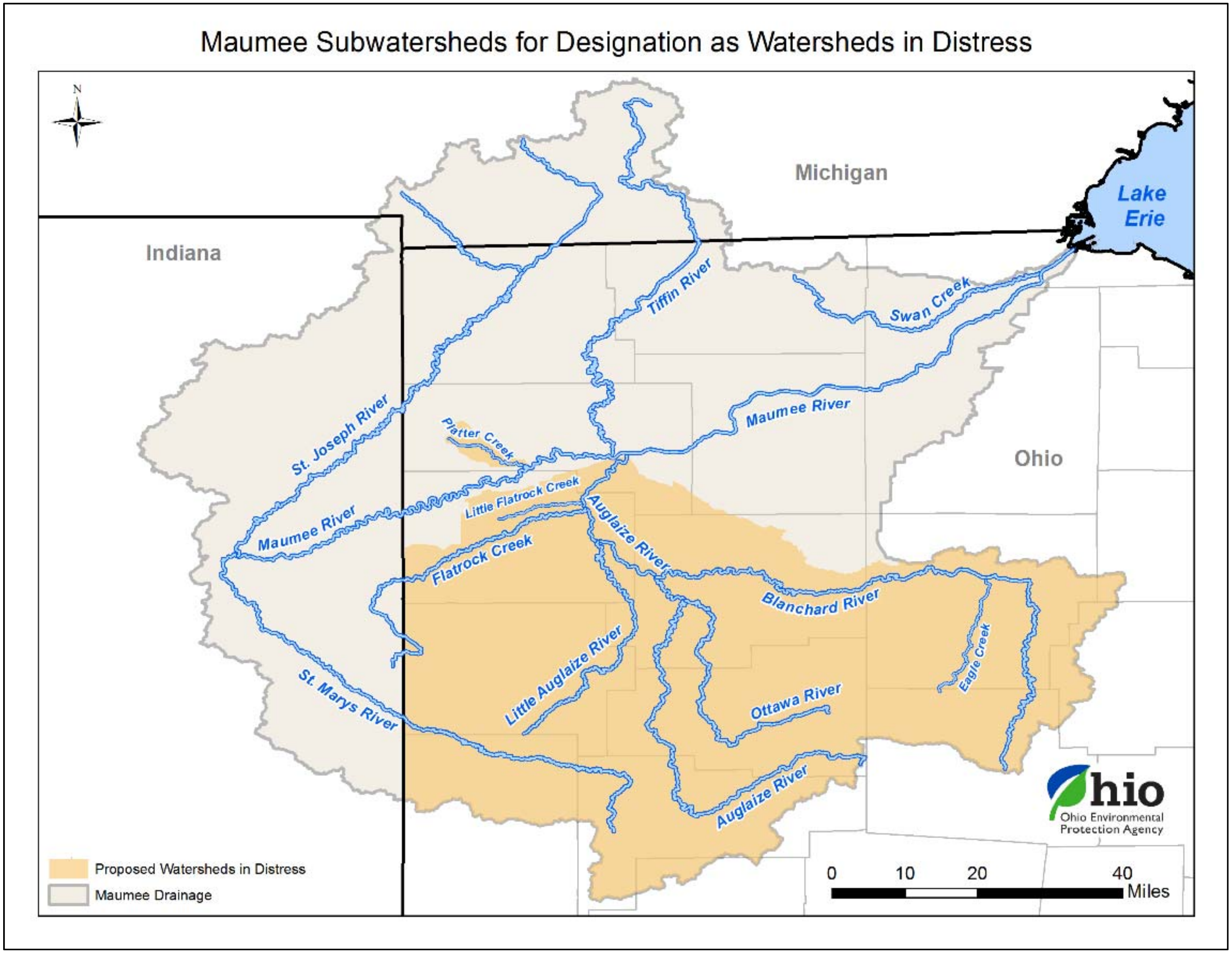
This report provides information related to an analysis of whether areas within the Western Lake Erie Basin watershed should be declared a "watershed in distress" as defined in Ohio Administrative Code (OAC) 901:13-1-20(A) by the director of the Ohio Department of Agriculture (ODA). (A complete version of OAC 901:13-1-20(A) is provided in Appendix A.) For such an analysis the director may consider the seven identified criteria as well as other relevant factors. ODA staff has conducted a review of data from Ohio EPA, Ohio Dept. of Health and Ohio Dept. of Natural Resources All water quality monitoring data were provided by the Ohio Environmental Protection Agency.

This report was developed by staff of the Division of Soil and Water Conservation and approved by the director for issuance to the general public, and submission to the Ohio Soil and Water Conservation Commission for its review and potential concurrence, as provided in OAC 901:13-1-20(B).

ODA recognizes that there are many other sources of nutrients impacting Lake Erie. However, this report focuses on the role of documented agricultural sources.

An overview of the Maumee River watershed and the proposed areas to be declared a "watershed in distress" is shown in Figure 1.

Figure 1 Maumee River watershed with proposed watershed in distress identified



Executive Summary

Due to harmful algal blooms and the release of related toxins occurring in the Western Basin of Lake Erie, the Ohio Department of Agriculture examined the need to declare Western Lake Erie Basin watershed and its surrounding drainage area as a "watershed in distress." Consequently, ODA staff has conducted a review of data from Ohio EPA, Ohio Dept. of Health and Ohio Dept. of Natural Resources for the Western Lake Erie Basin (WLEB) watershed and compared the findings with criteria listed in Ohio Administrative Code 901:13-1-20(A).

The first criterion in the regulations pertains to determinations by Ohio EPA as to the cause and sources of any watershed impairments and if those factors are related to nutrients from agricultural sources. Ohio EPA has identified several watersheds within the Western Lake Erie Basin watershed with relatively higher concentrations of phosphorus in the surface water. In addition, Ohio EPA lists all of the identified watersheds as impaired by nutrients or sedimentation/siltation from agricultural sources in the 2018 Integrated Water Quality Monitoring Report. These watersheds are listed below:

1) Auglaize River (HUC 04100007)
    - 1a) Ottawa River (HUC 0410000703, 0410000704, 0410000705)
    - 1b) Little Auglaize River (HUC 0410000706, 0410000707, 0410000708)
    - 1c) Little Flatrock Creek (HUC 041000071207)
2) Blanchard River (HUC 04100008)
    - 2a) Eagle Creek (HUC 041000080301, 041000080302)
3) St. Marys River (HUC 04100004)
4) Platter Creek (HUC 041000050206)

Three other criteria relate to the threat or potential threat to use of the lake as a source of drinking water and recreation, and the threat to humans and wildlife, due to the presence of harmful algal blooms. The Western Basin of Lake Erie has periodic algal and/or cyanobacterial blooms capable of producing toxins that are harmful to humans and wildlife. These watersheds also contribute to conditions that are a threat to a drinking water supply, public health and enjoyment of Lake Erie as a recreational water body.

Water quality sampling indicates that total phosphorus and dissolved reactive phosphorus concentrations in the identified watersheds within the Western Lake Erie Basin watershed are higher than the other watersheds of the Western Lake Erie Basin watershed.

Based on the above information and analysis, the identified watersheds within the Western Lake Erie Basin watershed are in distress as defined in OAC 901:15-1-20(A).

Comparison to Six Identified Criteria

1. The watershed is listed as impaired by nutrients and/or sediment from agricultural sources as determined by the Director of the Environmental Protection Agency.

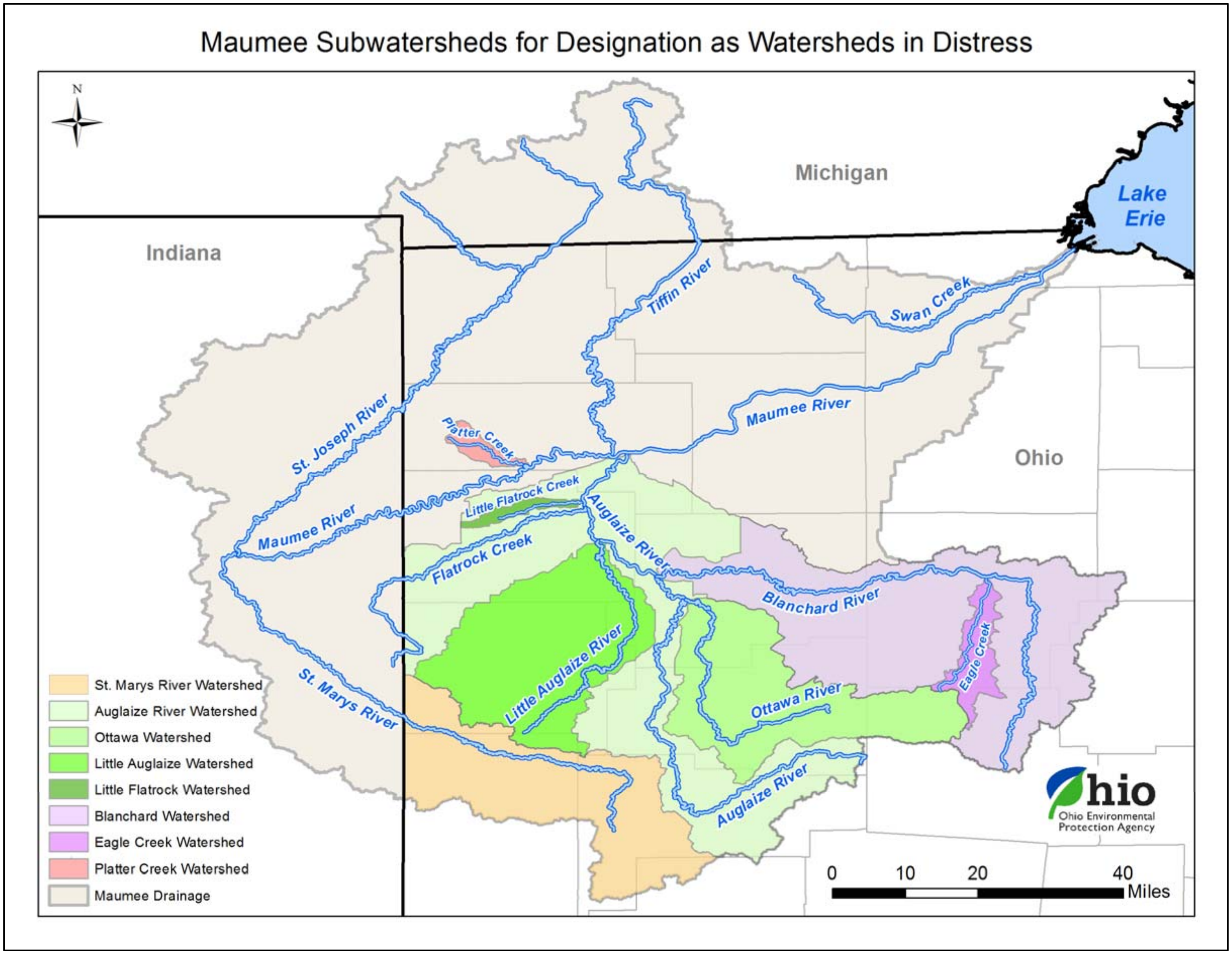
Ohio EPA's 2018 Integrated Water Quality Monitoring Report[1] characterizes the watershed draining to the Western Lake Erie Basin. Ohio EPA has identified several watersheds within the Western Lake Erie Basin watershed with relatively higher concentrations of phosphorus in the surface water. In addition, Ohio EPA lists all of these identified watersheds as impaired by nutrients or sedimentation/siltation from agricultural sources in the 2018 Integrated Water Quality Monitoring Report. These watersheds are listed below:

1) Auglaize River (HUC 04100007)
    1a) Ottawa River (HUC 0410000703, 0410000704, 0410000705)
    1b) Little Auglaize River (HUC 0410000706, 0410000707, 0410000708)
    1c) Little Flatrock Creek (HUC 041000071207)
2) Blanchard River (HUC 04100008)
    2a) Eagle Creek (HUC 041000080301, 041000080302)
3) St. Marys River (HUC 04100004)
4) Platter Creek (HUC 041000050206)

Table 1. The 2018 Integrated Water Quality Monitoring Report Status of selected watersheds.

Area	Subarea	HUC 8 Name	HUC 8	HUC 10 Name	HUC 10	HUC 12 Name	HUC 12	303(d) status
1		**Auglaize River**	04100007					aquatic life use impairment including nutrients and sedimentation/siltation
	1a			Ottawa River	041000703			aquatic life use impairment including nutrients and sedimentation/siltation
	1a				041000704			aquatic life use impairment including nutrients and sedimentation/siltation
	1a				0410000705			aquatic life use impairment including nutrients and sedimentation/siltation
	1b			Little Auglaize River	0410000706			Public Water Supply impairment caused by nitrates
	1b				0410000707			Public Water Supply impairment caused by nitrates
	1b				0410000708			Public Water Supply impairment caused by nitrates
	1c					Little Flatrock Creek	041000071207	aquatic life use impairment including habitat alteration and sedimentation/siltation
2		**Blanchard River**	04100008					aquatic life use impairment including flow regime changes, nutrients and sedimentation/siltation
	2a					Eagle Creek	041000080301	aquatic life use impairment including nutrients and low flow alterations
	2a					Eagle Creek	041000080302	aquatic life use impairment including nutrients and low flow alterations
3		**St Marys River**	04100004					aquatic life use impairment including mostly habitat alterations and sedimentation/siltation
4						**Platter Creek**	041000050206	aquatic life use impairment including flow regime changes, nutrients and sedimentation/siltation

Figure 2



Maumee Subwatersheds for Designation as Watersheds in Distress
N
Michigan
Indiana
Ohio
Lake Erie
Tiffin River
Swan Creek
Maumee River
St. Joseph River
Platter Creek
Little Flatrock Creek
Auglaize River
Flatrock Creek
Blanchard River
Little Auglaize River
Ottawa River
Eagle Creek
St. Marys River
St. Marys River Watershed
Auglaize River Watershed
Ottawa Watershed
Little Auglaize Watershed
Little Flatrock Watershed
Blanchard Watershed
Eagle Creek Watershed
Platter Creek Watershed
Maumee Drainage
0 10 20 40
Miles
Ohio Environmental Protection Agency

2. The watershed or a portion of the watershed exhibits conditions that are a threat to public health based on information provided by the Ohio Department of Health or local health district.

The Ohio Department of Health monitors conditions at beaches in Ohio through the "Beachguard" database and issues three types of advisories: bacteria contamination alert, recreational public health advisory and elevated recreational public health advisory. In 2017, four advisories were issued related to algal blooms and toxins. These advisories were in effect for a total of 75 days. Included in this report is a list of advisories related to algal bloom issued for beaches in the Western Lake Erie Basin in 2017 (Appendix B).

3. Streams, lakes or other waterbodies within the watershed exhibit periodic evidence of algal and/or cyanobacterial blooms capable of producing toxins that are harmful to humans, domestic animals or wildlife.

Ohio EPA's 2018 Integrated Water Quality Monitoring Report lists the Western Basin of Lake Erie as impaired for recreational use due to algal and cyanobacteria blooms. This designation was based, in part, due to the ambient HAB sampling that Ohio EPA conducts at Lake Erie as part of their nearshore Lake Erie monitoring programs. The State also uses remotely sensed imagery collected and processed by the National Oceanic and Atmospheric Administration or the National Aeronautical and Space Administration to assist in identifying the location of cyanobacteria blooms in Lake Erie. A full discussion of the methodology for this impairment designation appears in Section *F.4 Recreation Assessment for Algae in Western Lake Erie* of the 2018 Integrated Water Quality Monitoring Report.

A summary of the impairment status of Lake Erie from the 2018 Integrated Water Quality Monitoring Report appears in Table 2.

4. There is a threat to or presence of contaminants in public or private water supplies.

In 2016, Ohio finalized new rules for harmful algal blooms and cyanotoxins at public water systems, including requirements for routine microcystins and cyanobacteria screening monitoring and reporting. Starting June 1, 2016, Ohio public water systems were required to conduct routine monitoring for microcystins and cyanobacteria. Sufficient data were available to list 37 assessment units as impaired due to algae in Ohio EPA's 2018 Integrated Water Quality Monitoring Report. The impairment listing includes all assessment units in Lake Erie with public drinking water (PDW) supply intakes including the Western Basin shoreline and open water.

A summary of the impairment status of Lake Erie from the 2018 Integrated Water Quality Monitoring Report appears in Table 2.

Table 2. Status of Lake Erie Assessment Units from 2018 Integrated Water Quality Monitoring Report.

Section L3. Status of Lake Erie Assessment Units Assessment Unit	 Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
041202000101	Lake Erie Islands Shoreline (≤3m)	4.99	5	5	5	5	14
041202000201	Lake Erie Western Basin Shoreline (≤3m)	47.88	5	5	5	5	17
041202000202	Lake Erie Sandusky Basin Shoreline (≤3m)	68.01	5	5	5	5	16
041202000203	Lake Erie Central Basin Shoreline (≤3m)	13.39	5	5	5	0	9
041202000301	Lake Erie Western Basin Open Water (>3m)	527.30	3i	5	3	5	10
041202000302	Lake Erie Sandusky Basin Open Water (>3m)	361.71	3i	3	3	5	5
041202000303	Lake Erie Central Basin Open Water (>3m)	2544.98	3i	3	3	5	5

Category[1]		Subcategory	
0	No water currently utilized for water supply		
1	Use attaining	d	TMDL complete; new data show the AU is attaining WQS
		h	Historical data
		t	TMDL complete at HUC[2] 11 scale; AU attaining WQS at HUC 12 scale
		x	Retained from 2008 IR
2	Not applicable in Ohio system		
3	Use attainment unknown	h	Historical data
		i	Insufficient data
		t	TMDL complete at HUC 11 scale; there may be no or not enough data to assess this AU at the HUC 12 scale
		x	Retained from 2008 IR
4	Impaired; TMDL not needed	A	TMDL complete
		B	Other required control measures will result in attainment of use
		C	Not a pollutant
		h	Historical data
		n	Natural causes and sources
		x	Retained from 2008 IR
5	Impaired; TMDL needed	alt	Alternative restoration approaches[3]
		M	Mercury
		d	TMDL complete; new data show the AU is not attaining WQS
		h	Historical data
		p	Protection/preservation for threatened waters
		x	Retained from 2008 IR

5. There is a threat to or a presence of contaminants in a primary contact recreational water or bathing water as designated in OAC 3745-1.

Ohio EPA's 2018 Integrated Water Quality Monitoring Report lists the Western Basin of Lake Erie as impaired for recreational use. See Table 2. A full discussion of the methodology for this impairment designation appears in Section *F.4 Recreation Assessment for Algae in Western Lake Erie* of 2018 Integrated Water Quality Monitoring Report.

6. Other unacceptable nuisance conditions exist including the depletion of dissolved oxygen in water that results in impacts to aquatic life.

The Ohio Department of Natural Resources investigates any negative impacts to aquatic life in Ohio waters. Since 2011, ODNR has investigated 47 cases of agricultural pollution in the counties impacted by this watershed-in-distress designation. ODNR estimates the number of fish killed at over 200,000. A summary of investigations and the suspected pollution source is included in this report (Appendix C).

7. Analysis of other situations as determined by the director upon consultation with other federal, state and local agencies.

A. Ohio EPA has been conducting water quality monitoring throughout the Maumee River watershed. There is evidence that nutrient loads are higher in the southern portion of the watershed. In addition to nutrient monitoring data are two supporting facts:

    a. More streamflow is yielded in the Auglaize and St. Marys watersheds. Over the last 15 years there was 23% more streamflow discharged from the Auglaize/St. Marys compared to the St. Josephs and Tiffin. This means that the even if the nutrient concentrations were the same between the two watersheds more load is yielded from the Auglaize and St. Marys Rivers.

    b. There is more row crop agriculture in the southern portion of the watershed. An analysis of landuse in the Ohio EPA's nutrient mass balance studies shows that cultivated crops account for a greater percentage of landuse. For example, the Auglaize River drains 80% cultivated crops while the Tiffin River only 65%.

B. The recommended watersheds as in distress are also based on observed flow weighted mean concentrations (FWMC) of total and dissolved reactive phosphorus. Using FWMCs as opposed to load reduces flow driven variability during the period of record used for the calculation.

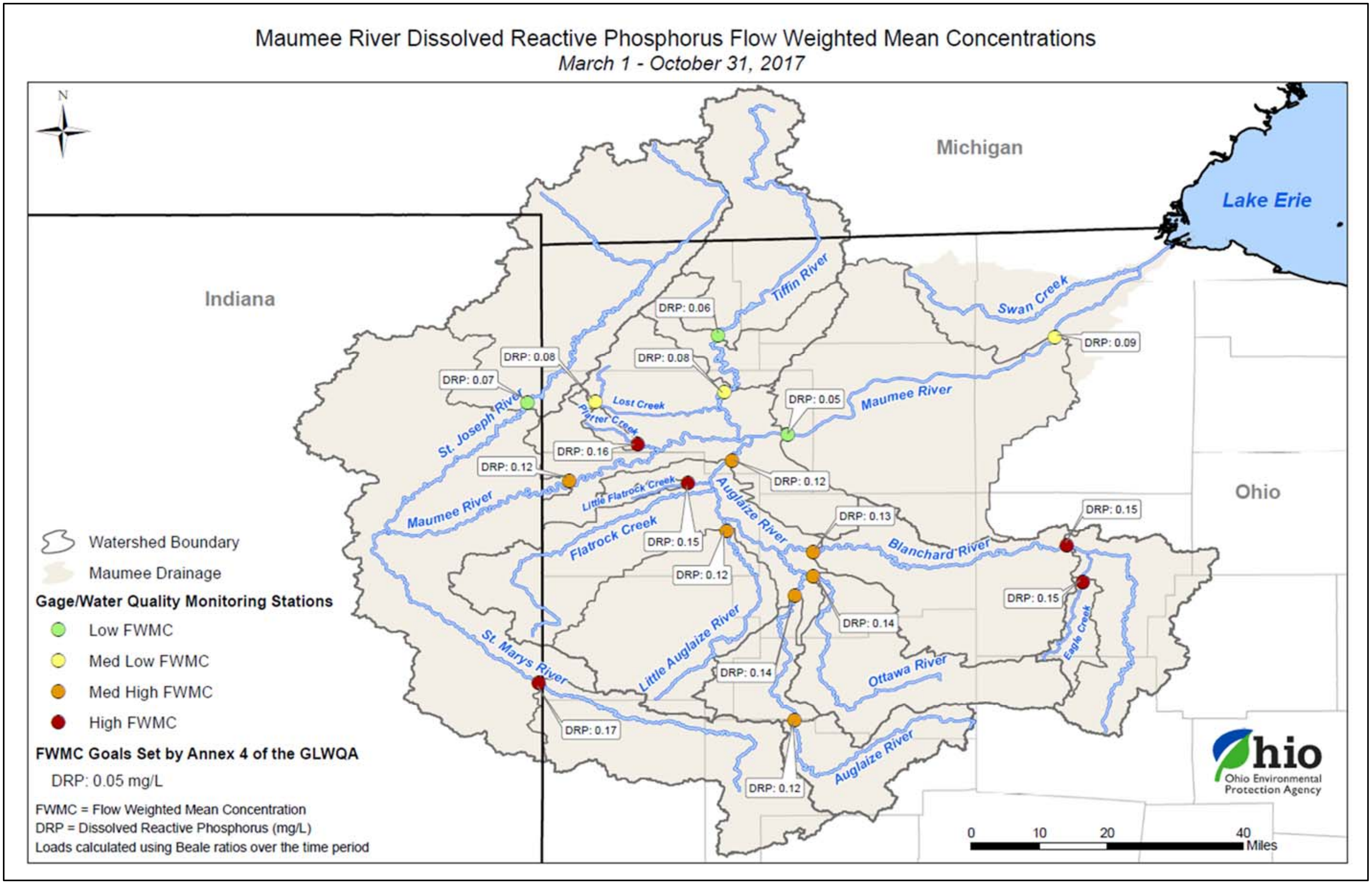
C. The FWMCs observed at monitoring stations in the Blanchard and Auglaize Rivers from March 2017 – October 2017 were the highest observed in the Ohio Portion of the Maumee Watershed. See Figure 3.

D. The Platter Creek HUC-12 is a 21.5 square mile watershed draining directly to the Maumee River in Defiance County. It was found to be impaired for aquatic life use due to alterations in the stream's flow regime, nutrient enrichment and sedimentation. Ohio EPA's assessment of this impairment notes row crop agriculture and livestock manure application as the primary sources of the stream's nutrient enrichment. The assessment of Platter Creek clearly shows phosphorus loading more similar to the Auglaize River watershed than the Tiffin or St. Joseph's watersheds.

E. In 2016, in response to the 2012 Great Lakes Water Quality Agreement (GLWQA) commitments, Canada and the U.S. adopted phosphorus reduction targets for Lake Erie. These goals for phosphorus loadings to Lake Erie are expected to produce a bloom no greater than those that occurred in 2004 or 2012. Ohio EPA conducted water quality monitoring in 2017 and identified areas in the Western Lake Erie Basin watershed where the phosphorus flow weighted mean concentrations are more than two times higher than the GLWQA goals. All of the watersheds identified to be designated a watershed in distress were found to have phosphorus flow weighted mean concentrations more than two times higher than the GLWQA goals (See Table 3 & Table 4).

F. The Indiana Domestic Action Plan identifies a FWMC averaged over an 8-year period in the St. Josephs River Watershed that meets the Annex 4 goal for TP, while the St. Marys yielded a concentration of 2x the Annex 4 target FWMC. This is consistent with the Ohio data from a shorter available period of record.

Figure 3



Maumee River Dissolved Reactive Phosphorus Flow Weighted Mean Concentrations
March 1 - October 31, 2017
N
Michigan
Lake Erie
Indiana
Ohio
Tiffin River
Swan Creek
Maumee River
St. Joseph River
Lost Creek
Platter Creek
Little Flatrock Creek
Flatrock Creek
Auglaize River
Blanchard River
Little Auglaize River
St. Marys River
Ottawa River
Eagle Creek
DRP: 0.06
DRP: 0.08
DRP: 0.08
DRP: 0.07
DRP: 0.05
DRP: 0.09
DRP: 0.16
DRP: 0.12
DRP: 0.12
DRP: 0.15
DRP: 0.13
DRP: 0.15
DRP: 0.12
DRP: 0.15
DRP: 0.14
DRP: 0.14
DRP: 0.17
DRP: 0.12
Watershed Boundary
Maumee Drainage
Gage/Water Quality Monitoring Stations
Low FWMC
Med Low FWMC
Med High FWMC
High FWMC
FWMC Goals Set by Annex 4 of the GLWQA
DRP: 0.05 mg/L
FWMC = Flow Weighted Mean Concentration
DRP = Dissolved Reactive Phosphorus (mg/L)
Loads calculated using Beale ratios over the time period
0 10 20 40
Miles
Ohio Environmental Protection Agency

Table 3. Total Phosphorus Flow Weighted Mean Concentration (FWMC) from 2017.

Total Phosphorus **Period of record 3/1/2017 – 10/31/2017**

Monitoring Station	Associated HUCs	Sample Count	Period Avg Q (cfs)	Daily Load (kg)	Load (MT)	Load (short tons)	FWMC (mg/L)
St. Josephs at Newville, IN	04100003	49	685	388	95	105	0.23
Tiffin at Stryker	04100006	383	395	279	68	75	0.29
Maumee at Waterville	04100003, 04100004, 04100005, 04100006, 04100007, 04100008, 04100009	339	7479	7109	1742	1920	0.39
Tiffin near Evansport	04100006	79	568	587	144	159	0.42
Blanchard near Findlay	0410000801, 0410000802, 0410000803	378	427	454	111	123	0.43
Lost Creek Trib	041000060601	438	4	5	1	1	0.44
Auglaize near Defiance	04100007	84	2847	3147	771	850	0.45
Ottawa near Kalida	0410000703, 0410000704, 0410000705	86	431	488	120	132	0.46
Blanchard near Dupont	04100008	87	758	894	219	241	0.48
Platter near Sherwood	041000050206	38	21	25	6	7	0.49
Auglaize near Kossuth	0410000701, 0410000702	47	272	335	82	90	0.50
St. Marys at Willshire	04100004	44	422	521	128	141	0.50
Maumee near Defiance	0410000706, 0410000707, 0410000708	86	6544	8112	1987	2191	0.51
Auglaize near Ft. Jennings	0410000701, 0410000702, 0410000709	86	440	629	154	170	0.58
Eagle above Findlay	041000080301, 041000080302	138	66	97	24	26	0.60
Little Flatrock near Junction	041000071207	43	16	24	6	7	0.60
Little Auglaize at Melrose	0410000707, 0410000708	82	506	849	208	229	0.69
Maumee at Antwerp	04100004, 04100003, 04100005	88	2598	5153	1263	1392	0.81

Table 4. Dissolved Reactive Phosphorus Flow Weighted Mean Concentration (FWMC) from 2017

Dissolved Reactive Phosphorus	**Period of record 3/1/2017 – 10/31/2017**						
Monitoring Station	**Associated HUC**	**Sample Count**	**Period Avg Q (cfs)**	**Daily Load (kg)**	**Load (MT)**	**Load (short tons)**	**FWMC (mg/L)**
Maumee near Defiance	04100007	83	6544	802	196	217	0.05
Tiffin at Stryker	04100006	370	395	60	15	16	0.06
St. Josephs at Newville, IN	04100003	49	685	119	29	32	0.07
Lost Creek Trib	041000060601	437	4	1	0	0	0.08
Tiffin near Evansport	04100006	79	568	116	28	31	0.08
Maumee at Waterville	04100003, 04100004, 04100005, 04100006, 04100007, 04100008, 04100009	339	7479	1671	409	451	0.09
Auglaize near Defiance	0410000706, 0410000707, 0410000708	83	2847	802	196	217	0.12
Maumee at Antwerp	04100004, 04100003, 04100005	87	2598	755	185	204	0.12
Auglaize near Kossuth	0410000701, 0410000702	44	272	81	20	22	0.12
Little Auglaize at Melrose	0410000707, 0410000708	70	506	152	37	41	0.12
Blanchard near Dupont	04100008	87	758	241	59	65	0.13
Auglaize near Ft. Jennings	0410000701, 0410000702, 0410000709	85	440	146	36	39	0.14
Ottawa near Kalida	0410000703, 0410000704, 0410000705	86	431	146	36	40	0.14
Eagle above Findlay	041000080301, 041000080302	138	66	23	6	6	0.15
Little Flatrock near Junction	041000071207	43	16	6	1	2	0.15
Blanchard near Findlay	0410000801, 0410000802, 0410000803	369	427	156	38	42	0.15
Platter near Sherwood	041000050206	31	21	8	2	2	0.16
St. Marys at Willshire	04100004	40	422	179	44	48	0.17

Conclusions

ODA staff has conducted a review of data from Ohio EPA, Ohio Dept. of Health and Ohio Dept. of Natural Resources for the Western Lake Erie Basin watershed and compared the findings with criteria for determining whether a watershed is in distress as provided in Ohio Administrative Code 901:13-1-20(A).

The Ohio EPA's 2018 Integrated Water Quality Monitoring Report lists the Lake Erie Western Basin Shoreline and Lake Erie Western Basin Open Waters as impaired for human health, recreation, aquatic life and public drinking water supply.

Water quality sampling at key points in the Western Lake Erie Basin indicates that total phosphorus and dissolved reactive phosphorus concentrations from these identified watersheds are higher than the other watersheds of the Western Lake Erie Basin watershed:

1) Auglaize River (HUC 04100007)
    - 1a) Ottawa River (HUC 0410000703, 0410000704, 0410000705)
    - 1b) Little Auglaize River (HUC 0410000706, 0410000707, 0410000708)
    - 1c) Little Flatrock Creek (HUC 041000071207)
2) Blanchard River (HUC 04100008)
    - 2a) Eagle Creek (HUC 041000080301, 041000080302)
3) St. Marys River (HUC 04100004)
4) Platter Creek (HUC 041000050206)

In addition, Ohio EPA lists all of these watersheds as impaired by nutrients or sedimentation/siltation from agricultural sources.

Based on the above information and analysis, the identified watersheds within the Western Lake Erie Basin watershed are in distress as defined in OAC 901:15-1-20(A).

References

1. Ohio Environmental Protection Agency. (2018). Ohio 2018 Integrated Water Quality Monitoring and Assessment Report. http://www.epa.ohio.gov/dsw/tmdl/OhioIntegratedReport#1798510016-report

Appendix A

Ohio Administrative Code
901:13-1-20 Designating watersheds in distress.

(A) The director may designate a watershed to be in distress, and thereby set requirements for the storage, handling and land application of manure; and/or the control of the erosion of sediment and substances attached thereto; and associated nutrient management plans for land and operations within the designated watershed boundaries. In evaluating a potential designation, the director may consider whether:

(1) The watershed is listed as impaired by nutrients and/or sediments from agricultural sources as determined by the director of environmental protection and published in the "Ohio Integrated Water Quality Monitoring and Assessment Report" pursuant to Section 303(d) of the Federal Water Pollution Control Act or waters are identified as such in an approved "Total Maximum Daily Load Report" pursuant to rule 3745-2-12 of the Administrative Code as required by Section 303(d) of the Federal Water Pollution Control Act;

(2) The watershed or a portion of the watershed exhibits conditions that are a threat to public health based on information provided by the Ohio Department of Health or local health district;

(3) Streams, lakes, or other waterbodies within the watershed exhibit periodic evidence of algal and/or cyanobacterial blooms capable of producing toxins that are harmful to humans, domestic animals or wildlife;

(4) There is a threat to, or presence of contaminants in public or private water supplies;

(5) There is a threat to, or presence of contaminants in a primary contact recreational water or a bathing water as designated in Chapter 3745-1 of the Administrative Code;

(6) Other unacceptable nuisance conditions exist including the depletion of dissolved oxygen in water that results in impacts to aquatic life;

(7) Other situations as determined by the director upon consultation with other federal, state and local agencies.

(B) Prior to proposing to designate a watershed in distress, the director shall prepare and issue a report documenting the factors in the watershed relating to the items in paragraph (A) of this rule.

(C) No designation of a watershed in distress shall be issued until the Ohio soil and water conservation commission consents by a majority vote to a proposed designation.

(D) The director may remove the watershed in distress designation upon reasonable confirmation of a sustained recovery, restoration and mitigation of the factors leading to the original designation.

Appendix B
Beach Advisories Related to Harmful Algal Blooms in the Western Lake Erie Basin 2017 from Ohio Department of Health

beachAccessTypeId	BeachName	Comment	CountyName	IssuingOrganizationName	ReasonTypeText	ReopenDate	StartDate	TypeId	TypeSeverityLevel	TypeText
PUB_PUB_ACC	Maumee Bay State Park (ERIE		Lucas	Ohio Department of Natural (	Algal Bloom/Toxin	8/16/2017 16:13	8/1/2017 16:15	HAB_WATCH_ADV	2	Recreational Public Health Advisory
PUB_PUB_ACC	Maumee Bay State Park (ERIE		Lucas	Ohio Department of Natural (	Algal Bloom/Toxin	8/31/2017 16:40	8/24/2017 15:26	HAB_WATCH_ADV	2	Recreational Public Health Advisory
PUB_PUB_ACC	Maumee Bay State Park (ERIE		Lucas	Ohio Department of Natural (	Algal Bloom/Toxin	9/25/2017 11:35	8/31/2017 16:41	HAB_WARNING_ADV	3	Elevated Recreational Public Health Advisory
PUB_PUB_ACC	Maumee Bay State Park (ERIE		Lucas	Ohio Department of Natural (	Algal Bloom/Toxin	10/19/2017 11:10	9/25/2017 11:36	HAB_WATCH_ADV	2	Recreational Public Health Advisory

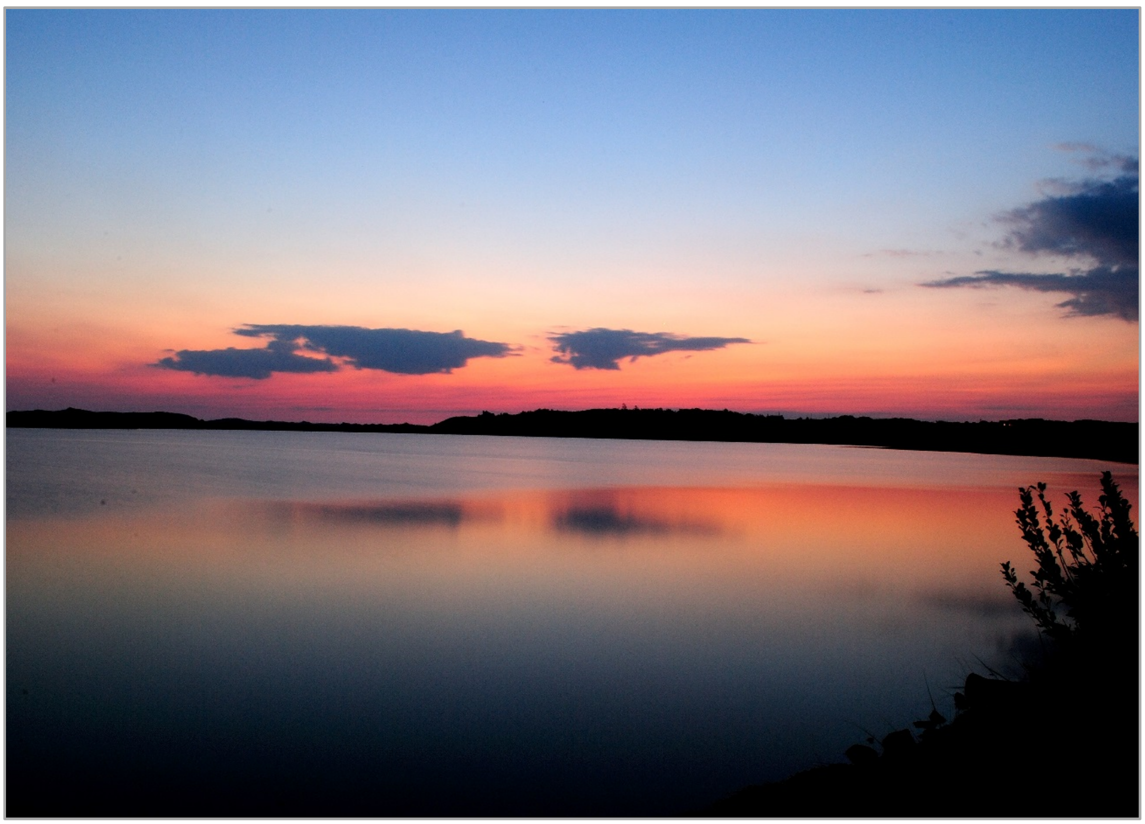
Appendix C

Ohio Department of Natural Resources – Investigations Related to Agricultural Pollution in Proposed Watersheds in Distress Jan 2011 – Jun 2018

County	Year	Suspected Kind of Pollutant	Fish/Wild Animal Kill	Number killed
Allen	2011	Manure	Yes	8625
Allen	2012	Manure	Yes	17442
Auglaize	2012	Fertilizer	Yes	9952
Auglaize	2012	Manure	Yes	28770
Mercer	2012	Manure	No	0
Mercer	2013	Manures	No	0
Mercer	2013	Other--Rye Silage	Yes	2
VanWert	2013	Manure	Yes	6855
VanWert	2013	Manure	No	0
VanWert	2013	Manure	No	0
Allen	2014	Manure	Yes	13
Allen	2014	Manure	Yes	6684
Allen	2014	Manure	Yes	17
Allen	2014	Manure	Yes	6159
Auglaize	2014	Manure	Yes	28047
Auglaize	2014	Manure	Yes	2719
Auglaize	2014	Fertilizer	No	0
Hardin	2014	Manure	No	0
Putnam	2014	Manure	Yes	3
Putnam	2014	Manure	No	0
Van Wert	2014	Manure	Yes	6855
Auglaize	2015	Fertilizer	Yes	4629
Hardin	2015	Silage	Yes	3
Mercer	2015	Manure	Yes	2598
Mercer	2015	Manure/Chemicals/Soap and Detergents	Yes	10203
Mercer	2015	Manure	No	0
Paulding	2015	Manure	Yes	3963
Paulding	2015	Manure	No	0
Paulding	2015	Manure	No	0
Van Wert	2015	Fertilizer	Yes	8860
Van Wert	2015	Manure	Yes	249
Van Wert	2015	Manure	No	0
Van Wert	2015	Manure	No	0
Wyandot	2015	Manure	Yes	2
Hardin	2016	Manure	No	0
Mercer	2016	Manure	Yes	Unknown
Allen	2017	Manure	Yes	36822
Auglaize	2017	Manure	Yes	4
Hardin	2017	Manure	Yes	14915
Mercer	2017	Manure	No	0

Mercer	2017	Manure	No	0
Mercer	2017	Manure	Yes	10
Paulding	2017	Manure	No	0
Putnam	2017	Manure	No	0
Van Wert	2017	Manure	No	0
Paulding	2018	Manure	Yes	362
Defiance	2018	Manure	No	0

Ohio 2018 Integrated Water Quality Monitoring and Assessment Report



Lake Erie

Division of Surface Water
Final Report

June 2018

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List of Acronyms and Abbreviations

AmphIBI	amphibian index of biotic integrity
AMP	Atrazine monitoring program
AOC	Area of Concern (as identified under the Great Lakes Water Quality Agreement)
ARRA	American Recovery and Reinvestment Act of 2009
AU	assessment unit
BAV	beach action value
BEACH	Beaches Environmental Assessment and Coastal Health (Act)
BMP	best management practice
BNR	biological nutrient removal
BUI	Beneficial Use Impairment (as described in the Great Lakes Water Quality Agreement)
CABB	Center for Applied Bioassessment and Biocriteria
CAFO	Concentrated Animal Feeding Operations
CDBG	Community Development Block Grant
CDC	Center for Disease Control
cfu	colony forming unit
Corps	U.S. Army Corps of Engineers
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSO	combined sewer overflow
CSP	Conservation Stewardship Program
CWH	coldwater habitat
CWA	Clean Water Act
DDAGW	Division of Drinking and Ground Waters
DDT	dichlorodiphenyltrichloroethane
DEFA	Division of Environmental and Financial Assistance
DES	Division of Environmental Services
DLG	digital line graph
DRG	digital raster graphic
DSW	Division of Surface Water
EAG	External Advisory Group
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
EWH	exceptional warmwater habitat
FCA	fish consumption advisory
FFY	federal fiscal year
FSA	Farm Service Agency
FWPCA	Federal Water Pollution Control Act
GIS	Geographic Information System
GLLA	Great Lakes Legacy Act
GLRC	Great Lakes Regional Collaboration
GLRI	Great Lakes Restoration Initiative
GLSM	Grand Lake St. Marys
GLWQA	Great Lakes Water Quality Agreement
GRP	Grassland Reserve Program
GRTS	Generalized Random Tessellation Stratified (survey design)
HAB	harmful algal bloom
HSD	honest significant difference
HUC	hydrologic unit code

IBI	index of biotic integrity
ICI	invertebrate community index
IDP	indirect discharge permit
IR	Integrated Report
kg	kilogram
L	liter
LA	load allocation
LAMP	lakewide action and management plan
LCI	Lake Condition Index
LDI	Landscape Development Intensity
LEAU	Lake Erie assessment unit
LEC	(Ohio) Lake Erie Commission
LENT	Lake Erie nutrient targets
LEPF	(Ohio) Lake Erie Protection Fund
LH	lake habitat
LHD	local health district
LRAU	large river assessment unit
LRW	limited resource water
LTCP	long-term control plan
MBI	Midwest Biodiversity Institute
MF	membrane filter
mg	milligram
mi^2	square miles
mL	milliliter
MIwb	modified index of well-being
MOR	monthly operating data
MPN	most probable number
MRBI	Mississippi River Basin Initiative
MS4	municipal separate storm sewer systems
MWH	modified warmwater habitat
NARS	National Aquatic Resource Survey
NCCA	National Coastal Condition Assessment
NCWQR	National Center for Water Quality Research
NEORSD	Northeast Ohio Regional Sewer District
ng	nanogram
NHD	National Hydrography Dataset
NLCD	National Land Cover Dataset
NOAA	National Oceanic and Atmospheric Administration
NOI	notice of intent
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NRCS	Natural Resources Conservation Service
NSMP	Nonpoint Source Management Plan
NSSP	National Shellfish Sanitation Program
NWI	National Wetland Inventory
NWQI	National Water Quality Initiative
OAC	Ohio Administrative Code
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
OMZA	outside mixing zone average

ORC	Ohio Revised Code
ORSANCO	Ohio River Valley Water Sanitation Commission
OSIP	Ohio Statewide Imagery Program
OTMP	Ohio Tributary Monitoring Program
OWDA	Ohio Water Development Authority
OWRC	Ohio Water Resources Council
PAHs	polyaromatic hydrocarbons
PHA	public health advisory
ppb	parts per billion
PCB	polychlorinated biphenyls
PCR	primary contact recreation
PDWS	public drinking water supply
POTW	publicly owned treatment works
PS	point source
PTI	permit to install
PTO	permit to operate
PWS	public water supply
QA	quality assurance
QC	quality control
QDC	qualified data collector
QSC	Quicksilver Caucus
RAP	Remedial Action Plan
RAS	return activated sludge
RF3	Reach File Version 3
RM	river mile
SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
SFY	state fiscal year (July 1 to June 30)
SIU	significant industrial user
sq mi	square miles
SSM	single-sample maximum
STORET	STOrage and RETtrieval (a U.S. EPA water quality database)
STV	statistical threshold value
SWIF	Surface Water Improvement Fund
SWIMS	Surface Water Information Management System
TDS	total dissolve solids
TMDL	total maximum daily load
TNTC	too numerous to count
TOC	total organic carbon
µg	microgram
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
USC	United States Code
USGS	U.S. Geological Survey
UV	ultraviolet
VIBI	vegetation index of biotic integrity
VIBI-FQ	VIBI – floristic quality
WAS	waste activated sludge
WAUs	watershed assessment unit
WBLE	western basin of Lake Erie

WEG	(Ohio EPA's) wetland ecology group
WHIP	Wildlife Habitat Incentives Program
WHO	World Health Organization
WLA	wasteload allocation
WPCLF	Water Pollution Control Loan Fund
WQ	water quality
WQC	Water Quality Certification (Section 401)
WQM	Water Quality Management (plan)
WQPSD	Water Quality Permit Support Document
WQS	water quality standards
WRP	Wetlands Reserve Program
WRRSP	Water Resource Restoration Sponsor Program
WSRLA	Water Supply Revolving Loan Account
WWH	warmwater habitat
WWTP	wastewater treatment plant

Executive Summary

The *Ohio Integrated Water Quality Monitoring and Assessment Report* summarizes water quality conditions in the State of Ohio. This report satisfies Ohio's water quality reporting requirements under Sections 303(d), 305(b) and 314 of the federal Clean Water Act. This report was last updated in 2016. **Analysis and listing changes are based on data collected during 2015 and 2016 for aquatic life and human health (fish tissue) uses; recreation and public drinking water supplies uses consisted of data from 2016 and 2017**.

Using methods devised to determine the suitability of waters for four specific uses—aquatic life (fish and aquatic insects), recreation (such as boating and swimming), human health (related to fish tissue contamination) and public drinking water supplies—available data were compared with water quality goals. The results indicate which waters are meeting goals and which are not. Waters not meeting the goals for one or more of the four types of uses are referred to as *impaired.* The waters found to be impaired are prioritized and scheduled for further study and restoration.

This report describes the methods used to judge impairment of each type of use and have evolved in each reporting cycle as the Agency gains access to more data and develops better ways to interpret them.

Results are reported for 1,538 watershed units, 38 large river units (in Ohio's 23 rivers that drain more than 500 square miles) and seven Lake Erie units. Additional information on streams draining between 20 and 500 square miles is also presented as this subset of waterbodies is used to calculate and track progress of Ohio's 80 percent full attainment by 2020 goal for wading and principal streams and rivers.

The percent of monitored miles of Ohio's large rivers in full attainment stayed steady compared to the same statistic reported in the 2016 IR. The 100 percent full attainment by 2020 aquatic life goal statistic for Ohio's largest rivers now stands at 87.5 percent, compared to 87.4 percent from the 2016 report. Conversely, smaller streams continue to improve with the percent of assessed sites in full aquatic life use attainment increasing from 66.1 percent to 69.3 percent. The top reasons for aquatic life impairment continue to be sediment, nutrients, habitat modification, hydromodification and organic enrichment.

For the human health use (fish tissue), polychlorinated biphenyl (PCB) contamination in fish is the cause of most of the human health impairments in Ohio. Mercury is the second leading cause.

The chemicals of concern causing impairment of the public drinking water supply use include nitrate, atrazine and cyanotoxin (due to certain algae). The primary source of the chemicals is nonpoint source runoff from agricultural land use. Additional sources of nitrate include home and commercial fertilizer application, failing septic systems, unsewered areas and wastewater treatment plant discharges. Of the 119 public drinking water supply assessment units, 37 are now listed as impaired by algae, with another 17 on the watch list for algae.

The recreation (bacteria) use analysis focuses on the number of bacteria in the water. For Lake Erie public beaches, the frequency of swimming advisories varies widely, ranging from 1.2 percent to more than 50 percent. Generally, beaches located near population centers have the most problems. Results are also reported for streams and inland lakes.

The recreation use has also been assessed for algae impacts in the western basin of Lake Erie. The western basin shoreline, the islands shoreline and the western basin open water assessment units are all listed as impaired by algae.

Of the 6,316 possible category assignments, the 2018 303(d) list includes changes in 209, with 69 delistings and 135 new listings. Most 303(d) removals and new listings are due to new data.

Changes since the 2016 Integrated Report

Changes made between the 2016 Integrated Report and the 2018 Integrated Report are as follows:

- This report contains revised assessment units for the entire Ohio portion of Lake Erie in Section D1.
- This report also discusses future methodology development for recreation assessment of Lake Erie based on algae blooms in Section I.
- The methodology for evaluating the recreation (bacteria) use has been updated to include the revised *E. coli* water quality criteria, effective January 2016, in Section F1.
- A new subcategory, 5p, was added to track which impairments are based on threatened status, primarily for nutrients.

Section

A

An Overview of Water Quality in Ohio

Clean water is important to Ohio's economy and standard of living.

Ohio is an economically important and diverse state with strong agriculture, manufacturing and service industries. Ohio is also a water-rich state bounded by Lake Erie on the north, the Ohio River on the south and more than 25,000 miles of named and designated streams and rivers within its borders. The suitability of these waters to support society's needs is critical to sustaining Ohio's economy and the standard of living of its citizens. Surface waters such as rivers, streams and lakes provide most of the water used for public drinking, for recreation such as swimming, boating and fishing, and for industrial uses including manufacturing, power generation, irrigation and mining.

Ohio EPA monitors water quality in Ohio and reports its findings.

Monitoring the quality of Ohio's valuable water resources is an important function of the Ohio Environmental Protection Agency (Ohio EPA). Since the early 1970s, Ohio EPA has measured the quality of Ohio's water resources and worked with industries, local governments and citizens to restore the quality of substandard waters. This report, updated every two years, is required by the federal Clean Water Act to fulfill two purposes: 1) to provide a summary of the status of the State's surface waters; and 2) to develop a list of waters that do not meet established goals—the impaired waters.

Under the Clean Water Act, once impaired waters are identified, the state must act to improve them. Typically, the actions include developing restoration plans [total maximum daily loads (TMDLs)]; water quality-based permits; and nonpoint source pollution control measures. As such, this report is an important document that provides information and direction to much of the State's work in water quality planning, monitoring, financial/technical assistance, permitting and nonpoint source programs.

For nearly 40 years, Ohio EPA has developed innovative monitoring methods that directly measure progress toward the goals of the Clean Water Act. Generally recognized as a leader in water quality monitoring, Ohio uses the fish and aquatic insects that live in streams to assess the health of Ohio's flowing waters. Aquatic animals are generally the most sensitive indicators of pollution because they inhabit the water all the time. A healthy stream community is also associated with high quality recreational opportunities (for example, fishing and boating). Stream assessments are based on the experience gained through the collection of more than 28,000 fish population samples and nearly 14,500 aquatic insect community samples.

In addition to biological data, Ohio EPA collects information on the chemical quality of the water (nearly 250,000 water chemistry samples), sediment and wastewater discharges; data on the contaminants in fish flesh; and physical habitat information about streams. Taken together, this information identifies the factors that limit the health of aquatic life and that constitute threats to human health.

Results show water quality is impaired but continues to improve, especially in the smaller watersheds.

Ohio EPA developed methods to determine how well Ohio's waters support four specific water uses: 1) human health impacts related to fish tissue contamination; 2) recreation; 3) human health impacts related to drinking water; and 4) aquatic life (fish and aquatic insects). Available data are compared with established water quality goals and the results of the comparison indicate which waters are meeting goals and which are not. The results for each use are discussed in the next few pages.

To assess the **human health impacts related to fish tissue contamination**, Ohio EPA uses the same data that are used to generate Ohio's sport fish consumption advisory. Although the data are the same, the analyses are different. Ohio EPA urges Ohio's anglers to consult the sport fish consumption advisory regarding which and how much fish to eat. A link to the fish consumption advisory website is available at the end of this section.

For analysis in this report, approximately half of Ohio's 1,538 watershed assessment units (WAUs) and two-thirds of the 93 publicly owned lakes assessed have some fish tissue data available. Of those, about 4 percent of the WAUs and 38 percent of the lakes do not have enough data to determine the impairment status. About one-third of the monitored WAUs are unimpaired for the contaminants, while just under two-thirds of the WAUs are impaired. For lakes, 11 percent are impaired while approximately 51 percent are not impaired by the six fish tissue contaminants [mercury, polychlorinated biphenyls (PCBs), chlordane, mirex, hexachlorobenzene and dichlorodiphenyltrichloroethane (DDT)].

Are fish safe to eat?

While most Ohio sport fish are safe to eat, low levels of chemicals like PCBs and mercury have been found in some fish from certain waters.

To help protect the health of Ohioans, Ohio EPA in conjunction with the Ohio Department of Health offers an advisory for how often these fish can be safely eaten. An advisory is advice and should not be viewed as law or regulation. It is intended to help anglers and their families make educated choices about where to fish, what types of fish to eat, how to determine the amount and frequency of fish consumed and how to prepare fish for cooking.

By following these advisories, citizens can gain the health benefits of eating fish while reducing their exposure to unwanted contaminants.

The most common contaminant is PCBs, followed by mercury. A few waters contain fish whose flesh is contaminated by dichlorodiphenyltrichloroethane (DDT), mirex or hexachlorobenzene; data show no streams or lakes with fish contaminated by lead. PCB contamination is widespread, usually because of historical sources. Areas with traceable contamination and areas of special concern are being addressed through programs such as the Great Lakes Legacy Act, Superfund or the Resource Conservation and Recovery Act.

Mercury contamination is ubiquitous because of aerial deposition from local, regional and global sources. Thus, solving the problem of mercury contamination requires solutions on a broader scale than at a watershed level. For example, Ohio targeted mercury from consumer products such as switches and thermometers through legislation banning the sale of such products. Ultimately, increases in renewable energy sources and clean coal technology usage will lessen Ohio's mercury burden.

Fish populations contaminated by hexachlorobenzene, DDT or mirex are already in the process of being restored through various initiatives in state and federal waste remediation programs.

Much of the **recreation** analysis focuses on the amount of bacteria in the water. For Lake Erie public beaches, the frequency with which individual beaches were recommended for a swimming advisory based on elevated bacteria levels above the state water quality standards for the entire five-year reporting period (2013-2017) ranged from near zero at Battery Park, East Harbor State Park, Lakeside and South Bass Island State Park to nearly 40 percent or more at Bay View West, Edson Creek, Euclid State Park, Lakeshore Park, Lakeview, Maumee Bay State Park (Erie), Sherod, Sims, Veteran's, Villa Angela State Park and White's Landing beaches.

Considerable variation in the frequency of advisories was observed between beaches and from season-to-season at many beaches. However, several beaches stand out as consistently good performers over the past several recreation seasons, including Battery Park, Bay Park, Catawba Island, Conneaut, East Harbor State Park, Kelleys Island, Lakeside and South Bass Island State Park, which all had a cumulative exceedance frequency of less than 10 percent on a seasonal basis. These beaches infrequently exceeded 10 days per season under advisement.

There were also several beaches that performed consistently poor with three beaches, including Bay View West, Edson Creek and Whites Landing beach, under advisement more than 50 percent of the time during the past five recreation seasons.

For inland streams, of the 170 assessment units having sufficient data available to determine the RU assessment status in 2018, 8 percent fully supported the use while 92 percent did not support the use. These results are comparable to the results from previous cycles that consistently show only a relatively small proportion of the state's watersheds demonstrate full support of the recreation use. Only 15 percent of the individual stream locations sampled by Ohio EPA in 2015 and 2016 were found to attain the applicable recreation criteria.

Is it safe to swim or wade?

For the most part, water in Ohio is safe for swimming or wading. Water activities are more dangerous after heavy rains due to the obvious physical dangers of being swept into the faster flows, but also because chemicals and bacteria wash into the streams along with the water that runs over the land. In some communities, sewage systems cannot handle the extra volume of water and release untreated sewage during and after heavy rains.

There are some areas where the waters and/or sediments have high levels of contaminants, including PCBs and polyaromatic hydrocarbons (PAHs), so swimming or wading in these areas is not recommended.

All six of the large river units evaluated in this cycle failed to support the recreation use. However, two of the lower Tuscarawas River segments came close to supporting, with one scoring a 94 and another having an index score of 82. Also, the Huron River mainstem, although not a large river assessment unit, was also documented to fully support the recreation use.

As for inland lakes, the frequency of exceedances during the five-year reporting period was 13.8 percent, slightly higher than the 12.4 percent rate reported in the 2011-2015 cycle. There were 28 inland lake beaches where the aggregated exceedance frequency was more than 10 percent with the highest being 66 percent at the Brooks Park beach at Buckeye Lake and followed closely by Buckeye Lake's Crystal Beach at 60 percent.

The western basin of Lake Erie has also been assessed for recreation use impacted by significant algae biomass present during the recreation season. As a result, Ohio is listing the shorelines and open water in the western basin as impaired for recreation use.

Human health impacts related to drinking water focus on nitrate, pesticides and cyanotoxins (due to certain algae). In Ohio, 110 public water systems use surface water (excluding Ohio River intakes) in 119 separate AUs.

Sufficient data were available to complete nitrate evaluations for half of the AUs of which 6 percent were identified as impaired and 45 percent were in full support. There are two new WAUs listed as impaired due to nitrates. Of the large rivers, three Maumee River and one Sandusky River AU remain impaired and there is a new impairment on one Scioto River AU. Most of the 31 waters placed on the nitrate watch list are in northwestern Ohio

Pesticides were evaluated for 32 AUs. Five of the AUs were impaired while the remaining 27 were in full support. There were no new assessment units identified as impaired due to pesticides. A total of 21 AUs were placed on the pesticide watch list because of elevated atrazine. These areas of elevated atrazine coincide with the predominantly agricultural land use in western and northwestern Ohio.

The monitoring of microcystins and cyanobacteria by Ohio public water systems greatly increased the data available to assess the algae indicator. Sufficient data were available to list 31 percent of the AUs as impaired due to algae, including 17 new AUs identified as impaired this reporting cycle. The impairment listing includes all AUs in Lake Erie with drinking water intakes. In addition, 28 WAUs and three LRAUs are now assessed as impaired. An additional 17 AUs were also placed on the algae watch list. WAUs that are impaired or on the watch list for cyanotoxins were found distributed across Ohio virtually in every geographic region.

Is water safe to drink?

Ohio EPA and public water systems around the state work hard to ensure that drinking water meets safe drinking water standards and that users have important information available about the sources and quality of the water. However, drinking water advisories do occur from time to time due to treatment plant malfunctions, water line breaks, and the rare case when source water contaminant levels exceed the plant's capacity to remove them.

It is important to remember that only a relatively small number of water systems have situations that warrant advisories. In 2010, 99 percent of all public water systems met all chemical standards. To get information about your local drinking water you can read the Consumer Confidence Report (CCR) provided annually by your community water system.

In this report, several waters are identified as impaired due to elevated nitrate or pesticides. Water systems in these areas and others with source water contaminants will issue public notice advisories or use additional treatment and water management strategies to ensure that safe water is delivered to their customers.

The bulk of the new data evaluated for the **aquatic life use** is in areas Ohio EPA sampled during 2015 and 2016. Watersheds intensively monitored during 2015 and 2016 included the St. Mary's River basin, selected Lake Erie Central Basin tributaries, selected direct tributaries to the Maumee River, selected Southeast Ohio River tributaries, selected Southwest Ohio River tributaries, the Conotton Creek basin, the Raccoon Creek basin and the Symmes Creek basin. The only large rivers comprehensively reassessed were the Whitewater River, Cuyahoga River and Raccoon Creek but updates for specific segments of the Auglaize River, Maumee River, Great Miami River, Little Miami River, Muskingum River, Tuscarawas River, Walhonding River and Scioto River were also completed with a lesser

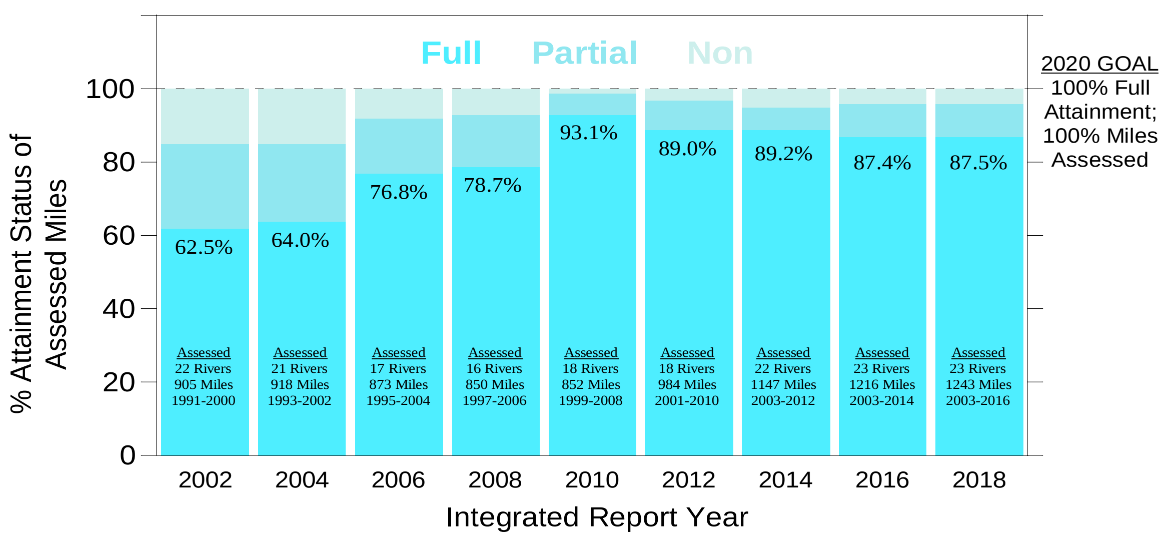
number of sites. Detailed watershed survey reports for many of the basins mentioned above are or will be available from Ohio EPA's Division of Surface Water (see Biological and Water Quality Report Index, ***epa.ohio.gov/dsw/document_index/psdindx.aspx***).

Large rivers are making progress toward the 100 percent attainment by 2020 aquatic life goal.

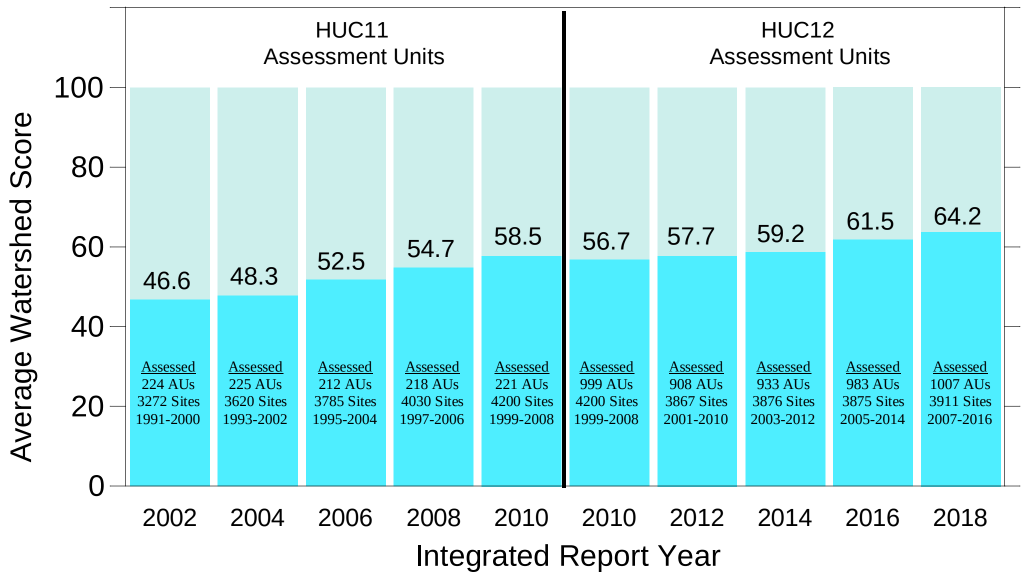
Ohio's large rivers (the 23 rivers that drain more than 500 square miles) remained essentially unchanged in percent of monitored miles in full attainment compared to the same statistic reported in the 2016 IR. Based on monitoring through 2016, the full attainment statistic now stands at 87.5 percent (1,089 of 1,243 assessed LRAU miles), up 0.1 percent from the 2016 IR. Significant large rivers assessed for the 2018 IR included the Whitewater River (2013 external data), Cuyahoga River (2016 external data) and Raccoon Creek (2016). Attainment statistics for these three rivers (three LRAUs) are as follows.

- Whitewater River: 100 percent full EWH attainment over 8.3 miles
- Cuyahoga River: 61.3 percent full WWH attainment over 24.2 miles
- Raccoon Creek: 100 percent full WWH attainment over 37.6 miles

Progress toward the 100 percent by 2020 aquatic life use goal for Ohio's large rivers is depicted in below figure. Between the 2002 and 2018 reporting cycles, the percentage of large river miles in full attainment has increased from 62.5 percent to 87.5 percent and, nearly 100 percent of total miles have been assessed. Continued success in approaching the 100 percent full attainment threshold for 100 percent of large river miles by 2020 will depend on sustained resources allocated to monitoring LRAUs with an emphasis on those which were last sampled prior to 2009 and whose data will exceed 10 years in age in 2018 (the last year of data to be included in the 2020 goal assessment). Eleven large rivers (15 AUs), representing nearly 490 large river miles, currently meet this constraint and none have been sampled or are scheduled for sampling.

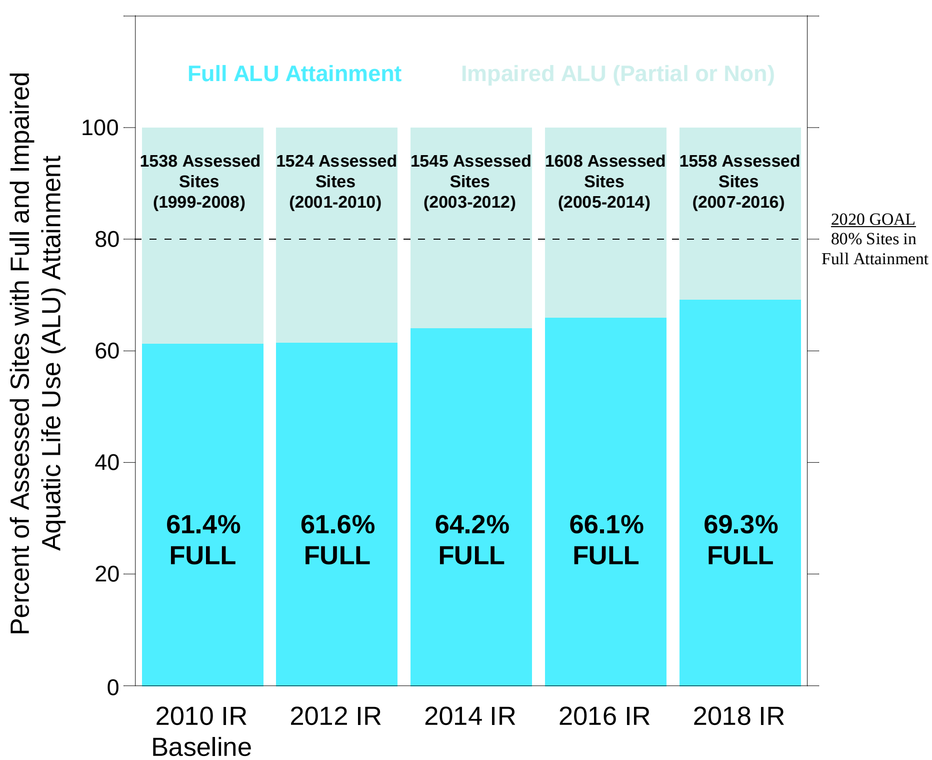


For Ohio's 1,538 12-digit HUCs, the score reflected a positive increase from the corresponding score reported in the 2016 IR. Based on monitoring through 2016, the average HUC12 WAU score stands at 64.2, a 2.7-point increase from the 2016 IR and a 5.0-point increase from the 2014 IR. The WAU score is roughly equivalent to the percentage of monitored sites with full aquatic life use attainment in WAUs assessed for this IR cycle. This trend and trajectory is typical of what has been observed over the last several cycles (a pattern of steady increases of 1-3 points). The following figure depicts the corresponding average score based on the old HUC11 WAUs, which were tracked from 2002 through 2010 and were used to gauge the progress of the 80 percent by 2010 aquatic life use goal as reported in the 2010 IR.



Note: Data compiled over the last nine IR cycles with the current 2018 cycle including data collected primarily from 2007-2016.

Progress toward the 80 percent by 2020 aquatic life use goal for Ohio's wading and principal stream and river sites (those monitored sites draining watersheds between 20 and 500 square miles) is depicted below. Contrasted with the 2010 IR statistic, when the 2020 goal benchmark was established, the percentage of qualifying sites in full attainment has increased nearly eight percentage points with an increase from 61.4 percent to 69.3 percent.



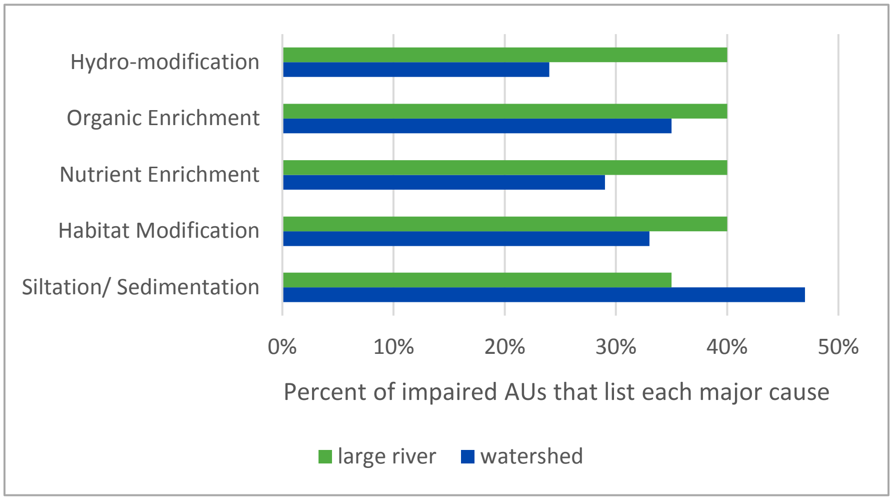
The collection of more biological data along the shore of Lake Erie through the Great Lakes Restoration Initiative allows a more current analysis of shoreline conditions. The aquatic life use of the Lake Erie shoreline is impaired due primarily to tributary loadings of nutrients and sediment, aggravated by the proliferation of exotic species, algal blooms and shoreline habitat modifications.

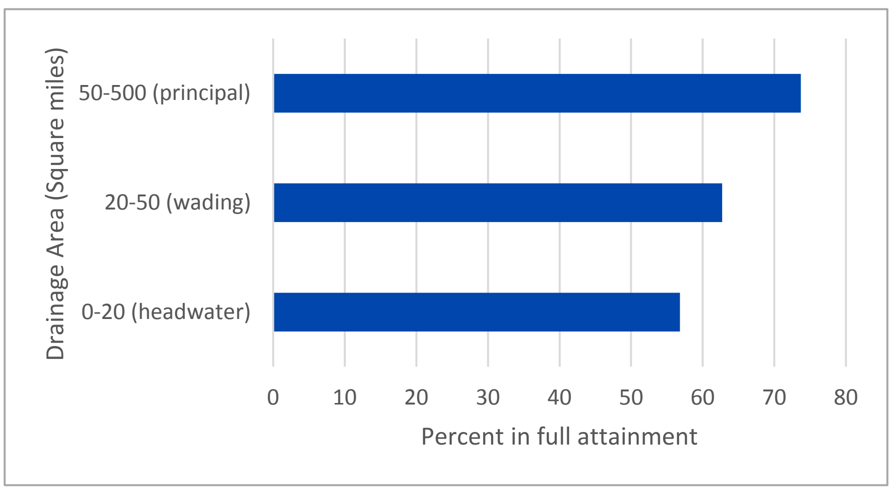
Most aquatic life impairment is caused by land disturbances related to agriculture activities and urban development.

Taking a closer look at the attainment status of individual sites grouped by the amount of land area drained by the stream at that point reveals that unhealthy fish and aquatic insect populations are more common on smaller streams. In other words, the larger the drainage area (and usually the larger the stream), the more likely the stream is to be healthy. This phenomenon correlates well with the most widespread causes associated with the aquatic life impairment in these watersheds.

The top five aquatic life impairment causes for the period 2003 through 2016 are:

- siltation/sedimentation
- organic enrichment
- habitat modification
- nutrient enrichment
- hydromodification





For watersheds, most impairment is related to modification of the landscape. These types of impairments have the most impact on smaller streams. Most of the impaired watershed units with current data had at least one of these causes contributing to impairment and many had two or more of the top five causes listed.

Of note is the prevalence of watersheds and large rivers that are impaired by the generic organic enrichment cause category; 35 percent of impaired watersheds show sewage-related impairments such as high biochemical oxygen demand, elevated ammonia concentrations and/or in-stream sewage solids deposition. This suggests that adequate treatment and disposal of human and animal wastes via wastewater treatment plants, home sewage treatment systems and land applications of septage and animal manure continue to be critical water quality issues in many Ohio watersheds.

The major causes and sources of water quality problems are described below.

Organic enrichment is the addition of carbon-based materials from living organisms beyond natural rates and amounts. Natural decomposition of these materials can deplete oxygen supplies in surface waters. Dissolved oxygen is vital to fish and other aquatic life and for the prevention of odors associated with the decomposition process.

Siltation/sedimentation describes the deposition of fine soil particles on the bottom of stream and river channels. Deposition typically follows high-flow events that erode and pick up soil particles from the land. Soil particles also transport other pollutants. As the flow decreases, the soil particles fall to the stream bottom. This reduces the diversity of stream habitat available to aquatic organisms.

Habitat modification is the straightening, widening or deepening of a stream's natural channel. Habitat modification can also include the degrading or complete removal of vegetation from stream banks; such vegetation is essential to a healthy stream.

These activities can effectively transform a stream from a functioning ecosystem to a simple drainage conveyance. Some aquatic life will not be protected from predators and stressful flows and temperatures. The stream also often loses its ability to naturally process water pollutants.

Hydromodification, or flow alteration, describes any disruption to the natural hydrology of a stream system. Flow alteration includes stream impoundment, increased peak flows associated with the urbanization of watersheds and water-table regulation through sub-surface drainage. Such changes can cause extended periods without stream flow, more extreme or frequent floods and loss of fast current habitat in dam pool areas.

Contamination by pathogens occurs when human or animal waste reaches the stream. Pathogenic organisms include bacteria, viruses and protozoa.

Contamination by pathogens is a human health issue, as skin contact or accidental ingestion can lead to various conditions such as skin irritation, gastroenteritis or other more serious illnesses.

Nutrient enrichment describes the excess contribution of materials such as nitrogen and phosphorus used for plant growth. Excess nutrients are not toxic to aquatic life but can have an indirect effect because algae flourish where excess nutrients exist. The algae die, and their decay uses up the dissolved oxygen that other organisms need to live. The aquatic community is stressed on both a daily basis and over the long term.

The same nutrients that cause impairment of the aquatic life beneficial use also are a major contributing factor to the recent extensive HABs that have been observed in Lake Erie, the Ohio River and many inland Ohio water bodies. Grand Lake St. Marys in western Ohio has been particularly affected. HABs, a visually identified concentration of cyanobacteria, can occur almost anywhere there is water: lakes, ponds, storm water retention basins, rivers, streams or reservoirs.

Many HAB-forming organisms are native to Ohio, but only cause problems when environmental conditions favor them. HABs can cause taste and odor problems in drinking waters; pollute beaches with scums; reduce oxygen levels for fish and other animals; cause processing problems for public water supplies; and may generate toxic chemicals. Knowing what triggers HABs is key to reducing their occurrence and impacts. HABs may be minimized, and some completely avoided, by reducing the nutrients and pollutants added to the water.

Understanding how various land uses impact water quality can lead to more effective prevention and restoration.

Ohio has embraced a wide variety of economic enterprises over the past 150 years, so it is not surprising that there is a large variety of causes and sources of impairment some of which are described below.

Row crop cultivation is a common land use in Ohio. Frequently, cultivated cropland involves tile drainage. The challenge is to carry out actions that improve water quality while maintaining adequate drainage for profitable agriculture. The land application of manure, especially during winter months, is often a large source of both bacteria and nutrients entering streams and subsurface drainage tiles. Many cropland practices involve the channelization of streams, which creates deeply incised and straight ditches or streams.

This disconnects waterways from floodplains, which has damaging impacts on the quality of the system. The regularity of the stream channel and lack of in-stream cover reduces biological diversity.

Land development is the conversion of natural areas or agriculture to residential, industrial or commercial uses. Numerous scientific studies show that increasing impervious cover (for example, hard surfaces such as roads, parking lots, and rooftops) harms water quality. More water runs off the hard surfaces and more quickly. The rate of erosion increases, and streams become unstable. The resulting channel is less able to assimilate nutrients and other pollution. Higher runoff volume increases the amount of pollutants (for example, nutrients, metals, sediment, salts and pesticides).

Another problem is that stream temperatures can be raised when water runs over hot pavement and rooftops or sits in detention basins. When this heated water enters a stream, the higher temperatures reduce dissolved oxygen concentrations that aquatic life need to survive. With proper planning of development, many of these problems can be mitigated or avoided entirely.

Agricultural livestock operations can vary widely in how they are managed. Pasture land and animal feeding operations can be sources of nutrients and pathogens. Frequently livestock are permitted direct access to streams. Direct access not only allows the input of nutrients and pathogens, but also erodes the stream bank, causing excess sediments to enter the stream and habitat degradation. The most critical aspect of minimizing water quality impacts from any size animal feeding operation is the proper management of manure in terms of application and storage.

Industrial and municipal point sources include wastewater treatment plants and factories. Wastewater treatment plants can contribute to bacteria, nutrient enrichment, siltation and flow alteration problems. Industrial point sources, such as factories, sometimes discharge water that is excessively warm or cold, changing the temperature of the stream. Point sources may contain other pollutants such as chemicals, metals and solids.

Acid mine drainage impacts streams with high levels of acidity (low pH); high metal concentrations; elevated sulfate levels; and/or excessive dissolved and suspended solids and/or siltation. Acid mine drainage often has toxic effects on stream organisms and degrades habitat quality when deposited metals form a crust on the stream bed and susceptible soils erode from areas disturbed from mining. Ultimately it reduces biological diversity, eliminates sensitive aquatic life, and lowers ecosystem productivity.

Solving Ohio's water quality problems will require collaboration and creativity.

Most of Ohio's water quality problems will not be solved by issuing a permit or building a new wastewater treatment system to treat point sources of pollution. Improving Ohio's surface water quality will require effectively managing land use changes to ensure that polluted runoff is either captured and treated or allowed to infiltrate through the soil before running off into a stream.

Restoring and protecting natural stream functions so that pollutants may be more effectively assimilated by streams is also critical. These actions will require various programs and people working collaboratively on local water quality issues and concerns. Local educational efforts and enhanced water quality monitoring will also play important roles if we are to see significant water quality improvements throughout Ohio.

Many areas of the state are benefitting by the participation of individuals and organizations in local watershed organizations. Some of these organizations have been active for quite some time and are successfully influencing local land use decision making and implementing projects designed to improve water quality in their watershed. In recent years, the emphasis for section 319(h) grant funding has shifted from hiring local watershed coordinators and developing plans to implementing water quality improvement projects such as stream restoration, dam removals, agricultural best management practices and others. Ohio EPA is measuring improvements resulting from these projects; however, there remain challenges associated with changing land use decisions and finding cooperative partners.

Ohio EPA is also actively working with ODNR and the Ohio Department of Health (ODH) to protect people from toxins produced by cyanobacteria that may be in recreational waters at concentrations that can affect human health. The state strategy outlines thresholds for identified algal toxins, establishes monitoring protocols and identifies the process for posting and removing recreation use advisories. Furthermore, a website was established to provide background information about HABs; tips for staying safe when visiting public lakes; links to sampling information and current advisories; and contact information for reporting suspected HABs. A link to this website is at the end of this section.

The report provides more detail, including Ohio's Section 303(d) list of impaired waters, as required by the Clean Water Act.

This overview is intended to provide a summary of water quality conditions, progress and challenges in Ohio; it is only the first section of the much larger and more detailed 2018 Integrated Report.

The opening sections of the report describe the universe of water quality in Ohio—the size and scope of Ohio's water resources, programs that are used to evaluate and improve water quality and funding sources for water quality improvement.

The middle sections are more technical and explain the beneficial uses assigned to Ohio's waters; the assessment methodologies used for the analyses of those uses; the data used to determine whether those uses are being supported; and the conclusions drawn about water quality conditions in each AU.

The closing sections describe how waters found to be impaired will be scheduled for further study. A collection of maps that illustrate current conditions follow the text. The report concludes with summary tables of various types. The 303(d) list is contained in Section L4. Summaries of the condition of each AU are available through the Interactive Maps link at ***epa.ohio.gov/dsw/tmdl/OhioIntegratedReport.aspx***.

For more information, please consult these web sites:

Many water quality reports on specific watersheds are mentioned in this overview. Find these reports at ***epa.ohio.gov/dsw/document_index/psdindx.aspx***

- Watershed restoration reports (TMDLs) — ***epa.ohio.gov/dsw/tmdl/index.aspx***
- Integrated Water Quality Monitoring and Assessment Report — ***epa.ohio.gov/dsw/tmdl/OhioIntegratedReport.aspx***
- Ohio EPA Division of Surface Water — ***epa.ohio.gov/dsw/SurfaceWater.aspx***
- Ohio EPA Division of Drinking and Ground Waters — ***epa.ohio.gov/ddagw/DrinkingandGroundWaters.aspx***
- Ohio EPA district office contact info — ***epa.ohio.gov/directions.aspx***
- Fish consumption advisory — ***epa.ohio.gov/dsw/fishadvisory/index.aspx***
- Harmful algal blooms — ***ohioalgaeinfo.com***
- Ohio Department of Health Beachguard (bacteria and algae) — ***publicapps.odh.ohio.gov/beachguardpublic/***
- List of Ohio watershed groups — ***ohiowatersheds.osu.edu/watershed-groups***
- Ohio Department of Agriculture, Soil and Water Conservation — ***agri.ohio.gov/divs/SWC/SWC.aspx***
- U.S. Environmental Protection Agency water program — ***water.epa.gov/***

Ohio's Water Resources

B1. Facts and Figures

Ohio is a water-rich state, bounded on the south by the Ohio River and the north by Lake Erie. These water bodies, as well as thousands of miles of inland streams and rivers and thousands of acres of lakes and wetlands, contribute to the quality of life of Ohio's citizens. The size and scope of Ohio's water resources are outlined in Table B-1.

Table B-1 — Ohio's water resource statistics.

Metric	Value	Source	Scale
State population	11,536,504	2010 Census[1]	
Land area	40,861 sq miles	2010 Census[2]	
Rivers and streams			
Miles of named and designated streams	>23,000	ODNR[3]	1:24K
Total miles	58,343	NHD[4]	1:24K
Miles of perennial streams	29,412	NHD[4]	1:24K
Miles of intermittent streams	28,931	NHD[4]	1:24K
Miles of primary headwater streams	>115,000	Ohio EPA[5]	
Miles of large rivers (draining more than 500 sq miles)	1,248	NHD[4]	1:24K
Miles of principal streams (draining 50 to 500 sq miles)	4,453	NHD[4]	1:24K
Border miles: Ohio River	451	USGS $7^{1/2}$' Maps	1:24K
Border miles: Lake Erie shoreline	290	USGS $7^{1/2}$' Maps	1:24K
Lakes/Reservoirs/Ponds			
Number of significant publicly owned lakes	447	ODNR[6]	1:24K
Total acreage of significant publicly owned lakes	118,963	ODNR[6]	1:24K
Wetlands			
Acreage	507,057	Ohio EPA[7]	1:24K
Percent of original wetlands	10 percent	Dahl[8]	

1 Source: ***census.gov/2010census/data/***
2 Source: ***census.gov/geo/reference/state-area.html***
3 Mileage for waters listed by Ohio Department of Natural Resources in *Gazetteer of Ohio Streams, 2nd edition* (ODNR 2001).
4 An estimate prepared from a computer-digitized map of U.S. streams and rivers produced by the U.S. Geological Survey (USGS) known as the National Hydrography Dataset (NHD). The NHD is based upon the content of USGS Digital Line Graph (DLG) hydrography data integrated with reach-related information from the U.S. EPA Reach File Version 3 (RF3). ***nhd.usgs.gov/index.html***
5 An estimate prepared by Ohio State University for Ohio EPA and reported in *Field Evaluation Manual for Ohio's Primary Headwater Habitat Streams* (Ohio EPA 2009).
6 Acreage for significant publicly owned lakes (> 5 acres) listed by Ohio Department of Natural Resources in *Inventory of Ohio's Lakes* (ODNR 1980).
7 Acreage for wetlands listed by Ohio EPA in *Intensification of the National Wetland Condition Assessment for Ohio: Final* Report (Ohio EPA 2015).
8 Loss of historic wetlands in Ohio estimated to be 90 percent (Dahl, 1990).

The larger water bodies included in Table B-1 comprise the major aquatic resources that are used and enjoyed by Ohioans for water supplies, recreation and other purposes. The quality of these perennial streams and other larger water bodies is strongly influenced by the condition and quality of the small feeder streams, often called the headwaters.

Approximately 28,900 miles of the more than 58,000 miles of stream channels digitally mapped in Ohio are headwater streams. However, the digital maps currently available for Ohio do not include the smallest of headwater channels. Results of a special study of primary headwater streams (drainage areas less than one square mile) place the estimate of primary headwaters between 146,000 to almost 250,000 miles (Ohio EPA 2009). Some of these primary headwater streams are, in fact, perennial habitats for aquatic life that supply base flow in larger streams. This illustrates the importance of taking a holistic watershed perspective in water resource management.

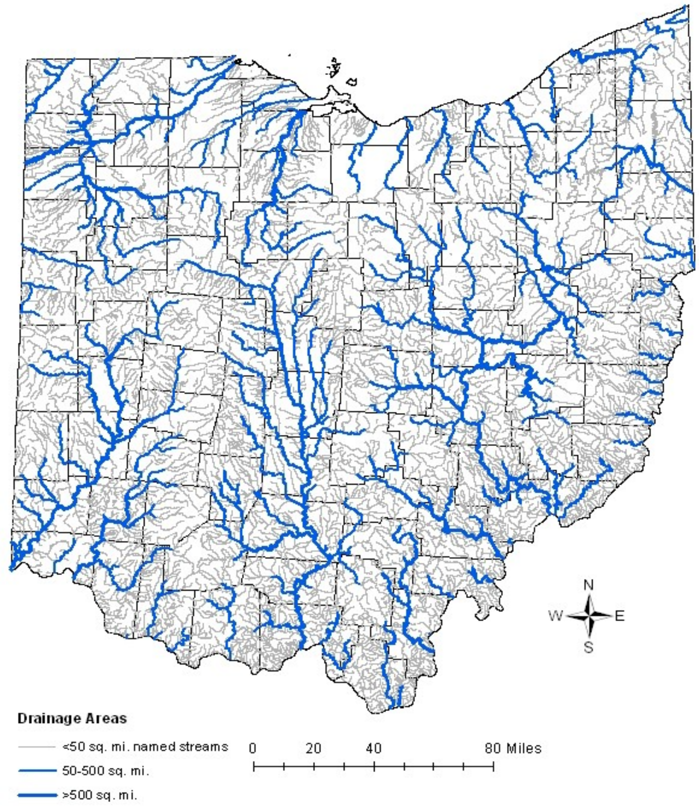


Figure B-1 — Map of Ohio's principal streams and large rivers.

The named streams and rivers that are readily recognized by the public are mostly those that drain more than 50 mi^2. These 254 principal streams and large rivers in Ohio (comprising 5,679 linear stream miles) are listed by major Ohio watershed in Table B-2. Figure B-1 graphically depicts the extent of these stream and river miles within Ohio.

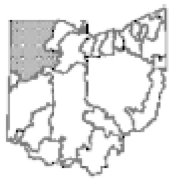
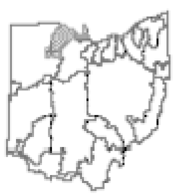
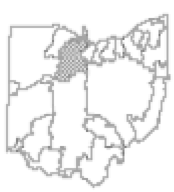
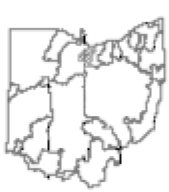
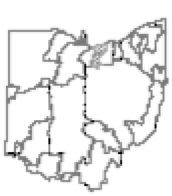
Ohio is an economically important and diverse state with strong manufacturing and agricultural industries. Many of the historical patterns of environmental impact in Ohio are related to the geographical distribution of basic industries, land use, mineral resources and population centers. Equally important, however, is an understanding of Ohio's geology, land form, land use and other natural features as these determine the basic characteristics and ecological potential of streams and rivers.

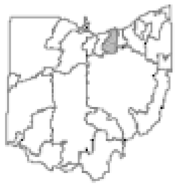
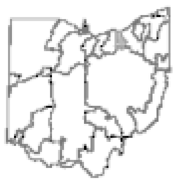
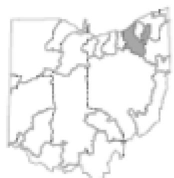
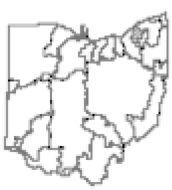
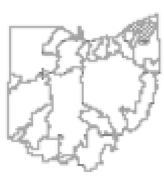
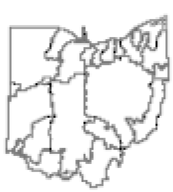
Ohio EPA bases the selection, development and calibration of ecological, toxicological and chemical/physical indicators on these factors. These indicators are then used via systematic ambient monitoring to provide information about existing environmental problems; threats to existing high-quality waters; and successes in abating water pollution problems in Ohio's surface waters.

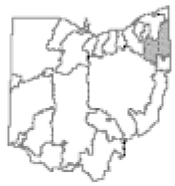
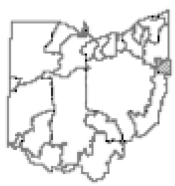
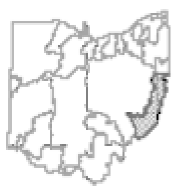
Figure B-2 — Ohio Scenic River System (ODNR 2017)
Source: ***watercraft.ohiodnr.gov/scenicriversmap***

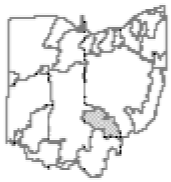
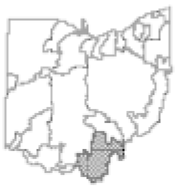
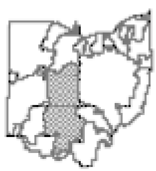
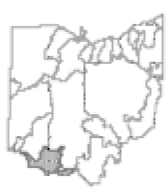
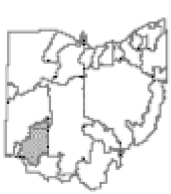
In Ohio, 14 river systems are included in the State Scenic Rivers Program, administered by the Ohio Department of Natural Resources (see Figure B-2). Between 1970 and 2008, a total of 674 miles were designated Scenic; 75 miles in three systems were designated Wild; and 79 miles in two systems were designated Recreational. Portions of three stream systems—the Little Miami, Little Beaver Creek and Big and Little Darby Creek—are also included in the National Wild and Scenic System. The total Ohio stream miles included in the national designation is 207 miles. More information on Ohio's scenic rivers can be found at ***watercraft.ohiodnr.gov/scenicrivers***.

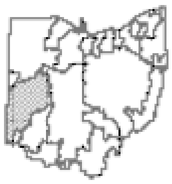
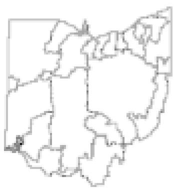
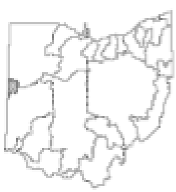
Table B-2 — List of Ohio's principal streams and large rivers.

Basin	Large Rivers (draining > 500 mi^2)	Principal Streams (draining > 50 mi^2 but less than 500 mi^2)	
Areas Draining to Lake Erie			
Maumee Basin 	Maumee River Auglaize River Blanchard River Tiffin River	Swan Creek Beaver Creek Bad Creek South Turkeyfoot Creek North Turkeyfoot Creek Flatrock Creek Powell Creek North Powell Creek Blue Creek Little Auglaize River Prairie Creek West Branch Prairie Creek Dog Creek Riley Creek Ottawa Creek Eagle Creek Ottawa River	Sugar Creek Hog Creek Jennings Creek Ottawa River Tenmile Creek St. Joseph River Fish Creek Nettle Creek West Branch St. Joseph River East Branch St. Joseph River St. Marys River Black Creek Mud Creek Lick Creek Brush Creek Bean Creek
Portage Basin 		Portage River Sugar Creek North Branch Portage River Toussaint Creek	South Branch Portage River Middle Branch Portage River Rocky Ford
Sandusky Basin 	Sandusky River	Wolf Creek East Branch Wolf Creek Sycamore Creek Broken Sword Creek	Green Creek Honey Creek Muddy Creek Tymochtee Creek
Huron Basin 		Huron River East Branch Huron River West Branch Huron River	
Vermilion Basin 		Vermilion River	

Basin	Large Rivers (draining > 500 mi^2)	Principal Streams (draining > 50 mi^2 but less than 500 mi^2)
Black Basin 		Black River East Branch Black River West Branch Black River
Rocky Basin 		Rocky River East Branch Rocky River West Branch Rocky River
Cuyahoga Basin 	Cuyahoga River	Tinkers Creek Breakneck Creek Little Cuyahoga River
Chagrin Basin 		Chagrin River Aurora Branch
Grand Basin 	Grand River	Mill Creek Rock Creek
Ashtabula Basin 		Ashtabula River Conneaut Creek

Basin	Large Rivers (draining > 500 mi²)	Principal Streams (draining > 50 mi² but less than 500 mi²)	
Areas Draining to the Ohio River			
Mahoning Basin 	Mahoning River	Meander Creek Mill Creek Mosquito Creek	Eagle Creek West Branch Mahoning River Pymatuning Creek
Little Beaver Basin 		Little Beaver Creek Bull Creek	North Fork Little Beaver Creek Middle Fork Little Beaver Creek West Fork Little Beaver Creek
Central Ohio Tributaries 		Captina Creek Cross Creek Duck Creek East Fork Duck Creek West Fork Duck Creek Little Muskingum River	McMahon Creek Short Creek Sunfish Creek Wheeling Creek Yellow Creek North Fork
Muskingum Basin 	Muskingum River Licking River Tuscarawas River Walhonding River Mohican River Wills Creek	Wolf Creek South Branch Wolf Creek West Branch Wolf Creek Olive Green Creek Conotton Creek Indian Fork Killbuck Creek Doughty Creek Apple Creek Rocky Fork Licking River South Fork Licking River Raccoon Creek North Fork Licking River Moxahala Creek Jonathan Creek Stillwater Creek Little Stillwater Creek Brushy Fork Sugar Creek South Fork Sugar Creek Sandy Creek Nimishillen Creek Still Fork White Eyes Creek	Wolf Creek Chippewa Creek Mill Creek Kokosing River Jelloway Creek North Branch Kokosing River Lake Fork Mohican River Muddy Fork Mohican River Jerome Fork Mohican River Black Fork Mohican River Rocky Fork Mohican River Clear Fork Mohican River Salt Fork Wills Creek Sugartree Fork Crooked Creek Leatherwood Creek Seneca Fork Buffalo Fork Little Hocking River Meigs Creek Salt Creek Wakatomika Creek Little Wakatomika Creek

Basin	Large Rivers (draining > 500 mi²)	Principal Streams (draining > 50 mi² but less than 500 mi²)	
Hocking Basin 	Hocking River	Margaret Creek Federal Creek Sunday Creek Monday Creek	Clear Creek Rush Creek Little Rush Creek
Southeast Ohio Tributaries 	Raccoon Creek	Indian Guyan Creek Leading Creek Little Scioto River Rocky Fork Little Scioto River Pine Creek Little Raccoon Creek	Elk Fork Shade River East Branch Shade River Middle Branch Shade River West Branch Shade River Symmes Creek Black Fork
Scioto Basin 	Scioto River Paint Creek	Big Beaver Creek Peepee Creek Walnut Creek Scippo Creek Walnut Creek Big Walnut Creek Mill Creek Alum Creek Blacklick Creek Bokes Creek Little Scioto River Rush Creek Big Darby Creek Little Darby Creek Deer Creek Sugar Run Olentangy River	Whetstone Creek North Fork Paint Creek Compton Creek Rocky Fork Paint Creek Rattlesnake Creek Lees Creek West Branch Rattlesnake Creek Sugar Creek East Fork Paint Creek Salt Creek Salt Lick Creek Middle Fork Salt Creek Laurel Run Scioto Brush Creek South Fork Scioto Brush Creek Sunfish Creek
Southwest Ohio Tributaries 		Bullskin Creek Eagle Creek West Fork Eagle Creek Ohio Brush Creek Baker Fork	West Fork Ohio Brush Creek Straight Creek White Oak Creek East Fork White Oak Creek North Fork White Oak Creek
Little Miami Basin 	Little Miami River	O'Bannon Creek Turtle Creek East Fork Little Miami River Stonelick Creek Todd Fork	Cowan Creek Caesar Creek Anderson Fork Massies Creek

Basin	Large Rivers (draining > 500 mi²)	Principal Streams (draining > 50 mi² but less than 500 mi²)	
Great Miami Basin 	Great Miami River Mad River Stillwater River Whitewater River	Indian Creek Clear Creek Bear Creek Wolf Creek Honey Creek Lost Creek Tawawa Creek Stony Creek Buck Creek Ludlow Creek	Greenville Creek Swamp Creek Dry Fork Fourmile Creek Sevenmile Creek Twin Creek Loramie Creek Muchinippi Creek South Fork Great Miami River
Mill Basin 		Mill Creek	
Wabash Basin 		Wabash River Beaver Creek	

B2. 2020 Water Quality Goals

Ohio has a variety of high-quality water resources and has set goals to track trends in water quality for many years. In the early 1990s, Ohio EPA established a goal of fully attaining the designated aquatic life use[1] in 80 percent of Ohio's streams and rivers by 2010. The purpose of the goal was not to supersede the Clean Water Act goal of 100 percent attainment for all uses, but rather to provide a reasonable target against which to track water quality improvements in Ohio. The 2010 Integrated Report marked the final accounting of 80 by 2010 goal progress and proposed new goals for the aquatic life beneficial use.

New goals for all four beneficial uses included in the integrated report (IR) were established in the 2012 report. Progress toward these goals is discussed in each IR cycle. A new goal for the public drinking water supply use, based on the algae indicator, was established in this report.

Table B-3 lists the goals, the statistic that will be tracked to measure progress and the baseline and status for each goal. See Section G for more information about the aquatic life use goal.

[1] Beneficial use designations describe existing or potential uses of water bodies. See Section D4 for additional description.

Table B-3 — 2020 goals for four beneficial uses, Lake Erie and the Ohio River.

Goal	Statistic to be Tracked	Baseline	Update
Public Drinking Water Supply Use			
All drinking water sources will attain WQS by 2020	Of those assessed, percent intakes/assessment units attaining for nitrates, atrazine, cryptosporidia (crypto) and algae	Nitrate: 93% attainment Atrazine: 71% attainment Crypto: insufficient data Source: 2010 IR Data range: 2004-2008	Nitrate: 88.3% attainment Atrazine: 84% attainment Crypto: 100% attainment[2] Source: 2018 IR Data range: 2012-2017
All drinking water sources will be assessed (nitrate, atrazine and algae) by 2020	Percent intakes/zones assessed	Nitrate: 34% assessed Atrazine: 13% assessed Source: 2010 IR Data range: 2004-2008	Nitrate: 50% assessed Atrazine: 27% assessed Source: 2018 IR Data range: 2012-2017
Human Health Use (Fish Tissue)			
More fish from Ohio's waters will be safe to eat by 2020	Levels of contaminants (mercury and PCBs) in sport fish compared with level in 2010	Not applicable	To be calculated in 2019 with 2009-2018 data
	Number of AUs listed as impaired for fish consumption compared to the 2010 IR	33% of AUs were impaired and 87% of LRAUs Source: 2010 IR Data range: 1999-2008	To be calculated in 2019 with 2009-2018 data
Recreation Use			
Ohio beaches and canoeing streams will be safe for swimming (meet WQS) by 2020	Lake Erie beaches below *E. coli* WQS on 90% of recreation days (single sample maximum), using most recent five years of data	5 of 22 (22%) major public beaches met target (note: one beach from 2010 report is no longer public) Source: 2010 IR Data range: 2004-2008	12 of 65 (18%) public beaches met target Source: 2018 IR Data range: 2013-2017
	For state park beaches, 90% of *E. coli* samples collected in past five years are below the bathing beach *E. coli* criterion	57 of 77 (75%) state park beaches met target Source: 2010 IR Data range: 2004-2008	47 of 75 (63%) state park beaches met target Source: 2018 IR Data range: 2013-2017
	Percent of assessed stream sites meeting seasonal geometric mean *E. coli* criteria, using most recent five years of data	Aggregate: 587 of 1,598 (37%) Class A: 165 of 349 (47%) Class B: 419 of 1,229 (34%) Class C: 3 of 20 (15%) Source: 2010 IR Data range: 2004-2008	Aggregate: 13 of 256 (15%) Source: 2018 IR Data range: 2013-2017

[2] Using the proposed criteria listed in Table H-1.

Goal	Statistic to be Tracked	Baseline	Update
Maintain adequate monitoring coverage on Ohio's watersheds, large rivers and beaches	Number of sites assessed (bacteria data in five-year period)	Watersheds: 472 of 1,538 (31%) assessed Large rivers: 15 of 38 (40%) assessed Beaches: 22 of 22 (100%) assessed (note: one beach from 2010 report is no longer public) Source: 2010 IR Data range: 2004-2008	Watersheds: 156 of 1,538 (10%) assessed Large rivers: 6 of 38 (16%) assessed Beaches: 65 of 65 (100%) assessed Source: 2018 IR Data range: 2013-2017
Aquatic Life Use			
100% full aquatic life use attainment on all Ohio large rivers by 2020	Percent assessed miles in full attainment of biological WQS criteria (large rivers drain more than 500 square miles)	93% (794 of 852 large river miles assessed) Total large river miles assessed: 852 of 1,227 (69%) Source: 2010 IR Data range: 1999-2008	87.5% (1,089 of 1,243 large river miles assessed) Total large river miles assessed: 1,243 of 1,248 (99.7%) Source: 2018 IR Data range: 2003-2016
80% full aquatic life use attainment on Ohio's principal streams and small rivers by 2020	Percent assessed sites in full attainment of biological WQS criteria (principal stream and small river sites drain between 20 and 500 square miles)	61% (944 of 1,538 principal stream and small river sites assessed) Source: 2010 IR Data range: 1999-2008	69.3% (1,079 of 1,558 principal stream and small river sites assessed) Source: 2018 IR Data range: 2007-2016
Identify more high-quality waters	Designate an additional 500 miles of stream, small river and large river reaches from undesignated, WWH, or other lower tier aquatic life use to EWH	2,222 field verified EWH miles Source: Ohio WQS (OAC 3745-1, effective 10/9/09) Data range: 1990-2007	3,212 field verified EWH miles, (current as of WQS use designation rulemakings effective 9/18/2017, plus additional field verifications of existing and recommended EWH use in select basins sampled from 2009-2016). Net new miles since 2010 IR baseline: 990 (154 recommended or field verified EWH stream and river reaches) For this cycle, 401 miles (58 recommended or field verified EWH stream or stream reaches) Source: Ohio WQS (OAC 3745-1) and basin TSDs
Maintain adequate monitoring coverage on Ohio's principal and small rivers	Number of sites assessed in 10-year period that have between 20- to 500-square-mile drainage area	1,538 sites Source: 2010 IR Data range: 1999-2008	1,558 sites Source: 2018 IR Data range: 2007-2016

Goal	Statistic to be Tracked	Baseline	Update
Monitoring Load Reduction Progress for Lake Erie and the Ohio River			
Develop and begin to implement a strategy for adequate monitoring coverage to calculate loadings from all significant watersheds to Lake Erie and the Ohio River	Number of sites at or near the mouths of major watersheds that have flow gages and water quality sampling frequently enough to calculate loads with an acceptable degree of certainty (for example, following Northeast-Midwest Institute or GLWQA Annex 4 recommendations)	Nine watersheds currently have flow gages and daily monitoring near the mouth of the watershed: Maumee, Portage, Sandusky, Cuyahoga, Muskingum, Scioto and the Great Miami. Two watersheds may have adequate data now but are funded by short-term grants: Vermillion and Black.	Goal established 2016. Flow gages and nutrient monitoring have been added near the mouth of the Huron River and Grand River.

Section

C

Managing Water Quality

The Ohio General Assembly directs Ohio EPA and other state government departments to manage Ohio's water resources. The U.S. Environmental Protection Agency (U.S. EPA) has also delegated to Ohio EPA the responsibility to administer certain federal programs in Ohio.

The functions of various water quality management programs are explained in this section, along with a description of some funding expenditures for water quality activities in Ohio. Some federal government programs are included. Local government programs and decisions (for example, ordinances, planning and zoning) can have major impacts on water quality, but are not described here.

C1. Program Summary – Surface Water

The goal of Ohio EPA's Division of Surface Water (DSW) is to restore and maintain Ohio's water resources. This goal reflects the national water quality objective as contained in the federal Clean Water Act (CWA), which is "... to restore and maintain the chemical, physical and biological integrity of the Nation's waters"—often referred to as the fishable/swimmable goal. Fishable/swimmable waters are resources that support stable, balanced populations of aquatic organisms that are ecologically healthy and provide safe water to the people of Ohio for public and industrial water supplies and recreation.

DSW has a full-time staff of approximately 200 located in Columbus and the five Ohio EPA district offices. The division also employs approximately 50 interns during the summer to assist with biological and chemical water quality surveys. Funding for the division is comprised of federal monies, environmental protection funds generated through solid waste disposal fees and annual discharge fees.

A watershed-based approach to assessments and delivery of services has been a program management objective within DSW for nearly three decades. In 1990, DSW initiated an organized, sequential approach to monitoring and assessment (the Five-Year Basin Approach) to better coordinate the collection of ambient monitoring data so that information and reports would be available in time to support water quality management activities such as the issuance of National Pollutant Discharge Elimination System (NPDES) permits and periodic revision of the Ohio water quality standards (WQS).

To establish the framework, the state was divided into 25 different areas that were aggregations of subbasins within major river basins. Each of the 25 areas were assigned to one of the five basin years, considering the need to appropriately distribute the monitoring workload among Ohio EPA's five district offices. The initial 1990 workload estimates and resource planning indicated that five years would be needed to complete the cycle of monitoring. However, the monitoring program has never been fully funded to meet those resource needs, and thus the monitoring cycle takes more than 10 years to complete, making it more generally a rotating basin approach rather than a Five-Year Basin Approach.

The rotating basin approach and the core work of the biological and water quality monitoring program have gradually become the division's assessment component within the Total Maximum Daily Load (TMDL) program. Ohio's TMDL program has been designed to be watershed-focused and to promote integration of other ongoing water program elements on a watershed basis.

Biological and Water Quality Surveys

Ohio EPA routinely conducts biological and water quality surveys on a systematic basis throughout the state. A biological and water quality survey is an interdisciplinary monitoring effort coordinated on a reach-specific or watershed scale. Such efforts may involve a relatively simple setting, focusing on one or two small streams, one or two principal stressors and a handful of sampling sites or a much more complex effort including entire drainage basins, multiple and overlapping stressors and tens of sites.

Each year, Ohio EPA conducts surveys in four to six major watersheds in Ohio with an aggregate total of 400 to 450 sampling sites. Biological, chemical and physical habitat monitoring and assessment techniques are employed in surveys to meet four major objectives:

- provide a current and thorough re-assessment of water quality conditions in watersheds that have federally approved TMDLs for pollutants identified as impairing beneficial uses based on data collected during prior surveys;
- determine the extent to which use designations assigned in the Ohio WQS are either attained or not attained;
- determine if use designations assigned to a given water body are appropriate and attainable and recommend designations or changes where needed; and
- determine if any changes in key ambient biological, chemical or physical indicators have taken place over time, particularly before and after the implementation of point source pollution controls or best management practices (BMPs).

The gathered data is processed, evaluated and synthesized in a biological and water quality report. The findings and conclusions of each biological and water quality survey may factor into regulatory actions taken by Ohio EPA and are incorporated into the Ohio WQS (Ohio Administrative Code (OAC) 3745-1), Water Quality Permit Support Documents, State Water Quality Management Plans, the Ohio Nonpoint Source (NPS) Assessment and the aquatic life beneficial use analysis in the Ohio Integrated Water Quality Monitoring and Assessment Report [this report, prepared to meet the requirements of CWA Sections 305(b) and 303(d)] and TMDLs.

More information about DSW's water quality monitoring and assessment program is available at ***epa.ohio.gov/dsw/bioassess/ohstrat.aspx***. An index with links to available biological and water quality reports can be found at ***epa.ohio.gov/dsw/document_index/psdindx.aspx***.

Biosolids

Sewage sludge is the solid, semisolid or liquid residue generated during the treatment of domestic sewage in a treatment facility. When treated and processed for beneficial use, sewage sludge becomes biosolids—nutrient-rich organic materials that can be safely recycled and applied as fertilizer. Only biosolids that meet the standards spelled out in Federal and state rules can be approved for use as a fertilizer. Publicly Owned Treatment Works (POTWs) make the decision whether to recycle the biosolids as a fertilizer, incinerate it or bury it in a landfill.

Ohio EPA received delegation to administer the biosolids program (CWA Section 503 Program) in 2005. In March 2000, the Ohio General Assembly passed House Bill (HB) 197 to provide the statutory authority for the director of Ohio EPA to seek delegation of the program. HB 197 modified the Ohio Revised Code (ORC) to provide the director of Ohio EPA the authority to adopt, enforce, modify and rescind rules necessary to implement the biosolids program. HB 197 also modified the ORC to include an annual sewage sludge fee to fund the program. Each dry ton of sewage sludge treated or disposed in the State of Ohio is assessed a fee, with a cap of $600,000 per year on all monies collected.

Shortly after the passage of HB 197, Ohio EPA began drafting rules that became effective in April 2002, as Ohio's Sewage Sludge Rules: Chapter 3745-40 of the OAC. The purpose of Chapter 3745-40 of the OAC is to "establish standards applicable to the disposal, use, storage, or treatment of sewage sludge or biosolids, which standards are intended to reasonably protect public health and the environment, encourage the beneficial use of biosolids and minimize the creation of nuisance odors." The most recent version of OAC 3745-40 became effective in July 2011.

Funded by annual sludge fees, Ohio EPA hired employees to complete sewage sludge management duties in the field and office. These employees perform compliance evaluation inspections at POTWs that beneficially use biosolids. They review annual data submitted by POTWs to ensure compliance with pollutant limits, monitoring and reporting requirements and perform authorization inspections at proposed land application sites. Field reconnaissance inspections are conducted at land application sites to verify compliance with site restrictions and management practices. These employees also review the NPDES permits that regulate sewage sludge generators.

Ohio EPA also funded college interns through the annual sludge fees to track authorized biosolids application sites. The interns developed a Geographic Information System (GIS) project to add authorized biosolids sites to a digital base map. Each authorized biosolids site receives a unique identification number through the GIS program. The GIS project is useful for managing the numerous land application sites and associated data such as cumulative pollutant loadings rates or proximity to source water protection areas for public drinking water supplies.

Combined Sewer Overflow Control Program

Combined sewers were built to collect sanitary and industrial wastewater, as well as storm water runoff, and transport these combined waters to a wastewater treatment plant (WWTP). During dry weather, they are designed to transport all flow to the WWTP. When it rains, the volume of storm water and wastewater may exceed the capacity of the combined sewers or of the WWTP. When this happens, the combined sewers are designed to allow a portion of the combined wastewater to overflow into the nearest stream, river or lake. This is a combined sewer overflow (CSO). Ohio has approximately 1,138 known CSOs in 89 CSO communities (June 2017), ranging from small, rural villages to large metropolitan areas.

In 1994, U.S. EPA published the national CSO Control Policy. Working from the national policy, Ohio EPA issued its CSO Control Strategy in 1995. The primary goals of Ohio's strategy are to control CSOs so that they do not significantly contribute to violations of water quality standards or the impairment of designated uses and to minimize the total loading of pollutants discharged during wet weather. Ohio's strategy addresses several issues that aren't covered by the national policy (for example, sanitary sewer extensions that occur up pipe of CSOs).

In 2000, Congress passed the Wet Weather Water Quality Act, which did two important things: it codified the 1994 national policy by making it part of the CWA and required that all actions taken to implement CSO controls be consistent with the provisions of the national policy.

Ohio EPA continues to implement CSO controls through provisions included in NPDES permits and using orders and consent agreements when appropriate. The NPDES permits for Ohio's CSO communities require them to implement the nine minimum control measures. Requirements to develop and implement Long-Term Control Plans (LTCPs) are also included where appropriate. In 2007, U.S. EPA adopted a new definition for the Water Safe for Swimming Measure, which sets goals to address the water quality and human health impacts of CSOs. The new definition sets a goal of incorporating an implementation schedule of approved projects into an appropriate enforceable mechanism, including a permit or enforcement order, with specific dates and milestones for 91 percent of the nation's CSO communities by September 2015. As of June 2017, 83 of Ohio's 89 CSO communities met this definition (93 percent), meeting the U.S. EPA's Safe for Swimming Measure goal.

Compliance Program

DSW staff works closely with the regulated community and local health departments to ensure that surface waters of the state are free of pollution. The regulated community with which DSW staff works includes wastewater facilities, both municipal and industrial; and small, unsewered communities experiencing problems with unsanitary conditions.

DSW staff provides technical assistance, conducts inspections of wastewater treatment plants, reviews operation reports, oversees land application of biosolids and manure from certain large concentrated animal feeding operations and investigates complaints regarding malfunctioning wastewater treatment plants and violations of Ohio's Water Quality Standards. DSW strives to ensure that permitted facilities comply with their National Pollutant Discharge Elimination System (NPDES) permits.

Concentrated Animal Feeding Operations

On Dec. 14, 2000, Governor Taft signed a bill that started the process of transferring authority to regulate concentrated animal feeding operations (CAFOs) to the Ohio Department of Agriculture (ODA), which now regulates construction and operation of large concentrated animal feeding facilities under their Permit-to-Install (PTI) and Permit-to-Operate (PTO) programs. However, PTI authority for sewage treatment and disposal systems at animal feeding facilities and for animal feeding facilities that discharge to POTWs remains with Ohio EPA.

Ohio EPA also retains authority for implementing the NPDES permit program for animal feeding operations until the revised delegation agreement with U.S. EPA that has been submitted by Ohio is approved by U.S. EPA. Because of federal rule revisions and court decisions, only facilities that meet the definition of a CAFO and that are discharging or proposing to discharge are required to apply to Ohio EPA for an NPDES permit.

The CAFO program at Ohio EPA uses a watershed perspective to prioritize work to some degree. The changes in the federal rule resulting in CAFO NPDES permits being required only when a facility discharges limits our need and ability to prioritize permitting by watersheds. However, the status of the watershed is considered in making decisions about enforcement and compliance activities (for example, supplemental environmental projects may be preferred over penalties; more technical assistance may be focused on TMDL watersheds).

Credible Data – Citizen Monitoring Program

The program's authorizing legislation was passed and signed by the governor in 2003. Ohio EPA adopted rules in 2006 (OAC Chapter 3745-4) for the program's operation and revised those rules in 2011 and 2018. The legislation and the rules are explicit in the desire to not only encourage the collection of water quality data by citizens, but also to ensure that the data are valid and useful for their intended purpose. In other words, the data should be credible. The rule package bears the name credible data because of this important feature and because the enabling legislation was referred to as the credible data bill. Thus, the words credible data appear in the terminology applied to citizen monitoring programs that choose to participate.

As envisioned by the legislation, any person with an interest in water quality should have a means to collect certain types of data useful for various inquiries about the quality of the water resource. Ohio EPA's role is to foster and broadly oversee the collection, analysis and use of data collected by such volunteer individuals and organizations. To promote scientific validity, Ohio EPA has established specific requirements to participate in the program and to collect data using approved study plans.

The law and the administrative regulations are the basis for establishing three broad categories or levels of data that will be deemed credible for distinctly different purposes. The overall premise is that there must be an increasing level of scientific rigor behind the sampling and analytical work as we progress from Level 1 to Level 2 to Level 3.

Level 1's purpose is primarily to promote public awareness and education about surface waters of the state. Level 1 may be appropriate for educators from soil and water conservation districts (SWCDs), park districts, health departments, schools or anyone with an interest in Ohio water quality.

Level 2 was designed with watershed groups in mind and may also be appropriate for SWCDs and health departments. Level 2 data can be used to evaluate the effectiveness of pollution controls, to conduct initial screening of water quality conditions and to promote public awareness and education about surface waters of the state. Level 2 groups are often in the position to perform the valuable function of monitoring long-term surface water quality trends in a watershed (where Ohio EPA may not have the resources to frequently revisit an area).

Level 3 provides the highest level of scientific rigor, and methods are equivalent to those used by Ohio EPA personnel. The law limits the director to using only Level 3 data collected under the credible data program for certain regulatory applications (for example, setting water quality standards and evaluating attainment of those standards). In other words, data submitted under this program as Level 1 and Level 2 data cannot be used for those regulatory purposes.

As of September 2017, the Agency has approved more than 1,200 qualified data collectors and 200 study plans. Ohio EPA has created a web-based portal for data entry and data access (Credible Data Online Application, ***epa.ohio.gov/dsw/credibledata/submission_of_data.aspx***), available through Ohio EPA's eBusiness Center.

Enforcement Program

Quarterly non-compliance reports are prepared by all delegated states and contain instances of non-compliance; State or Federal enforcement responses to the instances of non-compliance; other actions being taken to address the violations; and current compliance statuses for major dischargers. In cases in which Ohio EPA is unable to resolve continuing water quality violations, DSW may recommend that enforcement action be taken. An enforcement action could be Director's Final Findings and Orders completed within Ohio EPA or a court action through the Attorney General's Office. DSW enforcement staff work with Ohio EPA attorneys, as well as the Attorney General's Office, to resolve these cases. Where possible, an added emphasis and priority is given to actions in sensitive watersheds. All final enforcement orders are posted on the DSW webpage.

Inland Lakes Program

Ohio EPA initiated a renewed monitoring effort for inland lakes in 2008. This report assesses three of the four beneficial uses that apply to inland lakes: recreation; public drinking water supply; and human health (via fish tissue). Ohio EPA plans to update the water quality standards rules for lakes. Once these rule updates are complete, Ohio EPA expects to include an assessment of the aquatic life use for lakes as a factor in listing watershed or large river assessment units in future CWA Section 303(d) lists. More information about Ohio EPA's Inland Lakes Program may be found in Section I of this report.

Isolated Wetlands Permitting

Ohio Revised Code (ORC) 6111 requires anyone who wishes to discharge fill material into an isolated wetland within Ohio, regardless of whether on private or public property, to obtain an Isolated Wetland Permit (IWP) from Ohio EPA. Isolated wetlands are not connected to other surface waters and are not considered waters of the United States by the U.S. Army Corps of Engineers and, therefore, are not subject to CWA Sections 404 and 401.

Ohio EPA's regulatory authority regarding isolated wetlands is provided in ORC 6111.02 through 6111.028. There are three different levels of IWPs, depending on the quality of the wetland and the acreage of wetland proposed for impact. Level one IWPs are considered a general permit and reissued by Ohio EPA every five years. The current level one IWP was issued on April 10, 2017. Applicants must submit a pre-activity notice for authorization under the level one IWP. Level two and level three IWPs are considered individual permits and involve a public notice and comment period.

Level two IWP applications require the submittal of everything required with a level one IWP application along with an analysis of practicable on-site alternatives. Level three IWP applications require the submittal of everything required with a level one IWP application and must undergo a full antidegradation review in accordance with OAC 3745-1-05 (antidegradation) and OAC 3745-1- 54 (wetland antidegradation). Under Ohio's antidegradation review, the director may authorize the lowering of wetland quality resulting from the discharge of dredged or fill material only after determining that the lowering of wetland quality will not result in the violation of state water quality standards. This is achieved through: 1) conducting an alternatives analysis; 2) intergovernmental coordination with other state and federal resource agencies; and 3) a public involvement process. The alternatives analysis is intended to walk applicants through a deliberate procedure to avoid and minimize impacts to wetlands while still achieving the project's purpose and need.

Ohio EPA strongly encourages applicants to engage in pre-application coordination early in the development phase to help identify high-quality resources, discuss potential alternatives and identify mitigation obligations. Applicants must provide compensatory mitigation for any unavoidable impacts to isolated wetlands in accordance with ORC 6111.022 through 6111.023 and 6111.027. Under state law, each IWP application must contain specific items for the permit to be issued. Ohio EPA has 30 days from the date of receipt of a level one IWP to authorize the project under the general permit or require the applicant to apply for an individual IWP. When a level two IWP application is formally considered complete, Ohio EPA has 90 days to either issue or deny the permit. When a level three IWP application is formally considered complete, Ohio EPA has 180 days to either issue or deny the permit.

IWP staff are assigned a region of the state based on Ohio EPA districts. In addition, Ohio EPA has staff dedicated specifically to the review of coal mining and Ohio Department of Transportation (ODOT) projects, as well as the review of wetland mitigation project compliance. Additional staff is dedicated to wetland research in support of the IWP program.

Lake Erie Program

DSW participates in many Lake Erie- and Great Lakes-related issues and efforts. The key program areas are implementation of Remedial Action Plans (RAPs) under the Areas of Concern (AOC) Program and implementation of the binational Lake Erie Lakewide Action and Management Plan (LAMP). Restoration of AOCs and implementation of the Lake Erie LAMP are focused on reducing the loadings of pollutants and restoring all beneficial uses to these waterbodies. Both programs are described in the Great Lakes Water Quality Agreement (GLWQA) between Canada and the United States and are mandated under the Great

Lakes Critical Programs Act amendment to the CWA. The GLWQA was most recently revised in 2012 and the Agency is directly involved in implementing the new goals and requirements contained in the agreement.

Ohio EPA also conducts routine monitoring of Lake Erie (within Ohio's jurisdiction) and is responsible for reporting the Lake's condition and identifying impaired waters under the CWA. Ohio EPA initiated a *Comprehensive Lake Erie Nearshore Monitoring Program* in 2011 with the assistance of a Great Lakes Restoration Initiative (GLRI) grant to develop and implement a comprehensive monitoring program. Ohio's long-term monitoring program includes an assessment of water and sediment quality in the western and central basins at fixed ambient stations located in shoreline (bays) and nearshore areas. Biological monitoring includes tracking of burrowing mayfly[1] populations and calculation of fish index scores at select shoreline locations. The hypoxia/anoxia phenomenon in the Central Basin is also monitored with a series of transects that connect fixed ambient stations to the open waters. Periodic intensive surveys in bays, harbors and estuaries are also done.

This monitoring effort supports Annex 2 in the GLWQA, which calls for development of nearshore monitoring to support an integrated nearshore framework. Annex 4 of the GLWQA addresses nutrients and Ohio EPA's monitoring may also support assessment of the lake ecosystem objectives identified in the agreement. Monitoring will directly support the agency's CWA evaluation of the Lake Erie Assessment Units in the bi-annual Integrated Report (IR). Additionally, long-term monitoring will provide the data needed to evaluate water quality trends, assess the effectiveness of remedial and nutrient reduction programs, measure compliance with jurisdictional regulatory programs, identify emerging problems and support AOC delisting.

Areas of Concern and Remedial Action Plans

AOCs were initially identified in the early 1980s as the most environmentally degraded areas along Ohio's Lake Erie coast. Annex 1 of the GLWQA calls for restoration of beneficial uses that have become impaired due to local conditions at AOCs through development and implementation of RAPs. In many ways, these beneficial use impairments (BUIs) reflect similar goals as Ohio WQS but may have targets that differ slightly. BUIs include: restrictions on fish and wildlife consumption; tainting of fish and wildlife flavor; degradation of fish and wildlife populations; fish tumors or other deformities; bird or animal deformities or reproductive problems; degradation of benthos; restrictions on dredging; eutrophication or undesirable algae; restrictions on drinking water or taste and odor problems; beach closings; degradation of aesthetics; added costs to agriculture and industry; degradation of phytoplankton and zooplankton populations; and loss of fish and wildlife habitat.

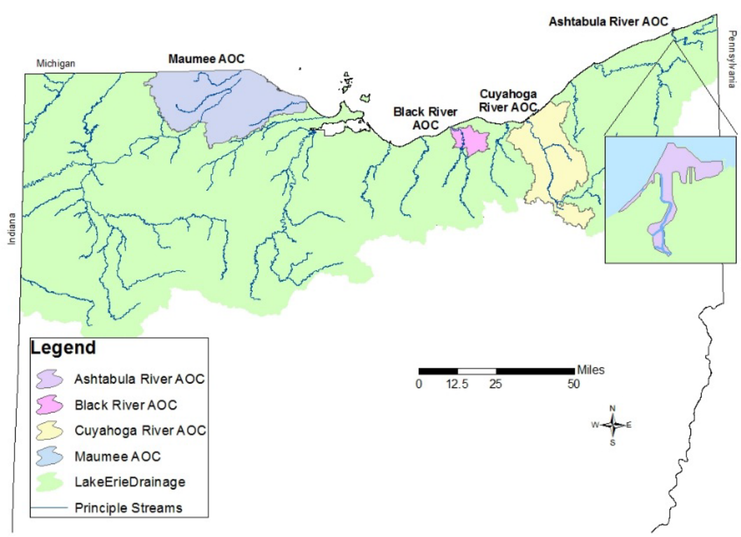


Figure C-1 — Ohio Lake Erie AOCs and major Lake Erie tributaries.

[1] As an indicator organism, the status of mayfly populations can be used to evaluate long-term changes in water and sediment quality (Krieger et al, 2004).

One way to track progress in AOCs is to measure how close the areas are to achieving restoration (delisting) targets. Restoration targets have been determined for each of the beneficial uses (aquatic life, human health, recreation and public drinking water supply) and the monitoring programs needed to evaluate the targets are now being designed and implemented. In 2014, Ohio EPA developed a new AOC program framework and updated the *Delisting Guidance and Restoration Targets for Ohio Areas of Concern*. The new framework and guidance provide clarity for how the state and local AOC advisory committees will work together to implement the needed management actions and remove BUIs and delist the AOC. The guidance also assists in tracking progress toward achieving the stated delisting goals under the Great Lakes Regional Collaboration (GLRC) and the associated Great Lakes Initiative Action Plan.

Ashtabula AOC

A series of successful dredging projects in 2006-2007 and 2012-2013 under the Great Lakes Legacy Act (GLLA) program, the GLRI and other recent dredging by the U.S. Army Corps of Engineers (Corps) were conducted to remediate contaminated sediments that was necessary to remove the BUIs for dredging; degradation of benthos; fish tumors; and fish consumption restrictions.

To address the fish population and habitat-related BUIs, Ohio EPA completed a large habitat restoration project on the 5 ½ Slip in 2012; and a sediment and restoration GLLA project in 2014 in the North Slip at Jacks Marine. In 2014, a significant milestone was reached with the completion of all management actions. The river is rapidly rebounding and in April 2014, the BUIs for fish consumption, fish and wildlife populations, and fish and wildlife habitats were formally removed.

There are now only three BUIs remaining in this AOC. Verification monitoring is needed to assess the effects of remediation and restoration activities including evaluation of the benthos community; fish tumors and other deformities; and characterization of current sediment quality. Once monitoring indicates that the river has responded as anticipated and restoration targets have been achieved, the Ashtabula River will be delisted as an AOC.

Black AOC

Two BUIs, fish consumption and eutrophication or undesirable algae, were recently removed, leaving seven BUIs, with one - fish tumors - listed as in recovery. U.S. EPA funded development of the *Lower Black River Ecological Restoration Master Plan* in 2009 and numerous restoration projects and characterization studies identified in the plan have been completed. In July 2015, the AOC was formally re-sized to include just the lower portions of the Black River mainstem watershed and the French Creek watershed (East and West Branches are now excluded). In July 2015, U.S. EPA also accepted a list from Ohio EPA and the local advisory committee identifying the remaining management actions. Ohio EPA is working with U.S. EPA, the Black River AOC Advisory Committee and local implementers to complete the remaining projects. Progress in this AOC is accelerating. The management actions are scheduled for completion in 2018-2019 and the local AOC Advisory Committee and partners are committed and energized to remove the remaining BUIs at that time.

Cuyahoga AOC

There are nine BUIs in the Cuyahoga River AOC (plus one locally derived one - public access). The local (public access) BUI was removed in December 2017, along with the degradation of aesthetics BUI. In 2016-2017, Ohio EPA worked with the Advisory Committee to develop a management action report from which a list will be developed. The entire mainstem is achieving delisting targets for biological populations except in the Rt. 82/Brecksville Dam pool, the Gorge Dam pool and in the navigation channel. Addressing the contaminated sediments is a top priority and a significant number of actions are currently underway. The ecological assessment for the Brecksville Dam removal project has been drafted, reviewed and public noticed. It is anticipated that the bid process may be in 2018 with demolition of the dam in 2019. The Gorge Dam removal planning process is proceeding with project agreements being drafted for sediment management.

Maumee AOC

The Maumee AOC is Ohio's largest and most complex AOC. Contaminated sediments, nonpoint sources, nutrient loads and habitat loss are all major causes of Beneficial Use Impairments. The Maumee River watershed is also a significant contributor to water quality concerns in the western basin of Lake Erie. The western basin is a priority concern under Annex 4 and the Lake Erie LAMP. An important milestone was reached in September 2015 with the removal of the first BUI (BUI12 – added costs to agriculture and industry). There are nine BUIs remaining. A GLLA sediment remediation project has been completed and Natural Resource Damage Assessment is nearly settled on the Ottawa River and other GLLA work on the mainstem Maumee and Otter Creeks are continuing. These sediment assessments, along with Ohio EPA's stream assessments, are vital in helping Ohio EPA and the local advisory committee determine restoration needs and priority management actions. With the reorganization of the AOC advisory committee a few years ago, along with the revitalized sense of purpose and focus on management action project identification, the Maumee AOC is making progress toward removing BUIs more quickly than previously expected.

Lake Erie Lakewide Action and Management Plan (LAMP, formerly LaMP)

Annex 2 of the GLWQA addresses binational lakewide management and specifies that the LAMPs for each of the Great Lakes shall document and coordinate the management actions required in the Annex. Specifically, Annex 2 calls for the following:

- establish lake ecosystem objectives;
- assemble, assess and report on existing scientific information;
- identify research, monitoring and other priorities to support management actions;
- conduct surveys, inventories and studies and support outreach efforts;
- identify additional action needed to address priority water quality threats;
- develop and implement lake-specific binational strategies; and
- by 2015, develop an integrated near shore framework for implementation.

The Lake Erie LAMP also serves as the primary mechanism for coordinating development and implementation of lakewide habitat, native species protection and conservation strategies as required in Annex 7 (Habitat and Species) of the GLWQA. The Lake Erie LAMP was originally intended to focus on reducing loadings of toxic chemical pollutants to the lake but now also includes strategies for addressing NPS pollutants such as nutrients and habitat alterations. The LAMP is a comprehensive framework that outlines the management actions needed to bring Lake Erie back to chemical, physical and biological integrity. Work to restore the AOCs and implement the LAMP program both support the U.S. EPA Strategic Plan objective 2.2 – Protect and Restore Watershed and Aquatic Ecosystems.

NPS and beach health issues listed in the GLRC and the GLRI plans are important issues for both the AOCs and the Lake Erie LAMP. Programs such as the CWA Section 319, the Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000, CSO Long-term Control Plans, NRCS-supported agricultural BMP programs and many others are existing efforts that RAP and LAMP partners must coordinate with to expedite restoration. Since January 2014, Ohio EPA's Lake Erie program has been managed alongside the NPS program, which has strengthened coordination between the two programs.

For both the AOCs and the LAMP, it is important to maintain the engagement of local communities and stakeholders. In Ohio's AOCs, the local communities and partners play significant roles in obtaining the resources for implementation, providing matching funds and sometimes serving as local project sponsors. A reliable, long-term source of funding is essential to continue to fund the administration and outreach costs associated with local coordinator leadership efforts. Public outreach efforts are also needed to better connect the decisions and projects in the watersheds to the environmental condition of the lake.

National Pollutant Discharge Elimination System (NPDES) Permits

To protect Ohio's water resources, Ohio EPA issues NPDES permits. These permits authorize the discharge of substances and establish other conditions related to activities such as CSOs, pretreatment, storm water and sludge disposal. This is an overview of the process for the development of individual NPDES permits.

Limit Types

The Clean Water Act has provisions for technical based effluent limits (TBELs) and water quality based effluent limits (WQBELs). When deriving an NPDES permit, the writer will compare applicable TBELs and WQBELs and apply the most stringent limit. Additionally, when the receiving stream has an approved final TMDL in place, the permit writer will incorporate the TMDL requirements.

Technical Based Effluent Limits

U.S. EPA issues effluent guidelines which are national standards for industrial discharges to surface waters and sewage treatment plants. The standards are based on the performance of treatment and control technologies and are linked to production amount or size. Therefore, permit writers only need the production amount or size to develop TBELs.

For example, a company which pours 1,000 tons of steel will have more allowable loading discharged than a company which pours one ton of steel. At the same time, the same TBEL will be applied whether you discharge to a large river like Ohio River or a small creek.

Water Quality Based Effluent Limits

Ohio rules require NPDES permits to be protective of the receiving stream uses, including public water supply, industrial, agricultural, aquatic life, human health and recreational. To develop limits to protect these uses, the first step is determining:

- Discharge Information
  - Concentrations of pollutants
  - Proposed flows
- Receiving Stream Information
  - In-stream chemistry data
  - Low-flow conditions
  - Applicable uses

The permit writer does a mass balance to determine the allowable discharge amounts which will be protective of the water quality criteria.

Total Maximum Daily Load

Receiving streams which are impaired may result in a TMDL for a certain pollutant, such as phosphorus. In these cases, point sources are allocated an amount (or load) of pollutant which will result in the stream fully obtaining its designated uses. The permit writer will use the TMDL as a technical document to justify permit limits.

NPDES Permit Implementation

NPDES permits are issued for a period of five years. Ohio EPA may re-open NPDES permits if the discharge is having adverse effects on human health or the environment. If not, the permit writer will reassess permit limits when the permittee submits the renewal application.

The keystone of the NPDES program is self-monitoring data provided by the permittee. The permittee monitors and submits effluent data throughout the duration of the permit. If limits are exceeded, the permittee is required to provide notice to Ohio EPA, state what caused the exceedance and what will be done to prevent future exceedances.

Ohio EPA can also perform sampling of the effluent, typically as part of a permit renewal or as part of a larger survey on the receiving stream watershed. A stream survey would also determine any potential biological impacts of the NPDES permit discharge. This sampling information is used to further evaluate the impacts the discharge may be having on the receiving stream and to justify any additional permit limits or conditions needed to eliminate adverse impacts.

Nonpoint Source (NPS) Program

The framework for Ohio's NPS program is provided in Ohio's Nonpoint Source Management Plan (NSMP). The updated NSMP, which outlines strategies and objectives for Ohio's NPS program through 2019 was approved by U.S. EPA Region V in 2015. The updated plan includes a description of Ohio's NPS Section 319(h) grant funding sources as well as a listing of state, federal and local partners who Ohio EPA wishes to implement the strategies outlined in the updated plan.

The NSMP plan provides four sections outlining the strategic vision along with aggressive (yet reasonable) goals and objectives of Ohio's NPS program over the next five years. These sections include:

- Urban Sediment and Nutrient Reduction Strategies—including recommended practices;
- Altered Stream and Habitat Restoration Strategies—including recommended practices;
- NPS Reduction Strategies—including practices and management actions to reduce silt, sediment and nutrient losses from agricultural lands; and
- High Quality Waters Protection Strategies.

Ohio's NPS program also manages DSW's Lake Erie AOC program. This program tracks implementation of remedial action plans on Lake Erie tributaries designated as Areas of Concern, supports Lake Erie shoreline monitoring and participates in the development and implementation of the LAMP, a document that outlines and helps coordinate management actions to protect and restore Lake Erie. More information about these programs is available in the Lake Erie program description above. The updated NSMP includes five-year goals and objectives for Ohio's Lake Erie program. The most current version of Ohio's NSMP is available at ***epa.ohio.gov/Portals/35/nps/NPS_Mgmt_Plan.pdf***.

Much of Ohio's population is in urban areas and many are located near major rivers that are impacted by hydromodification, riparian corridor losses and inputs from storm sewers. Ohio's NPS program is committed to partner with local communities, to provide leadership and funding and to use a well-defined hierarchy that prioritizes projects, so that high-magnitude causes of impairment are eliminated and impaired stream segments in urban areas are incrementally restored.

Progress toward achievement of Ohio's Section 319(h) grants program goals will continue to be measured as part of Ohio's NPS monitoring and assessment initiative. Ohio EPA staff conducts all monitoring (physical, chemical and biological) to determine the effectiveness of Section 319(h)-funded NPS projects. This initiative provides cost savings and improved data quality as well as critical information about 319(h) project effectiveness.

Pretreatment

The State of Ohio received authorization to administer the pretreatment program on July 27, 1983. As of August 2017, Ohio EPA has approved 128 municipal pretreatment programs and continues to provide pretreatment training and guidance. These pretreatment programs have the authority to issue permits to indirect industrial dischargers and enforce their own local regulations. Many of these programs, such as Cincinnati's Metropolitan Sewer District and Cleveland's Northeast Ohio Regional Sewer District, are national leaders and are regarded as very strong pretreatment programs.

In addition, Ohio EPA's pretreatment program issues permits through its indirect discharge permit (IDP) program. The IDP program permits, monitors, inspects and provides enforcement to the significant industrial users (SIUs) that discharge into pretreatment POTWs which do not have approved pretreatment programs. Through the IDP program, Ohio EPA prevents toxic discharges to these smaller POTWs and thereby reduces the potential for severe environmental harm.

A goal of Ohio EPA's pretreatment program is to permit 100 percent of SIUs with control mechanisms to implement applicable pretreatment standards and requirements. Ohio EPA's permit framework is designed to ensure that all SIUs within the state, regardless of the POTW's pretreatment program approval status, are issued permits. Those SIUs in approved POTW pretreatment programs are identified by industrial user surveys. SIUs discharging to a POTW without an approved program are identified primarily through inspections, permits to install and referrals from wastewater treatment plant operators. As of August 2017, there are 1,355 SIUs that discharge to POTWs with approved programs and 158 SIUs that discharge into pretreatment POTWs without approved pretreatment programs. For more information, please visit Ohio EPA's pretreatment program webpage at ***epa.ohio.gov/dsw/pretreatment/index.aspx***.

Section 208 Plans and State Water Quality Management Plan

Ohio EPA oversees the State Water Quality Management (WQM) plan. The State WQM plan is a requirement of CWA Section 303 and must include nine discrete elements:

1) TMDLs;
2) Effluent limits;
3) Municipal and industrial waste treatment;
4) NPS management and control;
5) Management agencies;
6) Implementation measures;
7) Dredge and fill program;
8) Basin plans; and
9) Ground water.

The State WQM plan is an encyclopedia of information used to plot and direct actions that abate pollution and preserve clean water. A wide variety of issues are addressed and framed within the context of applicable laws and regulations. For some issues and locales, information about local communities may be covered in the plan. Other issues are covered only at a statewide level. Many of the topics or issues overlap with planning requirements of CWA Section 208 (items 3-9 above). The state WQM plan includes, through references to separate documents, all 208 plans in the State.

Local governments typically conduct planning to meet the sewage disposal needs of the community. Ohio EPA has established guidelines for planning that are useful in the context of Section 208 and the State WQM plan. Local governments that follow these guidelines are more likely to have the results of their planning work incorporated into the state 208 plan prepared by Ohio EPA.

Under Section 208 of the federal CWA, states may designate regional planning agencies to prepare, maintain and implement water quality management plans. Ohio has six areawide planning agencies that have established their own operating protocols, committees and processes to involve local governments in shaping their 208 plans. All six areawide planning agencies updated their 208 plans in 2011, thanks to increased funding through the American Recovery and Reinvestment Act of 2009 (ARRA) and the state's biennium budget. Additional updates occur on an ongoing basis. The most recent 208 Plan amendments were approved by U.S. EPA on April 8, 2016.

Section 401 Water Quality Certifications

The CWA requires anyone who wishes to discharge dredged or fill material into the waters of the United States, regardless of whether on private or public property, to obtain a CWA Section 404 permit from the U.S. Army Corps of Engineers and a CWA Section 401 water quality certification (WQC) from the state. Ohio EPA is responsible for administering the CWA Section 401 WQC process in Ohio.

Rules governing the 401 review process are currently found in OAC 3745-1-05 (stream antidegradation), 3745-1-50 through 54 (wetland water quality standards) and 3745-32-01 through 03 (Section 401 WQCs). Under Ohio's antidegradation review, the director may authorize the lowering of water quality resulting from the discharge of dredged or fill material only after determining that the lowering of water quality will not result in the violation of state water quality standards. This is achieved through: 1) conducting an alternatives analysis; 2) intergovernmental coordination with other state and federal resource agencies; and 3) a public involvement process.

Applicants must develop alternatives for each development in accordance with 40 C.F.R. Part 230. The alternatives analysis is intended to walk applicants through a deliberate process to avoid and minimize impacts to aquatic resources while still achieving the project's purpose and need. Applicants must provide compensatory mitigation for any unavoidable impacts to streams and/or wetlands. The program emphasizes evaluation of physical habitat and biocriteria to determine potential impacts to water quality and to evaluate potential mitigation sites.

Ohio EPA strongly encourages applicants to engage in pre-application coordination early in the development phase to help identify high quality resources, discuss potential alternatives and identify mitigation obligations. Under state law, the 401 application must contain 10 specific items for the technical review to begin. When the application is formally considered complete, Ohio EPA has 180 days to conduct its technical review and either approve or deny the project. During this time, the applicant may withdraw the application. All projects are subject to minimum 30-day public comment period. Controversial projects may also require a public hearing.

Nationwide permits (NWPs) are general permits issued by the Corps for certain types of projects that are similar in nature and cause minimal degradation to surface waters of the state. There are currently 52 NWPs. Ohio EPA certified many of the NWPs on March 17, 2017 (subject to conditions). The NWPs must be renewed every five years.

401 staff are assigned a specific region of the state based on Ohio EPA districts. In addition, Ohio EPA has staff dedicated specifically to the review of coal mining and Ohio Department of Transportation (ODOT) projects, as well as the review of stream and wetland mitigation project compliance. Additional staff is dedicated to wetland research in support of the 401 WQC program.

Semi-Public Disposal System Inspection Contracts (HB 110)

Annually, Ohio EPA issues hundreds of permits for the installation and operation of small, commercial/industrial wastewater treatment and/or disposal systems. These may be onsite soil dissipation systems or discharging systems under the NPDES permit program for the treatment and disposal of sewage generated within the operation. To date, there are thousands of these small systems operating in Ohio. These semi-public systems may include apartment complexes, small businesses, industrial parks, etc. and, by definition, are any system that treats sewage from human activities up to a capacity of 25,000 gallons per day. Because of the magnitude and resources available, many of these systems have the potential of going without regular inspections to determine if they are complying with state rules, laws and regulations and ultimately protecting water quality.

As an aid to support this program, the Ohio General Assembly created Ohio EPA's HB110 program. The program is a contractual partnership between local health districts (LHDs) and Ohio EPA, whereby LHDs conduct, on behalf of the Agency, inspection and enforcement services for commercial sanitary waste treatment/disposal systems discharging up to 25,000 gallons per day (semi-publics).

Ohio EPA operates the HB110 program to better protect the public health and welfare and to protect the environment. Ohio EPA believes that because of the proximity, multitude of facilities and the availability of resources, oversight of operations for sanitary waste disposal at semi-publics may best be accomplished locally by qualified personnel. To offset costs of local oversight, state law (ORC 3709.085) authorizes LHDs to charge fees for inspection services to be paid by semi-publics.

Inspection Program

In accordance with Ohio EPA's HB110 contracts, LHDs regularly inspect sanitary facilities at semi-publics for compliance with Ohio's water pollution control laws and regulations. Investigations of complaints regarding waste disposal by semi-publics are also accomplished locally. LHDs are consulted prior to Ohio EPA approval of plans and issuance of PTIs for semi-publics. Installation inspections may be performed locally to ensure compliance with Ohio EPA's PTI conditions.

Enforcement Activities

In coordination with Ohio EPA, LHDs may notify entities of noncompliance with Ohio's water pollution control regulations. LHDs are also instrumental in identifying semi-publics installed without PTIs, of which Ohio EPA may not be aware. Where noncompliance notification and informal requests fail to correct violations, entities may be referred to Ohio EPA for enforcement or the county prosecutor may bring an action under local nuisance ordinances. All discharges of pollutants in a location where they cause pollution to waters of the state that are unpermitted or above permitted amounts are statutory nuisances under Revised Code 6111.04.

Training Program

Ohio EPA intends to provide periodic training for LHDs. Training programs will focus on sanitary waste disposal for semi-public facilities, technical assistance, inspection issues and enforcement case development.

Summary

The HB110 program is a unique opportunity for Ohio EPA and LHDs to assist one another in achieving the mutual goal of protecting public health and welfare. Through responsible regulation of semi-public facilities, the local community will benefit from decreased health risks and the state will benefit from improvements in water quality. Ohio EPA welcomes the participation of all LHDs.

Storm Water Permit Program

Ohio EPA implements the federal regulations for storm water dischargers. Dischargers currently covered include certain municipalities (Phases I and II of the program) with separate storm sewer systems (MS4s) and those facilities that meet the definition of industrial activity in the federal regulations, including construction.

In 1992, Ohio EPA issued two NPDES general storm water permits: one for construction activity and the other for all remaining categories of industrial activity. The strategy was to permit the majority of storm water dischargers with these baseline general permits (33 USC Section 1342; OAC Chapter 3745-38). It is estimated that more than 42,000 storm water discharges have been granted general permit coverage since that time.

The industrial permit has been renewed five times. The construction permit was renewed in April 2013 for the third time and addresses large and small constructions sites. The one-page application form is called a Notice of Intent (NOI). Ohio EPA responds to NOIs with approval letters for coverage under one of the general permits or, in limited instances, instructions to apply for an individual permit.

After the baseline general permits were issued, Ohio EPA directed its efforts toward additional permitting, compliance and enforcement activities, education and technical assistance. Inspections and complaint investigations for compliance and enforcement have been handled at the district level as resources allow. BMPs and pollution prevention have been the major thrust of education and technical assistance activities.

On the municipal side of permitting, five large and medium municipalities in Ohio submitted applications between November 1991 and November 1993. A work group was formed with the cities to draft acceptable permit language for the municipal permits. BMPs included in a citywide storm water management plan were the primary focus of the permits. The cities of Dayton, Toledo and Akron received their original permits in 1997. Exceptions for Cleveland and Cincinnati were also processed[2]. Columbus received its initial permit in 2000. Permits for Columbus, Toledo and Akron have been renewed twice. Dayton's permit has been renewed three times.

Additional categories of discharges, both public and privately owned, were included in Phase II. U.S. EPA issued Phase II regulations in December 1999. The Phase II storm water regulations required a general permit for small MS4s be issued by December 2002 and required applications by March 2003.

[2] Phase I federal storm water regulations required permit coverage for municipal separate storm sewer systems (MS4s), which had an MS4 service population of 100,000 or more to obtain NPDES permits. The cities of Cleveland and Cincinnati demonstrated that their MS4 service population was less than 100,000 people because of large areas of these cities being served by combined sewers. These two cities were permitted under Phase II of the small MS4 general permit in March 2003. Cleveland and Cincinnati currently have coverage under the third-generation small MS4 general permit.

Ohio EPA issued two general permits for small MS4s during 2002. One is a baseline permit and the second is for MS4s in rapidly developing watersheds. This latter permit accelerated construction and post-construction measures to protect surface waters from the impacts of high-density land use development. Federal regulations allowed small MS4s to apply for individual NPDES permits in lieu of general permit coverage. No small MS4 within Ohio chose the individual permit option. The third generation of the small MS4 general permit was renewed on Sept. 11, 2014.

On the construction side of permitting, Ohio EPA has begun to develop and issue watershed-specific construction permits if recommended by a TMDL. On Sept. 12, 2006, Ohio EPA issued a watershed-specific construction permit for the Big Darby Creek watershed. This permit was renewed on Oct. 1, 2012. On Jan. 23, 2009, Ohio EPA issued a watershed-specific construction permit for portions of the Olentangy River watershed. This permit was renewed on June 2, 2014. These permits contain conditions/requirements that differ from the standard construction permit and each other. Ohio EPA anticipates developing additional watershed specific permits when recommended by TMDLs.

Total Maximum Daily Load (TMDL) Program

The TMDL program identifies and restores polluted waters. TMDLs can be viewed simply as problem solving: investigate the problem; decide on a solution; implement the solution; and check back to make sure the solution worked. By integrating programs and aligning resources, Ohio is pursuing TMDLs as a powerful tool to develop watershed-specific prescriptions to improve impaired waters.

Ohio uses three key enhancements to the basic federal TMDL requirements to increase the chances that real, measurable improvements in Ohio's water resources will result:

1) an initial, in-depth watershed assessment to obtain recent data for analysis of problems and discussion of alternatives;
2) implementation actions identified as part of the TMDL with follow-through in permitting and incentive programs such as 319 and loan funds; and
3) involving others – citizens, landowners, officials, natural resource professionals – in the process.

Involving others is critical to restoring waters. Working watershed by watershed, Ohio EPA meets with citizens and landowners to explain the findings of our water quality studies and to identify workable solutions to the problems found. Ohio EPA includes other agencies that can improve water resources either by exercising their authority in new ways or through relationships they have already established with critical decision makers. After solutions are identified and recommendations are made, Ohio EPA meets with consultants, elected officials and others to ensure that projects continue to completion.

Recent Developments in the TMDL Program

On March 24, 2015, the Supreme Court of Ohio determined that "A TMDL established by Ohio EPA pursuant to the Clean Water Act is a rule that is subject to the requirements of R.C. Chapter 119, the Ohio Administrative Procedure Act. Ohio EPA must follow the rulemaking procedure in R.C. Chapter 119 before submitting a TMDL to U.S. EPA for its approval and before the TMDL may be implemented in an NPDES permit." (*Fairfield Cty. Bd. of Commrs. v. Nally,* 143 Ohio St.3d 93, 2015-Ohio-991 available online at ***supremecourt.ohio.gov/rod/docs/pdf/0/2015/2015-Ohio-991.pdf***).

Subsequently, Ohio EPA collaborated with stakeholders and the Ohio General Assembly which passed legislation exempting TMDLs from the ORC Chapter 119 rulemaking procedure. The statute was revised effective Sept. 29, 2017, and includes the following: 1) reinstates previously approved TMDLs; 2) requires stakeholder outreach at several points in the project; 3) mandates consideration of several technical and financial items; 4) affirms that TMDLs are not actions of the director and challenges are made through the NPDES permit appeal process; and 4) requires Ohio EPA to adopt administrative rules for stakeholder notification and significant public interest by December 2018. Ohio EPA is in the process of drafting rule language and prioritizing and updating projects to incorporate the new requirements where needed.

All TMDLs are available on Ohio EPA's website at ***epa.ohio.gov/dsw/tmdl/index.aspx***.

Water Quality Standards (WQS) Program

Many different sources and types of pollution affect Ohio's water quality. The CWA states that authorized states and tribes must adopt water quality standards that protect public health or welfare; enhance water quality; and provide for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water. Water quality standards contain three elements to ensure the goals of the CWA are met: designated uses; numerical or narrative criteria designed to protect and measure attainment of the use designation; and antidegradation policy.

The key components of Ohio's WQS (OAC Chapter 3745-1) are described below.

Beneficial use designations describe existing or potential uses of water bodies. They take into consideration the use and value of water for public water supplies, protection and propagation of aquatic life, recreation in and on the water, agricultural, industrial and other purposes. Ohio EPA assigns beneficial use designations to water bodies in the state. There may be more than one use designation assigned to a water body. Examples of beneficial use designations include: public water supply; primary contact recreation; and aquatic life uses (warmwater habitat, exceptional warmwater habitat, coldwater habitat.).

Numeric criteria are concentrations of specific chemicals or levels of parameters in water that protect aquatic life and human health. Numeric criteria are based on sound scientific rationale and must contain sufficient parameters to be protective of designated uses. Numeric criteria are developed to protect human health and both acute and chronic toxicity for aquatic life and form the basis of discharge permit (NPDES) limits.

Narrative criteria are general water quality criteria that apply to all surface waters. These criteria state that all waters shall be free from sludge, floating debris, oil and scum, color and odor producing materials, substances that are harmful to human, animal or aquatic life, public health nuisances associated with raw or poorly treated sewage and nutrients in concentrations that may cause algal blooms. Narrative criteria also state that discharges from human activity must be free from substances in concentrations that are toxic or rapidly lethal in the mixing zone.

Biological criteria are based on aquatic community characteristics and provide a direct measure of attainment of aquatic life uses. The principal biological evaluation tools used by Ohio EPA are the index of biotic integrity (IBI), the modified index of well-being (MIwb) and the invertebrate community index (ICI). These three indices are based on species richness, trophic composition, diversity, presence of pollution-tolerant individuals or species, abundance of biomass and the presence of diseased or abnormal organisms. The IBI and the MIwb apply to fish. The ICI applies to macroinvertebrates. Ohio EPA uses the results of sampling reference sites to set minimum criteria index scores for use designations in water quality standards. During biological assessments, depression of indices can be used to identify causes for impairment of designated uses.

Antidegradation policy aims to keep clean waters cleaner than the applicable chemical criteria set by the standards wherever possible. The policy is adopted in rule (OAC 3745-1-05) and describes the conditions under which lowering water quality may be authorized under a discharge permit from Ohio EPA. Existing beneficial uses must be maintained and protected. Water quality better than that needed to protect existing beneficial uses must be maintained unless lower quality is deemed necessary to allow important economic or social development (existing beneficial uses must still be protected).

Public participation is mandated and encouraged in all administrative rule makings, including the WQS. Any interested individuals are afforded an opportunity to participate in the process of developing water quality standards. Ohio EPA reviews and, as appropriate, revises water quality standards at least once every three years. When water quality standards revisions are proposed, the public is notified of these revisions. A public hearing is held to gather input and comments.

Wetland Bioassessment Program

Numerous grants from U.S. EPA over many years have funded work that is advancing the science of wetland assessment methodologies in Ohio. Published work includes an amphibian index of biotic integrity (AmphIBI) for wetlands, a vegetation index of biotic integrity (VIBI) for wetlands and a comparison of natural and mitigation (constructed) wetlands. More recently, reports on an assessment analysis of the association between streams and wetland condition and functions in the Big Run Scioto River watershed, incorporating wetland information with data from other surface water resources to develop a TMDL analysis of a central Ohio watershed and the development of a GIS tool to identify potential vernal pool habitat restoration areas have been made available on DSW's webpage (***epa.ohio.gov/dsw/401/ecology.aspx***).

DSW recently finalized a report from a U.S. EPA grant to assess the ecological condition of 50 randomly selected natural wetlands across Ohio to generate a scorecard of wetland condition. This grant intensifies data collected as part of U.S. EPA's National Wetland Condition Assessment conducted across the United States in 2011. Also in progress is a detailed study to improve mitigation success in Ohio, which will include: a publicly-accessible GIS website for selecting sites with a high likelihood of achieving ecological success; the creation of a simple soil health assessment tool to better identify sites that may require remediation due to historical soil disturbances; and a survey of reference condition riparian habitats to develop specific ecological performance goals for riparian vegetation restoration projects.

DSW has also recently streamlined its VIBI procedure to simplify data collection, analysis and interpretation, with the goal of enhancing the utility of this assessment as a monitoring tool for wetland restoration projects. The modified procedure, called the VIBI-Floristic Quality (VIBI-FQ), is beginning to be used to monitor compensatory mitigation, 319 grants and contaminated clean-up sites, which have required the establishment of wetland habitat. The initial results have been extremely encouraging. Additionally, DSW has conducted VIBI-FQ monitoring on 10 reference condition riparian forests and in 2018 will begin using the VIBI-FQ to monitor non-wetland riparian habitats associated with stream restoration projects. DSW will use this riparian vegetation data to establish consistent performance standards for stream mitigation and restoration projects.

Wetland Protection Program

Ohio's Wetland Water Quality Standards (OAC 3745-1-50 to -54) contain definitions, beneficial use designations, narrative criteria and antidegradation provisions that guide Ohio EPA's review of projects in which applicants are seeking authorization to discharge dredged or fill material into wetlands. OAC 3745-1-53 gives all wetlands the wetland designated beneficial aquatic life use. However, wetlands are further defined as Category 1, 2 or 3 based on the wetland's relative functions and values, sensitivity to disturbance, rarity and potential to be adequately compensated for by wetland mitigation.

Category 1, 2 and 3 wetlands demonstrate minimal, moderate and superior wetland functions, respectively. Category 1 wetlands are typified by: low species diversity; a predominance of non-native species; no significant habitat or wildlife use; and limited potential to achieve beneficial wetland functions. Category 2 wetlands may be typified by: wetlands dominated by native species but generally without the presence of, or habitat for, rare, threatened or endangered species; as well as wetlands that are degraded but have a reasonable potential for reestablishing lost wetland functions. Category 3 wetlands typically possess: high levels of diversity; a high proportion of native species; high functional values; and may contain the presence of, or habitat for rare, threatened and endangered species. Wetlands that are scarce, either regionally or statewide, form a subcategory of Category 3 wetlands for which, when allowable, only short-term disturbances may be authorized.

The rigor of the antidegradation review conducted under OAC 3745-1-50 through -54 is based on the category of the wetland(s) proposed to be impacted. Category 1 wetlands are classified as limited quality waters and may be impacted after examining avoidance and minimization measures and determining that no significant impacts to water quality will result from the impacts. Category 2 and 3 wetlands are classified as general high-quality waters and may be impacted only after a formal examination of alternatives and a determination that the lowering of water quality is necessary to accommodate social and economic development. In addition, an applicant must demonstrate that public need is achieved to receive authorization to impact Category 3 wetlands. Compensatory mitigation ratios are based on wetland category, vegetation class and proximity of the mitigation to the impact site.

C2. Program Summary – Environmental and Financial Assistance

The Division of Environmental and Financial Assistance (DEFA) includes the Office of Financial Assistance (OFA), which promotes water quality benefits by financing cost-effective and environmentally sound wastewater and drinking water infrastructure improvements and other water resource projects. OFA works in conjunction with the Ohio Water Development Authority (OWDA) to administer two state revolving loan funds (SRFs) — the Ohio Water Pollution Control Loan Fund (WPCLF) and the Water Supply Revolving Loan Account (WSRLA). More information about the specific financial assistance provided by OFA and OWDA during this report cycle can be found in Section C6: Funding Sources for Pollution Controls.

Water Pollution Control Loan Fund

Projects eligible for financing under the WPCLF include municipal wastewater treatment improvements (for example, sewage treatment facilities, interceptor sewers, sewage collection systems and storm sewer separation projects) and nonpoint pollution control projects. This state revolving fund, jointly administered by Ohio EPA and OWDA, was established in 1989 to replace the construction grants program. Construction loans from the WPCLF are available at several interest rates: a standard rate, which is below market rates; a small community interest rate, which is below the standard interest rate; and one percent and zero percent interest rate loans for hardship communities. Principle forgiveness is also available for communities that are of the greatest financial need. Planning and design loans are available at a short-term interest rate.

Eligible activities include:

- improvements to and/or expansions of wastewater treatment facilities;
- improvement or replacement of on-lot wastewater treatment systems;
- brownfield/contaminated site remediation;
- agricultural runoff control and BMPs;
- urban storm water runoff;
- septage receiving facilities;
- landfill closure;
- septic system improvement;
- development of BMPs; and
- forestry BMPs.

More information about the WPCLF can be found at ***epa.ohio.gov/defa/ofa.aspx***.

Water Resource Restoration Sponsor Program (WRRSP)

A satellite program of the WPCLF is the Water Resource Restoration Sponsor Program (WRRSP). The WRRSP was developed by Ohio EPA and has been a part of the WPCLF since 2000. The intent of the WRRSP is to address a limited and under-assisted category of water resource needs in Ohio through direct WPCLF loans. The goal of the WRRSP is to counter the loss of ecological function and biological diversity that jeopardize the health of Ohio's water resources. The program achieves this goal by providing funds, through WPCLF loans, to finance implementation of projects that protect or restore water resources and by ensuring either maintenance or attainment of warmwater habitat or higher designated aquatic life uses under Ohio's water quality standards. Since its inception, more than $160 million has been awarded through the WRRSP.

Water Supply Revolving Loan Account Fund

The Ohio Water Supply Revolving Loan Account (WSRLA) provides an opportunity for mutually beneficial partnerships between Ohio EPA and Ohio's public water systems to assure a safe and adequate supply of drinking water for all the citizens of Ohio. This is accomplished primarily by providing below-market interest rates for compliance-related improvements to community (public) water systems and non-profit non-community public water systems. Additionally, the WSRLA can provide technical assistance to public water systems in a variety of areas from the planning, design and construction of improvements to enhancing the technical, managerial and financial capacity of these systems.

The WSRLA is administered by Ohio EPA's DDAGW and DEFA. Certain financial management services are also provided by OWDA. More information about WSRLA can be found at ***epa.ohio.gov/defa/EnvironmentalandFinancialAssistance.aspx***.

C3. Program Summary – Drinking and Ground Waters

The mission of Ohio EPA's Division of Drinking and Ground Waters (DDAGW) is to "protect human health by characterizing and protecting ground water quality and ensuring that Ohio's public water systems provide adequate supplies of safe drinking water." The division has several programs in place to achieve this mission.

Drinking Water Program

Every Ohioan relies on a safe source of drinking water. DDAGW's drinking water program has jurisdiction over 4,500 public water systems that are required to ensure a safe and adequate supply of drinking water to more than 11 million Ohioans.

The drinking water program's functions include: overseeing the design and construction of drinking water treatment facilities through plan approval; conducting sanitary survey inspections; administering an operator certification program and a drinking water revolving loan fund; managing compliance monitoring for bacteriological and chemical contaminants; working with public water systems to implement corrective actions when significant deficiencies are identified; developing state rules and guidance for implementing new federal drinking water regulations; and sharing public water system information with the public on the division's website. Significant interdivision and interagency efforts are being expended to assist public water systems and implement Ohio's *Public Water System Harmful Algal Bloom Response Strategy*.

Ground Water Program

DDAGW's ground water program maintains a statewide ambient ground water quality monitoring program; shares ground water quality data on the division website; conducts ground water quality investigations; provides technical support to other Ohio EPA programs by providing technical expertise on local hydrogeology and ground water quality; and protects ground water resources through the regulation of waste fluid disposal in its underground injection control program for Class I, IV and V wells.

HABs Program

In 2016, DDAGW established a new program section to address harmful algal blooms (HABs). The purpose of this program is to provide oversight and implementation of the new rules for public water systems and to coordinate Ohio's HAB response strategy for drinking water and recreational waters. Ohio Senate Bill 1, passed in July 2015, established ORC 3745.50 and directed Ohio EPA to serve as the coordinator of harmful algae management and response. New and revised HAB rules became effective on June 1, 2016, and include analytical protocols, establishment of health advisories and public notification protocols and triggers, sampling, treatment technique, algaecide application and reporting requirements.

DDAGW manages and coordinates response to bloom reports, maintains the website ***ohioalgaeinfo.com*** and an online HABs database and mapping application and provides technical assistance and training related to HAB sampling procedures, treatment optimization, reservoir management and other related topics. Significant interdivision and interagency efforts are being expended to assist public water systems to assure the safety of finished drinking water. Additionally, Ohio EPA's HABs program conducts outreach to local health districts and other local agencies to provide guidance and technical expertise in response to HABs in recreational waters.

State of Ohio Coordinated Response

As incidents of HABs have increased, Ohio's response continues to evolve. The ***ohioalgaeinfo.com*** website provides links to the State of Ohio's HAB response strategies; background information about HABs; tips for staying safe when visiting public lakes; links to sampling information; and current advisories and contact information for reporting suspected HABs. It also includes historic and current cyanotoxin data for public water supplies and a link to the ODH BeachGuard site, which has information about recreation advisories for both bacteria and algae (***http://publicapps.odh.ohio.gov/BeachGuardPublic/Default.aspx***).

Ohio EPA, ODH and ODNR have continued a close partnership to develop and implement the unified state response strategy for recreational waters. The agencies annually review and revise the State of Ohio's *Harmful Algal Bloom Response Strategy for Recreational Waters* and work together throughout the season under an interagency communication and coordination framework.

Algal Toxin Monitoring and Phytoplankton Monitoring

Monitoring of HABs has occurred in a variety of ways across the state. Ohio EPA-DSW conducts ambient HAB sampling at inland lakes and Lake Erie as part of their inland lakes (Section I3) and nearshore Lake Erie monitoring programs (Section C1), and public water systems routinely monitor for HABs on their source waters and provide that data to Ohio EPA. DSW's Inland Lakes data also provided paired cyanobacteria screening (via qPCR) and cyanotoxin results which was used to evaluate the cyanobacteria screening tool. Additional information about algal toxin monitoring at public water systems and assessment of the public drinking water supply beneficial use is addressed in Section H.

The routine microcystin and cyanobacteria screening analysis required by Ohio's public water systems using surface water sources provides an indication of HAB occurrence across the state. Microcystins continue to be the most commonly detected cyanotoxin, detected at 47 percent of Ohio's PWS source waters. Microcystin-producing genes were detected at 56 percent of source waters and saxitoxin-producing genes were detected at 38 percent of source waters. Cylindrospermopsin-producing genes were only detected at two sites with the actual toxin only detected at one location. Ohio EPA's follow up sampling, triggered by saxitoxin-producing gene detections, indicated saxitoxins were detected at 18 percent of PWS source waters.

Recreational waters across the state continue to be impacted by HABs, and during 2016-2017 the state had at least six waters with posted recreational advisories. Ohio DNR routinely monitors the state beaches and waters for HABs and analyzes for microcystins at beaches if a bloom is suspected. All state park beaches and boat ramps have informational HAB signs posted during the season. Local health districts and park managers are becoming more involved in HAB response, including sample collection and posting local advisories. Ohio EPA continues to provide technical and analytical assistance to support local response as needed.

Ohio EPA continued funding the Lake Erie charter captains to collect water quality samples during charter fishing runs in the Western Basin of Lake Erie during 2016 (151 samples) and 2017 (146 samples). Funding was provided to Ohio State University to administer the program and conduct analysis at Stone Laboratory, supporting development of local lab capacity and expertise to serve the region.

Use of Satellite Imagery to Evaluate HABs on Lake Erie and Inland Waters

The State uses remotely sensed imagery collected and processed by the National Oceanic and Atmospheric Administration (NOAA) or the National Aeronautical and Space Administration (NASA) to assist in identifying the location of cyanobacteria blooms in Lake Erie, inland state park lakes, and portions of the Ohio River. For state recreation managers, the imagery is used as a tool to assist in visual confirmation of algal bloom presence. These remote sensing tools can provide information on lakes or rivers that are at least 300 meters wide. A processed image can detect HABs approximately 1-2 feet below the surface when the human eye cannot. It can also detect algal blooms in turbid waters when the blooms can be difficult to visually identify. Hyperspectral imaging by airplane may also be used during times of increased cloud cover to supplement the satellite images. For Lake Erie, NOAA prepares a bi-weekly bulletin depicting satellite images of HABs, predicted algal bloom densities and wind directions. NOAA's experimental Lake Erie forecast system switched to operational status in 2017 and remains an invaluable tool provided to thousands of subscribers in the state, including state agencies, public water systems, beach managers and the public. More information on the NOAA HAB detection and monitoring program for Lake Erie can be found at the Great Lakes Environmental Research Lab website at ***glerl.noaa.gov/res/HABs_and_Hypoxia/***.

Ohio is also one of four states participating in NOAA's Cyanobacteria Assessment Network (CyAN) Project. Beginning in May 2017, Ohio EPA reviewed near daily images for cyanobacteria detections, generated maps of cyanobacteria detections for individual lakes, and shared a summary of current cyanobacteria detections and lake maps with ODNR, ODH and public water systems. This tool provided valuable information about Ohio's inland waters and early warning on HAB formation. More information about the CyAN project can be found at the U.S. EPA website at ***epa.gov/water-research/cyanobacteria-assessment-network-cyan***.

Outreach

Ohio EPA continues to coordinate a workshop at Ohio Sea Grant Stone Laboratory in August of each year. This two-day workshop, Dealing with Cyanobacteria, Algal Toxin and Taste and Odor Compounds, attracts public water supply operators and water managers from Ohio and other states. Instructors include experts from NOAA, OSU and public water supply operators with experience dealing with HABs. Ohio EPA also provided annual training each spring for ODNR park managers on HAB sampling and response. Starting in 2016 and continuing in 2017, Ohio EPA provided webinars and in-person workshops to public water systems, local health departments, emergency management agencies and local governmental officials throughout the state. Ohio EPA also provided presentations and share the State's HAB monitoring and response experience with numerous U.S. EPA regions, states and other groups.

Source Water Protection Program

Several programs are in place or are being implemented to help protect Ohio's water resources. The source water assessment and protection program protects aquifers and surface water bodies that are used by public water systems. A public water supply beneficial use assessment methodology has been developed in conjunction with DSW and it is being implemented.

C4. Program Summary – Environmental Services

For Ohio EPA to protect public health and the environment, Agency staff depend on scientific data to make well-informed decisions. The Division of Environmental Services (DES), Ohio EPA's laboratory, provides most of this data. DES analyzes environmental samples for more than 300 parameters. The laboratory provides chemical and microbiological analyses of drinking, surface and ground water; wastewater effluent; sediment; soil; sludge; manure; air filters and air canisters; and fish tissue.

DES processes approximately 10,000 samples annually, generating approximately 139,500 inorganic and 91,000 organic data points. DES also administers U.S. EPA's Discharge Monitoring Report-Quality Assurance Study Program, inspects drinking water and wastewater laboratories and provides technical assistance to Ohio EPA divisions as well as state and local agencies.

C5. Cooperation among State Agencies and Departments

Ohio Lake Erie Commission

The Ohio Lake Erie Commission (OLEC) is comprised of the directors of Ohio EPA and the Ohio departments of natural resources, transportation, development, health and agriculture and up to five additional public members appointed by the governor. The role of OLEC is to preserve Lake Erie's natural resources; to protect the quality of its waters and ecosystem; and to promote economic development and tourism in the region. OLEC develops and is guided by the *Lake Erie Protection and Restoration Strategy*, which identifies 12 priority issues on which the member state agencies and other partners focus their attention. OLEC administers Ohio's Lake Erie Protection Fund, which was established to finance research and implementation projects aimed at protecting, preserving and restoring Lake Erie and its watershed. The fund is supported through tax-deductible donations and purchases of Lake Erie license plates, which display the Marblehead Lighthouse, Toledo Harbor Lighthouse or the Lake Erie life preserver. The Commission also receives Ohio's share of the interest earnings from the Great Lakes Protection Fund, an interstate trust fund established in 1989 to protect and restore the Great Lakes. Since its inception in 1993, the Commission has awarded approximately $13 million for projects that focus on issues critical to the effective state management of Lake Erie and that further the goals of the *Lake Erie Protection and Restoration Strategy*. More information is available online at ***lakeerie.ohio.gov***.

C6. Funding Sources for Pollution Controls

It is beyond the means of this report to place a dollar value on the environmental improvements gained to date. However, Ohio EPA has documented the recovery of numerous major river segments including the Cuyahoga River, Licking River, Paint Creek and Scioto River. The most successful restoration efforts in Ohio have been those that have combined one or more funding sources to reach water resource goals. Different funding sources are directed toward many facets of water resource management, so there is always a challenge to pursue and coordinate the various programs at once. Such coordination takes time and administrative effort to be successful.

There are several funding sources for water quality improvement projects in Ohio. Funding for wastewater and drinking water infrastructure improvement projects is available through: Ohio EPA (WPCLF and WSRLA); the Ohio Water Development Authority (OWDA); Ohio Public Works Commission (OPWC); U.S. Department of Agriculture (USDA) Rural Development; and the Community Development Block Grant (CDBG) program. Ohio EPA's *State and Federal Funding for Drinking Water and Wastewater Systems* details some of these funding sources. There is also funding available for preservation, conservation and restoration projects that directly benefit water quality. These include: Clean Ohio Fund; Section 319 Grants Program; Great Lakes Restoration Initiative (GLRI); Conservation Reserve Program (CRP); and Ohio EPA's WRRSP. Additional funds from the federal government, as well as the investment in water pollution control measures made by municipal and county governments and the private sector, are the reason for dramatic improvements in water quality in Ohio since the inception of the federal CWA in 1972.

A summary of funding sources, amounts and trends is presented here. Efforts have been made to include sources not traditionally associated strictly with water quality improvement, but that nevertheless have the potential to positively impact Ohio's water resources.

Clean Ohio Fund

Although not tied directly to measures of water resource improvement, a major Ohio bond fund provides funds for projects that should positively impact water quality in the state. The Clean Ohio Fund, created in November 2000, provides $400 million over four years for brownfield environmental cleanup projects and green space and conservation preservation projects. Placed before Ohio's voters as Issue 2 in 2008, the ballot initiative was overwhelmingly approved in all 88 counties, which extended the Fund with another $400 million bond program. The Fund consists of three competitive funding programs, as described below.

Clean Ohio Green Space Conservation Program

The Clean Ohio Green Space Conservation Program helps to fund preservation of open spaces, sensitive ecological areas and stream corridors. The program awards $37,000 per year to projects that:

- Protect habitat for rare, threatened or endangered species;
- Preserve high quality wetlands and other scarce natural resources;
- Preserve streamside forests, natural stream channels, functioning floodplains, and other natural features of Ohio's waterways;
- Support comprehensive open space planning;
- Secure easements to protect stream corridors, which may be planted with trees or vegetation to help reduce erosion and fertilizer/pesticide runoff;
- Enhance eco-tourism and economic development related to outdoor recreation in economically challenged areas;
- Reduce or eliminate nonnative, invasive plant and animal species;
- Provide safe areas for fishing, hunting and trapping in a manner that provides a balanced eco-system.

Clean Ohio Agricultural Easement Purchase Program

The Clean Ohio Local Agricultural Easement Purchase Program (LAEPP) provides funding to assist landowners and communities in preserving Ohio's farmland. The program purchases agricultural easements from landowners who volunteer to keep their land in agricultural production in perpetuity. In 2015, almost $6 million was awarded through this program; and, in 2016, a little more than $7.5 million was awarded.

Clean Ohio Trails Fund

The Clean Ohio Trails Fund, administered through the Ohio Department of Natural Resources, provides funding to local governments, park and joint recreation districts, conservancy districts, soil and water conservation districts and non-profit organizations to improve outdoor recreational opportunities for Ohioans by funding trails for outdoor pursuits of all kinds. Eligible projects include: land acquisition for a trail; trail development; trailhead facilities; engineering; and design. In 2015, just over $6 million was awarded through this program; and, in 2016, $10.5 million was awarded.

More information about Clean Ohio Fund can be found at ***development.ohio.gov/cleanohio/***. Information about the Clean Ohio Trails Fund can be found at ***realestate.ohiodnr.gov/outdoor-recreation-facility-grants***.

Ohio Water Development Authority

OWDA offers financial assistance for several project types, either alone or in conjunction with a state agency (including Ohio EPA). In addition to solid waste, brownfields and emergency programs, OWDA oversees the Fresh Water Program. The Fresh Water Program is a market-based rate program that mirrors the below-market financing available through the WSRLA and the WPCLF (see below). The OWDA 2016 annual report provides an overall summary of loan expenditures for all State of Ohio water and wastewater programs in 2016 (OWDA 2017). More information about OWDA can be found at ***www.owda.org***.

Table C- 1 — OWDA loans administered during calendar years 2015 - 2016.

	2016		2015	
Project Type	Number	Amount	Number	Amount
Planning				
Water	22	$3,187,582	23	$6,006,860
Wastewater	37	$18,093,691	38	$32,530,233
Subtotal	**59**	**$21,281,273**	**61**	**$38,537,093**
Construction				
Water	64	$301,545,853	82	$171,818,412
Wastewater	175	$673,222,273	124	$784,602,894
Alternative Storm Water	3	$4,085,446	0	0
Brownfield	4	$4,331,286	7	$18,853,245
Local Economic Development	1	$10,595,567	0	0
Subtotal	**247**	**$993,780,931**	**213**	$975,274,551
Total	306	$1,015,062,204	274	$1,013,811,644

Water Pollution Control Loan Fund

In calendar year 2016, the WPCLF financed many municipal wastewater treatment needs, as well as NPS pollution control needs. Through this program, $632,483,026 in financing was provided for 153 projects, of which 96 projects were for municipal point sources and 57 projects assisted NPS controls.

The WPCLF financed implementation of 96 municipal wastewater treatment projects costing $619,184,526. These projects directly addressed sources of impairment for Ohio water resources. Nearly half of these loans (45 percent or 43 loans), totaling $91,845,696, were made to communities with a service population of fewer than 5,000 people.

During calendar year 2016, a total of $13,298,500 was awarded for 57 NPS pollution control projects. The Water Resource Restoration Sponsor Program (WRRSP) financed 10 projects for $13,090,362 to protect and restore stream and wetland aquatic habitats. Additionally, the WPCLF awarded 57 direct (principal forgiveness) loans, administered through county health departments, totaling $13,298,500 for the correction of failing home sewage treatment systems to economically distressed individuals.

Water Supply Revolving Loan Account

The Water Supply Revolving Loan Account focuses on drinking water supplies. In SFY 2016, the fund made 46 loans totaling $152,203,792, which included $80,867,052 to economically disadvantaged communities.

Section 319 Grants Program

Ohio EPA receives federal CWA Section 319(h) funding to implement a statewide NPS program, including offering grants to implement local projects to reduce the impacts of nonpoint sources of pollution. Annual funding for local sub-grant awards typically averages $2.5 million. Section 319(h) grants are awarded for projects such as low-head dam removal, natural stream channel restoration, wetland restoration and other types of projects designed to restore impaired waters. Projects identified in watersheds with TMDLs and/or with endorsed watershed action plans that focus on eliminating identified sources of impairment or restoring impaired waters are most likely to receive funding. Other eligible activities include lake management projects and agricultural BMPs that are not funded under Farm Bill programs. Nearly all successful grant applications are from watersheds that have either completed an endorsed local watershed action plan or in watersheds where TMDL studies have been completed. More information can be found at ***epa.ohio.gov/dsw/nps/index.aspx***.

Federal Farm Bill Funding in Ohio

Among funding sources from the federal government, conservation programs connected to the federal Farm Bill are notable. Administered by USDA, several programs provide cost-share, technical assistance and economic incentives to install and/or implement NPS pollution reduction practices. The 2016 Farm Bill included significant changes in programs such as:

- consolidation of conservation programs for flexibility, accountability and adaptability at the local level;
- linkage of basic conservation practices to crop insurance premium subsidy for highly erodible lands and wetlands; and
- building upon previous successful partnerships and encouraging agricultural producers and partners to design conservation projects that focus on and address regional priorities.

Ohio EPA works closely with the Ohio Natural Resources Conservation Service (NRCS) on several water quality related landscape initiatives, including the Great Lakes Restoration Initiative and the National Water Quality Initiative (NWQI). Ohio EPA has assisted with selecting priority watersheds and practices in these initiatives and provides water quality monitoring.

Programs that set aside farmlands such as the Conservation Reserve Program (CRP) and the Conservation Reserve Enhancement Program (CREP) are among the most popular of available programs in Ohio. Targeted acreage through these programs is intended to be environmentally sensitive for land that can have a particularly deleterious impact on natural resources when farmed. Examples include highly erodible land, land near waterways, land that was formerly wetland and lands that can serve as habitat critical to declining wildlife populations. It is a potential concern that once contracts expire on the marginal or environmentally sensitive lands, those acres may revert to agricultural production.

Conservation Reserve Enhancement Program

The CREP is a federal-state conservation partnership program intended to protect environmentally sensitive cropland and convert it to native grasses, trees and other vegetation. The CREP uses financial incentives to encourage farmers and ranchers to enroll in contracts of 10-15 years. In return, participants are incentivized annually 150-175 percent of crop rental rates, depending on the type of vegetation planted. Ohio is one of two states in the nation to have three CREP watersheds. Most existing CRP and CREP land retirement program acres involve stream-side grass strips. There are opportunities to further expand acreage under these programs to include practices that better reduce rate and amount of agricultural runoff. These practices include: filter area; wooded riparian corridors; and/or wetlands designed to trap, retain, intercept, distribute, store and/or treat runoff from cropland.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is another widely used, well-funded program in the Farm Bill. EQIP is designed to improve management practices and facilities on working farms to achieve environmental quality goals. Several specific practices are eligible for funding through EQIP, covering broad categories such as nutrient and pesticide management and storage, manure management and storage, livestock fencing, conservation tillage, cover cropping, conservation crop rotation and drainage water management, among others. Historically, most EQIP-funded practices in Ohio have gone toward installation of livestock fencing, access roads, manure storage units and other structural practices). Recognizing that NPS pollution from agriculture is largely related to management (for example, crop rotations and tillage management, or fertilizer application timing, method, rate and form), Ohio-NRCS offered incentive payments to farming operations to adopt a suite of management practices, including conservation tillage, nutrient management plan implementation and cover crops.

More information about the Agricultural Act of 2014 and related programs in Ohio is available at ***nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/*** and ***nrcs.usda.gov/wps/portal/nrcs/site/oh/home***.

C7. New 303(d) Vision Implementation in Ohio

In December 2013, U.S. EPA announced a new "Vision" for the CWA Section 303(d) program to provide an updated framework for implementing the responsibilities under the impaired waters program. U.S. EPA recognized that "… there is not a one-size-fits-all approach to restoring and protecting water resources." Under the new Vision, states will be able to develop tailored strategies to implement the 303(d) program in the context of their water quality goals.

The Vision effort grew out of frustration caused by the 1990s-era litigation concerning the pace at which TMDL analyses were being completed. The resulting consent decrees forced many states to produce great *quantities* of TMDLs that many felt did not contain the necessary *quality* to effectively improve water quality. As the decrees were completed, discussion centered on how to produce better TMDLs that could be implemented to bring about measurable improvements in the quality of the nation's waters.

Fortunately, Ohio was not burdened by a harsh consent decree and was able to carefully consider how to proceed with TMDLs. Fifteen years ago, Ohio EPA developed an approach to TMDLs that already aligns with the spirit of the Vision. The Ohio TMDL program strives to:

- focus on CWA responsibilities across programs;
- build on the state's investments in monitoring, especially biological monitoring;
- use data efficiently, for multiple programs and purposes;
- restore beneficial uses;
- focus on watersheds: maintain rotating basin structure to enable adaptive management; and
- recognize that water quality is impacted by the actions of many and that it will change over time.

Ohio's program grew out of the Agency's water mission, which is rooted in the CWA. Today's new national Vision developed from the same roots, so it should not be surprising that Ohio has been on the Vision path for several years.

Ohio TMDL Program Relative to the Vision Goals

The national Vision contains six goal statements related to prioritization, assessment, protection, alternatives, engagement and integration. While its TMDL program is generally well placed relative to these goals, Ohio expects to continue to improve its program. Potentially the biggest opportunities are in the areas of protection and engaging other organizations to help with implementation. The following is a summary of the goals and how Ohio has been addressing each goal to date as detailed in U.S. EPA's *A Long-Term Vision for Assessment, Restoration and Protection under the Clean Water Act Section 303(d) Program* (U.S. EPA, 2013), available at ***epa.gov/sites/production/files/2015-07/documents/ vision_303d_program_dec_2013.pdf***.

Prioritization Goal

For the 2016 integrated reporting cycle and beyond, States review, systematically prioritize, and report priority watersheds or waters for restoration and protection in their biennial integrated reports to facilitate State strategic planning for achieving water quality goals.

The intent of the Prioritization Goal is for States to express CWA 303(d) Program priorities in the context of the State's broader, overall water quality goals.

-- U.S. EPA, 2013

Based on the state's established monitoring investment and expertise, Ohio's initial priority (in approximately 2000) was on aquatic life use impairments in streams. This priority led to the development of nutrient, sediment, habitat, dissolved oxygen and related TMDLs. A few years later, the agency began to focus on recreation use impairments, which yielded bacteria TMDLs. More recently, work has involved public drinking water use impairments involving nitrate and pesticides TMDLs.

In addition to a focus on restoring uses, other priorities were to begin with headwaters and work downstream. To date, the state has not adopted a geographic priority, choosing instead to work statewide which helps to maintain work balance among district offices. In cases where other agencies or stakeholders have initiated projects, TMDLs in watersheds has been delayed.

Moving forward, Ohio intends to use the following prioritization framework (**bold** items indicate clarification or change from past practices).

Long Term General Priorities:

- continue to work statewide, using rotating basin scheduling for assessment and listing **but on a more limited basis to allow for increased focus on lakes and protecting downstream uses**;
- sharpen focus on Public Water Supply Use;
- **Incorporate HAB considerations into priorities (both PDWS use and ultimately Recreation use)**;
- concentrate recreation TMDLs on **High-Use** recreation waters;
- continue to make mercury and legacy/sediment metals low-priority TMDLs as other approaches are anticipated to be more effective

Annual Prioritization of Impaired Waters for TMDL Development: Ohio will continue to use the Priority Point System in Section J2 of the IR. Points are given for presence and severity of Human Health impairment, Recreation Use impairment, Public Water Supply impairment and Aquatic Life Use impairment. Scores by HUC12 range from 1-16.

In addition, the Agency will consider geographic coverage, severity of the impairments represented by the above scores/points for the entire project area and add the following considerations:

- Social Factors (highly used recreational waters, drinking water supply for significant populations, ongoing/sustained involvement of any local groups or government, etc.)
- Value Added (is a TMDL the most efficient way to achieve improved water quality?)
- Is there an approved watershed action plan – if so how many implemented projects?
- How much regulatory authority exists over sources?
- Is there an alternative way to improve water quality more quickly than a TMDL? (for example, immediate implementation of an existing plan or projects, or imposing more stringent permit limits to address a localized problem)

- Are there other factors in play? Examples include:
  - pending enforcement for a discharger (possible 4B option);
  - USACE modeling of reservoir discharge to improve downstream water quality;
  - local or statewide strategy or requirements in place to address a particular issue/pollutant (for example, new health department rules for HSTS if they are sole/primary source of impairment)

Over time, Ohio will strive to develop a more objective system for weighing the social factors and value-added concepts. In each IR, the state plans to provide results of the most recent assessments and prioritization exercise as outlined above; list resulting high-priority TMDL projects; and include schedules for those anticipated to be completed in the next two years.

Assessment Goal

By 2020, States identify the extent of healthy and CWA Section 303(d) impaired waters in each State's priority watersheds or waters through site-specific assessment.

The purpose of this Goal is to encourage a comprehensive understanding of the water quality status of at least each State's priority areas.

-- U.S. EPA, 2013

Ohio has maintained a robust biology and chemistry monitoring program for more than 30 years, maintaining consistent protocols and systematically expanding into new water body types. Assessments are based on surveys conducted using a rotating basin approach. The assessments use site-specific data of the highest quality and the status of waters is reported in watershed reports and summarized in biennial IRs that meet the reporting requirements of CWA 305(b) and 303(d). A framework of goals and measures has been in place for several years and reported on biennially in the Ohio IR.

Protection Goal

For the 2016 reporting cycle and beyond, in addition to the traditional TMDL development priorities and schedules for waters in need of restoration, States identify protection planning priorities and approaches along with schedules to help prevent impairments in healthy waters, in a manner consistent with each State's systematic prioritization.

The intent of the Protection Goal is to encourage a more systematic consideration of management actions to prevent impairments in healthy waters (i.e., unimpaired waters) in order to maintain water quality or protect existing uses or high-quality waters.

-- U.S. EPA, 2013

Protection of the water resource is built into Ohio's CWA programs in multiple ways. Watershed surveys measure the attainment potential and status for all waters; thus, they identify waters to restore and to protect. Tiered aquatic life uses identify "better than CWA" goals for high-quality streams. About 14 percent of Ohio's streams already have this higher use designation. TMDLs have included protection strategies and informational TMDLs to encourage protection of streams currently meeting their designated uses. Ohio also has an active antidegradation process to protect existing uses and plans to update the list of waters afforded higher protection under antidegradation.

Ohio has also issued NPDES permits to protect against water quality impairment and anticipates continuing that approach where warranted. One example is the general construction storm water permits for the Olentangy River and Darby Creek watersheds. Those permits include measures designed to protect the high quality of the streams from development impacts. Other watersheds are being considered for similar actions.

Ohio will explore how other types of plans (Nine-Element Watershed Plans for instance) or regulatory actions could be used more effectively to protect our highest quality waters and/or those that are of high importance for drinking water or recreation.

Alternatives Goal

By 2018, States use alternative approaches, in addition to TMDLs, that incorporate adaptive management and are tailored to specific circumstances where such approaches are better suited to implement priority watershed or water actions that achieve the water quality goals of each state, including identifying and reducing nonpoint sources of pollution.

The purpose of this Goal is to encourage the use of the most effective tool(s) to address water quality protection and restoration efforts.

-- U.S. EPA, 2013

Ohio has been using several alternatives to improve water quality. Relying on the biological criteria as the measure for aquatic life attainment means that restoring habitat to build a stream's capacity to process pollutants can be as or more effective than load reduction; Ohio TMDLs have routinely promoted habitat enhancement. After the first few TMDLs recommended dam modifications to enhance capacity, dam modifications were pursued in areas without TMDLs. The state has used CWA Section 319 funds to remove or modify many dams.

In the past, Ohio EPA worked with mining agencies and the Corps to develop a standard alternative for acid mine drainage problems by aligning processes to quantify load reductions, thus meeting the needs of multiple programs with one project. There have also been several instances where NPDES permits have been adjusted to address point source impairments as monitoring identifies them, in advance of completing a TMDL. In other cases, TMDLs have recommended a stressor study to address impairment where the source could not be identified. This follow-up attention increases the chances that the problem may be eliminated or, at a minimum, data will be available for a future TMDL.

Under the new Vision, Ohio EPA also plans to use approaches that are an alternative to a TMDL. These approaches will be designed to address specific impairments caused by pollutants such as phosphorus or perhaps bacteria. Approaches may include developing Nine-Element Watershed Plans, revising NPDES permit limits or conditions, funding installation of BMPs, supporting local health departments in implementing new rules for household sewage treatment systems, etc. These approaches will be pursued where there is clear legal authority to do so and circumstances are such that they are likely to result in water quality improvements more efficiently than a TMDL.

Engagement Goal

By 2014, EPA and the States actively engage the public and other stakeholders to improve and protect water quality, as demonstrated by documented, inclusive, transparent, and consistent communication; requesting and sharing feedback on proposed approaches; and enhanced understanding of program objectives.

The purpose of the Engagement Goal is to ensure the CWA 303(d) Program encourages working with stakeholders to educate and facilitate actions that work toward achieving water quality goals.

-- U.S. EPA, 2013

Ohio engages the public and other stakeholders in several ways. Ohio EPA maintains an extensive website with information about TMDLs, monitoring and implementation in watersheds across the state[3].

In addition to the outreach in individual CWA programs, the TMDL program developed a standard TMDL project communication plan to engage the public, government and technical stakeholders within a project area. The plan includes a standard set of meetings, demonstrations, articles, new releases, etc., that are tied to TMDL project milestones.

In recent years, the CWA Section 319 program has strived to reach beyond stakeholders with general interest to focus on local decision makers and groups who have the wherewithal to act on the ground to improve water quality. These include local governments and park districts.

The preparation of the IR (containing the 303(d), or impaired waters, list) is an open process. Several years ago, an incubator section was added to preview changes that were being contemplated for future listings (for example, adding new beneficial use analyses, revising methodologies or assessment unit types). The section allows for longer-term feedback for public consideration of changes that can have significant impacts. Ohio will strive to complete the IR every two years so that the process remains dynamic and reliable.

Integration Goal

By 2016, EPA and the States identify and coordinate implementation of key point source and nonpoint source control actions that foster effective integration across CWA programs, other statutory programs (e.g., CERCLA, RCRA, SDWA, CAA), and the water quality efforts of other Federal departments and agencies (e.g., Agriculture, Interior, Commerce) to achieve the water quality goals of each state.

The intent of this Goal is to integrate the CWA Section 303(d) Program with other relevant programs that play a role in influencing water quality, in order to collectively and more effectively achieve the water quality goals of States, Tribes, and Territories.

-- U.S. EPA, 2013

As described earlier, program integration is the foundation of Ohio's TMDL work, including both technical and funding programs. Ohio has adopted the Safe Drinking Water Act into the 303(d) listing process and has completed TMDLs for drinking water impairments. Ohio has directed CWA Section 319 funding to park districts and local governments that can directly implement actions to improve water quality by using TMDLs to identify suitable projects. Ohio EPA has also worked with the U.S. Forest Service, U.S. Army Corps of Engineers and state and federal mining agencies to address common water quality goals and to complete TMDLs and TMDL alternatives.

[3] ***epa.ohio.gov/dsw/tmdl/index.aspx***

On a practical level, each TMDL project is completed by a team of Ohio EPA staff that represents many aspects of the clean water programs, including drinking water. The team members include staff from various CWA program areas. At a minimum, these program areas include: monitoring and assessment; water quality modeling; NPDES permits; enforcement; water quality standards; and TMDL. Staff from the Agency's Public Water Supply program and Public Interest Center are also part of each team. Ohio EPA district offices and central office both contribute to the effort. On some projects, local representatives such as active watershed group leaders or Soil and Water Conservation District staff are involved during the study plan phase and throughout the project.

For most projects external input is sought for developing the implementation portion of the TMDL. Most commonly, Soil and Water Conservation Districts and watershed groups are consulted, but permittees or other entities may also be asked for input in the development stage of the implementation plan, depending upon the issues in the watershed. While there is always room for improvement, Ohio EPA does not propose significant changes in the integration aspect over the next few years in terms of our internal coordination.

Section

D

Framework for Reporting and Evaluation

D. Framework for Reporting and Evaluation

This section describes the framework and basic elements for evaluating and reporting the water quality information in this report.

The 2018 Integrated Report (IR) continues Ohio's evolution to a fully-formed watershed basis for reporting on water quality conditions. Since 1988, Ohio has maintained strong linkages between Clean Water Act (CWA) Section 305(b) reporting and Section 303(d) listing. Under the title Water Resource Inventories, Ohio prepares CWA Section 305(b) reports every two years using a biologically based assessment methodology[1]. Subsequently, CWA Section 303(d) lists were compiled using the output of CWA Section 305(b) reporting in 1992, 1994, 1996 and 1998. In 2002, the first IR was produced, addressing the needs of both reporting requirements.

Reporting on Ohio's water resources continues to develop, including more data types and more refined methodologies. The basic framework for this report is built on four beneficial uses:

- **Aquatic Life** — Analysis of the condition of aquatic life was the long-standing focus of reporting on water quality in Ohio and continues to provide a strong foundation. The 2018 methodology is unchanged from what was used in the 2016 IR. Additionally, as in the 2012, 2014 and 2016 IRs, a methodology for assessing the aquatic life condition of inland lakes is previewed for possible inclusion in the 2020 report, provided necessary rule revisions to the Ohio Water Quality Standards (WQS) are promulgated.
- **Recreation** — A methodology for using bacteria data to assess recreation suitability was developed for the 2002 report and was refined several times in subsequent reports. Substantial changes to the methodology occurred again in 2018 to accommodate revisions to the recreational WQS approved in 2016 that included changes to the numeric criteria and averaging period; adoption of the Statistical Threshold Value (STV); and collapse of the three classes of primary contact use into a single primary contact recreation (PCR) use. The 2018 methodology also includes an assessment of the Lake Erie western basin open waters based on algae blooms (see Section F 4).
- **Human Health** — A methodology for comparing fish tissue contaminant data to human health criteria via fish consumption advisories was included in the 2004 report. That methodology has been refined in each subsequent report to align more directly with the human health water quality criteria. The methodology was changed in the 2010 report to be consistent with the methodology described in U.S. EPA's 2009 guidance for implementing the methylmercury water quality criterion. The methodology has not changed for the 2018 report.
- **Public Drinking Water** — The assessment methodology for the public drinking water supply (PDWS) beneficial use was first presented in the 2006 report. Updates to the methodology have been presented in subsequent reports. For the 2014 report, it was revised to include a new core indicator based on algae and associated cyanotoxins, and assessment units listed as impaired for algae. The methodology has not changed for the 2018 report.

The methodology for assessing support of each beneficial use is described in more detail in Sections E through H.

[1] In 1990, the linkage of fish and macroinvertebrate community index scores and attainment of aquatic life use designations was established in Ohio's Water Quality Standards (OAC 3745-1).

D1. Assessment Units

The 2018 IR continues the watershed orientation outlined in previous reports; the assessment units have not changed significantly from the 2010 report. Throughout this report, references are made to large rivers and watersheds as assessment units defined for 303(d) listing purposes. Data from individual sampling locations in an assessment unit are accumulated and analyzed; summary information and statewide statistics are provided in this report. The three types of assessment units (AUs) are:

- **Watershed Assessment Units (WAUs)** — 1,538 watersheds that align with the 12-digit hydrologic unit code (HUC) system. Ohio HUC numbers are lowest in the northwest corner of the state, proceeding approximately clockwise around the state. The first two digits of Ohio numbers are either 04 (draining to Lake Erie) or 05 (draining to the Ohio River).
- **Large River Assessment Units (LRAUs)** — 38 segments in the 23 rivers that drain more than 500 square miles; the length of each river included is from the mouth of each river upstream to the point where the drainage area reaches approximately 500 square miles.
- **Lake Erie Assessment Units (LEAUs)** — Seven segments for the entire Ohio portion of Lake Erie. Each of three basins (western, Sandusky, central) are divided into two units (shoreline and open water). The shoreline area is defined as the portion that extends along each basin out to and including a depth of three meters from the shore; the open water is the area in Ohio beyond three meters. The islands shoreline is its own unit and includes the shoreline of each island up to and including a depth of three meters.

  Each basin's extent is described as follows:
  - western basin shoreline and open water (OH-MI state line to Marblehead);
  - Lake Erie islands shoreline (including South Bass Island, Middle Bass Island, North Bass Island, Kelleys Island, West Sister Island and other small islands);
  - Sandusky basin shoreline and open water (Marblehead to Lorain Ridge); and
  - central basin shoreline and open water (Black River/Lorain Ridge to OH-PA state line).

Ohio River assessment units have been defined by the Ohio River Valley Water Sanitation Commission (ORSANCO). See Section D2 for additional discussion of ORSANCO's work.

It is important to remember that the information presented here is a summary. All the underlying data observations are available and can be used for more detailed analysis of water resource conditions on a more localized, in-depth scale. Much of the information is available in watershed reports available at ***epa.ohio.gov/dsw/document_index/psdindx.aspx***.

Total Maximum Daily Load (TMDL) reports, available at ***epa.ohio.gov/dsw/tmdl/index.aspx***, are another source of more in-depth analyses.

Ohio's large rivers, defined for this report as draining greater than 500 square miles, are illustrated in Figure D-1. Ohio's watershed units are shown in Figure D-2. Lake Erie assessment units are shown in Figure D-3.

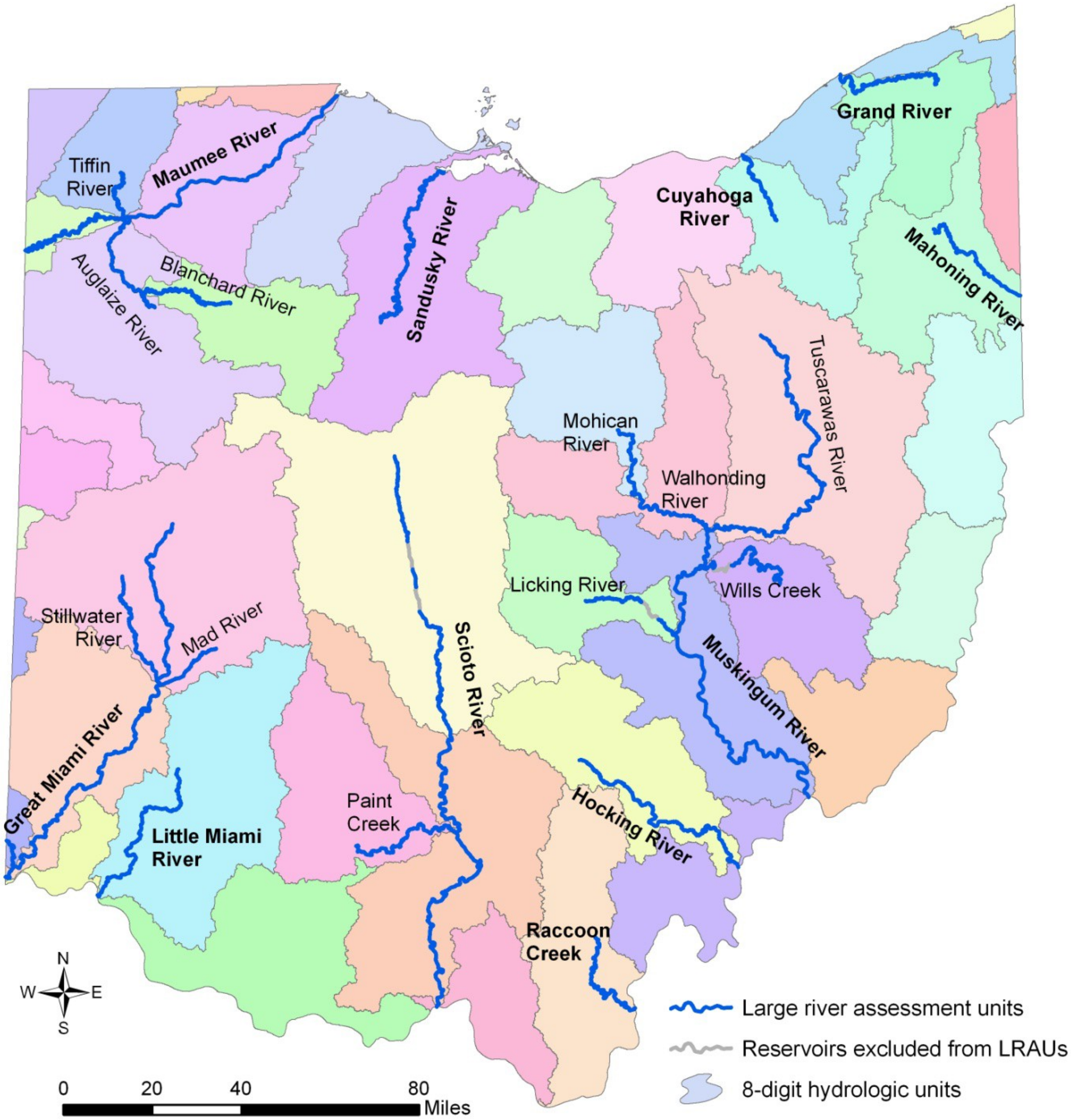


Figure D-1 — Ohio's large rivers (rivers with drainages greater than 500 mi^2) and their watersheds.
Note: Bolded river names indicate the primary mainstem of that drainage basin.

Figure D-2 — Ohio's 12-digit WAUs (gray lines) and 8-digit hydrologic units (heavy black lines).

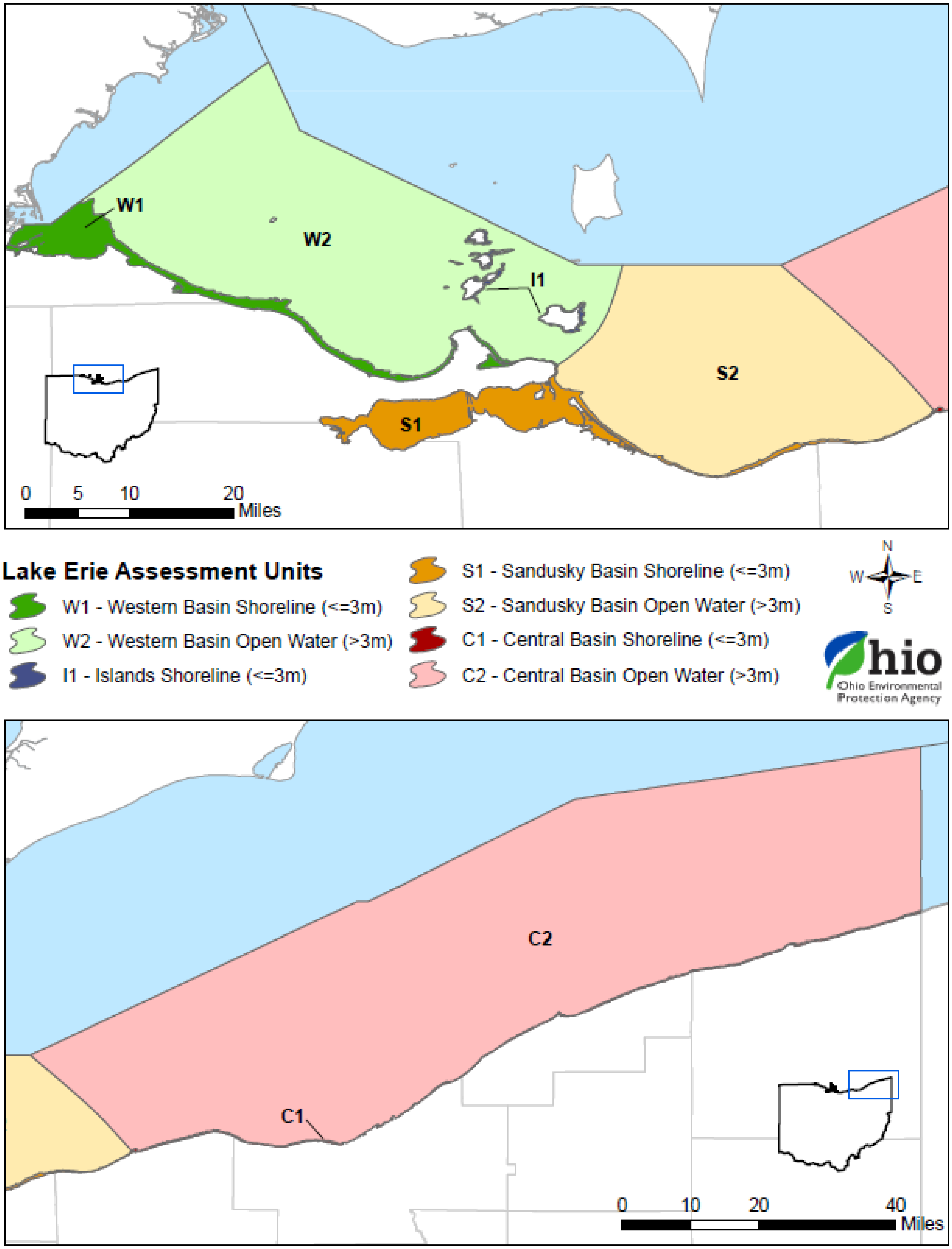


Figure D-3 — Ohio's Lake Erie assessment units – western basin, islands, Sandusky basin and central basin shorelines and open water areas.

D2. Evaluation of the Ohio River

For evaluation of the Ohio River, Ohio EPA defers to the Ohio River Valley Water Sanitation Commission (ORSANCO). ORSANCO is an interstate commission, established on June 30, 1948, to control and abate pollution in the Ohio River Basin. It represents eight states and the federal government. Member states include Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia and West Virginia. ORSANCO operates programs to improve water quality in the Ohio River and its tributaries including: setting wastewater discharge standards; performing biological assessments; monitoring for the chemical and physical properties of the waterways; and conducting special surveys and studies. ORSANCO also coordinates emergency response activities for spills or accidental discharges to the river and promotes public participation in the programs such as the Ohio River Sweep, River Watchers Volunteer Monitoring Program and Friends of the Ohio.

Since 1948, ORSANCO and its member states have cooperated to improve water quality in the Ohio River Basin so that the river and its tributaries can be used for drinking water, industrial supplies and recreational purposes; and can support healthy and diverse aquatic communities. ORSANCO operates monitoring programs to check for pollutants and toxins that may interfere with specific uses of the river and conducts special studies to address emerging water quality issues.

As a member of the Commission, the State of Ohio supports ORSANCO activities, including monitoring of the Ohio River mainstem, by providing funding based on state population and miles of Ohio River shoreline. As such, monitoring activities on the Ohio River are coordinated and conducted by ORSANCO staff or its contractors. More information about ORSANCO and the Ohio River monitoring activities conducted through that organization can be found online at ***orsanco.org***.

Ohio EPA participates in an ORSANCO workgroup to promote consistency in 305(b) reporting and 303(d) listing. The workgroup discussed and agreed upon methods to evaluate attainment/non-attainment of aquatic life, recreation and public water supply uses, as well as impairments based on sport fish consumption advisories. ORSANCO prepares the Section 305(b) report for the Ohio River and has indicated the impaired beneficial uses and segments of the Ohio River. Ohio EPA defers to the ORSANCO analysis and the list of impaired Ohio River segments found in 2016 Biennial Assessment of Ohio River Water Quality Conditions (ORSANCO 2016). ORSANCO plans to complete a biennial assessment in 2018 and will be available at: ***orsanco.org/biennial-assessment-of-ohio-river-water-quality-conditions-305b***.

D3. Evaluation of Lake Erie

Lake Erie is bordered by four states and one Canadian province. As such, it has federal oversight by two sovereign nations. Unlike most other waters in Ohio, Lake Erie has a more complicated governance structure with a binational agreement (GLWQA) between the U.S. and Canada providing a framework to identify binational priorities and implement actions that improve water quality. For comparison, assessment and reporting on one of Ohio's other multi-state waters, the Ohio River, is conducted by ORSANCO, which, as stated above, is an interstate commission representing eight states and the federal government.

Ohio's assessment and impairment designation for Lake Erie has been the focus of considerable discussion between Ohio EPA, U.S. EPA and local stakeholders. Ohio's position has been that since the open waters of Lake Erie are multi-jurisdictional and multi-national, that U.S. EPA should take the lead on setting targets and assessment methods for all parties to use. Since there has been no progress is establishing federal targets for the lake, Ohio has proceeded, with the considerable aid of several universities and NOAA, to develop a method for assessing the western basin open waters in Ohio for algae blooms. This methodology is presented in Section F4 and utilizes the revised assessment units defined in Section D1.

As in the 2016 report, the shoreline units have been assessed for all four beneficial uses using the already established methods, and all but the central basin shoreline is listed as impaired for all four uses (the central basin shoreline is not impaired for public water supply since the intakes are located in the open water assessment unit). See Sections E through H for more information on each use assessment.

D4. Ohio's Water Quality Standards Use Designations

Beneficial use designations describe existing or potential uses of water bodies. They take into consideration the use and value of water for public water supplies, protection and propagation of aquatic life, recreation in and on the water, agricultural, industrial and other purposes. Ohio EPA assigns beneficial use designations to water bodies in the state. There may be more than one use designation assigned to a water body. Examples of beneficial use designations include: public water supply, primary contact recreation and numerous sub-categories of aquatic life use. Table D-1 lists all of Ohio's water quality standards (WQS) designated uses and outlines how the use was evaluated for the Ohio 2018 IR. Additional information is included in Section F4 about the WQS and uses evaluated for the western basin of Lake Erie related to algae.

Table D-1 — Ohio water quality standards in the 2018 IR.

Beneficial Use Category	Key Attributes[2]	Evaluation status in the 2018 IR
Categories for the protection of aquatic life		
Coldwater habitat (CWH)	native cold water or cool water species; put-and-take trout stocking	Assessed on case by case basis
Seasonal salmonid habitat (SSH)	supports lake run steelhead trout fisheries	No direct assessment, streams assessed as EWH or WWH
Exceptional warmwater habitat (EWH)	unique and diverse assemblage of fish and invertebrates	65.5 percent of the WAUs and 99.7 percent of the LRAUs fully assessed using direct comparisons of fish and macroinvertebrate community index scores to the biocriteria in Ohio's WQS; sources and causes of impairment were assessed using biological indicators and water chemistry data.
Warmwater habitat (WWH)	typical assemblages of fish and invertebrates	
Modified warmwater habitat	tolerant assemblages of fish and macro-invertebrates; irretrievable condition precludes WWH	
Limited resource water	fish and macroinvertebrates severely limited by physical habitat or other irretrievable condition	Assessed on case by case basis
Categories for the protection of human health		
Human health [fish consumption]	all waters outside mixing zones	43 percent of the WAUs, 100 percent of the LRAUs assessed and all four Lake Erie shoreline AUs assessed using applicable water quality criteria
Categories for the protection of recreational activities		
Bathing Waters	Lake Erie (entire lake); for inland waters, bathing beach with lifeguard or bathhouse facility	All four Lake Erie shoreline AUs fully assessed based on analysis of data collected from 65 public beaches
Primary Contact Recreation (PCR)	waters suitable for one or more full-body contact recreation activity such as wading and swimming; three classes are recognized, distinguished by relative potential frequency of use	11 percent of the WAUs and 26 percent of the LRAUs assessed using applicable PCR geometric mean E. coli criteria
Secondary Contact Recreation (SCR)	waters rarely used for recreation because of limited access; typically located in remote areas and of very shallow depth	Assessed as part of the WAU using applicable SCR geometric mean E. coli criteria
Categories for the protection of water supplies		
Public Water Supply	waters within 500 yards of all public water supply surface water intakes, publicly-owned lakes, waters used as emergency supplies	Sufficient data were available to assess 50 percent of the 119 AUs with PDWS use; assessed using chemical water quality data; only waters with active intakes were assessed
Agricultural Water Supply	water used, or potentially used, for livestock watering and/or irrigation	Not assessed
Industrial Water Supply	water used for industrial purposes	Not assessed

D5. Sources of Existing and Readily Available Data

For two decades Ohio EPA has placed a high priority on collecting data to accurately measure the quality of Ohio's rivers and streams. Therefore, the Agency has a great deal of information and data to draw upon for the IR. The available data sets from Ohio EPA and external sources, including efforts used to obtain

[2] Reasons for which a water body would be designated in the category.

additional data, are also discussed below. The 2008 IR marked the first time that Ohio's credible data law was fully implemented in generating external data for consideration.

The credible data law, enacted in 2003 (ORC 6111.50 to 6111.56), requires that the director of Ohio EPA adopt rules which would, among other things, do the following:

- establish a water quality monitoring program for the purpose of collecting credible data under the act; require qualified data collectors to follow plans pertaining to data collection; and require the submission of a certification that the data were collected in accordance with such a plan; and
- establish and maintain a computerized database or databases of all credible data in the director's possession and require each state agency in possession of surface water quality data to submit that data to the director.

Ohio EPA adopted rules in 2006, which were revised in 2011 and 2018, to establish criteria for three levels of credible data for surface water quality monitoring and assessment and to establish the necessary training and experience for persons to submit credible data. Apart from a few exceptions, people collecting data and submitting it to Ohio EPA for consideration as credible data must have status as a qualified data collector (QDC). Only Level 3 data can be used for decisions about beneficial use assignment and attainment; water quality standards; listing and delisting (303(d) list); and TMDL calculations.

Ohio EPA solicited data from all Level 3 QDCs for the 2018 IR. The letter requesting data and the website containing information about how to submit data are included in Section D6.1. Table D-2 summarizes the WQS uses evaluated in the 2018 IR, the basic types of data used, the period of record considered, the sources of data and the minimum amount of data needed to evaluate a water body. Specific methodologies used to assess attainment of the standards are described in more detail in Sections E through H.

Table D-3 summarizes the data Ohio EPA used in the 2018 IR. Ohio EPA's 2018 IR uses fish contaminant data to determine impairment using the human health-based water quality criteria. Fish consumption advisories (FCAs) were not used in determining impairment status. However, the public should use the FCAs in determining the safety of consuming Ohio's sport fish.

The evaluation of bacteria, biological and water quality survey data was not changed from the approach used in the 2010 IR. Data collected by Ohio EPA and Level 3 QDCs were evaluated. The following QDCs and state and federal environmental agencies that are excepted from the QDC requirement submitted data or the data were available from readily obtained reports:

- Ohio Department of Natural Resources
- U.S. Geological Survey
- Northeast Ohio Regional Sewer District
- Midwest Biodiversity Institute/Center for Applied Bioassessment and Biocriteria
- Heidelberg College
- The Ohio State University
- Ohio Department of Health
- Cuyahoga County Board of Health
- EnviroScience, Inc.
- EA Science and Technology, Inc.
- Cleveland Metroparks
- Clermont County Office of Environmental Quality
- Ohio University Voinovich School
- MAD Scientist

Additional information about data available for Lake Erie related to algae is included in Section F4.

Table D-2 — Data types used in the 2018 IR.

WQS Uses and Criteria Evaluated (basic rationale[3])	Type of Data Time Period	Source(s) of Data	Minimum Data Requirement
Human health, single route exposure via food chain accumulation and eating sport fish (criteria apply to all waters of the State)	Fish Tissue Contaminant Data 2007 to 2016	Fish Tissue Contaminant Database	Data collected within past 10 years[4]. Two samples, each from trophic levels 3 and 4 in each WAU or inland lake.
Recreation uses - evaluation based on a comparison of E. coli levels to applicable geometric mean and STV E. coli criteria in the WQS.	E. coli counts 2013 to 2017 (May through October only)	Ohio Dept of Health Cuyahoga County Health Department Northeast Ohio Regional Sewer District (NEORSD)	Five or more E. coli samples collected within a 90-day period; at least one site per AU; data period 2013-2017
Aquatic life (specific sub-categories), fish and macroinvertebrate community index scores compared to biocriteria in WQS [OAC 3745-1-07(C) and Table 7-1]	Watershed scale biological and water quality surveys and other more targeted monitoring 2005 to 2016	ODNR U.S. Geological Survey NEORSD Midwest Biodiversity Institute Heidelberg College Ohio State University EnviroScience, Inc.	Fish and/or macroinvertebrate samples collected using methods cited in WQS [OAC 3745-1-03(A)(5)]. Generally, two to three locations sampled per WAU (12-digit HUC).
Public drinking water supply (criteria apply within 500 yards of active drinking water intakes, all publicly owned lakes, and all emergency water supplies)	Chemical water quality data 2010 to 2017	SDWIS (PWS compliance database) Syngenta Crop Protection, Inc. (Atrazine Monitoring Program)[5]	Data collected within past five years. Minimum of 10 samples with a few exceptions (noted in Section H).

[3] Additional explanation is provided in the text of Section D2.

[4] Data more than 5 years old are historical data. The rules provide that “Credible data may include historical data if the director identifies compelling reasons as to why the data are credible.” ORC 6111.51(D) also says: “If the director has obtained credible data for a surface water, the director also may use historical data for the purpose of determining whether any water quality trends exist for that surface water.”

[5] These data were collected as part of an intensive monitoring program at community water systems required by the January 2003 Atrazine Interim Reregistration Eligibility Decision and subsequent Memorandum of Agreement between U.S. EPA and the atrazine registrants (including Syngenta Crop Protection, Inc.).

Table D-3 — Description of data used in the 2018 IR from sources other than Ohio EPA.

Entity	Dates data were collected	Data description	Basis of qualification[6]
NPDES permittees	2013 – 2017 (May – Oct only)	Bacteria	Data credible – submittal pursuant to permit
Ohio Department of Health (ODH)	2013 – 2017 (May – Oct only)	Bacteria	State agency
Cuyahoga County Health Department	2013 – 2017 (May – Oct only)	Bacteria	Level 3 qualified data collector (under ODH's study plan)
Northeast Ohio Regional Sewer District	2013 – 2017 (May – Oct only)	Bacteria	Level 3 qualified data collector
	Jul 2006 – Oct 2016	Physical habitat	
	Jun 2006 – Oct 2016	Biology	
	Apr 2006 – Oct 2016	Chemistry	
	2008	Fish tissue	
Ohio Department of Natural Resources	Apr 2006 – Nov 2016	Fish tissue	State agency/Level 3 qualified data collector
	Sep 2006 – Oct 2016	Biology (fish only)	
	Jun – Oct 2016	Physical habitat	
PWS compliance database (permittees)	Jan 2012 – Oct 2017	Chemistry	Data credible – submittal pursuant to permit
Syngenta Corp Protection, Inc.	Jan 2012 – Dec 2017	Chemistry	See footnote[7]
The Ohio State University	May – Oct 2006	Biology (macroinvertebrates only)	Level 3 qualified data collector
Midwest Biodiversity Institute	Jul 2010 – Oct 2016	Biology	Level 3 qualified data collector
		Physical habitat	
		Chemistry	
Enviroscience, Inc.	Sep – Nov 2011	Biology	Level 3 qualified data collector
		Physical habitat	
Ohio Department of Transportation	Jun 2007 – Oct 2010	Biology (fish only)	State agency/Level 3 qualified data collector
		Physical habitat	
Heidelberg College	Jun 2012 – Oct 2012	Biology (macroinvertebrates only)	Level 3 qualified data collector
EA Science and Technology, Inc.	Jul 2014 – Oct 2014	Biology	Level 3 qualified data collector
Cleveland Metroparks	Jun 2012 – Sep 2014	Biology (fish only)	Level 3 qualified data collector
Clermont County Office of Environmental Quality	May 2009 – Sep 2016	Chemistry	Level 3 qualified data collector
Ohio University – Voinovich School	Jun 2016 – Sep 2017	Biology (fish only)	Level 3 qualified data collector
		Physical Habitat	
		Chemistry	
MAD Scientist, Inc	Jun 2016 – Sep 2016	Biology (fish only)	Level 3 qualified data collector

[6] Level 3 Qualified Data Collector requirements are described in OAC Rule 3745-4-03(A)(4). Included above are Qualified Data Collectors Ohio EPA has approved for stream habitat assessment, fish community biology, benthic macroinvertebrate biology and/or chemical water quality assessment.

[7] These data were collected as part of an intensive monitoring program at community water systems required by the Jan 2003 Atrazine Interim Reregistration Eligibility Decision and subsequent Memorandum of Agreement between U.S. EPA and the atrazine registrants (including Syngenta Crop Production, Inc.).

D6. Public Involvement in Compiling Ohio's Section 303(d) List of Impaired Waters

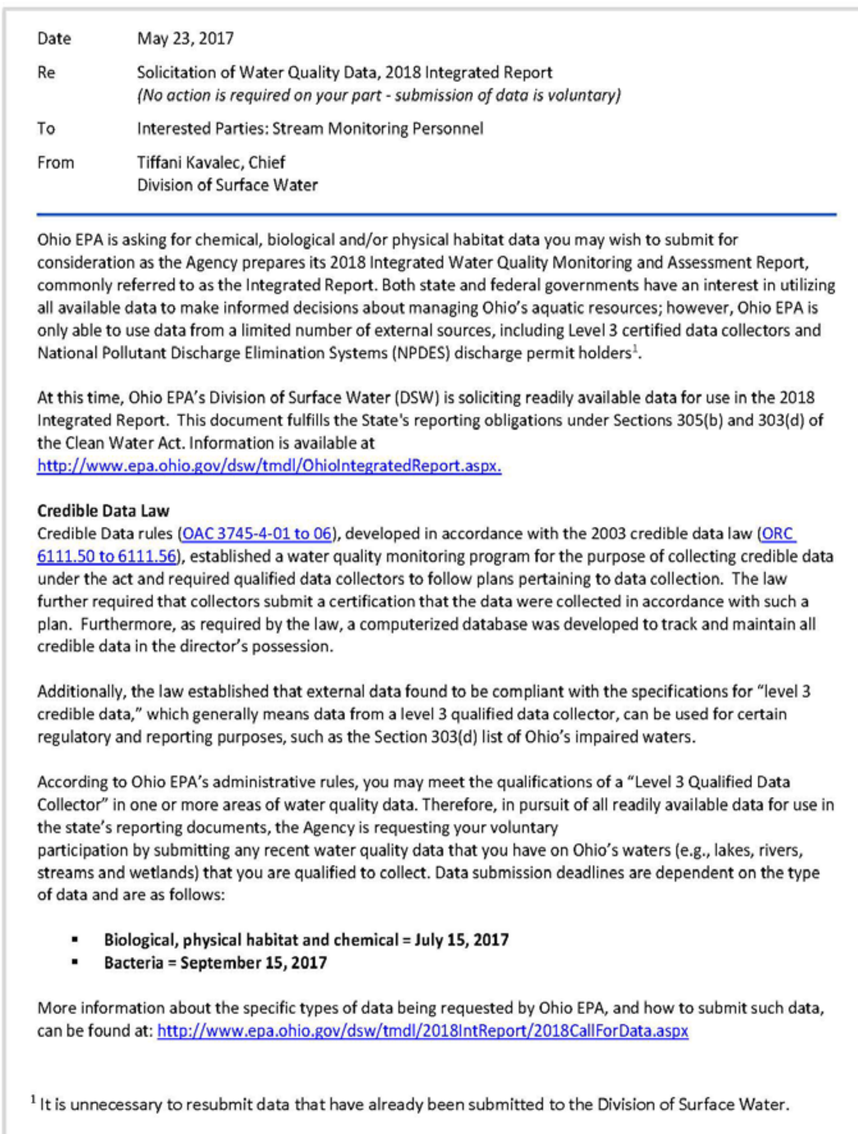
The public was involved in various ways in the development of the 2018 IR. Several means of public communication are discussed below.

Much of the data used in this report have been presented to the public in meetings and publications concerning individual watersheds. Data and assessments have also been available in previous 305(b), 303(d) and IRs. All this information can be accessed from the following website: ***epa.ohio.gov/dsw/formspubs.aspx***.

The draft 2018 303(d) list, contained in the draft 2018 IR, will be also available for public review and comment prior to submitting the final list and report to U.S. EPA.

D6.1 Solicitation for External Water Quality Data, 2018 IR Project (May 23, 2017)

A memorandum soliciting level 3 qualified data was emailed to all Level 3 qualified data collectors on May 23, 2017. The memorandum is displayed below.



Date	May 23, 2017
Re	Solicitation of Water Quality Data, 2018 Integrated Report *(No action is required on your part - submission of data is voluntary)*
To	Interested Parties: Stream Monitoring Personnel
From	Tiffani Kavalec, Chief Division of Surface Water

Ohio EPA is asking for chemical, biological and/or physical habitat data you may wish to submit for consideration as the Agency prepares its 2018 Integrated Water Quality Monitoring and Assessment Report, commonly referred to as the Integrated Report. Both state and federal governments have an interest in utilizing all available data to make informed decisions about managing Ohio's aquatic resources; however, Ohio EPA is only able to use data from a limited number of external sources, including Level 3 certified data collectors and National Pollutant Discharge Elimination Systems (NPDES) discharge permit holders[1].

At this time, Ohio EPA's Division of Surface Water (DSW) is soliciting readily available data for use in the 2018 Integrated Report. This document fulfills the State's reporting obligations under Sections 305(b) and 303(d) of the Clean Water Act. Information is available at http://www.epa.ohio.gov/dsw/tmdl/OhioIntegratedReport.aspx.

Credible Data Law

Credible Data rules (OAC 3745-4-01 to 06), developed in accordance with the 2003 credible data law (ORC 6111.50 to 6111.56), established a water quality monitoring program for the purpose of collecting credible data under the act and required qualified data collectors to follow plans pertaining to data collection. The law further required that collectors submit a certification that the data were collected in accordance with such a plan. Furthermore, as required by the law, a computerized database was developed to track and maintain all credible data in the director's possession.

Additionally, the law established that external data found to be compliant with the specifications for "level 3 credible data," which generally means data from a level 3 qualified data collector, can be used for certain regulatory and reporting purposes, such as the Section 303(d) list of Ohio's impaired waters.

According to Ohio EPA's administrative rules, you may meet the qualifications of a "Level 3 Qualified Data Collector" in one or more areas of water quality data. Therefore, in pursuit of all readily available data for use in the state's reporting documents, the Agency is requesting your voluntary participation by submitting any recent water quality data that you have on Ohio's waters (e.g., lakes, rivers, streams and wetlands) that you are qualified to collect. Data submission deadlines are dependent on the type of data and are as follows:

- **Biological, physical habitat and chemical = July 15, 2017**
- **Bacteria = September 15, 2017**

More information about the specific types of data being requested by Ohio EPA, and how to submit such data, can be found at: http://www.epa.ohio.gov/dsw/tmdl/2018IntReport/2018CallForData.aspx

[1] It is unnecessary to resubmit data that have already been submitted to the Division of Surface Water.

D6.1.1 Web Page with Instructions for Submitting Level 3 Credible Data

For organizations interested in submitting data to Ohio EPA, a web page was established with instructions on what qualified data to be submitted and how to do so. The website content is displayed below.

2018 Integrated Water Quality Monitoring and Assessment Report - Call for Level 3 Credible Data

Information about submitting Level 3 credible data to Ohio EPA is organized as outlined below. More information about the Integrated Report is on the ***Ohio Integrated Water Quality Monitoring and Assessment Report page***.

- What kind of data does Ohio EPA want?
    - Microbiological Data
    - Biological and Physical Data
    - Chemical Water Quality Data
- Do I have Level 3 data?
- Have I already given Ohio EPA my data?
- What will be needed in addition to data?
    - Microbiological Data Requirements
    - Biological, Chemical and Physical Data Requirements
- How do I send the data?
- To whom do I send the data?

To access the information, click on the relevant link below.

What kind of data does Ohio EPA want?
Ohio EPA is asking for biological, physical habitat and/or chemical data you may wish to submit for consideration as the Agency prepares its 2018 Integrated Report. Both the state and federal governments have an interest in utilizing all available data to make informed decisions about managing Ohio's aquatic resources. Ohio EPA is soliciting data primarily from NPDES major permit holders, level 3 qualified data collectors and others that may be in possession of level 3 credible data. The data can be of various types (bacteria, biological, physical and chemical water quality data) and must have been collected during the following time frames:

- Bacteria = 2016 – 2017 (recreation season)
- Biological, physical habitat, and chemical = 2015 – 2016

Microbiological Data
Ohio EPA measures recreation use attainment by comparing the level of indicator bacteria present in ambient water samples against the bacteria criteria contained in ***rule 3745-1-37 of Ohio's water quality standards***.

These indicator bacteria serve as predictors for the possible presence of enteric pathogens in the water that can cause a variety of illnesses. The type of indicator bacteria that Ohio EPA is utilizing in the 2018 Integrated Report is **E. coli**.

Data collected by NPDES discharge permit holders at ambient stream sites upstream and downstream of discharge locations and reported in discharge monitoring reports will be extracted from the SWIMS database. **It is unnecessary to resubmit data already submitted into SWIMS.** However, if bacteria data were collected at additional ambient stations and not reported through SWIMS, permit holders may voluntarily submit this data to the Agency. Data must have been collected between May 1, 2016, and September 15, 2017, and must meet the basic terms of acceptability found in the requirements listed below.

Biological and Physical Habitat Data
Ohio EPA measures aquatic life use attainment in Ohio streams and rivers by comparing indices generated from fish and aquatic macroinvertebrate data against the biological criteria contained in Ohio's water quality

standards, ***OAC 3745-1-07, Table 7-1***. Field collection and data analysis methodologies for fish and macroinvertebrate community assessments are strictly adhered to and must follow procedures as outlined in documents available from Ohio EPA's ***biological criteria website***. Physical habitat data should be in the form of the Qualitative Habitat Evaluation Index (QHEI) and must be submitted if fish community data are being submitted. QHEI procedure manuals and forms can also be found at the above website location.

Chemical water quality data collected in conjunction with biological data is of interest to Ohio EPA. Data should follow the parameters discussed below.

Chemical Water Quality Data

Ohio EPA primarily uses sampling methods described in the 2015 "***Surface Water Field Sampling Manual***." Sample collection and analysis method references are listed in paragraph (C) of ***OAC 3745-4-06***. Ohio EPA is interested in other chemical water quality data collected and analyzed by these methods or others of similar quality control/quality assurance rigor.

Do I have Level 3 data?

Credible Data rules (***OAC 3745-4-01 to 06***), developed in accordance with the 2003 credible data law (***ORC 6111.50 to 6111.56***), established a water quality monitoring program for the purpose of collecting credible data under the act and required qualified data collectors to follow plans pertaining to data collection. The law further required that collectors submit a certification that the data were collected in accordance with such a plan. Furthermore, as required by the law, a computerized database was developed to track and maintain all credible data in the director's possession.

Additionally, the law established that external data found to be compliant with the specifications for "level 3 credible data," which generally means data from a level 3 qualified data collector, can be used for certain regulatory and reporting purposes, such as the Section 303(d) list of Ohio's impaired waters.

If you have collected data following these procedures, then you may have level 3 credible data eligible for inclusion in the Integrated Report

Have I already given Ohio EPA my data?

External data Ohio EPA has received and may use for 305(b)/303(d) reporting:

Entity	Dates data were collected	Data description	Basis of qualification1
NPDES permittees	2013 – 2017 (May – Oct only)	Bacteria	Data credible – submittal pursuant to permit
Ohio Department of Health (ODH)	2013 – 2017 (May – Oct only)	Bacteria	State agency
Cuyahoga County Health Department	2013 – 2017 (May – Oct only)	Bacteria	Level 3 qualified data collector (under ODH's study plan)
Northeast Ohio Regional Sewer District	2013 – 2017 (May – Oct only)	Bacteria	Level 3 qualified data collector
	Jul 2006 – Oct 2016	Physical habitat	
	Jun 2006 – Oct 2016	Biology	
	Apr 2006 – Oct 2016	Chemistry	
	2008	Fish tissue	
Ohio Department of Natural Resources	Apr 2006 – Nov 2016	Fish tissue	State agency/Level 3 qualified data collector
	Sep 2006 – Sep 2014	Biology (fish only)	
	Jun – Oct 2016	Physical habitat	

PWS compliance database (permittees)	Jan 2010 – Dec 2015	Chemistry	Data credible – submittal pursuant to permit
Syngenta Corp Protection, Inc.	Jan 2010 – Dec 2015	Chemistry	See footnote2
The Ohio State University	May – Oct 2006	Biology (macroinvertebrates only)	Level 3 qualified data collector
Midwest Biodiversity Institute	Jul 2010 – Oct 2016	Biology Physical habitat Chemistry	Level 3 qualified data collector
Enviroscience, Inc.	Sep – Nov 2011	Biology Physical habitat	Level 3 qualified data collector
Ohio Department of Transportation	Jun 2007 – Oct 2010	Biology (fish only) Physical habitat	State agency/Level 3 qualified data collector
Heidelberg College	Jun 2012 – Oct 2012	Biology (macroinvertebrates only)	Level 3 qualified data collector
EA Science and Technology, Inc.	Jul 2014 – Oct 2014	Biology	Level 3 qualified data collector
Cleveland Metroparks	Jun 2012 – Sep 2014	Biology (fish only)	Level 3 qualified data collector
Clermont County Office of Environmental Quality	May 2009 – Sep 2016	Chemistry (drinking water)	Level 3 qualified data collector

1 Level 3 Qualified Data Collector requirements are described in OAC Rule 3745-4-03(A)(4). Included above are Qualified Data Collectors Ohio EPA has approved for stream habitat assessment, fish community biology, benthic macroinvertebrate biology and/or chemical water quality assessment.

2 These data were collected as part of an intensive monitoring program at community water systems required by the Jan 2003 Atrazine Interim Reregistration Eligibility Decision and subsequent Memorandum of Agreement between U.S. EPA and the atrazine registrants (including Syngenta Crop Production, Inc.).

What will be needed in addition to data?
Specific guidelines for submission of data are listed below. While these guidelines correspond to the regulations regarding credible data, they are not verbatim. To see the regulations, please go to OAC 3745-4-06.

Microbiological Data Requirements
Specific guidelines for submission of data are listed below. While these guidelines correspond to the regulations regarding credible data, they are not verbatim. To see the regulations, please go to ***OAC 3745-4-06***.

Microbiological Data Requirements

- An individual or organization that submits bacteria data to Ohio EPA for consideration in the 2018 Integrated Report shall attest to the validity of the data and adhere to the data quality specification listed here. The submission of data must cover the following:
- Sampling and test methods, QA/QC specifications: Sampling must be conducted in a manner consistent with procedures contained in Standard Methods for the Examination of Water and Wastewater or the 2015 "***Surface Water Field Sampling Manual***."
- Analytical testing must be conducted in accordance with U.S. EPA approved methods under ***40 CFR 136.3***. Acceptable references for methods for qualified data collectors are given in ***paragraph (C) of OAC 3745-4-06*** and include Ohio EPA references, U.S. EPA references and Standard Methods. Data submissions must include a description of the Quality Assurance/Quality Control (QA/QC) plans

under which the bacteria sample analysis occurred. This should address topics such as sample handling and preservation, sample holding time, chain of custody, precision, accuracy, etc.

- Description of Sampling Program: A brief description of the purpose of data collection and the sampling design considerations should be provided. Were specific sources of potential contamination under investigation? Were samples collected at fixed station locations? How often and under what kinds of environmental conditions were samples collected? Have the results been published in a report or the scientific literature?
- Minimum Data Submission: Ohio EPA is requesting only bacteria data (E. coli) collected during the recreation season (May 1st to October 31st) for 2016 and (May 1st to September 15th) for 2017. The following information must be included in the data submission in an electronic spreadsheet or database format:
- Sample collection date
- Sample collection method (with reference)
- Sample site location including waterbody name, county, river mile (if known), latitude/longitude (decimal degrees or degrees, minutes, and seconds)
- E. coli count
- Identification of units associated with bacteria counts
- Any applicable data qualifiers (as received from the lab, if applicable)
- Contact name, address, telephone number and email address of the person submitting the data set
- Identification of the laboratory performing the sample analysis.
- Biological, Chemical and Physical Habitat Data Requirements
- An individual or organization who submits biological, chemical and/or physical habitat data to Ohio EPA for consideration in the 2018 Integrated Report shall attest to the validity of the data and adhere to the data quality specifications listed here. The submission of data must cover the following:
- Analytical and sampling procedures (examples):
- ***Surface Water Field Sampling Manual***
- ***Habitat and biology sampling manuals***
- Only data that are consistent with these guidelines can be considered Level 3 data.
- Description of Sampling Program: A brief description of the purpose of data collection and the sampling design considerations should be provided. Were specific sources of potential contamination under investigation? Were samples collected at fixed station locations? How often and under what kinds of environmental conditions were samples collected? Have the results been published in a report or the scientific literature?
- If the data have been or will be submitted as part of the Credible Data Program and there is an approved project study plan, this requirement is potentially waived, pending a successful data review that confirms study plan was adhered to as written.
- Minimum Data Submission: Ohio EPA is requesting biological, chemical and physical habitat data collected from 2015-2016. The following information must be included in the data submission in an electronic spreadsheet or database format:
- Sample collection date
- Sample collection method (with reference)
- Sample site location including waterbody name, county, river mile (if known), latitude/longitude (decimal degrees or degrees, minutes and seconds)
- Type of data collected (fish, macroinvertebrate, chemical and physical parameters)
- Analytical and collection methodologies used (include references)
- Any applicable data qualifiers (as received from the lab, if applicable)
- Contact name, address, telephone number, and email address of the person submitting the data set
- Identification of the laboratory performing the sample analysis (if applicable)
- Weather conditions, flow and precipitation (all optional)

How do I send the data?

If you have bacteria data collected from surface waters in Ohio, Ohio EPA would be interested in discussing its possible use in the Integrated Report. **Contact Chris Skalski at (614) 644-2144 or *chris.skalski@epa.ohio.gov* before preparing and submitting any information.**

The Agency's capacity to accept and utilize the data in preparation of the Integrated Report is dependent upon a variety of factors and the use of all data brought to our attention may not be possible. Data must have been collected after May 1, 2016, and must meet the basic acceptability specifications listed above. Data must be provided in electronic format such as STORET, Excel or Access.

Ohio EPA already has data from some credible data collectors, as listed in the table above. Additional data may be available and Ohio EPA is soliciting these data. If you have biological, chemical or physical habitat data collected from surface waters in Ohio, Ohio EPA would be interested in discussing its possible use in the Integrated Report. **Contact Jeff DeShon at (614) 836-8780 or *jeffrey.deshon@epa.ohio.gov* before preparing and submitting any information.** The Agency's capacity to accept and utilize the data in preparation of the Integrated Report is dependent upon a variety of factors and the use of all data brought to our attention may not be possible. Data must have been collected after January 1 2015, and must meet the basic acceptability specifications listed above. Data must be provided in an electronic format such as STORET, Excel or Access.

To whom do I send the data?
Submit microbiological data and supporting information listed above by September 15, 2017 to Chris Skalski, ***chris.skalski@epa.ohio.gov***, Ohio EPA/DSW, P.O. Box 1049, Columbus, Ohio 43216-1049.

Submit biological, physical, and chemical water quality data and supporting information listed above by July 15, 2017, to Jeff DeShon, ***jeffrey.deshon@epa.ohio.gov***, Ohio EPA/Groveport Field Office, 4675 Homer-Ohio Lane, Groveport, Ohio 43125.

D6.2 Web Page Announcing 2018 Integrated Report Preparation

As shown below, Ohio EPA announced the preparation and anticipated schedule[8] of the 2018 Integrated Report on its website (***epa.ohio.gov/dsw/tmdl/OhioIntegratedReport.aspx***).

Preparation of 2018 Integrated Report is Underway

Ohio EPA is preparing the 2018 Integrated Report, which fulfills the State's reporting obligations under Section 305(b) (33 U.S.C. 1315) and Section 303(d) (33 U.S.C. 1313) of the Federal Clean Water Act. The report will indicate the general condition of Ohio's waters and list those waters that are currently impaired and may require Total Maximum Daily Load (TMDL) development in order to meet water quality standards.

When will the report be completed?

Major project milestones and expected dates for completion are:

Refine methodologies / compile data	June - October 2017
External level 3 credible data are due to Ohio EPA	July 15, 2017 (bio/physical/chem); Sept 15, 2017 (bacteria)
Prepare list / internal review	October - December 2017
Public notice draft 303(d) list	December 2017 – January 2018
Respond to comments / prepare final list	February - March 2018
Submit to U.S. EPA Region V for approval	April 1, 2018

Please continue to check this Web site for updates.

Call for Level 3 Credible Data

Information regarding level 3 credible data submission can be found at the following webpage.

[8] Due to a variety of factors, the 2018 Integrated Report did not follow the originally anticipated schedule.

D6.3 Notice of Availability and Request for Comments CWA Section 303(d) TMDL Priority List for 2018

Public Notice Date: March 22, 2018

OHIO ENVIRONMENTAL PROTECTION AGENCY PUBLIC NOTICE

NOTICE OF AVAILABILITY and REQUEST FOR COMMENTS Federal Water Pollution Control Act Section 303(d) TMDL PRIORITY LIST FOR 2018

Public notice is hereby given that the Ohio Environmental Protection Agency (Ohio EPA) Division of Surface Water (DSW) is providing for public review and comment the *2018 Integrated Water Quality Monitoring and Assessment Report.* This report includes the Total Maximum Daily Load (TMDL) priority list for 2018 as required by Section 303(d) of the Federal Water Pollution Control Act (a.k.a., Clean Water Act), 33 U.S.C. Section 1313(d). The list indicates the waters of Ohio that are currently impaired and may require TMDL development in order to meet water quality standards. The list is contained within Section L4, which, in accordance with federal guidance, satisfies the Clean Water Act requirements for both Section 305(b) water quality reports and Section 303(d) lists. The report describes the procedures that Ohio EPA used to develop the list and indicates which areas have been selected for TMDL development during federal fiscal years 2018 through 2020.

Ohio EPA will present information about the list through a webinar on April 25, 2018, at 2:00 pm. The webinar may be viewed at Ohio EPA's Central Office, Conference Room A, 50 West Town Street, Suite 700, Columbus, Ohio 43215 or by registering and joining online at: https://ohioepa.webex.com/mw3200/mywebex/default.do?siteurl=ohioepa. All visitors to Ohio EPA must register at the Security desk in the lobby upon arrival. Please bring photo identification (such as a valid driver's license). For security reasons, visitors are required to wear their badge at all times while in the building. Please arrive early to complete these procedures.

All interested persons wishing to submit comments on the list for Ohio EPA's consideration may do so by email to EPATMDL@epa.ohio.gov or in writing to Ohio EPA, Division of Surface Water, P.O. Box 1049, Columbus, Ohio 43216-1049 Attn: 303(d) Comments, by the close of business, May 4, 2018. Comments received after this date may be considered as time and circumstances allow.

After reviewing the comments, Ohio EPA will submit a final document to the United States Environmental Protection Agency (U.S. EPA) for approval.

The report is available for review on Ohio EPA's Division of Surface Water website at http://epa.ohio.gov/dsw/tmdl/OhioIntegratedReport.aspx. To arrange to inspect Agency files or records pertaining to the document, please contact Richard Bouder at (614) 644-2782. To request notice of when Ohio EPA submits the document to U.S. EPA, please contact the e-mail address above or call Rahel Babb at (614) 728-2384.

D6.3.1 Response to Comments Received regarding the Request for Comments CWA Section 303(d) TMDL Priority List for 2018

D7. Public Comments and Responses to Comments on Draft Report

The draft Ohio 2018 Integrated Water Quality Monitoring and Assessment Report (a.k.a., Integrated Report or IR) was available for public review from March 22, 2018 through May 4, 2018.

During that time frame, 25 sets of public comments were received on the draft report, as follows:

Name	Organization
Ed Thomas, Director, Regulatory Affairs	The Fertilizer Institute
Ray Flasco	Private citizen
FOMR Water Quality Committee	Friends of the Mahoning River (FOMR)
Jared A. Bartley, CFM, Rocky River Watershed Program Manager	Cuyahoga Soil and Water Conservation District
Adam Lehmann, Stream Specialist	Hamilton County Soil and Water Conservation District
John Stark, Director of Freshwater Conservation	The Nature Conservancy
Marj Mulcahy	Private citizen
Eric B. Partee, LMC Executive Director	Little Miami Conservancy (LMC)
Laura Fay, FLOW Science Committee, chairwoman	Friends of Lower Olentangy Watershed (FLOW)
Kim Folk-Axe	Private citizen
Chris Steffen, Jr., National Leadership Council Representative Donald Dean, President	Ohio Council of Trout Unlimited
Chris Tavenor, Law Fellow Trent Dougherty, General Council	Ohio Environmental Council
No names were provided	Ohio Cattlemen's Association Ohio Pork Council Ohio Dairy Producers Association
Chris O. Yoder, Research Director	Midwest Biodiversity Institute (MBI)
Madeline Fleisher, Senior Attorney	Environmental Law and Policy Center
Jean-Luc Kreitner, Staff Attorney	Environmental Law and Policy Center
Crystal Davis, Policy Director	Alliance for the Great Lakes
Kristy Meyer, Vice President of Policy, Natural Resources	Ohio Environmental Council
Gail Hesse	National Wildlife Federation
Sandy Bihn, Executive Director	Lake Erie Foundation and Lake Erie Waterkeeper
Adam J. Sharp, Executive Vice President	Ohio Farm Bureau Federation
Kirt Merritt, Executive Director Tadd Nicholson, Executive Director Christopher Henney, President and CEO	Ohio Soybean Association Ohio Corn and Wheat Ohio Agribusiness Association
William Ringo, Treasurer	Guardians of GLSM
Hope Taft, Co-Chair	Little Miami Rivers Kleeners and Little Miami Watershed Network
William T. McCarthy	Private citizen
Catherine and Eric Paetz	Private citizen
Tyler Bender	Private citizen
Sheelagh McCarthy	Private citizen

Most of the comments are expressed verbatim as to how they were received; however, grammatical errors and typos may have been corrected and many comments were reduced to just the main points or requests. Please note that page number references to the draft report may not correspond to the same page numbers in the final report. **Furthermore, responses were only prepared for comments that pertained to the 303(d) list and/or the data that supports the list; other comments were taken into consideration but may not be acknowledged in the text below.**

Complete copies of the comments are included at the end of this section.

Comments Related to Specific Watersheds

Comment 1: While per Sections C7 and J2 there seems to be an internal Ohio EPA discussion about the effectiveness of the TMDL process, and planning to follow a new "Vision," will the TMDL Assessment be completed for the Mahoning River, and, if so, when?

Comment 2: The lower Mahoning and its tributaries do not appear in Table J-15, even though upper stretches were completed in 2011. If an alternative process is anticipated, such as one associated with planned dam removal, can you summarize what that might involve in current discussion? How would such an alternative process include local initiatives under way, and related activity such as the Youngstown Consent Decree?

Responses 1-2: The Biological and Water Quality Study of the Lower Mahoning River report will be available for stakeholder review and comment soon. This is step two of the TMDL development process. Then Agency will review the water quality impairments, if applicable, along with the causes and sources of those impairments to determine what the appropriate mechanism is to restore the river's water quality. The projects included in Table J-15 are further along in the development process and more likely to be completed in the next two years.

Comment 3: The area for the Mahoning River Mainstem, as found in Section L4, is reported as being 1.68 square miles. This does not seem to be correct. Is the area included in the assessment a factor evaluated in the priority points accumulated?

Response 3: The area for the large rivers is wrong and has been corrected. This is not a factor that is used to calculate priority points. The process for determining priority points can be found in Section J.

Comment 4: The Assessment Unit Summary for HUC 04110001 02 03 (Rocky River) indicates that the Designated Aquatic Life Use for portions of Abram Creek is "Modified Warmwater Habitat – Channel Modified." In fact, per OAC 3745-1-20, the Designated Aquatic Life Use for Abram Creek is "Warmwater Habitat." Ohio EPA had proposed to change the Abram Creek designation to MWH-CM but ceded to local requests to maintain the WWH designation. This designation and associated Attainment Status should be accurately reflected in the Assessment Unit Summary for HUC 04110001 02 03 in the 2018 Integrated Report.

Response 4: The assessment unit summary will be revised to reflect the correct aquatic life use designation and attainment status.

Comment 5: Little Miami Conservancy (LMC) would note that attainment of several watersheds throughout the State of Ohio is based on data older than ten years. Historical data is very important but using this as a determination of present day attainment and the health of the aquatic ecosystem is of concern because of the dynamic conditions of lotic and lentic aquatic ecosystems.

The last comprehensive water quality monitoring sampling conducted by Ohio EPA of the lower Little Miami River occurred in 2007. The attainment status and TMDL for this portion of the river is based on that data. It is noted that Credible Level 3 sampling was conducted on the lower reach in 2012 by Midwest Biodiversity Institute/Center for Applied Bioassessment and Biocriteria (MBI), who was contracted with Hamilton County Metropolitan Sewer District, and this data did document impairment in areas Ohio EPA had previously not noted impairment. We understand Ohio EPA conducted some limited sampling of these same site sampled by MBI and came to different conclusions.

It is unclear in the 2018 IR, where this data is discussed or how it fits into the attainment status for the lower Little Miami River.

It is of concern to the Little Miami Conservancy that Ohio EPA uses data older than 10 years to report attainment in the IR.

Response 5: Ohio EPA received and reviewed the sampling results from MBI but had some questions/concerns with the data. There were some large deviations from both the IBI and MIwb scores (compared to Ohio EPA data collected in 2007 and 2012) at a number of sites, and to date has not been approved as Level 3 data for the purpose of inclusion in the Integrated Report.

Comment 6: Per page G-1 (Background and Rationale), FLOW understands that Ohio EPA has limited resources and cannot study every watershed on a 10-year rotation. We also acknowledge that using historical data as stated, "some earlier data collected between 2003-2006 were retained for specific watershed and large river assessments" is necessary and "can be used if the director has identified compelling reasons as to why data are credible".

FLOW requests that Ohio EPA continue to utilize historical Olentangy River Data in Integrated Reports unless newer data to replace it is available. Of all the 2003-2004 Olentangy watershed data, Ohio EPA chose to use include only one data point (V04Q05 Downstream of Bill Moose Run).

All the sites from Ohio EPA's monitoring efforts in the Deep Run, Rush Run and Mouth of the Olentangy River 12 Digit HUCs from the 2003-2004 Technical Support Document could have been included in this report. The lack of data on the Olentangy Tributaries gives a misleading picture of the health of the watershed.

The omission of data has resulted in a misleading report of the water quality of the Olentangy based on previous Ohio EPA reports. Previously the Deep Run HUC had the highest water quality as a designated Exceptional Warmwater Habitat and a State Scenic River, this portion of the Olentangy needed minor restoration. Using Ohio EPA's 2018 Integrated Assessment Report would lead some to prioritize their efforts solely in this Hydrologic Unit Code (HUC).

We appreciate all that Ohio EPA's Division of Surface Water is doing to improve water quality and request that you conduct a reassessment of the IR 2018 for the Olentangy to include all the 2003-2004 data. And possibly include the 1999 sampling data as well.

Response 6: The Integrated Report provides a summary of the status of the State's surface waters. In general, for the aquatic life use, ten years of data is included in the interactive map and used in the summary statics included in the report. The 2003-2004 survey data on the Olentangy River falls out of this window. That does not mean that attainment determinations based on that data go away. Section L4 List of Prioritized Impaired Waters still contains the Olentangy River HUCs with the assessments made based on the 2003-2004 survey, unless newer data is available.

For the Mouth Olentangy River HUC-12 (050600011103), the 2003-2004 data for the station at Olentangy River at Columbus, downstream Bill Moose tributary is included on the map because this entire HUC was reassessed using new data collected in 2015 at three other stations within the HUC.

Comment 7: Please explain what "Category 4c Impaired not a pollutant" means? Specifically, FLOW is concerned about what this means for Brandige Run- Olentangy River 4 Ch.

Response 7: The reporting Category 4c is used for situations where there is impairment but a TMDL is not needed because the impairment is not caused by a pollutant (e.g. metal, nutrient, bacteria). For this HUC-12, the main cause of aquatic life impairment is a flow regime alteration, with accompanying sedimentation/siltation. The source of the impairment is a dam or impoundment. In this case, the removal of the dam or impoundment is most likely to bring the HUC back into attainment.

Comment 8: Rush Run HUC (05060001 11 02) is listed on page L-27 as Category 1it for Aquatic Life Use. Since there is no data for this 12-digit HUC, shouldn't the category be 3it (Use attainment unknown, TMDL conducted at HUC 11, not enough data to assess this Assessment Unit (AU)?

Response 8: The Rush Run HUC was sampled in 2003-2004. Sites within the HUC were found to be in attainment. The age of data, as a stand-alone factor, is not sufficient justification to revise an assessment unit category listing from 1 to 3.

Comment 9: The ten-year time frame for Tappan Lake to work through the process and to be delisted is too long.

Response 9: The agency is pleased that there is local interest in evaluating and planning to improve the Tappan Lake water quality and believes that the efforts will be more successful than the agency simply developing a TMDL. The time frame is likely realistic, given that the impacts are suspected to be from sources like mining that may take quite a bit of time and money to mitigate.

General Comments

Comment 10: In reviewing the *Draft 2018 Integrated Water Quality Monitoring and Assessment Report*, I was struck by the absence of much of the tabular and graphical analysis in Section G that has been so useful for interpreting results in past years (e.g. Tables G-2, G-3, and G-4 from the 2016 report are missing). I feel particularly strongly that the information in table G-4 from the 2016 report ("Prevalence of the top five causes of aquatic life impairment in watershed and LRAUs"), be included as it is quite useful for prioritizing efforts for watershed management strategies statewide. I would further encourage the Agency to conduct and present this analysis on an Ecoregion basis to facilitate more localized regional watershed management planning. Ideally, two summary tables (one with state-wide data and one broken-down by ecoregion) would be provided identifying number of instances for ALL "causes" of non-attainment of ALU.

Response 10: Please review Section G of the 2018 Integrated Report again, the tables referenced in the comment are included. Thank you for the suggestion to include ecoregions in the presentation of our data. Please be aware that ecoregion associations may be available in the technical support documents associated with monitored watershed to which links are available on the interactive map. Also available on the interactive map website is a link to the GIS data associated with the report cycle. A link to the Interactive Map that coincides with the 2018 IR can be found here: ***http://oepa.maps.arcgis.com/apps/webappviewer/index.html?id=5df599f41fd241be8de26576ed4d6aae***. A link to the GIS shapefiles can be found in the "About" pane.

Comment 11: In G3.1, the "% Attainment Status for LRAUs" seems to have peaked in 2010 and stayed close to the same or slightly declined since then. What explanation might there be for this apparent lack of further improvement? The agency should note the recent trend as well as progress made in the late 1990s and early 2000s.

Response 11: As noted in the 2012 Integrated Report, the aquatic life statistic for large rivers decreased slightly from 2010 "largely because of new assessments in four large rivers, three of which flow through highly urbanized areas and receive large quantities of flow from wastewater treatment facilities." These four rivers were the Sandusky River, Cuyahoga River, Scioto River (middle) and Great Miami River (lower). Please note, the statistics are based upon the large rivers that were sampled during a specified window of time and therefore do not include all large rivers.

The 2012 Integrated Report notes that "Taken collectively since the 1980s, the quality of aquatic life in all of Ohio's large rivers has shown a remarkable improvement. Then, only 21 percent of the large rivers met water quality standards, increasing to 62 percent in the 1990s, to 89 percent today (in the 2012 report). Areas not meeting the standards have decreased from 79 percent in the 1980s to 38 percent in the 1990s to 11 percent today (in the 2012 report)."

Comment 12: Ohio EPA has water quality data dating back approximately 40 years. It is high quality data that tells an important story of the challenges and efforts made by the State for its citizens to improve the quality of its waters. We may have misunderstood in the IR in section G, but it appears the Ohio EPA may be selectively evaluating only the latest 10 years of data for trend assessment rather than assessing the entire database for an assessment unit or watershed. Is this the intention of Ohio EPA? By reducing the database, removing historical data, Ohio EPA risks not catching long-term changes in trend assessment that may reflect decreases in attainment.

Response 12: The IR reports status of water quality on a broader, statewide basis than trends for individual HUCs. The individual biological and water quality reports for a specific watershed contain more details on the trends in attainment. As new databases become available, such as U.S. EPA's Assessment, Total Maximum Daily Load Tracking and Implementation System (ATTAINS), trend analysis for a HUC may become easier and more customizable.

Comment 13: FLOW requests that you return the water quality app to the Geographic Information System service so that we can have access to all Ohio EPA data again. This will be helpful to FLOW and our partners in assessing priorities for projects for water quality improvements, many of which are needed in our urban tributaries.

Response 13: A link to the Interactive Map that coincides with the 2018 IR can be found here: ***http://oepa.maps.arcgis.com/apps/webappviewer/index.html?id=5df599f41fd241be8de26576ed4d6aae***. Also, on this page, in the "About" pane, can be found a link to the GIS shapefiles that are downloadable and useable in your own GIS project.

Comment 14: FLOW noticed errors in how Ohio EPA is assigning priority points in the list of Assessment Units in Section L. Specifically, our concern is about how priority points, listed in Table J-3 (page 241) for Aquatic Life Use and Recreational Use are assigned.

1 point for scores between 0-25

2 points for scores between 75.1-100 should have 4 points

3 points for scores between 25.1-50 should have 2 points

4 points for scores between 50.1- 75 should have 3 points

Are these merely typos in the report or were the priority points for each assessment unit miscalculated?

Response 14: This is not a typo. Priority point rationale are described on page J-4: "For the recreation and aquatic life uses, points are assigned based on a computed index score (see Sections F2 and G2). The lowest quartile (scores between 0 and 25) get the fewest points because a TMDL may not be the most effective way to address the impairments. Scores in this range indicate severe basin-wide problems, comprehensive degradation that may require significant time and resources and broad-scale fixes, including, possibly, fundamental changes in land use practices. Education about the effects various practices have on water quality and encouraging stewardship may be more effective in these areas than a traditional TMDL approach. Scores in the highest quartile (between 75.1 and 100) generally indicate a localized water quality issue. Addressing the impairment may not require a complete watershed effort; rather, a targeted fix for a specific problem may be most effective. Thus, these receive the next lowest number of priority points. The most points are awarded for scores in the middle quartiles (between 25.1 and 50 and between 50.1 and 75), indicating problems of such scale that purposeful action should produce a measurable response within a 10-year period. These waters are the best candidates for a traditional TMDL." This system of priority points has been in place since the 2010 IR.

Comment 15: Ohio has one of the leading programs among states in the U.S. that allows the agency to produce something better than a simple statewide estimate of use attainment and non-attainment. Based on our experience in reviewing state programs, the analyses like that in ***Large Rivers are Making Progress Toward the 100 Percent Attainment by 2020 Aquatic Life Goal*** in Section A are the outcome of a nearly 40-year commitment to a robust M&A program and a level of spatial detail that matches the scale of water quality management. Many states, because of a lack of spatial detail in their M&A, over-extrapolate their results from many fewer monitoring sites (including those who employ statistical networks) resulting in not only a reduced accuracy in the application of those results, but a clear severance from meaningfully affecting water quality managements programs.

While we recognize the quality and integrity of the nearly 40 years of M&A on the large river assessment units, we are concerned about the expression of the most recent results in the 2018 IR. The lead in statement *"Ohio's large rivers (the 23 rivers that drain more than 500 square miles) remained essentially unchanged in percent of monitored miles in full attainment compared to the same statistic reported in the 2016 IR"* is essentially correct. However, we see this section at least implying that 100% full attainment will occur by 2020, which means that a gain of 12.5% will need to "found" if the goal is to be attained. This section of the IR needs to take a step back and report what has actually happened since 2010 and also to include the full set of results back to 1980. Two graphics are provided to assist in that process and we have assessed the likelihood of actually improving beyond the 2008 full attainment rate of 93.1% in an article on the MBI website (Figure 1). Instead, we see a decline of 5.6% between 2008 and 2016, which we also believe represents a leveling off of improvements seen prior to 2008 *at a*

minimum and more likely an actual decline. We suggest that the agency modify the IR to recognize this and also the unlikelihood of meeting the 2020 goal especially given the current deregulatory climate. This also highlights the critical importance of maintaining the M&A level of effort otherwise the agency will lose the ability to credibly assess these trends into the future. This issue alone reaffirms our concerns about the pending 80% reduction in the level of sites evaluated annually beginning in 2018.

Comment 16: MBI is concerned about the apparent decision to utilize only the most recent 10 years of assessment data to analyze trends. While we recognize the practical utility of a 10-year period

as a "rule-of-thumb" for considering data as being applicable to a particular river or stream at a given point in time, there is no particular validity in that time frame. It should be applied differently to non-attaining vs. attaining streams and rivers and it should also consider the quality at the same time. We would not expect and EWH river to decline and if the stressor levels have not increased the quality should be the same in 10 years or 20 years. For assessing long term trends, we strongly advise the agency to retain all of the years of assessment dating back to 1980 and simply adding the new biennium of results in each successive reporting cycle. If only the prior 10 years are assessed, then it will only be another reporting cycle before the peak attainment of 93.1% is lost from the analysis and providing an inaccurate assessment of decline or improvement. Again, to preclude misreading these trends we urge the agency to retain all the biennial cycles and updating them to include the years in between 1980 and 2016. We would be willing to work with the agency to build such an analysis.

The HUC-12 assessment shows a continuing improvement and we recommend including the results back to 1980 to provide a solid historical perspective. The attainment rate is well below the large river assessment units and due to the different degrees of success in controlling point and nonpoint sources of impairment.

Response 15-16: While we do not intend to revise the 2018 IR, we appreciate the comments and will take them under advisement for future reports. As you know, the goals will need to be reset in the 2020 report, and that may also be a good time to update/revise our presentation and discussion of the trends.

Comment 17: Ohio in its assessment units and scoring has the lowest number of points allowable in the human health category. Human health is extremely important. Explain??

Response 17: The human health beneficial use in the Integrated Report pertain to the consumption of sport caught fish. In general, the sources of the most common fish tissue contaminants (mercury and PCBs) are remediated through programs other than the TMDL program and, therefore, are assigned a lower priority point value for TMDL development.

Comments Related to Monitoring Schedule

Comment 18: While we appreciate the need to address the new TMDL requirements, we strongly encourage Ohio EPA to resume a full (e.g., up to 6 or 7 basins/watersheds, ~500 sites) monitoring schedule in 2019, using the geometric survey design similar to that used since the 1980s.

Comment 19: Ohio EPA's 2016 Integrated Report contained a Long-Term Monitoring Schedule map depicting monitoring through 2027 for the State of Ohio. This map with the schedule for comprehensive water quality monitoring for Ohio appears to be missing from the 2018 report. The Little Miami Conservancy feels this schedule is imperative to maintain the high-quality data the State of Ohio produces…. Will Ohio EPA provide a long-term monitoring schedule in the 2018 IR or will the schedule be provided in another format?

Comment 20: Ohio EPA has operated an exemplary monitoring and assessment (M&A) program that is nearing 40 years for inland rivers and streams...We therefore urge the agency to reveal the intent of any changes to stakeholders, especially those who have come to rely on the outputs and outcomes of one of the most comprehensive approaches in the U.S. As it reads now the ***Ohio EPA Monitors Water Quality in Ohio And Reports its Findings*** discussion in Part A potentially provides a very misleading message about the future of the program that many stakeholders have simply expected to exist well into the future. There are many other concerns, more than we can state in these comments, but we do not see how any fundamental interruption in the design and execution of this program will allow the agency to effectively execute its mission of protecting and restoring water quality in support of measuring the attainability and attainment of designated uses.

Response 18-20: Ohio EPA currently has over 45 outstanding TMDL and/or Biological and Water Quality Study reports that need to be completed by the same staff that are responsible for doing the field work. With TMDL legislative changes, we need a couple of years to reduce that report back log. In the meantime, we will be evaluating if future monitoring can be done in more efficient and effective ways - especially having completed surveys in all significant watershed areas for TMDL purposes at least once now. We are evaluating the use of a probabilistic approach layered with specific needs monitoring (e.g. bracketing point sources for permit support) as we work to develop a sustainable monitoring schedule. We hope to hold some stakeholder sessions over the next year to discuss options (e.g. ecoregional assessments) and then provide a new schedule in 2020 Integrated Report.

Comments Related to Lake Erie

Comment 21: Given the importance of the Western Basin to the overall health of Lake Erie and to its role as a public drinking water source, the **Ohio EPA must prioritize its implementation of TMDLs moving forward with the Western Basin in mind**.

The main source of nonpoint source pollution throughout the Maumee Basin is most likely agricultural activities. The *Nutrient Mass Balance Study* notes that the Auglaize River, for instance, has 80 percent of its landscape devoted to cultivated crops, and the entire watershed is 79 percent agricultural production of all forms. Because Phosphorus and Nitrogen are the principal nutrients that can increase the intensity of HABs, the **Ohio EPA must ensure that it properly prioritizes TMDLs throughout the region and accounts for phosphorus and nitrogen that results from nonpoint source pollution in those TMDLs.** Ohio EPA can use its TMDLs to clearly identify where it can focus its efforts to promote Best Management Practices to reduce nonpoint source pollution.

Response 21: As indicated in Table J-15, four of the six TMDL projects expected to be submitted to U.S.EPA for approval in the next fiscal year are for Lake Erie, and three of those are for the western basin. The comment about ensuring that the TMDLs account for nonpoint source pollution is well taken, and we will be considering that as we move forward with our pending projects.

Comment 22: … OEC believes that in the final version of the *2018 Integrated Water Quality Monitoring and Assessment Report*, the **Ohio EPA should also include a schedule that discusses when it will update older TMDLs in the Maumee and Portage Basins to account for the new impairment status of the Western Basin.**

Of course, the OEC does not expect the Ohio EPA to accelerate the update of old TMDLs before the agency develops TMDLs for watersheds that presently lack such a guiding document. However, if the **Ohio EPA takes seriously its goal to "Incorporate HAB considerations into priorities (both PDWS use and ultimately Recreation use)," then it must develop a schedule to improve and replace old TMDLs that do not properly account for the Western Basin's algae impairment status. The Draft Report is the perfect moment to outline that schedule, and updated TMDLs can serve as a key opportunity to highlight the ongoing voluntary activities throughout the Maumee and Portage Basins designed to reduce nonpoint source pollution.** Updated TMDLs can also provide the public and policy makers with a clear perspective on water quality throughout the region.

Response 22: The state is only required to include a TMDL schedule for the next 2 years in the Integrated Report, which it has done. While we do not disagree that the old TMDLs need updated, we simply do not have the resources to do so in the next 2 years while also completing the new TMDLs. No changes will be made to the 2018 IR, but the comment will be considered in our administrative planning for the program.

Comment 23: Based upon the use of satellite images for this process, is it implied that the size of the algae bloom is directly proportional to the toxicity of the bloom from a recreational stand-point?

Comment 24: According to the proposed assessment methodology, it is bad if the presence of cyanobacteria is at levels at or above the threshold for detection via the satellite images. How does the presence of cyanobacteria adversely impact recreation? Why base the assessment method at a low cyanobacteria density? Why could it not be based on a medium level?

Response 23-24: The density of the bloom is more closely tied to toxicity and therefore recreational impacts. Cyanobacteria cell counts above 20,000 cells/mL are associated with a higher likelihood of having measurable concentrations of microcystins, with 10 ug/L being possible in highly toxic blooms (above Ohio EPA's microcystins recreational health advisory concentration). Source: World Health Organization, Toxic Cyanobacteria in Water, 1999, Chapter 5 ***http://www.who.int/water_sanitation_health/publications/toxicyanobact/en/***. Historic data show the western basin of Lake Erie is typically dominated by microcystins-producing *Microcystis* blooms (articles showing shift to *Microcystis* dominance: Bridgeman et. al., "A novel method for tracking western Lake Erie *Microcystis* blooms, 2002 – 2011", 2012 ***https://www.utoledo.edu/nsm/lec/pdfs/A_novel_method_for_tracking_bridgeman.pdf*** and Meyer et. al. "Genome Sequences of Lower Great Lakes Microcystis Sp. Reveal Strain-Specific Genes That Are Present and Expressed in Western Lake Erie Blooms" 2018 ***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5647855/***)

It should also be noted that a comparison of using a 20,000 cells/mL benchmark to a 100,000 cells/mL benchmark did not change the impairment determination.

Comment 25: How was it determined that a threshold of 30% of the western basin open water unit area with a density of 20,000 cells/mL is acceptable?

Response 25: When cyanobacteria capable of producing cyanotoxins, especially *Microcystis*, exceed concentrations of 20,000 cells/ml, there is a higher likelihood that cyanotoxins will be present at detectable concentrations. The relationship between the presence of *Microcystis* blooms and elevated microcystins concentrations has been well documented in the Lake Erie western basin. The 30 percent coverage was reached by an iterative process to set the threshold at a bloom size close to the 2004 and 2012 blooms, which was established by the GLWQA Annex 4 committee to be an acceptable bloom size. This approach was developed and recommended by the researchers and is being used by the agency to interpret the narrative water quality standards. We consider 30 percent coverage in more than 30 days over a season to be the point at which the algae with a density of 20,000 cell/mL or greater becomes a nuisance and impedes recreation at a significant level (i.e. no longer meets the use).

Comment 26: If a bloom covers less than 30% of the western basin open water but is far denser in cyanobacteria cell count, is it still not impaired?

Response 26: It would not be impaired using this assessment method. As stated in the report, for this large body of water where blooms move and change daily, the intent is not to conclude each small or very short-term bloom causes the water to be listed as impaired, but to ensure that widespread, longer lasting blooms do result in an impairment listing. This is similar to how the beaches are evaluated for recreation use based on bacteria (E. Coli). A single exceedance of the maximum criteria does not make the assessment unit impaired, but multiple exceedances of the maximum criteria or an exceedance of the geometric mean criteria do result in an impairment designation (see Section F, pages F2-F5). There is a realization that some exceedances may occur, but if they are small in nature and/or very infrequent, they do not necessarily mean the water cannot be used for its intended purpose overall.

Comment 27: On page F-34 the report mentions that the use of MODIS was the "first phase" of this process. Is there documentation on the next phase of this process? Will there be an opportunity for input on future processes?

Comment 28: On page I-19 the report indicates the satellite images will be used in conjunction with information from "researchers at the Ohio State University/Stone Laboratory, University of Toledo and Bowling Green State University." We appreciate the use of these tremendous academic assets in the development of a better understanding of the algae issue. The same page indicates that these universities were utilized in 2017 for water sampling.

Was the information gathered at that time utilized in conjunction with the satellite information discussed earlier as part of the impairment designation? If so, how was it utilized?

Moving forward, will the impairment designation be based upon the "Phase 1" use of MODIS, or will it utilize research from these universities or will it be a combination thereof?

Comment 29: The draft Report presents the first phase of Ohio's assessment method for recreational use attainment due to the presence of algae in WLE. What is Ohio EPA's plan for the next phase and what components will it contain? When will that phase be available for review and comment?

Response 27-29: The water quality sampling results and available data were discussed with the researchers during the method development. The concern at this time is that amount of sampling locations, sampling frequency and methods need to be evaluated to determine what is appropriate to conclude that, for instance, the microcystin levels are high enough and/or frequent enough to result in a recreation impairment in such a large body of water. Also, at this time there is no concentration threshold established at the federal or state level to compare the toxicity to for recreation impairment (U.S.EPA has drafted criteria for microcystin and cylindrospermopsin but has not yet finalized it). So Ohio EPA intends to continue working with the researchers to develop an appropriate sampling scheme and assessment method for the actual toxicity levels of the blooms (primarily microcystin concentrations in the western basin, but other cyanobacteria need to be explored for areas like the Sandusky Bay and central basin), as well as continue to monitor other parameters like chlorophyll that could possibly serve as indicators of the use impairment (violation of the narrative water quality standard). The intent is to use these sampling results in conjunction with the satellite data for future assessments, but exactly what and how needs to be worked out.

There is some discussion about future phases in Section I. As those are further explored, at a minimum they would be included in draft Integrated Reports (e.g. the 2020 Integrated Report) for input.

Comment 30: We understand and can appreciate the desire to separate out the assessment units in Lake Erie. Yet as previously mentioned, the challenge with this approach is as you become more targeted, accurate information becomes less available. Specifically, to have an assessment unit for the island shoreline, it would be appropriate to access information at this granular level. As such, we question the validity of having such a small assessment unit when the shape files available from NOAA are unable to differentiate between the island shoreline and the western basin open water as mentioned on page F-36.

Response 30: The shoreline units have been maintained because they are important for evaluating the other use designations since data for those evaluations are collected closer to the land. In particular, the recreation use based on bacteria is most critical at beaches which have been and are intended to continue to be evaluated using only data collected within typical beach areas (i.e. not out in the open waters). Since blooms are known to shift and often hug the shorelines, the public water systems with intakes in the shoreline measured significant microcystin levels, and there is more potential for exposure by swimming/boating/other recreation there, it was concluded that the island shoreline should be considered impaired by algae for recreation use as well as the open water.

Comment 31: The reporting on beneficial use impairments in the Lake Erie Nearshore and Areas of Concern is well done and comprehensive enough, but we are concerned that new and emerging threats

that are documented for drinking water supplies and recreation represents a threat to other designated uses including aquatic life. The toxic byproducts of cyanobacteria are toxic to fish and other aquatic life thus we are recommending that it be recognized as a potential cause of impairment. While not a robust assessment, we had a small project in Maumee Bay in 2018 the results of which represented a backsliding to conditions observed in the early 1990s. Furthermore, one site had DELT anomalies far in excess of the BUI delisting criteria. Given the potential for at least chronic effects we advise looking more closely at the role of Mycrosystin in having adverse impacts on aquatic life use attainment in the nearshore of Maumee Bay and adjacent waters.

Response 31: Ohio EPA continues to monitor the fish and mayflies along the shore of Lake Erie and hopes to maintain a robust enough data set to track impacts such as these. We have been supporting Ohio State University and others to study microcystin in fish tissue and will continue to support and collaborate with the researchers on these issues to the extent we can. In addition, there are studies and models being developed at the national/international level through the GLWQA Annex 2 that will continue to provide more information about the ecosystem in the future.

Comment 32: It seems a bit contradictory and confusing for Ohio to acknowledge and commit to a 40% phosphorous reduction and a reduction for dissolved reactive phosphorous to have an 'acceptable' level of algae. Instead of using the 40% reduction in the western basin of Lake Erie which is part of Annex 4 in the Great Lakes Water Quality Agreement, Ohio has determined an alternate method of assessing when the western basin is no longer impaired. It seems that the 40% reduction etc. should be the benchmark for eliminating the impaired designation. Why did Ohio change from the 40% reduction for removing the impaired designation to an algae coverage formula?

Response 32: Ohio has not changed from the 40 percent phosphorus load reduction goals for the tributaries to the lake. In fact, the bloom coverage goal for determining impairment status was derived by aiming for size of bloom that is expected to occur when the 40 percent phosphorus load reduction goal from the tributaries is met (blooms no bigger in size than 2004 or 2012).

Comment 33: The NOAA Experimental Lake Erie Harmful Algal Bloom Bulletin has a threshold for cyanobacteria detection of 20,000 cells/mL. The estimated cyanobacteria density is determined through the strength of the measured reflectance signal at multiple wavelengths. What is the relationship between toxin production and cyanobacteria density?

Response 33: For over the past decade, western basin Lake Erie cyanobacteria blooms have been dominated by microcystins-producing *Microcystis* blooms (see prior references in the response to comments 23-24), so a relationship between the phycocyanin spectral signature and severity of the cyanotoxin producing bloom can be made. In other lake systems dominated by non-cyanotoxin producing cyanobacteria genera or strains the relationship may be different (high biomass blooms may not be linked to cyanotoxin production). This is one reason Ohio EPA is proposing to use the NOAA satellite data to help identity impaired conditions on Lake Erie and not on Ohio's inland lakes, where links to toxicity may not be as clearly defined.

Comment 34: Current research being conducted by The Ohio State University at Stone Lab is showing that the ratio of cyanobacteria toxin in the water to the amount of cyanobacteria biomass present changes from year to year and within the summer. The highest toxin per biomass ratio routinely occurs at the start of the bloom and this ratio decreases throughout the summer as nitrate concentrations in the water column decrease. The result is that the composition of the bloom shifts from highly-toxic to low to non-toxic strains of *Microcystis*. The data again leads to the question – How does the presence of cyanobacteria in the later stages of a bloom adversely impact recreation?

Response 34: Recreation season is typically over by the end stages of a bloom (October) when cyanotoxin concentrations can be lower. Microcystins concentrations have been measured above recreational thresholds well after the traditional September Labor Day end of recreation season during severe HAB years. In addition, some Lake Erie public water systems have had their peak microcystins detection in October, after the traditional end of recreation season. In 2017, microcystins sampling in Lake Erie conducted by the cities of Toledo and Oregon exceeded recreational thresholds after Labor Day.

Comment 35: Section I: NWF supports the acknowledgement in I4 for the need for long term monitoring in Lake Erie but this needs to be a more complete discussion of needs and plans for a more robust analysis of Lake Erie condition. Ohio EPA should identify in the final report its intentions to develop plans and commitments for biological monitoring (including mayfly, phytoplankton, zooplankton and periphyton). Ohio EPA should include discussion on the data needed to apply the Aquatic Life Use Index Score for the open waters of Lake Erie (listed as no data available for analysis). Ohio EPA is in the unique position to apply its expertise and responsibility towards tracking changes in status and condition of the lake. Lake Erie is particularly susceptible to changes in condition and we need long term commitments for a robust monitoring program. We understand that funding may not be currently available, but Ohio EPA has a responsibility and an opportunity to define a minimum needs monitoring program in the IR. While Ohio EPA has deferred to USEPA and then to university and NOAA scientists for a protocol for assessing the open waters, it needs to leverage its own in-agency expertise for identifying the need to track status and condition of Lake Erie.

Response 35: The Integrated Report is not required to contain a detailed accounting of the monitoring needs for determining impairment of the state's waters. However, there are mentions/references to Ohio EPA's nearshore monitoring program for Lake Erie (including an overview on page C7) which is fully expected to continue. The monitoring schedule for the tributaries is being evaluated and is expected to be provided again in the 2020 report. It should be noted that the development of the assessment method was a collaborative process, with input provided by the researchers at Ohio EPA's request to gain a broader perspective of experts, and the result is ultimately the agency's methodology.

Comment 36: Section I: While there is brief mention of monitoring related to algal blooms, NWF requests that Ohio EPA expand this discussion to include needs and plans to address additional cyanotoxins in Lake Erie for future reporting. The specific thresholds for cyanotoxins in the public drinking water use attainment analysis are clear but the satellite imagery analysis has limitations. As mentioned in Section F, the relationship between the presence of *Microcystis* blooms and elevated microcystin concentrations has been well documented in the Lake Erie western basin. However, cell density and the potential for human health impacts for other cyanotoxins with less scum formation are less well understood. We are concerned that saxitoxins, anatoxin-*a* and cylindrospermopsin could be overlooked in the attainment analysis for recreation and more importantly, for human health exposure. Consideration for future monitoring of algal toxins in recreational waters in Lake Erie and potentially other inland beaches should be presented in this section for the recreation use attainment analysis in future IRs.

Response 36: While no changes to the 2018 report will be made, your comment will be considered as we develop plans to enhance and expand our assessment methods.

Comment 37: Sandusky Shoreline and Sandusky Open Water: The table presented in the webinar "2018 Lake Erie Results" shows that the Sandusky Shoreline is listed as impaired for Recreation E. coli but not for Recreation Algae. Nor is the Sandusky Open Water listed for algae. Please explain how Sandusky Bay in particular does not meet the thresholds for algae established with the new methodology, particularly when satellite imagery depicts presence of algae every year and is often the first area to show earliest in the season and the latest to fade in the fall. The Section K map indicates the Sandusky Shoreline as impaired, but without the e. coli/algae distinction. The map indicates no data available for the Sandusky Open Water assessment unit. I could not find any narrative in the report to provide any explanation. Please clarify if I missed it.

Response 37: As noted in responses 25 and 33, western basin Lake Erie cyanobacteria blooms have been dominated by microcystins-producing *Microcystis* blooms for many years, so a relationship between the phycocyanin spectral signature and severity of the cyanotoxin producing bloom can be made. This relationship has not yet been developed for other cyanobacteria blooms (e.g. the planktothrix dominated blooms in the bay). The agency has contacted NOAA and is working on a plan to obtain the necessary information and develop similar assessment methods for the Sandusky Bay and central basin areas of the lake.

Comment 38: There should be an assessment for determining impairment for the central basin of Lake Erie which would be based on frequency and size of the dead zone along with if the dead zone is impacting the central basin public drinking water intakes.

Response 38: The agency has been collecting dissolved oxygen and other data related to the anoxic zone, along with the other states bordering the central basin, to understand the extent and movement of the zone. We will continue to collect data and work to develop an assessment method for the anoxic zone.

Summarized Comment 39: There should be a western Lake Erie TMDL scheduled that is designed to include all US western Lake Erie watersheds and would assess high flow nutrient – phosphorous and nitrogen inputs during high flow. That TMDL should be given the highest priority ranking. Lacking that, a thorough discussion of why no TMDL is being pursued should be in the report. Ohio EPA is asked to reconsider whether its ongoing "alternative" efforts under Annex 4 of the Great Lakes Water Quality Agreement are in fact an adequate substitute for a TMDL for western Lake Erie.

Completing TMDLs for all 32 watersheds with nutrient loading limits that aggregate up to the GLWQA loading target should be an urgent priority. Such an effort would equate to a "whole lake" TMDL**. A timeline and schedule should be included in the final 2018 Integrated Report**

Response 39: The report does include an explanation about why a TMDL is not being pursued immediately and clearly indicates the western basin load reductions are a priority for the agency and the State. The agency recognizes that if there is no progress then a TMDL may ultimately be required but does not believe that a TMDL alone is adequate to address the problem. The Ohio Domestic Action Plan is intended to be a living document that will be updated/enhanced regularly to ensure progress towards the GLWQA Annex 4 goals – which are based on high flow nutrient reduction needs. Actions to reduce nutrients will require the efforts of multiple stakeholders at the local, state and federal levels. Lastly, the tributaries to the western basin are among the highest priorities to complete TMDLs. The western basin is a high priority for action (just not necessarily a lake TMDL), and the efforts will continue as stated in the report.

Comment 40: Ohio's assessment units for Lake Erie and its TMDL analysis are as clear as mud to the average reader. It appears the scoring for recreation is low while for public drinking water higher. Both of these should receive the highest points because of cyanobacteria/microcystin has very high toxicity that is dangerous for Lake Erie public water intakes and for all who swim or come in contact with the algae.

Response 40: We will consider this for future reports. The shoreline units do receive very high priority points for both drinking water (if there are intakes) and recreation. However, we recognize that we need to evaluate our priority scoring system and consider how best to accommodate multiple pollutants for one use impairment.

Comment 41: The Auglaize and Tiffin Rivers should not be delisted because Heidelberg data shows that these two rivers are major sources of nutrients that are causing problems for Lake Erie. It appears that OEPA is delisting for low flow etc. and is not considering high flow when there is the most significant runoff to Lake Erie. Ohio's assessment system is fatally flawed when it fails to assess high flow runoff after heavy rains.

Response 41: The upper Auglaize River has an existing TMDL report approved in 2004, therefore impaired HUCs within this project area have been delisted. The lower Auglaize River was surveyed in 2014. A Load Analysis Plan will be prepared for the 12 sites found to be in non-attainment in this project as the next step in the TMDL process. The Tiffin River was surveyed in 2013 and a TMDL report is in preparation. Ohio EPA's routine watershed surveys are designed and intended to determine near field attainment of designated uses. Ohio EPA conducts or collaborates on other monitoring that is designed and intended to determine loading to downstream waters, such as Lake Erie. It should also be noted that watersheds that are sources of pollutants to downstream waters do not have to be listed as impaired to be considered for restoration/implementation projects.

Comment 42: The 2018 Draft Integrated Report states that Ohio EPA requested input from various researchers regarding metrics to be used to provide a "scientifically relevant determination of impairment" using targets to meet these Annex 4 goals. Ohio EPA appears to have concluded that this can be achieved by assuring that the algae bloom is not greater than what occurred in 2004 and 2012. As discussed below, Ohio EPA's methodology used to support the nutrient impairment designation has not been made available to the public for review and comment. No data or technical justification was provided in the Draft 2018 Integrated Report. Nor did the report provide the linkage between this new methodology and the Annex 4 bloom severity target. We believe it is critical for stakeholders to have the opportunity to review the data and technical justification before the open waters of the lake are declared impaired. This is particularly important because the same target (and linkage) will need to be used to assess when the lake is no longer impaired and is meeting the Annex 4 goal. A peer review process that includes researchers that informed the GLWQA 2012 threshold for algae bloom severity seems to be in order.

Response 42: The report outlines the methodology and data used to develop the assessment method. The water quality data is available upon request, but as usual is not provided as part of the Integrated Report. More information about the method is also available upon request and has been provided to the two parties that did request it. Most of the researchers that provided input to the agency are on the GLWQA Annex 4 subcommittees or task teams and several were involved in the bloom severity threshold discussions/recommendations.

Comment 43: Ohio EPA's Draft Integrated Report does not indicate that the designated uses of the open waters of the WLEB are not being met or are otherwise threatened. Although the report provides a summary of events reflecting recurring water quality problems (algal blooms) in the open waters: there is no indication that the Agency substantiated the conclusion that water quality standards are either not being attained or are threatened or prepared a Section 301 nonpoint source assessment identifying impairment or threats to water quality standards attainment from nonpoint source pollution. In addition, there appears to be no explanation in the report for the decision to base the impairment determination exclusively on limited satellite imaging data, particularly when that data collection/analysis process has not been *demonstrated* to satisfy the level 3 credible data standard required by RC 6111.52(C).

Response 43: The report mentions in Section F that data such as nutrient and chlorophyll samples were discussed, but they are not considered the best measures of algal bloom impacts and we do not have numeric water quality standards to compare them to. The agency and researchers also have questions/concerns about where and when to sample very large bodies of water to make decisions based on spot sampling of specific parameters, which we hope to address with additional sampling in the 2018 and 2019. The narrative water quality standard to be met includes a prohibition against nutrients that create nuisance growths of algae, and a prohibition against toxic substances. The threshold for determining impairment (or not) is based on a bloom size that we could reasonably conclude does not constitute a nuisance (i.e. that size that occurred in 2004 or 2012), and a cell density level that is not expected to produce significant toxicity levels.

Comment 44: U.S. EPA's rules require that Ohio EPA consider "all existing and readily available water quality-related data and information" when making impairment listing determinations and submit with all final impairment listings to U.S. EPA, a rationale for any decision not to consider such data and information. Table D-3, Description of the data used in the 2018 IR from sources other than Ohio EPA, appears to be incomplete, as it does not include the satellite image data.

Response 44: There is a statement prior to tables D-2 and D-3 that "Additional information about data available for Lake Erie related to algae is included in Section F4." This can be summarized and included in Section D in the future, but for this initial report we believed it was important to present all information about the new method in one place (but we did not want to repeat it in several places, so references were included instead). Table F-19 lists all the data that was reviewed for potential use in the western basin algae assessment.

Comment 45: Under R.C. 6111.56(B), Ohio EPA is prohibited from listing waters of the State as impaired without first demonstrating that the failure to meet applicable water quality standards is not due to the existence of naturally occurring conditions in the open waters of the Western Basin. Ohio EPA has not addressed the complicated issues of climate change or global warming in the Draft Integrated Report. Even if the phosphorus load reduction targets anticipated under Annex 4 were to be realized, some consideration of these factors in the Integrated Report is warranted and these factors may lend themselves to a Category 5-alt determination.

Response 45: Many water quality experts with varying backgrounds have been involved in the GLWQA Annex 4 efforts and have concluded that a driving force behind the algal blooms in the western basin are the nutrient loads from the tributaries. We understand climate change, in particular more intensive rain events that mobilize nutrient runoff, may play a role in the algae blooms.

Comment 46: The methodology Ohio EPA used to list the Lake Erie open waters as impaired, which Ohio EPA has not used previously to support any nutrient-based impairment listing of Ohio's waters, has not been subjected to meaningful notice and opportunity for engagement by interested stakeholders. 40 CFR 25.5(b)(2), which prescribes the overarching public involvement requirements for state environmental agencies, requires that agencies provide the public with the relevant information "at the earliest practical time," and states that fact sheets and other data summaries "shall not be a substitute for public access to the full documents."

Ohio EPA does not have a methodology to comply with 40 CFR 130.7(a), which requires that "the process for developing section 303(d) lists **and public participation** be described in the state's continuing planning process under section 303(e)." *Guidance for 1994 303(d) Lists*, November 26, 1993. (Emphasis added). U.S. EPA's guidance regarding the need to timely and fully engage the public in impairment decision-making was updated as recently as January 23, 2018, where the Agency reaffirmed the mandate that "EPA and the states actively engage the public…as demonstrated by documented, inclusive, transparent, and consistent communication.

Ohio EPA's engagement with the public on the proposed impairment designation of the open waters of the Western Lake Erie Basin is insufficient. The Draft 2018 Integrated Report itself acknowledges that only "**much** of the data used in the report have been presented to the public." It does not say "all," or even "most." The report does not provide any of the NOAA satellite data (or indicate where it is available), does not indicate Ohio EPA's basis for concluding that the (post-2012) data meets level 3 credible data standards, and does not describe the basis for the Agency's adoption of the 20,000 cells/mL, 30% coverage for 10 days metric. The lack of communication on these (and other) critical components of Ohio EPA's decision-making compromises the ability of the public to meaningfully participate in the process.

We believe that Ohio EPA should provide additional information to the public prior to using the new satellite data – based methodology to determine that the open lake waters are impaired. We request that the data and associated analysis used in this determination be made publicly available for all interested stakeholders. We also request a technical analysis of the interconnectedness between this new method and the state's obligation under Annex 4 of the GLWQA. Ohio EPA's engagement with the public on the proposed impairment needs additional time prior to the finalization of the Draft 2018 Integrated Report.

Response 46: The draft report was released shortly after the methodology was developed (input presented by researchers in January 2018 and the narrative was written by the agency while drafting the IR in spring of 2018). The method was public noticed as part of the Integrated Report for >40 days, a webinar was provided with an opportunity to ask questions, and the agency provided the underlying data in our possession to the parties that requested it. If a specific request for information is received, we will be happy to provide our records. The underlying data has not been included as part of the Integrated Report in the past but has been made available upon request. As the 2018 report is already past due, the agency is not willing to extend the comment period.

Comment 47: Developing a new numeric 10-day algal cell count/density metric as the standard to define nutrient impairment for the open waters of Lake Erie constitutes the *de facto* establishment of a new nutrient-based, numeric water quality standard for the Lake. Yet this standard has not undergone notice and comment rulemaking, as required by RC 6111.041 and RC Chapter 119.

…Ohio EPA's new satellite-based, algal cell count/density numeric standard should undergo the rulemaking procedures set forth in RC Chapter 119 before the standard is used to assess the impairment status of the open waters of the Western Basin. That is the rule of law established by the Ohio Supreme Court in *Fairfield Cty. Bd. of Comrs. v. Nally*, 143 Ohio St.3d 93 (2015).

… Ohio EPA's new 10-day algal cell count/density metric "does more than simply aid in the interpretation of existing rules and statutes. Instead, it prescribes a legal standard that did not previously exist." Also, as in *Fairfield County*, this new standard has a general and uniform effect even though it will not be implemented until a TMDL and NPDES permit, nutrient management plan, or other regulatory steps are taken.

The 10-day algal cell count/density metric utilized in the Draft 2018 Integrated Report is a water quality standard, just as was the phosphorus target value of 0.11 mg/l taken from the 1999 Association Report. Unless and until it is formally promulgated by Ohio EPA as a rule, it is not appropriate or lawful for the Agency to use it as such. As the Supreme Court held in *Fairfield County*, when state agencies bypass formal rulemaking "affected persons are denied access to the process that the General Assembly intended them to have, *i.e.*, the early, informed, and meaningful opportunity to challenge the legality of the standards…and the underlying assumptions, data, logic, and policy choices that Ohio EPA made in developing the standard.

Response 47: The Integrated Report is just that - a report required by federal statute on the water quality status. We do not agree that the proposed assessment method is establishing a water quality standard. The State has inherent authority and discretion to use science and professional judgment to inform implementation of a narrative standard – and the narrative standards applicable to all state waters (OAC 3745-1-04 (D-E)) were used for the impairment determination. The narrative water quality standards have been adopted in accordance with state rulemaking requirements. It should also be noted that the impairments are tied to specific limited portion of Lake Erie (not a statewide impact/implication).

Comment 48: …Ohio EPA's decision not to give a "5-alternative" designation to the open waters of Lake Erie is especially puzzling given that the State is already pursuing just the sorts of alternative approaches that it indicated it would pursue in its 2015 303(d) Vision Implementation Plan.

In light of these extensive approaches to addressing impairments caused by phosphorus, **the State should consider designating the open waters of Lake Erie as "5-alternative" and assigning a lower priority ranking for those waters. While there is more work to be done to restore water quality, the State should employ an adaptive management approach and allow these alternative approaches a chance to achieve water quality goals. It should not reflexively head straight down the TMDL path.**

Response 48: The 5-alt category is being considered by Ohio EPA. However, the state must first develop an alternative plan and that plan must be reviewed and accepted by U.S.EPA before U.S.EPA can/will approve a 303(d) list with a 5-alt category included. While Ohio EPA believes that the Domestic Action Plan in conjunction with our other initiatives form the basis of an alternative plan, we have additional ideas to enhance/fine tune the Domestic Action Plan and have not yet developed a formal 5-alt proposal to submit to U.S. EPA. That is under consideration and may be used in future lists.

Copies of comment letters follow and include those from organizations followed by private citizens.

D6.3.2 Comments Received during the Request for Comments CWA Section 303(d) TMDL Priority List for 2018

National Wildlife Federation
Comments on the
Ohio 2018 Integrated Water Quality Monitoring and Assessment Report

May 4, 2018

1. The National Wildlife Federation (NWF) applauds Ohio EPA in the designation of the open waters of Lake Erie as impaired. We support the methodology developed by the universities, NOAA and the agency utilizing satellite imagery and the thresholds for density and duration.

2. Section D. NWF supports the delineation of Lake Erie into the seven assessment units. We believe it is an appropriate consolidation of the ten assessment units initially proposed in the 2014 Integrated Report (IR) and the three units used in previous IRs.

3. Section I: NWF supports the acknowledgement in I4 for the need for long term monitoring in Lake Erie but this needs to be a more complete discussion of needs and plans for a more robust analysis of Lake Erie condition. Ohio EPA should identify in the final report its intentions to develop plans and commitments for biological monitoring (including mayfly, phytoplankton, zooplankton and periphyton). Ohio EPA should include discussion on the data needed to apply the Aquatic Life Use Index Score for the open waters of Lake Erie (listed as no data available for analysis). Ohio EPA is in the unique position to apply its expertise and responsibility towards tracking changes in status and condition of the lake. Lake Erie is particularly susceptible to changes in condition and we need long term commitments for a robust monitoring program. We understand that funding may not be currently available, but Ohio EPA has a responsibility and an opportunity to define a minimum needs monitoring program in the IR. While Ohio EPA has deferred to USEPA and then to university and NOAA scientists for a protocol for assessing the open waters, it needs to leverage its own in-agency expertise for identifying the need to track status and condition of Lake Erie.

4. Section I: While there is brief mention of monitoring related to algal blooms, NWF requests that Ohio EPA expand this discussion to include needs and plans to address additional cyanotoxins in Lake Erie for future reporting. The specific thresholds for cyanotoxins in the public drinking water use attainment analysis are clear but the satellite imagery analysis has limitations. As mentioned in Section F, the relationship between the presence of *Microcystis* blooms and elevated microcystin concentrations has been well documented in the Lake Erie western basin. However, cell density and the potential for human health impacts for other cyanotoxins with less scum formation are less well understood. We are concerned that saxitoxins, anatoxin-*a* and cylindrospermopsin could be overlooked in the attainment analysis for recreation and more importantly, for human

health exposure. Consideration for future monitoring of algal toxins in recreational waters in Lake Erie and potentially other inland beaches should be presented in this section for the recreation use attainment analysis in future IRs.

5. Section J-3: Ohio EPA assigns the impaired AUs for Lake Erie low priority points stating that the tributary TMDLs and other actions are underway for Lake Erie. However, recent reports (second edition of the Nutrient Mass Balance Study for Ohio's Major River Basin and the 2017 Western Lake Erie Tributary Water Monitoring Summary) indicate little to no progress has been made in nutrient reduction. Clearly, more needs to be done and the actions described in J-3 are not enough.

   NWF strongly supports the project under contract with Tetratech to develop a method for setting load reduction goals for Lake Erie and to evaluate whether tributary TMDLs will provide the load reductions to "protect the lake." However, we do not expect that existing tributary TMDLs will align with the GLWQA targets. This project needs to be accelerated along with adoption of nutrient loading limits in watershed TMDLs that **align with GLWQA targets**, and not just "protect the lake" as described in the J-3 narrative. **Completing TMDLs for all 32 watersheds with nutrient loading limits that aggregate up to the GLWQA loading target should be an urgent priority.** Such an effort would equate to a "whole lake" TMDL. A timeline and schedule should be included in the final 2018 Integrated Report. Our greatest opportunity for success is when we can bring all programmatic tools together. We need to create the links between the GLWQA targets and the tools of the Clean Water Act. The previous targets for Lake Erie under the GLWQA in the early 1980s resulted in the 1 mg/l phosphorus limit for all major wastewater treatment plants in the Lake Erie basin, an excellent example of how the nonbinding GLWQA was incorporated into Clean Water Act authorities to bring about change. Utilizing the current GLWQA targets presents a powerful opportunity for integrating the components of tributary/watershed-based TMDLs with the needed reductions of nutrient loading to Lake Erie. Why allow programmatic silos to perpetuate when gains can be made by leveraging programs to work in concert with the other?

6. Sandusky Shoreline and Sandusky Open Water: The table presented in the webinar "2018 Lake Erie Results" shows that the Sandusky Shoreline is listed as impaired for Recreation E. coli but not for Recreation Algae. Nor is the Sandusky Open Water listed for algae. Please explain how Sandusky Bay in particular does not meet the thresholds for algae established with the new methodology, particularly when satellite imagery depicts presence of algae every year and is often the first area to show earliest in the season and the latest to fade in the fall. The Section K map indicates the Sandusky Shoreline as impaired, but without the e. coli/algae distinction. The map indicates no data available for the Sandusky Open Water assessment unit. I could not find any narrative in the report to provide any explanation. Please clarify if I missed it.

May 4, 2018

Via email to epatmdl@epa.ohio.gov

Ohio Environmental Protection Agency
Division of Surface Water
P.O. Box 1049
Columbus, Ohio 43216-1049
Attn: 303(d) Comments

Re: Comments on Ohio's Draft 2018 Integrated Water Quality Monitoring and Assessment Report

To Whom It May Concern:

The Environmental Law & Policy Center, the Alliance for the Great Lakes, and the Ohio Environmental Council (collectively, "Environmental Groups") appreciate the opportunity to submit these comments regarding the draft Ohio 2018 Integrated Water Quality Monitoring and Assessment Report ("Draft 2018 IR") on behalf of our members throughout Ohio and the Midwest region who rely on Lake Erie for their drinking water, livelihoods, and day-to-day enjoyment.

For almost a decade, harmful algal blooms ("HABs"), resulting mainly from phosphorus pollution from agricultural sources, have been periodically contaminating significant portions of the western Lake Erie basin. These HABs often produce cyanotoxins like microcystin that threaten human and animal health and drive drinking water treatment costs. Even when these cyanotoxins are absent, HABs can cover large swaths of the western basin water with green scum that deters people from fishing, swimming, boating, or otherwise recreating in Lake Erie. This problem is only likely to worsen as climate change results in more severe and frequent spring rainstorms that cause much of the agricultural runoff into the western Lake Erie basin.

The Clean Water Act ("CWA") is a vital tool for confronting and addressing the phosphorus pollution that drives HABs in western Lake Erie. Ohio EPA has taken an important step in applying the Clean Water Act's framework by proposing to designate all of western Lake Erie, including the open waters, as impaired by phosphorus pollution. But that is not enough.

Having determined that the western Lake Erie basin is impaired by phosphorus pollution under the CWA, Ohio EPA's next step should be to prepare a Total Maximum Daily Load ("TMDL") that provides a "pollution diet" by setting an overall cap on phosphorus loadings and allocating that cap among the various sources of phosphorus in the watershed. Troublingly, the Draft 2018 IR suggests that the agency intends to stop short on implementing its CWA obligations in favor of focusing on existing efforts – primarily, implementation of the state Domestic Action Plan under Annex 4 of the Great Lakes Water Quality Agreement, under which Ohio has agreed to work toward reducing phosphorus loadings into western Lake Erie by 40% by 2025. Not only is this proposed approach inconsistent with the CWA's legal requirements, but we are also concerned that it will leave Lake Erie in the same place in 2025 as it is today: dealing with a potentially existential threat that undermines its role as a vital resource for the entire region. Ohio should be using all of the tools at its disposal to address this pressing problem rather than focusing on a single agreement that, among other flaws, lacks key accountability and transparency mechanisms available under the CWA.

Impairment Designation for the Open Waters of Western Lake Erie

Given the ecological, economic, and recreational importance of Lake Erie to those in the Great Lakes region and beyond, we commend Ohio EPA's decision to recognize the damage that harmful algal blooms are doing to this vital resource and to fully designate the Ohio waters of the western Lake Erie basin as impaired. It is clear that the agency and supporting stakeholders invested significant time and effort in developing a workable methodology for assessing impairment by phosphorus pollution and the harmful algal blooms that it causes.

The 2018 impairment designation for Ohio's Lake Erie waters presents a fuller picture than previous Ohio EPA assessments. Although the 2016 Integrated Report designated the shoreline and drinking water intakes for western Lake Erie as impaired based on the impacts of toxic algae on their use as public drinking water supply, that earlier assessment ignored the question of whether western Lake Erie's designated recreational uses are being attained. Cyanotoxins from algal blooms are a central concern for the millions of people who get their drinking water from Lake Erie, as well as businesses that rely on the lake as a source of clean, safe water. However, there are many more individuals and companies that rely on Lake Erie as a recreational asset, whether for swimming, fishing, boating, waterskiing, or just enjoying the view.

Thus, we are pleased that the Draft 2018 IR acknowledges this important facet of Lake Erie's value by including a methodology for determining whether HABs impair the recreational use of western Lake Erie, and concluding that they do. This formal finding is consistent with on-the-ground research showing that the incidence of HABs on western Lake Erie has a significant effect on recreational use, such as purchases of fishing licenses,[1] and may even affect nearby property values in the long-term.[2] Notably, according to one of the scientists who helped develop the impairment methodology for the Draft 2018 IR, western Lake Erie could have been designated impaired using this more comprehensive methodology as early as 2010.[3]

Prioritization of Western Lake Erie for Total Maximum Daily Load (TMDL) Development

In the Draft 2018 IR, Ohio EPA has proposed to list all of the Lake Erie Assessment Units ("LEAUs") in the western basin as Category 5 for recreation and public drinking water supply designated uses. Section 303(d) of the CWA obligates a state to promulgate a TMDL for any

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[1] David Wolf, Will Georgic& H. Allen Klaiber, *Reeling in the damages: Harmful algal blooms' impact on Lake Erie's recreational fishing industry*, 199 J. of Envtl. Mgmt. 148, 148-157 (2017).
[2] *See* David Wolf & Henry Klaiber, *Bloom and bust: Toxic algae's impact on nearby property values*, 135 Ecological Economics 209, 209-221.
[3] Tom Henry, *Data shows Lake Erie impairment declaration was justified in 2010*, THE TOLEDO BLADE (Apr. 13, 2018), http://www.toledoblade.com/local/2018/04/13/Data-shows-Lake-Erie-impairment-declaration-was-justified-in-2010.html (last visited May 3, 2018).

water body it has designated as impaired. A TMDL sets a limit on pollution that can be discharged into the waterway and still achieve "the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."[4] A TMDL is subdivided into: (1) the loading allotments for existing and future point sources of pollution (known as a "wasteload allocations"); and (2) the loading allotments for existing and future nonpoint sources of pollution or natural background sources of pollution (known as a "load allocations").[5]

A state's duty to establish TMDLs applies whether the sources of pollution impairing a water body are "point" sources that discharge pollution subject to NPDES permits or "non-point" sources outside the traditional permitting structure of the CWA.[6] If a state fails to carry out this CWA duty, then U.S. EPA must do so.[7] Once established, a TMDL must be incorporated into the state's required "continuing planning process" ("CPP") to achieve water quality standards.[8]

However, a state may prioritize development of certain TMDLs over others. Ohio EPA's Draft 2018 IR provides two mechanisms for doing so. First, Ohio EPA has created a subcategory for its "Category 5" listing for impaired waters, labeled "5-alternative." The Draft 2018 IR indicates that Ohio EPA will use that subcategory to "report on alternative restoration approaches for CWA 303(d) listed waters" (page J-1), consistent with the agency's plan to "use approaches that are an alternative to a TMDL" where "they are likely to result in water quality improvements more efficiently than a TMDL." (Page C-31) Second, Ohio EPA formally assigns all impaired water bodies in the state an individual priority ranking, based on specific metrics outlined in Table J-3, as well as more qualitative considerations set forth on page J-5.

For the Lake Erie Assessment Units ("LEAUs") in the western Lake Erie basin, the Draft 2018 IR assigns 14 priority points for the Lake Erie Islands Shoreline; 17 priority points for the Lake Erie Western Basin Shoreline; and 10 priority points for the Lake Erie Western Basin Open Water. Of the more than a thousand water bodies on Ohio EPA's 2018 impairment list, those scores put the Lake Erie Western Basin Shoreline as the highest priority assessment unit, the Lake Erie Islands Shoreline as sixth-highest, and the Lake Erie Western Basin Open Waters in the top 30. The Draft 2018 IR does not specifically discuss how Ohio EPA applied the qualitative factors from page J-5 for the LEAUs, but does state that "Ohio EPA is actively participating in TMDLs for tributaries as well as many other actions for Lake Erie outlined in Section J3, so priority for Ohio EPA-initiated TMDLs is assigned a low priority for those waters." (Page J-3)

This explanation suggests that Ohio EPA is *de facto* categorizing the western Lake Erie basin assessment units as "5-alt." However, absent a more detailed discussion of Ohio EPA's application of its prioritization methodology, the rationale for the agency's low prioritization of a

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[4] 33 U.S.C. §§ 1313(d)(1)(C).
[5] *See* 40 C.F.R. §§ 130.2(e)-(i).
[6] *Pronsolino v. Nastri*, 291 F.3d 1123 (9th Cir. 2002).
[7] *See, e.g., Scott v. City of Hammond*, 741 F.2d 992, 996 (7th Cir. 1984).
[8] *See* 33 U.S.C. § 1313(e)(2).

TMDL for the western Lake Erie Assessment Units remains unclear. The Environmental Groups therefore respectfully request that the Final 2018 IR include a thorough discussion of Ohio EPA's reasoning in declining to pursue a TMDL for the western Lake Erie basin as a top priority in dealing with the harmful algal bloom crisis.

Even more importantly, the Environmental Groups urge Ohio EPA to reconsider whether its ongoing "alternative" efforts under Annex 4 of the Great Lakes Water Quality Agreement are in fact an adequate substitute for a TMDL for western Lake Erie. Ohio EPA has itself admitted that its own most recent analyses show that the state's current efforts to reduce agricultural manure and fertilizer runoff through voluntary programs and incentive payments – efforts that also form the bulk of the Ohio Domestic Action Plan – have not "moved the needle" on reducing phosphorus loading into the lake.[9] Even before that, the umbrella Domestic Action Plan prepared by U.S. EPA to summarize all of the state plans acknowledged that it might be necessary to "implement[] a suite of conservation practices on nearly every acre in the watershed through voluntary programs" in order to achieve the 40% target under Annex 4 – requiring 770,000 acres of additional cover crops and more than a million additional acres of subsurface placement in the Maumee River watershed alone.[10] The U.S. Domestic Action Plan also indicates that "the key federal and state programs and projects at work in the basin" are on track to reach only a third of the phosphorus reductions needed to meet the Annex 4 goal.[11]

In light of these facts, Ohio EPA should not rely on its Domestic Action Plan and other ongoing efforts as a reason to put off its CWA obligation to prepare a TMDL for the western Lake Erie basin. Rather, a TMDL should be a top priority for the state, as reflected in its own point rankings. Moreover, the Draft 2018 IR specifically states that "Ohio EPA is making inland lakes used for public water supply a focus for the next several years for monitoring and improving water quality through TMDLs or other approaches," and that "Ohio EPA considers nutrients (primarily phosphorus as the TMDL parameter) to be the priority for" its work to clean up inland

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[9] Ohio EPA, 2017 Western Lake Erie Monitoring Study Shows High Phosphorus Levels, http://www.epa.state.oh.us/News/OnlineNewsRoom/NewsReleases/TabId/6596/ArticleId/1302/language/en-US/2017-western-lake-erie-monitoring-study-shows-high-phosphorous-levels.aspx (last visited May 3, 2018); Marion Renault, *Ohio has 'long way to go' to solve Lake Erie's algae problem, state officials say*, THE COLUMBUS DISPATCH (Apr. 29, 2018), http://www.dispatch.com/news/20180429/ohio-has-long-way-to-go-to-solve-lake-eries-algae-problem-state-officials-say. Prior to Ohio EPA's acknowledgment of this lack of progress, the Environmental Groups previously published reports and submitted public comments about the inadequacy of the Ohio Domestic Action Plan and other existing state actions to reduce phosphorus pollution. *See, e.g.*, Alliance for the Great Lakes et al., EXPECTATIONS FOR DOMESTIC ACTION PLANS UNDER THE GREAT LAKES WATER QUALITY AGREEMENT (June 21, 2016), http://freshwaterfuture.org/wp-content/uploads/2014/09/Expectations-for-Domestic-Action-Plans-under-the-Great-Lakes-Water-Quality-Agreement_21June2016-1.pdf; Ohio Environmental Council, Alliance for the Great Lakes, & Environmental Law & Policy Center, Comments on Ohio's draft Domestic Action Plan, submitted to Karl Gebhardt, Deputy Director, Water Resources & Lake Erie Programs, Ohio EPA (Sept. 25, 2017).
[10] U.S. EPA, U.S. Action Plan for Lake Erie 96 (2018).
[11] *Id.* at 97.

lakes. (Page J-6) Lake Erie fits within these stated priorities as not only a source of drinking water for millions of people, but also a key natural resource for the entire region's economy and ecology. Undoubtedly the significant analysis and data-gathering that has taken place under Annex 4 and beyond can contribute to relatively speedy development of a TMDL, but as detailed below the Annex 4 process is not itself a replacement for the unique value that a TMDL can provide in Ohio's efforts to reduce phosphorus pollution. The western Lake Erie basin should accordingly be first in line for a TMDL in Ohio.

The Value of a TMDL for the Western Lake Erie Basin

Ohio EPA is now turning to the state legislature to supplement the state's existing approach to reducing phosphorus loadings to Lake Erie with enforceable requirements for management of fertilizer and manure.[12] The Environmental Groups agree that requiring the agricultural sector to adopt common-sense measures to reduce phosphorus pollution is vital to stopping HABs in western Lake Erie.[13] However, a TMDL is an important piece of the puzzle as Ohio EPA moves forward.

While a TMDL does not, by itself, restrict the discharge of pollutants, it provides a blueprint for future actions by the state to restore impaired waters. As described above, developing a TMDL for a particular waterbody involves setting specific wasteload allocations for point sources and load allocations for nonpoint sources.[14] This exercise requires states to analyze and address where pollution discharges are coming from, and allows states to consider what levels of reductions in those discharges are actually achievable with existing or new regulatory tools. Thus, a TMDL is a key "informational tool" for a state considering how to achieve necessary pollution reductions.[15]

As Ohio considers how to best target existing funding and enforcement efforts, and what new regulatory tools may be warranted, a TMDL can offer not just a "pollution diet," but also a roadmap for how to follow that diet. This is especially important in light of the fact that Senate

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[12] Tom Henry, *Running out of Lake Erie options, Ohio looks to get tougher on farmers*, THE TOLEDO BLADE (Apr. 13, 2018), http://www.toledoblade.com/local/2018/04/13/Running-out-of-Lake-Erie-options-Kasich-administration-looks-to-get-tougher.html.

[13] A number of credible experts have provided recommendations for practical policy and legal reforms that would put Ohio on a path toward reducing agricultural pollution enough to achieve its phosphorus reduction goals, such as mandatory soil testing and subsurface fertilizer or manure application. *See, e.g.* Kristen Fussell *et al.*, SUMMARY OF FINDINGS AND STRATEGIES TO MOVE TOWARD A 40% PHOSPHORUS REDUCTION (Sept. 25, 2017), *available at* http://www.lakeeriefoundation.org/wp-content/uploads/2017/12/White-Paper-Strategies-Summary.pdf.

[14] *See* 40 C.F.R. §§ 130.2(e)-(i).

[15] *Pronsolino v. Nastri*, 291 F.3d 1123, 1129 (9th Cir. 2002); *see also City of Arcadia v. EPA*, 265 F. Supp. 2d 1142, 1144 (N.D. Cal. 2003) ("TMDLs established under Section 303(d)(1) of the CWA function primarily as planning devices and are not self-executing."); *Idaho Sportsmen's Coal. v. Browner*, 951 F. Supp. 962, 966 (W.D. Wash. 1996) ("TMDLs inform the design and implementation of pollution control measures.").

Bill 1, the state legislature's last attempt to address phosphorus pollution in Lake Erie after the 2014 Toledo drinking water crisis, is among the efforts that have so far failed to measurably reduce phosphorus loadings to western Lake Erie. A TMDL could help ensure that any further legislative efforts are targeted at measures that will make a real difference. Furthermore, the assignment of pollutant load allocations to specific Ohio geographies under a TMDL transparently identifies discrete targets for the state's efforts to protect Lake Erie. Such geographic targeting is essential to ensure that future actions efficiently reduce phosphorus inputs from nonpoint agricultural sources. It also provides important transparency by helping to identify the private actors that are the ones actually causing nutrient pollution discharges to Lake Erie.

The assertion in the Draft 2018 IR that Ohio's formulation of its Domestic Action Plan is "very similar to the TMDL process" – implying that the two would produce similar impacts – is inaccurate. A TMDL must go through review by U.S. EPA for adequacy and should include "reasonable assurances" that the overall pollution cap and individual allocations are actually achievable.[16] This was a key feature of the TMDL put in place for Chesapeake Bay, because the participating states identified real and actionable consequences that would result if they did not meet specific loading targets, such as limitations on U.S. EPA funding; stepped-up U.S. EPA supervision and enforcement of existing CWA requirements; or additional restrictions for nutrient point sources such as Concentrated Animal Feeding Operations.[17] If either Ohio EPA or U.S. EPA prepares a TMDL, it could and should include such provisions to provide real incentives for Ohio policymakers and stakeholders to make needed changes at the state level to reduce non-point source nutrient pollution. These provisions, as well as the overall nutrient reduction targets, would then be subject to judicial review that would offer crucial accountability in determining whether Ohio has a workable plan to address the pollution driving HABs in western Lake Erie.

Conclusion

Lake Erie is the backdrop for more than 120,000 water-dependent jobs and more than $14 billion in tourism revenue annually. The lake provides drinking water for approximately three million Ohioans every day and should be a cornerstone of the state's identity as a place that takes protection of public health, economic growth and environmental sustainability. We therefore appreciate the state's recent action to list the open waters of Lake Erie as impaired. The next step is to take action to address that impairment. Ohio has already invested billions in the restoration and protection of Lake Erie over the last decade. With the knowledge gained from

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[16] 33 U.S.C. §§ 1313(d)(2), 1341(a)(4); *Am. Farm Bureau Fed'n v. U.S. EPA*, 792 F.3d 281, 307 (3d Cir. 2015).

[17] A copy of the 2010 Chesapeake Bay TMDL is available at https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-document. The TMDL's "Reasonable Assurance and Accountability Framework" section required the Chesapeake Bay states to submit a series of "Watershed Implementation Plans," and provided that U.S. EPA would evaluate the results of those plans every two years. U.S. EPA also identified a number of potential actions it could take to ensure development of appropriate plans, attain the projected pollution reductions, and undertake necessary reporting. U.S. EPA, Chesapeake Bay TMDL Document 7-12 (Dec. 29, 2010).

that effort, we urge you to take advantage of the TMDL tools already available to you under the federal Clean Water Act to begin the next phase of saving Lake Erie.

Sincerely,

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Ohio EPA, Division of Surface Water
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Attn: 303(d) comments
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May 3, 2018

Dear Division of Surface Water:

The Nature Conservancy in Ohio has reviewed the draft released March 22, 2018, of the Ohio "2018 2018 Integrated Water Quality Monitoring and Assessment Report." The Conservancy greatly appreciates the effort that went into the report and especially the new sections on current issues such as the condition of Lake Erie, Harmful Algal Blooms and Ohio's significant and high quality wetlands. Thank you for the opportunity to provide the following comments.

In summary, our comments are:

- We commend the agency for including the excellent summary of current and past actions in "Section J3. Addressing Nutrients in Lake Erie" and encourage its distribution as a separate, readily accessible document.
- We appreciate the Agency's effort to work with the coalition of experts (NOAA, universities, etc.) on what constitutes impairment for the open waters of Lake Erie. The emphasis on current science and technically-based agreement is on track and should be supported.
- We encourage Ohio EPA and the Ohio Lake Erie Office to be strong leaders in tracking and measurement of progress toward removing Lake Erie from designation as impaired.
- In G3.1, the "% Attainment Status for LRAUs" seems to have peaked in 2010, and stayed close to the same or slightly declined since then. What explanation might there be for this apparent lack of further improvement? The agency should note the recent trend as well as progress made in the late 1990s and early 2000s.
- While we appreciate the need to address the new TMDL requirements, we strongly encourage Ohio EPA to resume a full (e.g., up to 6 or 7 basins/watersheds, ~500 sites) monitoring schedule in 2019, using the geometric survey design similar to that used since the 1980s.
- We strongly encourage Ohio EPA to continue the effort described in Section I1. Wetlands, and conduct these recommended wetland assessments, reporting on conditions in future IRs.
- Given the overall decline of the Ohio mussel community, we encourage the Agency to include coverage of the status of mussels in Ohio in future Integrated Reports and TMDLs.

More detailed comments are attached to this summary. We appreciate the effort and additions that went into this report and the new topics that are being added and emphasized. Thank you for the opportunity to comment, and we look forward to the final version and to working with you in the future. Please contact me at jstark@tnc.org, or Anthony Sasson at asasson@tnc.org, 614-717-2770 if there are any questions.

Sincerely,

John Stark

Director of Freshwater Conservation

cc: Anthony Sasson, TNC

The Nature Conservancy in Ohio
Comments re: draft Ohio EPA "2018 Integrated Water Quality Monitoring and Assessment Report"

Lake Erie

In "Section I5 Lake Erie" of the 2014 Integrated Report (IR), the Agency proposed "an assessment unit framework (which) provides an overview of available data." The draft 2018 IR appears to address this framework and data, and the agency is to be commended for following through on such analyses.

In the draft 2018 IR, "Section J3. Addressing Nutrients in Lake Erie" provides an excellent summary of what is being done to reduce Harmful Algal Blooms (HABs) and improve central basin hypoxia in Ohio. This includes more detail of progress, especially in agricultural BMP implementation, and measurement of the success of these programs. We encourage Ohio EPA to work with NOAA, universities, USDA/NRCS, ODA and others to further document programmatic and outcome measures.

We encourage Ohio EPA to issue this Section J3 summary, or revisions, as a separate, readily accessible document to inform the public of the scope of actions Ohio has taken.

D3. Evaluation of Lake Erie
Pg D-7:
"Ohio has proceeded, with the considerable aid of several universities and NOAA, to develop a method for assessing the western basin open waters in Ohio for algae blooms. This new methodology is presented in Section F4, and utilizes the new assessment units defined in Section D1."

The report includes new coverage of Lake Erie, its condition and impairment, and methods for measurement. We thank Ohio EPA for covering these areas, establishing a definition of impairment, and new topics. We greatly appreciate the coordinated effort the Agency has undertaken, including the cooperation with NOAA and the universities and the compilation of information in this report. We offer our support for the Section D1. Assessment Units, i.e., the new assessment units for the entire Ohio portion of Lake Erie, and the assessments such as F.4 Recreation Assessment for Algae in Western Lake Erie, on developing methods for determining the condition of the western basin open waters in Ohio for algae blooms.

We thank Ohio EPA for working with a coalition of experts (NOAA, universities, etc.) on what constitutes impairment for the open waters of Lake Erie. The emphasis on current science and technically-based agreement is commendable. We encourage Ohio EPA to participate in and expand ongoing science with these. As you know, the Conservancy is active in addressing nutrient runoff to the Western Lake Erie Basin and we offer our support for the future.

We encourage Ohio EPA and the Ohio Lake Erie Office to be strong leaders in tracking and measurement of implementation of the progress toward removing Lake Erie from designation as impaired. We recognize the Annex 4 process of developing loading targets and Domestic Action Plans. Ohio EPA is familiar with such tracking, as is commonly done in the TMDL process and in the Integrated Reports, and the overall mechanism to measure progress should be similar, as illustrated in "Figure J-6, State TMDL vs Binational Annex 4."

Section G: Evaluating Beneficial Use: Aquatic Life

G1.2 General Determination of Attainment Status
(and - J6: Schedule for TMDL Work; K: Maps)

Ohio EPA has done an excellent job of collecting and managing data related to the biological, habitat and chemical conditions in and health of Ohio's streams. These data are extremely useful for many reasons and we encourage continuation of their collection. In past IRs, Ohio EPA has included maps with the "Long-Term Monitoring Schedule" for Ohio watersheds, e.g., that from Section K, Maps, of the 2016 IR is at http://epa.ohio.gov/Portals/35/tmdl/2016intreport/MonitSched_2016.pdf. No map illustrating a monitoring schedule is included in the draft 2018 IR and we are concerned that there is not a projected long-term monitoring map or schedule.

Our understanding is that monitoring that would result in watershed water quality reports will be significantly reduced in 2018, with perhaps only one watershed monitored, plus limited other monitoring such as for Section 319 project and fish tissue purposes. We recognize that this should be an aberration due to requirements of the Ohio Supreme Court decision ("Recent Developments in the TMDL Program," Section C on pages C-16 and C-17) which resulted in new procedures for TMDLs.

While we appreciate the need to address the new TMDL requirements, <u>we strongly encourage Ohio EPA to resume a full (e.g., up to 6 or 7 watersheds) monitoring schedule in 2019</u>. We also encourage using a geometric survey design like that used for at least the last decade or more (e.g., ~70 or more monitoring sites per watershed). Otherwise, without an extensive, robust monitoring schedule we are concerned about potential impacts to the program such as staff and institutional memory loss, data continuity (loss of the ability to continue to review watershed and statewide trends, such as in Section G: Evaluating Beneficial Use: Aquatic Life), or failure to have enough information to detect degradation and take action. This monitoring is essential for determining, as noted in "B2. 2020 Water Quality Goals," Table B-3, if Ohio is reaching goals, such as for Aquatic Life Use, "100% full aquatic life use attainment on all Ohio large rivers by 2020" and "80% full aquatic life use attainment on Ohio's principal streams and small rivers by 2020." Determining upgrades to higher use designations also is important, recognizing the Table B-3 goal to "Identify more high-quality waters."

Ohio EPA watershed monitoring provides a great service that we would like to see continued with a return to a full schedule by 2019.

G3.1 LRAUs
Pg G-8:

> "Continued success ... will depend on ... monitoring LRAUs with an emphasis on those which were last sampled prior to 2009 and whose data will exceed 10 years in age in 2018."
> "Eleven large rivers (15 AUs), representing nearly 490 large river miles, currently meet this constraint and none have been sampled or are scheduled for sampling."

In Figure G-2, ("Percent attainment status and goal progress ... LRAUs...) % Attainment Status seems to have peaked in 2010, and stayed close to the same or slightly declined since then. What explanation might there be for this apparent lack of further improvement? We encourage discussion in the report on this relatively recent portion of the graph. Recognizing there is a 100% attainment goal by 2020, what are the challenges to LRAU attainment exceeding 90% and higher in the future? How does the agency intend to address what appears to be this plateau in progress?

The agency also should note the recent trend as well as progress made in the late 1990s and early 2000s.

We also would expect that with the reduction in statewide monitoring by Ohio EPA for 2018 and given the eleven large rivers (data exceeding ten years old) not sampled or scheduled for sampling, that the agency might encounter a shortage of LRAUs to use in this calculation. How might that affect the calculation of this LRAU attainment trend for the 2020 IR and later reports? We therefore encourage a return to a full monitoring program in 2019, including LRAUs.

I1. Wetlands

We thank Ohio EPA for including wetlands in the IR since 2012. The draft IR sections, I1.1 Documented High-Quality Wetlands and I1.2 Significant Wetland Areas, and two tables, Table I-1 — List of high-quality wetland areas, and Table I-2 — List of significant wetland areas, are welcome additions to the report and should be included and refined in future reports.

Section "I1.3 Next Steps" states "Ohio EPA proposes that periodic Level 2 and Level 3 field assessments be conducted on a random selection of wetlands within targeted HUC12 watersheds on a rotating basin schedule." We strongly encourage Ohio EPA to continue this effort and conduct these assessments, reporting on conditions in future IRs. We agree with the Ohio EPA's Wetland Ecology Group that those that lack prior assessment data should be the focus, and we encourage Ohio EPA to provide resources needed for wetland staff to accomplish this.

Mussels

As we recommended in our comments on previous Ohio EPA's Integrated Reports, we encourage the Agency to include coverage of the status of mussels in Ohio in future Integrated Reports and TMDLs. Given the overall decline of the Ohio mussel community, range reductions of many Ohio-listed species, additional species listings by the U.S. Fish and Wildlife Service, and emerging knowledge about issues such as ammonia's impacts on mussels, the Agency could correlate its extensive biological, chemical and physical data with its own mussel data and that from other sources. As the Agency has done with Lake Erie's impairment, it is time to review and assess Ohio mussel communities and include them with the review of fish and other macroinvertebrates. A cooperative effort with others, including the U.S. Fish and Wildlife Service, ODNR, universities and others, such as is being done for Lake Erie impairment, would help determine the status of Ohio mussel species and could lead to developing effective strategies to prevent further range reduction and extirpation. With its expertise in stream monitoring and data analysis, Ohio EPA is a well-qualified leader in how to do such assessments.

Freshwater mussels are at significant risk throughout Ohio (e.g., see ODNR's listed species, available at http://wildlife.ohiodnr.gov/species-and-habitats/state-listed-species). ODNR's listed mollusks include 24 endangered mussel species, four threatened and eight species of concern; eleven species are considered extirpated, and six are extinct. These 53 represent a significant percentage of the 80 mussel species that have been recorded in Ohio (Watters et al 2009[1]). These changes are also an indication that challenges remain to the health of our streams.

[1] Watters, G.T., M.S. Hoggarth and D.H. Stansbery. 2009. Freshwater Mussels of Ohio. The Ohio State University Press, Columbus.

Comments of the Ohio Environmental Council
Regarding
The Draft 2018 Integrated Water Quality Monitoring and Assessment Report

Ohio EPA, Division of Surface Water
Attn: 303(d) Comments
P.O. Box 1049
Columbus, Ohio 43216-1049

To the Ohio EPA Division of Surface Water:

Please see the comments below regarding the 2018 Integrated Water Quality Report. The Ohio Environmental Council (the "OEC") provides these comments as a supplement to the joint comments submitted today by the Environmental Law & Policy Center ("ELPC"), Alliance for the Great Lakes ("ALG") and the OEC. These supplemental comments focus on the TMDL priority list for the Maumee River Basin and related assessment units. If you have any questions, please do not hesitate to contact us.

Introduction

The OEC applauds the recent actions taken by the Ohio Environmental Protection Agency (Ohio EPA), especially regarding their decision to list the Western Basin of Lake Erie as impaired with regards to algae. The OEC looks forward to working with the Ohio EPA and other stakeholders to develop robust regulatory mechanisms and galvanize community support to fix the pollution crisis causing the Lake's impairment status.

With these goals in mind, the OEC focuses these comments on the immense and complex watershed that flows into the Western Basin: The Maumee Basin, which includes the Maumee River and its major tributaries, the Blanchard, Auglaize, and Tiffin Rivers. The Portage River 8-digit Assessment Unit also flows into the Western Basin. If the Ohio EPA is to reduce the intensity of Lake Erie's harmful algal blooms (HABs), it must ensure that upstream TMDLs are effectively implemented and enforced. Because the agency chose not to promulgate numeric criteria for the Western Basin's impairment status, the only measurable numeric criteria connected to the algae lives in those other TMDLs.

Therefore, the OEC provides these comments in addition to the joint comments focusing on the need for a TMDL on the Lake's open waters, to note where the Ohio EPA should clarify or justify its reasoning for certain TMDL prioritizations in light of the Western Basin's new impairment status.

Upstream TMDLs are necessary to protect the Western Basin

In the Integrated Water Quality Report, the Ohio EPA emphasizes, among others, the following long term general priorities for its TMDL program:

1. "Work statewide, using rotating basin scheduling for assessment and listing but on a more limited basis to allow for increased focus on lakes and protecting downstream uses;" and

2. "Incorporate HAB considerations into priorities (both PDWS use and ultimately Recreation use)."[1]

Ohio EPA provided a comprehensive scientific overview of its assessment methodology for its narrative criteria for the Western Basin on pages F-27 to F-36 of the *Integrated Water Quality Monitoring and Assessment Report.* Given the monumental effect of HABs, the OEC believes it is vitally important for the agency to have a scientifically robust monitoring tool to determine if the Western Basin manages to escape its impaired status for algae.

Given the importance of the Western Basin to the overall health of Lake Erie and to its role as a public drinking water source, the Ohio EPA must prioritize its implementation of TMDLs moving forward with the Western Basin in mind. In its recent *State of Ohio Nutrient Mass Balance Study*, the Ohio EPA emphasized in the first sentence that "excess nutrients (nitrogen and phosphorus) stimulate algal growth affecting water quality."[2] In addition, the Study found that the phosphorus loads for the Maumee and Portage watersheds was 88 and 87 percent, respectively, due to nonpoint source pollution.[3] The Maumee watershed also suffers from massive nitrogen loads, reaching "an average of 41,100 mta," the highest of all measured watersheds in Ohio.[4] Like phosphorus, the nitrogen loads for rivers flowing into Lake Erie primarily resulted from nonpoint source pollution.[5]

The main source of nonpoint source pollution throughout the Maumee Basin is most likely agricultural activities. The *Nutrient Mass Balance Study* notes that the Auglaize River, for instance, has 80 percent of its landscape devoted to cultivated crops, and the entire watershed is 79 percent agricultural production of all forms.[6] Because Phosphorus and Nitrogen are the principal nutrients that can increase the intensity of HABs, the Ohio EPA must ensure that it properly prioritizes TMDLs throughout the region and accounts for phosphorus and nitrogen that

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[1] *2018 Integrated Water Quality Monitoring and Assessment Report - DRAFT*, Ohio Environmental Protection Agency, (March 2018), at C-29, http://epa.ohio.gov/Portals/35/tmdl/2018intreport/2018IR_FinalDraft.pdf.
[2] *State of Ohio Nutrient Mass Balance Study*, Ohio Environmental Protection Agency, (March 2018), at 2, http://epa.ohio.gov/Portals/35/documents/Nutrient%20Mass%20Balance%20Study%202018_Final.pdf.
[3] Id. at 3.
[4] Id.
[5] Id.
[6] Id. at 25.

results from nonpoint source pollution in those TMDLs. Ohio EPA can use its TMDLs to clearly identify where it can focus its efforts to promote Best Management Practices to reduce nonpoint source pollution.

The Report's TMDL Priority List

According to the Report, the Ohio EPA has completed 22 of 32 TMDLs for the Lake Erie watershed, with the 10 remaining TMDLs under development.[7] However, many of those completed TMDLs were developed years before the new Impairment Status created for the Western Basin of Lake Erie regarding algae. The Draft Report does not list a schedule for reviewing these older TMDLs. Given the new information regarding the relationship between excess phosphorus, nitrogen, and algae, updating those TMDLs is vital to ensuring communities have the best guidance available on how to reduce their agricultural pollution.

Consider the following (nonexhaustive) table noting the dates of TMDL approval within the Maumee and Portage Basins:

TMDL	**Date Approved by U.S. EPA**	**Pollutants Allocated by U.S. EPA**
Auglaize River	September 23, 2004	Ammonia, phosphorus, pathogens, sediment
Toussaint Creek	September 22, 2006	phosphorus
Sugar Creek	May 8, 2007	bacteria
Beaver Creek	September 28, 2007	Nutrients (phosphorus and nitrate), bacteria
Blanchard River, select sections, and Riley Creek	July 2, 2009	Phosphorus, bacteria, sediment
Swan Creek	January 6 and October 25, 2010	*E. coli*, total phosphorus, nitrate, nitrogen, total suspended solids, total aluminum, total copper, ammonia, total dissolved solids, dieldrin, strontium, benzo(a)pyrene
Portage River and Rocky Ford	September 30, 2011	*E.coli*, total phosphorus, carbonaceous biochemical oxygen demand, sediment
Ottawa River	April 15, 2014	*E. coli*, total phosphorus, sediment

[7] Supra FN 1, at J-12.

The OEC notes that Ohio EPA plans completion of TMDLs for many Western Basin tributaries between the present and 2021, including the Maumee River, the St. Joseph River, Fish Creek, the Tiffin River, Bean Creek, Lick Creek, and Turkeyfoot Creek. The OEC expects these TMDLs will include a discussion on how they can best accomplish their collective goal of limiting HABs in the Western Basin of Lake Erie.

However, the OEC believes that in the final version of the *2018 Integrated Water Quality Monitoring and Assessment Report*, the Ohio EPA should also include a schedule that discusses when it will update older TMDLs in the Maumee and Portage Basins to account for the new impairment status of the Western Basin.

Consider the TMDL for the Upper Auglaize River, issued in 2004.[8] The TMDL does not discuss agricultural nonpoint source pollution in the context of the Lake Erie Western Basin. Ohio EPA needs to update these TMDLs to address the new impairment status.

Of course, the OEC does not expect the Ohio EPA to accelerate the update of old TMDLs before the agency develops TMDLs for watersheds that presently lack such a guiding document. However, if the Ohio EPA takes seriously its goal to "Incorporate HAB considerations into priorities (both PDWS use and ultimately Recreation use)," then it must develop a schedule to improve and replace old TMDLs that do not properly account for the Western Basin's algae impairment status. The Draft Report is the perfect moment to outline that schedule, and updated TMDLs can serve as a key opportunity to highlight the ongoing voluntary activities throughout the Maumee and Portage Basins designed to reduce nonpoint source pollution. Updated TMDLs can can also provide the public and policy makers with a clear perspective on water quality throughout the region.

Furthermore, if the Ohio EPA developed a schedule for updating its old TMDLs throughout the Western Basin, it could actually jump start future conversations to regulate nonpoint source pollution. If the legislature knew that the Western Basin TMDLs would be updated by a certain date, it would know it needed to pass legislation regulating nonpoint source pollution before those TMDLs were completed. Then, the Ohio EPA could implement new rules regulating nonpoint source pollution directly into the TMDL process (if the Assembly decided to give it that power).

Conclusion

The OEC recognizes the immense amount of work that has gone into developing the Integrated Report. The priority lists show that the Ohio EPA is taking seriously its role to implement TMDLs that protect the waters of the state, especially after the momentary delay in TMDL development due to unexpected legal precedent.

However, the OEC hopes that the Ohio EPA will consider our comments provided above and

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[8] See *Upper Auglaize River Watershed TMDLs*, Ohio Environmental Protection Agency, (2004), http://epa.ohio.gov/portals/35/tmdl/UpperAuglaizeFinalTMDL.pdf.

develop a clear plan for integrating the TMDL process for the Maumee and Portage Basins with the new Impairment Status for the Western Basin of Lake Erie regarding algae. If the state truly wishes to solve this important drinking water and water quality problem, it must take a holistic approach that revises and updates its guiding documents when necessary. Given the massive levels of phosphorus and nitrogen entering the rivers and eventually the Lake each year, it will not be easy to solve the problem. But with careful planning, the Ohio EPA can lead the state and the other state and federal agencies with whom it coordinates to protect the Western Basin of Lake Erie from HABs.

Respectfully Submitted,

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Friends of the
MAHONING RIVER

April 22, 2018

Subject: Ohio EPA's Draft 2018 Water Quality Report

To Whom It May Concern:

Friends of the Mahoning River (FOMR) is a not for profit, community organization whose mission is to advocate for the Mahoning River through education about the river and her watershed. FOMR advocates safe recreation on the river and envisions the restoration of the Mahoning River to its pre-industrial condition.

During the steel making heyday, the Mahoning River had nine fully integrated steel mills both drawing water to use in their industrial processes and discharging wastewater back into the river. At times, the river water reached temperatures in excess of 100 degrees Fahrenheit. The chemicals in the discharged wastewater included greases and oils, solvents, metals, and more. Much of the river ecology was destroyed; what fish could be found were mutated and diseased.

In the 1940s, the Mahoning river was essential to the United States in our war efforts during World War II. The river was also essential during the period of U.S. expansion and growth after the war. Not many thought about the water quality or ecology until such things as Rachel Carson's book, *Silent Spring*, Love Canal, and the burning of the Cuyahoga River brought environmental awareness to the forefront.

With the birth of the Environmental Protection Agency, many sources of pollution, coming from pipes and stacks, were addressed. In Ohio, many of our rivers have been restored via improved wastewater treatment standards, reducing or preventing non-point sources of surface water pollution, and the removal of dams on rivers with the associated contaminated sediments.

Restoration efforts for the Mahoning have not kept pace with many rivers in Ohio. Locations exist where contaminated sediments have resulted in health advisory bans warning citizens against contact with the sediments. Many of these areas are associated with the low head dams constructed by the steel making facilities that are now defunct. Today, they function only to accumulate contaminated sediments and act as major safety hazards for paddlers on the river; in some cases, resulting in the death of the paddlers.

Ohio EPA's Draft Water Quality Report

Upon review of the Ohio EPA's draft Water Quality Report, the FOMR observe that the Mahoning River continues to be on the list of impaired water bodies. Ohio EPA has yet to complete the study of Total Maximum Daily Load for the mainstem of the Mahoning River. In the absence of the TMDL data, the attainment indicators such as aquatic life use and recreational use cannot be fully evaluated.

While per Section C7 and J2, there seems to be an internal Ohio EPA discussion about the effectiveness of the TMDL process, and planning to follow a new "Vision", will the TMDL assessment be completed for the Mahoning River, and if so, when?

The lower Mahoning and its tributaries do not appear in Table J-15, even though upper stretches were completed in 2011. If an alternative process is anticipated, such as one associated with planned dam removal, can you summarize what that might involve in current discussion? How would such an alternative process include local initiatives under way, and related activity such as the Youngstown Consent Decree?

Section L4. *Section 303(d) List of Prioritized Impaired Waters.* This table, which has prioritized Ohio's surface waters, has the Mahoning River Mainstem (Eagle Creek to Pennsylvania Border) listed as 1.68 square miles.

This does not seem to be correct. Is the area included in the assessment a factor evaluated in the priority points accumulated?

<u>Recreation and Water Quality</u>

Recreational use on the Mahoning River is on the rise. In 2017, ODNR hosted an Ohio Paddle on the Mahoning River; and the estimated number of boats on the river on that day, was 80. The city of Girard has completed the installation of a kayak/canoe launch on the Mahoning River; a celebratory paddle is scheduled for June 9, 2018. A kayak livery, expanding from the Cuyahoga River, is starting up in Trumbull County. The Village of Lowellville has an ambitious plan for riverfront recreation, including boating. Lawrence County PA, while outside of Ohio, has several initiatives encouraging paddle boating, and this attracts traffic on the lower Mahoning in Ohio.

Are people safe paddling the river? Contacting the sediments?

<u>Water Quality and Biological Study of the Mahoning River</u>

The Ohio EPA's Water Quality and Biological Study conducted in 2013-2014 has not been released to the public. Is this typical for the report to be released four to five years after the study is completed? When will it be released? When will the next Water Quality and Biological Study for the Mahoning River be conducted?

Ohio EPA is charged with protecting human health and the environment. **Does the Agency have maps showing where the contaminated sediments in the Mahoning River are located? Are there signs warning citizens of the health hazard? If not,**

are readily accessible maps or signs, or support for local agencies to offer them, planned?

The Mahoning River is considered by many in our community, including the Chamber of Commerce and the business community, as a valued asset; for economic development as well as a positive environmental attribute. FOMR envisions a restored river; but realizes assistance from the Ohio EPA is essential.

What other plans and timeline does the Ohio EPA have for the Mahoning River?

Friends of the Mahoning River are grateful, Ohio EPA, for all you do to protect the environment. But frankly, and especially considering the historic service of the Mahoning River watershed for our country, the subsequent environmental costs absorbed by the watershed community, as well as the continued and ongoing social struggles in our communities, FOMR feels the Mahoning River has been neglected, relative to other recreational and lifestyle watersheds.

The FOMR does not dispute prioritizing watersheds key to improving Lake Erie and water supply conditions such as the Maumee and Scioto above the Mahoning. However, FOMR believes it is time for the state, and the nation, to repay the Mahoning River by working to restore her water quality now…whatever it takes.

Sincerely,

Friends of the Mahoning River
9710 King Graves Road N.E.
Warren, Ohio 44484

Signed, on behalf of Friends of the Mahoning River

water quality committee

Ohio EPA, Division of Surface Water
Attn: 303(d) Comments
P.O. Box 1049
Columbus, Ohio 43216-1049

Comments: Ohio Integrated report

Sent via email May 4, 20178

To: epatmdl@epa.ohio.gov

From: Sandy Bihn, Executive Director Lake Erie Foundation and Lake Erie Waterkeeper
sandylakeerie@aol.com

Comments to the Ohio EPA 'Integrated Report' prepared for USEPA to meet Clean Water Act Requirements.

Please consider the following comments:

1. Section C-6 fails to list local government and public drinking and wastewaters providers substantial funding for pollution control – both in drinking water treatment costs and capital improvements and wastewater treatment costs and capital improvements.
2. There is a statement in Section J 3 the report that "TMDLs were not developed to address the excessive wet weather loads delivered to Lake Erie." This dooms all nutrient reduction plans for Lake Erie and other waters impaired due to algae. It is estimated that in 2017, 78% of the load entering Lake Erie came from nine rainfall events. This simply means that reductions during low flow will never come near the 40% reduction needs to reduce Lake Erie's harmful algae. There should be a western Lake Erie TMDL scheduled that is designed to include all US western Lake Erie watersheds and would assess high flow nutrient – phosphorous and nitrogen inputs during high flow. This would include an implementation plan that has targets for high flow nutrient reductions.
3. On page one of the executive summary, there is a statement on the sources of nitrates which should include manure.
4. There should be an assessment for determining impairment for the central basin of Lake Erie which would be based on frequency and size of the dead zone along with if the dead zone is impacting the central basin public drinking water intakes.
5. The report does not follow the Clean Water Act provision for reasonable assurances to address pollution from non point sources and needs to do so.
6. It appears in the report that the Great Lakes Water Quality Annex 4 provisions are being used as a substitute for TMDL's and other Clean Water Act requirements. The Agreements should instead be using and following the Clean Water Act, as required by law, instead of substituting with the Domestic Action plans which for Ohio, lack accountability and measurement.
7. Grad Lake St. Marys(GLSM) is Ohio's largest inland lake. Ohio lists GLSM as impaired and has conducted a TMDL that was completed in 2008. The Clean Water Act requires that once there is a TMDL, there is an implementation plan that shows progress (or the lack of) to continue to ensure that over time progress is made to have Grand Lake St. Marys delisted. Ohio elected (there is

correspondence with USEPA on this) to substitute the implementation plan to a distressed watershed, which Ohio claimed would work better than the implementation plan.

GLSM has been posted for no contact for swimming for the past nine years. It has become clear that it was a mistake for USEPA to approve Ohio's deviation from the Clean Water Act/implementation plan process. What should have been done, is for Ohio to make the distressed watershed as part of the implementation plan with a requirement to report progress – or the failure of – and to take additional steps to reduce nutrient loadings, especially from manure into Grand Lake St. Marys. Monitoring shows that total phosphorous has gone down but dissolved reactive phosphorus – the driver of the algae, has not been reduced.

There is much economic and environmental consequences to the continuing toxic algae problem in GLSM. Clearly, Ohio's approach to reduce toxic algae in GLSM is not working. In fact, Ohio DNR is now proposing to dredge a part of the lake with a beach and put up a n air curtain to keep the waters of GLSM away from the beach – quite bizarre and certainly not reducing sources as required under the Clean Water Act.

This a request for Ohio to develop an Implementation plan for Grand Lake St. Marys as required under the Clean Water Act.

8. Ohio was required by USEPA years ago to develop nutrient standards which would be very helpful for assessing nutrient reduction progress. Phosphorous standards for rivers and lakes need to be developed in a stated and committed time frame as is required under the Clean Water Act.
9. It seems a bit contradictory and confusing for Ohio to acknowledge and commit to a 40% phosphorous reduction and a reduction for dissolved reactive phosphorous to have an 'acceptable' level of algae. Instead of using the 40% reduction in the western basin of Lake Erie which is part of Annex 4 in the Great Lakes Water Quality Agreement, Ohio has determined an alternate method of assessing when the western basin is no longer impaired. It seems that the 40% reduction etc. should be the benchmark for eliminating the impaired designation. Why did Ohio change from the 40% reduction for removing the impaired designation to an algae coverage formula?
10. Ohio in its assessment units and scoring has the lowest number of points allowable in the human health category. Human health is extremely important. Explain??
11. The ten year time frame for Tappan Lake to work through the process and to be delisted is too long.
12. This statement on Lake Erie nutrients in the report lacks a statement of measurement and accountability and specificity:

    "J3. Addressing Nutrients in Lake Erie Ohio is working to address its contribution to the problems in Lake Erie through: nutrient TMDLs on tributaries; numerous state initiatives to reduce nutrient loads from Ohio in accordance with the Domestic Action Plan; and active participation on Annex 4 (Nutrients) and other Great Lakes Water Quality Agreement (GLWQA) efforts. Effective lake management and coordinated implementation are needed to address the Western Basin of Lake Erie algal blooms and the Central Basin hypoxia issues, requiring a multi-state and binational effort. Currently, there are many parallel planning and management efforts ongoing at the state, federal and binational level. For the open waters of Lake Erie, respecting and working through the binational governance framework is the appropriate process and Ohio intends to aggressively pursue state measures that complement the process and are neither duplicative nor contradictory".

    This statement needs to include a time frame, accountability and measurement. The sections below it about the Collaborative Agreement for a 20% reduction by 2020 simply are not credible. Recently, there has been acknowledgement that after about ten years of efforts to reduce western Lake Erie nutrients, little to no progress has been made. Doing the same ole same ole is not acceptable.
13. Ohio's assessment units for Lake Erie and its TMDL analysis are as clear as mud to the average reader. It appears the scoring for recreation is low while for public drinking water higher. Both of

these should receive the highest points because of cyanobacteria/micorcystin has very high toxicity that is dangerous for Lake Erie public water intakes and for all who swim or come in contact with the algae.

14. Western Lake Erie needs a TMDL and Ohio EPA should schedule one because of the threat to drinking water, human health, recreation and aquatic like. The voluntary agreement based path that Ohio is taking has no track record for success. Chesapeake tried agreements for thirty years and they failed. It was not until there was a TMDL that real progress was made.
15. Ohio needs to assert the reasonable assurance provisions of the Clean Water Act to address non point nutrient reductions in the western Lake Erie watershed.
16. The Auglaize and Tiffin Rivers should not be delisted because Heidelberg data shows that these to rivers are major sources of nutrients that are causing problems for Lake Erie. It appears that OEPA is delisting for low flow etc. and is not considering high flow when there is the most significant runoff to Lake Erie. Ohio's assessment system is fatally flawed when it fails to assess high flow runoff asfter heavy rains.

Ohio EPA, Division of Surface Water May 4, 2018
Attn: 303(d) Comments
P.O. Box 1049
Columbus, Ohio 46216-1049

RE: Little Miami Conservancy comments regarding the OEPA 2018 Integrated Water Quality Monitoring and Assessment Report

To Whom It May Concern:

The Little Miami Conservancy (LMC) appreciates the opportunity to comment on the Draft OEPA 2018 Integrated Water Quality Monitoring and Assessment Report (IR). LMC offers the following comments:

1) LMC would note that attainment of several watersheds throughout the State of Ohio is based on data older than ten years. Historical data is very important, but using this as a determination of present day attainment and the health of the aquatic ecosystem is of concern because of the dynamic conditions of lotic and lentic aquatic ecosystems. The anthropogenic effects of land use and development in watersheds can be detrimental to the health of the aquatic environment.

   The Little Miami River, the first river in Ohio to be designated National and State Scenic River, is a highly desirable watershed for wildlife and for people to live and to recreate. Development of residences, commercial properties, and industry is ongoing in the watershed, adding loadings to wastewater treatment plants, increasing impervious surfaces, and suburban stormwater runoff.

   The last comprehensive water quality monitoring sampling conducted by Ohio EPA of the lower Little Miami River occurred in 2007. The attainment status and TMDL for this portion of the river is based on that data. It is noted that Credible Level 3 sampling was conducted on the lower reach in 2012 by Midwest Biodiversity Institute/Center for Applied Bioassessment and Biocriteria (MBI), who was contracted with Hamilton County Metropolitan Sewer District, and this data did document impairment in areas Ohio EPA had previously not noted impairment. We understand Ohio EPA conducted some limited sampling of these same site sampled by MBI, and came to different conclusions.

   It is unclear in the 2018 IR, where this data is discussed or how it fits into the attainment status for the lower Little Miami River.

It is of concern to the Little Miami Conservancy that Ohio EPA uses data older than 10 years to report attainment in the IR.

2) The OEPA 2016 Integrated Report contained a Long-Term Monitoring Schedule map depicting monitoring through 2027 for the State of Ohio. This map with the schedule for comprehensive water quality monitoring for Ohio appears to be missing from the 2018 report. The Little Miami Conservancy feels this schedule is imperative to maintain the high quality data the State of Ohio produces. The data generated by this type of monitoring, documents the health of our streams, rivers, and lakes for the safety of the citizens of Ohio who use our waterbodies for fishing, swimming, boating, and drinking water sources. Many environmental improvement projects and the efficient use of taxpayer dollars depends on this data.

   Ohio is recognized nationwide for its quality aquatic assessment program. Monitoring of aquatic organisms provides detection of environmental concerns that may not be obvious through other monitoring methods. Will Ohio EPA provide a long-term monitoring schedule in the 2018 IR or will the schedule be provided in another format?

3) Ohio EPA has water quality data dating back approximately 40 years. It is high quality data that tells an important story of the challenges and efforts made by the State for its citizens to improve the quality of its waters. We may have misunderstood in the IR in section G, but it appears the Ohio EPA may be selectively evaluating only the latest 10 years of data for trend assessment rather than assessing the entire database for an assessment unit or watershed. Is this the intention of Ohio EPA? By reducing the database, removing historical data, Ohio EPA risks not catching long-term changes in trend assessment that may reflect decreases in attainment.

Again, the Little Miami Conservancy (LMC) appreciates the opportunity to comment on the Draft OEPA 2018 Integrated Water Quality Monitoring and Assessment Report.

LMC looks forward to your response to these concerns, and to continuing the historic partnership between OEPA and LMC that has made great strides in the protection and restoration of the Little Miami – a true national treasure here in Ohio.

Sincerely,

Eric B. Partee
LMC Executive Director

Midwest Biodiversity Institute, Inc.
P.O. Box 21561
Columbus, OH 43221-0561

Ohio EPA, Division of Surface Water
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Columbus, Ohio 43216-1049
Attn: 303(d) comments
epa.tmdl@epa.ohio.gov

May 4, 2018

To Whom It May Concern:

The Midwest Biodiversity Institute (MBI) has reviewed the draft Ohio "2018 Integrated Water Quality Monitoring and Assessment Report" released on March 22, 2018. MBI is a not-for-profit corporation specializing in applied research with aquatic bioassessments, water quality standards, monitoring and assessment, and state bioassessment program development. As part of our mission MBI has conducted in depth reviews of 25 state, three federal, and two tribal programs since 2002. These reviews have included the development and implementation of the monitoring and indicators needed to produce a biennial 305[b]/303[d] Integrated Report (IR). In addition, MBI has also conducted comprehensive watershed bioassessments in Ohio and other states that emulate the essential concepts and attributes of the Ohio EPA program that is reflected in the 2018 IR. It is from this base of experience that we offer the attached comments and suggestions for improving the draft report.

Historically, Ohio EPA has operated one of the leading state programs, now spanning 39 years. We believe that it is in the best interests of the State of Ohio and the many stakeholders with an invested interest in water quality to see that the IP reflects the many positive accomplishments achieved over that time period while at the same time providing an accurate assessment of recent trends. Ohio is one of the few states that can report at this level of detail and accuracy and we look forward to this level of quality continuing well into the future.

Very truly yours,

Chris O. Yoder, Research Director
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Comments on Draft 2018 Ohio Integrated Report
Submitted by Midwest Biodiversity Institute

Monitoring to Support Impaired Waters Listings and TMDLs

Ohio EPA has operated an exemplary monitoring and assessment (M&A) program that is nearing 40 years for inland rivers and streams. This approach allows Ohio EPA to use M&A data and information to support ***all*** water quality management programs. States with lesser levels of rigor in their M&A and WQS programs are limited to producing a biennial IR and at a much lesser level of detail in terms of spatial detail and content. There is no question one the essential components of the Ohio program is the systematic implementation of M&A and the rigor in the spatial context and biological, chemical, and physical indicators upon which the assessments are based. However, the absence of a monitoring schedule is of concern as is the intent to scale back on the number of watershed and mainstem river assessments in 2018. While we understand the impact of the Supreme Court ruling on the TMDL program, an 80% reduction in what has been the baseline M&A effort for nearly 40 years raises many questions not only about the future direction of monitoring, but the Ohio EPA surface water program as a whole. We therefore urge the agency to reveal the intent of any changes to stakeholders, especially those who have come to rely on the outputs and outcomes of one of the most comprehensive approaches in the U.S. As it reads now the ***Ohio EPA Monitors Water Quality in Ohio And Reports its Findings*** discussion in Part A potentially provides a very misleading message about the future of the program that many stakeholders have simply expected to exist well into the future. There are many other concerns, more than we can state in these comments, but we do not see how any fundamental interruption in the design and execution of this program will allow the agency to effectively execute its mission of protecting and restoring water quality in support of measuring the attainability and attainment of designated uses.

The Ohio EPA program is rated as one of the most rigorous and comprehensive in accordance with the U.S. EPA program evaluation guidance *"Biological Assessment Program Review: Assessing Level of Technical Rigor to Support Water Quality Management"* (U.S. EPA 2013). The most recent review conducted in 2007 resulted in Ohio program attaining Level 4 (the highest) and a score of 98.1%. At least part of the score is the result of the agency being able to manage and sustain a mature M&A program at a spatial scale that meets the needs of being able to assess the effectiveness of water quality management programs, tracking trends, and responding to new threats. While the 2007 program review emphasized the inland rivers and streams program, it is quite evident that what was accomplished over three decades of development and implementation has trickled down to having similarly robust methods for assessing other waterbody types including wetlands, the Lake Erie Nearshore, and the Ohio River. Therefore, while we are not requesting for this to be discussed in the 2018 IR, the agency needs to recognize how fundamental changes made in the near future will affect all aspects of future IRs and their water quality management programs.

Reference:
U.S. EPA. 2013. Biological Assessment Program Review: Assessing Level of Technical Rigor to Support Water Quality Management. EPA 820-R-13-001. Office of Water, Office of Science and Technology, Washington, D.C. 144 pp.
http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/biocriteria/technical_index.cfm.

Lake Erie Nearshore & AOCs

The reporting on beneficial use impairments in the Lake Erie Nearshore and Areas of Concern is well done and comprehensive enough, but we are concerned that new and emerging threats that are documented for drinking water supplies and recreation represents a threat to other designated uses including aquatic life. The toxic byproducts of cyanobacteria are toxic to fish and other aquatic life this we are recommending that it be recognized as a potential cause of impairment. While not a robust assessment, we had a small project in Maumee Bay in 2018 the results of which represented a backsliding to conditions observed in the early 1990s. Furthermore, one site had DELT anomalies far in excess of the BUI delisting criteria. Given the potential for at least chronic effects we advise looking more closely at the role of Mycrosystin in having adverse impacts on aquatic life use attainment in the nearshore of Maumee Bay and adjacent waters.

We are appreciative of the agency recognizing the vital role of habitat and stream health in dealing with the effects of excessive nutrient enrichment. The statement in Part J *"The long-term solution is to reduce sources of nutrients while holistically restoring stream health and improving the waterway's ability to assimilate and utilize nutrients. This is also known as the stream's assimilative capacity. Restoring stream health will not only reduce the amounts of nutrients that reach the receiving water body, but restoration of in-stream and riparian habitat supports a healthy ecosystem, builds resilience to climate change impacts and improves recreational opportunities"* is on target as is the listing of habitat as a TMDL eligible stressor. However, the use of the term "habitat" is almost completely absent in ***Ohio's Domestic Action Plan for Lake Erie*** and many of the associated documents produced by the bevy of entities involved in assessing, modeling, and dealing with implementation practices to reduce nutrient loadings to Lake Erie. In our view the majority of these efforts are focused almost entirely on loading determinations without an apparent regard to the assimilative capacity of the watershed network. We suggest the agency exert some leadership in assuring that habitat is a primary factor in the management practices for reducing the adverse effects of nutrients in Lake Erie. If habitat continues to be relegated to a subsidiary role, then the attainability of the

BUIs in Maumee Bay and Lake Erie will no doubt be questioned which could lead to some undesirable outcomes in the current deregulatory environment.

Aquatic Life Use Attainment in Inland Rivers and Streams

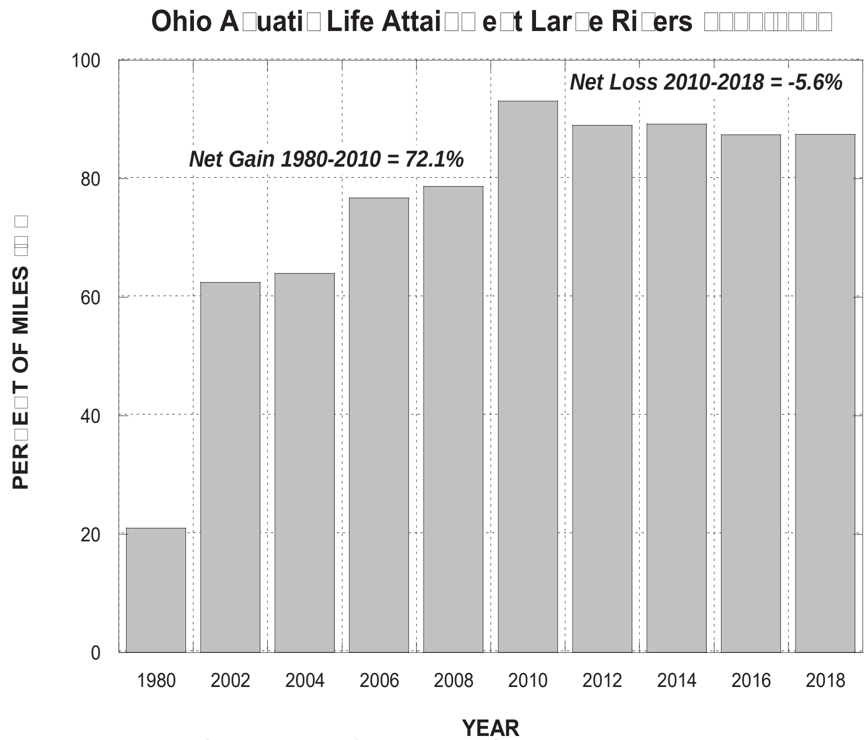
As indicated earlier in our comments Ohio has one of the leading programs among states in the U.S. that allows the agency to produce something better than a simple statewide estimate of use attainment and non-attainment. Based on our experience in reviewing state programs, the analyses like that in ***Large Rivers are Making Progress Toward the 100 Percent Attainment by 2020 Aquatic Life Goal*** in Section A are the outcome of a nearly 40 year commitment to a robust M&A program and a level of spatial detail that matches the scale of water quality management. Many states, because of a lack of spatial detail in their M&A, over-extrapolate their results from many fewer monitoring sites (including those who employ statistical networks) resulting in not only a reduced accuracy in the application of those results, but a clear severance from meaningfully affecting water quality managements programs.

While we recognize the quality and integrity of the nearly 40 years of M&A on the large river assessment units, we are concerned about the expression of the most recent results in the 2018 IR. The lead in statement *"Ohio's large rivers (the 23 rivers that drain more than 500 square miles) remained essentially unchanged in percent of monitored miles in full attainment compared to the same statistic reported in the 2016 IR"* is essentially correct. However, we see this section at least implying that 100% full attainment will occur by 2020, which means that a gain of 12.5% will need to "found" if the goal is to be attained. This section of the IR needs to take a step back and report what has actually happened since 2010 and also to include the full set of results back to 1980. Two graphics are provided to assist in that process and we have assessed the likelihood of actually improving beyond the 2008 full attainment rate of 93.1% in an article on the MBI website[1] (Figure 1). Instead, we see a decline of 5.6% between 2008 and 2016, which we also believe represents a leveling off of improvements seen prior to 2008 *at a minimum* and more likely an actual decline. We suggest that the agency modify the IR to recognize this and also the unlikelihood of meeting the 2020 goal especially given the current deregulatory climate. This also highlights the critical importance of maintaining the M&A level of effort otherwise the agency will lose the ability to credibly assess these trends into the future. This issue alone reaffirms our concerns about the pending 80% reduction in the level of sites evaluated annually beginning in 2018.

[1] A Retrospective on the Clean Water Act in Ohio: Is Today As Good As It Gets? https://midwestbiodiversityinst.org/publications/articles/a-retrospective-on-the-clean-water-act-in-ohio-is-today-as-good-as-it-gets.

We are also concerned about the apparent decision to utilize only the most recent 10 years of assessment data to analyze trends. While we recognize the practical utility of a 10 year period as a “rule-of-thumb” for considering data as being applicable to a particular river or stream at a given point in time, there is no particular validity in that time frame. It should be applied differently to non-attaining vs. attaining streams and rivers and it should also consider the quality at the same time. We would not expect and EWH river to decline and if the stressor levels have not increased the quality should be the same in 10 years or 20 years. For assessing long term trends we strongly advise the agency to retain all of the years of assessment dating back to 1980 and simply adding the new biennium of results in each successive reporting cycle. If only the prior 10 years are assessed, then it will only be another reporting cycle before the peak attainment of 93.1% is lost from the analysis and providing an inaccurate assessment of decline or improvement. Again, to preclude misreading these trends we urge the agency to retain all of the biennial cycles and updating them to include the years in between 1980 and 2016. We would be willing to work with the agency to build such an analysis.

The HUC12 assessment shows a continuing improvement and we recommend including the results back to 1980 to provide a solid historical perspective. The attainment rate is well below the large river assessment units and due to the different degrees of success in controlling point and nonpoint sources of impairment.



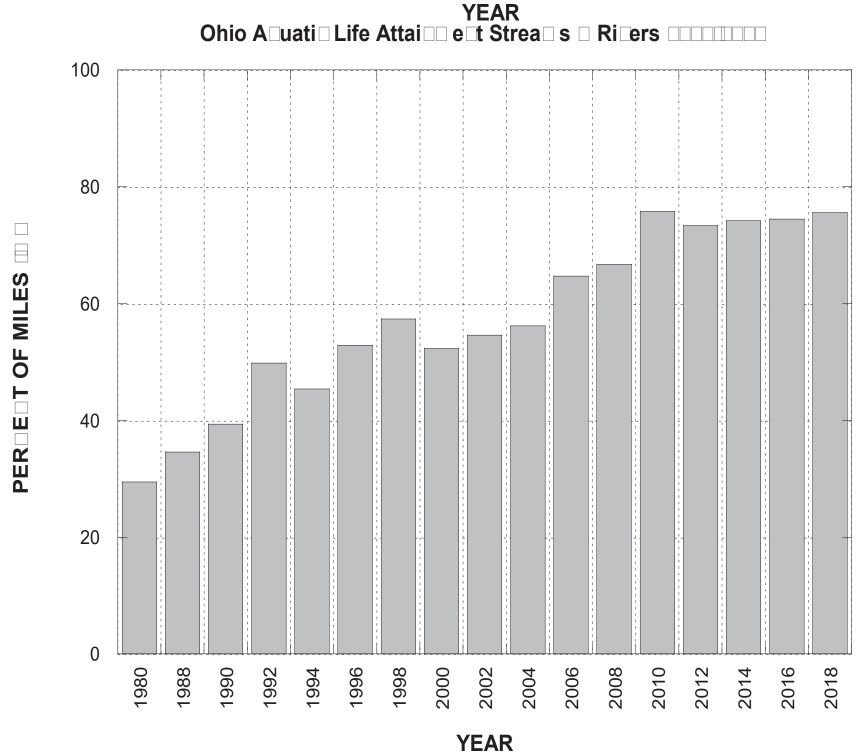


Figure 1. *Trends in attainment of aquatic life uses in Ohio large river assessment units between 1980 and the 2002-18 reporting periods by Ohio EPA (upper) and for all stream and river units combined between 1980 and the 1988-2018 reporting periods (lower).*

Friday, May 4, 2018

Ohio Environmental Protection Agency
Division of Surface Water
Attn: 303(d) Comments
P. O. Box 1049
Columbus, Ohio 43216-1049

To Whom it May Concern,

We appreciate the opportunity to comment on the Ohio Integrated Water Quality Monitoring and Assessment Report. Ohio's livestock organizations and farmers are neither opposed or supportive of an impairment designation for Lake Erie. Rather, we share the same goal of the Ohio Environmental Protection Agency (Ohio EPA) and the Ohio General Assembly, which is to improve Ohio's water quality standards and to ensure the highest quality of water both for today, and for the future. That is why our organizations continue to be cooperative, willing partners of the Ohio EPA, the legislature and other advocates in helping Ohio closely examine the issues and contribute to the efforts aimed at this goal.

Without a thorough understanding of the science that was used to determine the "impairment" of Lake Erie - or any of the other bodies of water – we cannot attest to, nor dissuade, from the scientific validity. As such our comments below are not meant to indicate that the use of Moderate Resolution Imaging Spectroradiometer through NOAA is an incorrect format. Instead the questions below are intended to help us better understand the process and science that was used to come to this determination:

- Based upon the use of satellite images for this process, is it implied that the size of the algae bloom is directly proportional to the toxicity of the bloom from a recreational stand-point?
- How was it determined that a threshold of 30% of the western basin open water unit area with a density of 20,000 cells/mL is acceptable?
- If a bloom covers less than 30% of the western basin open water but is far more dense in cyanobacteria cell count, is it still not impaired?
- On page F-34 the report mentions that the use of MODIS was the "first phase" of this process. Is there documentation on the next phase of this process?
    - Will there be an opportunity for input on future processes?

On page I-19 the report indicates the satellite images will be used in conjunction with information from "researchers at the Ohio State University/Stone Laboratory, University of Toledo and Bowling Green State University."[1] We appreciate the use of these tremendous academic assets in the development of a better understanding of the algae issue. The same page indicates that these universities were utilized in 2017 for water sampling.

- Was the information gathered at that time utilized in conjunction with the satellite information discussed earlier as part of the impairment designation?
    - If so, how was it utilized?
- Moving forward, will the impairment designation be based upon the "Phase 1" use of MODIS, or will it utilize research from these universities or will it be a combination thereof?

We understand and can appreciate the desire to separate out the assessment units in Lake Erie. Yet as previously mentioned, the challenge with this approach is as you become more targeted, accurate information becomes less available. Specifically, to have an assessment unit for the island shoreline, it would be appropriate to access information at this granular level. As such, we question the validity of having such a small assessment unit when the shape files

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[1] Ohio Environmental Protection Agency, Division of Surface Water. *Ohio 2018 Integrated Water Quality Monitoring and Assessment Report*. March 2018. Pg.I-19.

available from NOAA are unable to differentiate between the island shoreline and the western basin open water as mentioned on page F-36.[2]

Agriculture understands its contribution to this issue, and it's important to note that livestock farmers have been working to be part of the solution for decades. In fact, it is an important reminder that the Livestock Environmental Permitting Program was established in December 2000 by Ohio's legislature to proactively manage the environmental impact of the expanding livestock facilities in Ohio. Livestock farmers have embraced this permitting program, which is among the most stringent in the nation, and they must adhere to the rules - established upon sound science and best management practices. Livestock facilities that fit the criteria for a Concentrated Animal Feeding Operation designation must be permitted and adhere to rigorous rules established to protect the environment and the communities in which they operate.

Over the years, many would argue that non-point agriculture has done more to protect the environment at its own expense than any other non-point contributor. That being said, regardless of farm size, livestock agriculture has embraced the need for continuous improvement of managing manure as a natural fertilizer and identifying new, innovative and cost-efficient ways to manage, store and apply manure as a natural fertilizer to contribute toward healthy and productive soil.

Again, we appreciate the opportunity to comment on the Ohio Integrated Water Quality Monitoring and Assessment Report. We share your goal of having a scientific process to designate impairment, and we ask for robust consideration of the points raised above as this moves forward.

Sincerely,

Ohio Cattlemen's Association
Ohio Cattlemen's
Association
10600 U.S. Highway 42
Marysville, OH 43040

OH PORK ohio pork council
Ohio Pork Council
5930 Sharon Woods Blvd.
Columbus OH 43229

OHIO DAIRY PRODUCERS ASSOCIATION
Ohio Dairy Producers Association
2800 Corporate Exchange Dr.
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Columbus OH

OPA OHIO POULTRY ASSOCIATION
Ohio Poultry Association
5930 Sharon Woods Blvd.
Columbus OH 43231

[2] Ohio Environmental Protection Agency, Division of Surface Water. *Ohio 2018 Integrated Water Quality Monitoring and Assessment Report*. March 2018. Pg. F-36

OHIO FARM BUREAU

Working together for Ohio farmers to advance agriculture and strengthen our communities.

May 4, 2018

Ohio EPA Division of Surface Water
Attention: 303(d) comments
P.O. Box 1049
Columbus, Ohio 43216-1049

Re: Ohio Farm Bureau Federation's comments on the draft 2018 Integrated Water Quality Monitoring and Assessment Report

Please accept Ohio Farm Bureau Federation's comments on the draft 2018 Integrated Water Quality Monitoring and Assessment Report (the "Report"). These comments will focus on the assessment for algae in Western Lake Erie ("WLE").

While we believe the Great Lakes Water Quality Agreement is a preferable plan for improving water quality compared to impairment, it is important to note that Farm Bureau has never opposed the impairment designation for WLE. Regardless of the impairment designation, our goal has been and will continue to be focused on the great work being done by Ohio's farmers, be it voluntarily or under enactment of laws such as Senate Bill 150 and Senate Bill 1, to reduce nutrient runoff.

We do however have some questions surrounding the methodology of the assessment tool for determining the open waters of WLE as impaired and offer the following comments and questions.

1. The draft Report presents the first phase of Ohio's assessment method for recreational use attainment due to the presence of algae in WLE.

- What is Ohio EPA's plan for the next phase and what components will it contain?
- When will that phase be available for review and comment?

2. The NOAA Experimental Lake Erie Harmful Algal Bloom Bulletin has a threshold for cyanobacteria detection of 20,000 cells/ml. The estimated cyanobacteria density is determined through the strength of the measured reflectance signal at multiple wavelengths.

- What is the relationship between toxin production and cyanobacteria density?

3. According to the proposed assessment methodology, it is bad if the presence of cyanobacteria are at levels at or above the threshold for detection via the satellite images.

- How does the presence of cyanobacteria adversely impact recreation?

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- Why base the assessment method at a low cyanobacteria density? Why could it not be based on a medium level?

4. Current research being conducted by The Ohio State University at Stone Lab is showing that the ratio of cyanobacteria toxin in the water to the amount of cyanobacteria biomass present changes from year to year and within the summer. The highest toxin per biomass ratio routinely occurs at the start of the bloom and this ratio decreases throughout the summer as nitrate concentrations in the water column decrease. The result is that the composition of the bloom shifts from highly-toxic to low to non-toxic strains of Microcystis.

- The data again leads to the question – How does the presence of cyanobacteria in the later stages of a bloom adversely impact recreation?

We have concerns that impairment will slow the current efforts by Ohio's farmers as it creates uncertainty on what will be expected of them. Farmers will be hesitant to invest in new technologies and practices if they are not certain they are the same practices that may be required by impairment. We are also concerned that impairment will be a lengthy legal and regulatory process that could take until 2025 for implementation of an action plan to begin. This coincidentally is the same date that the Great Lakes Water Quality Agreement stipulates that all parties should have attained the 40 percent nutrient reduction goal.

Thank you for consideration of Ohio Farm Bureau Federation's comments.

Sincerely,

Adam J. Sharp

Adam J. Sharp
Executive Vice President
Ohio Farm Bureau Federation

AS/ts

Ohio EPA, Division of Surface Water May 4, 2018
P.O. Box 1049
Columbus, Ohio 43216-1049
Attn: 303(d) Comments
via email EPATMDL@epa.ohio.gov

Dear Sirs and Mesdames:

The Ohio Corn and Wheat Growers Association (OCW), the Ohio Soybean Association (OSA), and the Ohio AgriBusiness Association appreciate the opportunity to provide comments on the draft Ohio's 2018 Integrated Water Quality Monitoring and Assessment Report, which includes the Clean Water Act Section 303(d) list of impaired waters. Together, OCW and OSA represent the interests of over 25,000 farmers across Ohio. These mostly small businesses are a critical component of Ohio's economy and create one out of eight jobs in the state. The Ohio AgriBusiness Association represents more than 225 companies that make up Ohio's fertilizer industry along with the grain, feed, seed, and crop protection industries serving Ohio agriculture.

We believe that to restore and maintain Lake Erie's water quality, that Ohio's top priority and primary area of emphasis must be the adoption of sound, practical measures and systems that, to the best of our knowledge and understanding, will make a positive contribution to the health of the lake. This should be the approach taken by all the stakeholders whose activities may be contributing to the lake's water quality problems, including but not limited to agriculture. Ohio agriculture is committed to this proactive approach, expanding on the strong and sustained history of actions we have taken that demonstrate this commitment, as explained below. We will do this independent of whether the lake receives an official Clean Water Act impairment designation or not, and we will do this despite the significant procedural, substantive and scientific concerns that we articulate below about the accuracy, validity, and therefore practical usefulness, of the 2018 report's proposed impairment designations. We respectfully request that you consider these comments, including the request of extending the comment period, while at the same time remain a full partner with us in support of our own ongoing and on-the-ground efforts to improve Lake Erie's water quality.

PROGRESS AND OUR ONGOING COMMITMENT

Water quality is, and has been, a top priority for Ohio's grain farmers. OCW and Ohio Soybean Council (OSC) fund research to increase the understanding of the relationships between agricultural practices and impacts on water quality, including algae blooms in Lake Erie. On an ongoing basis, we evaluate and recommend to our members throughout the state actions they can take to cost-effectively improve water quality, remain profitable, and continue to contribute to Ohio's economy.

The best basin-wide analysis that we are aware of reporting on how these and the many other efforts of farmers have expanded over time is from the USDA Natural Resources Conservation Service's (NRCS) 2016 Western Lake Erie Basin (WLEB) special study looking at the changes in conservation practice adoption on cultivated cropland acres between the 2003-2006 and 2012 periods and issued in 2016[1]. We are confident that the conservation practice adoption progress that farmers made over period has continued and likely grown considerably. That report found, for example, that:

- Cropland acres managed with one or more structural practice controlling erosion increased from 34 to 54 percent of acres.
- Cropland acres managed with an edge-of-field trapping practice, such as a filter or buffer, increased from 18 to 31 percent of acres.
- Nitrogen and phosphorus application methods improved. Acres on which all nutrient applications were incorporated in some manner (knifed, injected, tilled, or banded) increased. The percent of cropped acres on which nitrogen was incorporated at every application increased from 29 to 43 percent and on which phosphorus was incorporated at every application increased from 45 to 60 percent.
- About 71 percent of acres had a soil test within the last 5 years in the 2012 conservation condition.
- Use of precision agriculture techniques increased. Acres on which GPS was used to map soil properties increased from 8 percent to 36 percent of cropland acres. The use of variable rate technology increased from 4 to 14 percent of cropland acres.

Ohio agriculture, working in partnership with many stakeholders and the State of Ohio, have been aggressively engaged in efforts that are almost certainly building on and expanding this progress documented in the NRCS report. Since 2011, the Ohio Corn Marketing Program (OCMP), the Ohio Small Grains Marketing Program (OSGMP), and the OSC have invested more than $3.5 million of farmer dollars in research and education to help mitigate nutrient-related problems in Ohio. These programs provide significant resources to research initiatives being conducted by The Ohio State University to better understand and improve nutrient-related conditions in Ohio. These include:

- Participating in edge of field research to identify how phosphorus leaves Ohio fields and evaluate management practices to determine the best management practices (BMPs) that will effectively limit phosphorus transport from farmers' fields to streams.
- Supporting fertilizer placement research.
- Funding updates to the Ohio portion of the Tri-State Fertilizer recommendations which will be updated this year.
- Providing nutrient management plan (NMP) development assistance to Western Lake Erie Basin (WLEB) farmers.
- Revising the Best Management Practices Manual.
- Identifying the economics associated with BMPs to help encourage adoption of cost-effective BMPs.

We also provide financial and other support to the 4RTomorrow awareness campaign led by the Ohio Federation of Soil and Water Conservation Districts, which provides education to Ohio farmers on nutrient

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[1] U.S. Department of Agriculture, Natural Resources Conservation Service. 2016. Effects of Conservation Practice Adoption on Cultivated Cropland Acres in Western Lake Erie Basin, 2003-06 and 2012. 120 pp. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/ceap/pub/?cid=nrcseprd949606

stewardship. We support the voluntary 4R Nutrient Stewardship Program's fertilizer retailer certification program led by the Ohio AgriBusiness Association and The Nature Conservancy. This program has certified 37 branch facilities, covers 1.9 million acres and serves 3,580 clients in the WLEB as well as additional facilities, clients, and acres throughout the state.

Additionally, our organizations continue to support our members located in the WLEB in their efforts to comply with the Ohio Domestic Action Plan, the Ohio Clean Lakes Initiative, Ohio Senate Bill 1, Ohio Senate Bill 150, and other nutrient reduction efforts.

COMMENTS ON THE DRAFT REPORT

As we support our members in these nutrient reduction efforts, we are concerned with Ohio EPA's sudden about-face regarding inclusion of the open waters of the WLEB on the 2018 Draft Ohio 303(d) list, based on a review of satellite imagery. We are concerned that this change in direction will divert attention from the collaborative efforts of the United States and Canada to meet the goals of Annex 4 of the Great Lakes Water Quality Agreement (GLWQA) to restore and protect the waters of the Great Lakes. Annex 4 has already established a phosphorus "diet" based on multiple lines of scientific investigations. Efforts need to be directed at implementation of nutrient reduction efforts to meet this "diet". With the Draft Integrated Report, Ohio has proposed a novel (and as far as we know, not yet peer reviewed) approach to link estimates of bloom size and frequency to impairment. We recognize that many stakeholders believe that the next step after the impairment listing should be development of a TMDL. A TMDL will require additional time and will slow nutrient reduction progress and likely increase the cost to all sources to achieve the desired outcome.

We are requesting an extension of the comment period so that we can obtain additional information to better understand the approach that Ohio EPA used to make the impairment listing and whether there are additional data that should be considered as part of this listing. **We also offer the following technical and procedural comments** on the Draft 2018 Integrated Report for your consideration. Given the scientific and policy concerns associated with this document, we believe that **additional stakeholder outreach** is warranted. We also believe that the open waters of WLEB, if they are to be declared "impaired" in the final report, should be placed in **Category 5-alt to reflect the ongoing efforts to restore WLEB and reduce phosphorus loads in the tributaries.**

Relationship of New Targets to Annex 4 of the Great Lakes Water Quality Agreement

The U.S. EPA's Great Lake National Program office coordinates the effort to comply with the GLWQA. The most recent update to the GLWQA included Annex 4, which required, among other things, updates to the phosphorus loading targets for the open waters of each of the Great Lakes and a determination of appropriate loading allocations (by country) to achieve the Lake Ecosystem Objectives. For the nearshore waters, load reductions targets are required for priority watersheds. The revised Lake Erie loading targets and objectives were finalized in 2015. The result is a commitment from the U.S. to reduce phosphorus loading to the western and central portions of the lake by 40 percent, from 2008 levels (to meet the 2012 threshold for algae bloom severity at a frequency of nine out of ten years).

In response to the update to the GLWQA, a U.S. Action Plan for Lake Erie was developed, with input from each impacted state, including Ohio. Each entity developed a Domestic Action Plan that includes specific actions to meet the Annex 4 reduction goals.

The 2018 Draft Integrated Report states that Ohio EPA requested input from various researchers regarding metrics to be used to provide a "scientifically relevant determination of impairment" using targets to meet these Annex 4 goals. Ohio EPA appears to have concluded that this can be achieved by assuring that the algae bloom is not greater than what occurred in 2004 and 2012. As discussed below, Ohio EPA's methodology used to support the nutrient impairment designation has not been made available to the public for review and comment. No data or technical justification was provided in the Draft 2018 Integrated Report. Nor did the report provide the linkage between this new methodology and the Annex 4 bloom severity target. We believe it is critical for stakeholders to have the opportunity to review the data and technical justification before the open waters of the lake are declared impaired. This is particularly important because the same target (and linkage) will need to be used to assess when the lake is no longer impaired and is meeting the Annex 4 goal. A peer review process that includes researchers that informed the GLWQA 2012 threshold for algae bloom severity seems to be in order.

Procedural Concerns

OEPA's Proposed Nutrient Impairment Designation of the Open Waters of the Western Basin of Lake Erie is Missing Several U.S. EPA Procedural Requirements.

Ohio EPA's Draft Integrated Report does not indicate that the designated uses of the open waters of the WLEB are not being met or are otherwise threatened. Although the report provides a summary of events reflecting recurring water quality problems (algal blooms) in the open waters: there is no indication that the Agency substantiated the conclusion that water quality standards are either not being attained or are threatened or prepared a Section 301 nonpoint source assessment identifying impairment or threats to water quality standards attainment from nonpoint source pollution. In addition, there appears to be no explanation in the report for the decision to base the impairment determination exclusively on limited satellite imaging data, particularly when that data collection/analysis process has not been *demonstrated* to satisfy the level 3 credible data standard required by RC 6111.52(C).

U.S. EPA's rules require that Ohio EPA consider "all existing and readily available water quality-related data and information" when making impairment listing determinations and submit with all final impairment listings to U.S. EPA, a rationale for any decision not to consider such data and information. Table D-3, Description of the data used in the 2018 IR from sources other than Ohio EPA, appears to be incomplete, as it does not include the satellite image data.

In addition, under R.C. 6111.56(B), Ohio EPA is prohibited from listing waters of the State as impaired without first demonstrating that the failure to meet applicable water quality standards is not due to the existence of naturally occurring conditions in the open waters of the Western Basin. Ohio EPA has not addressed the complicated issues of climate change or global warming in the Draft Integrated Report. Even if the phosphorus load reduction targets anticipated under Annex 4 were to be realized, some consideration of these factors in the Integrated Report is warranted and these factors may lend themselves to a Category 5-alt determination.

Ohio EPA's Methodology Used to Support the Nutrient Impairment Designation of the Open Waters of the Western Basin has not been Made Available to the Public for Review and Comment.

The proposed impairment designation is based on Ohio EPA's finding that algal cell count/density in the open waters of the Western Basin frequently exceeded a level (20,000 cells/ml) established as a "nominal floor" by the National Oceanic and Atmospheric Administration (NOAA) to control the generation of cyanotoxins.[2] Using satellite imaging data collected by NOAA for the open waters on certain (clear) days from July through October between 2012 and 2017, Ohio EPA calculated the number of 10-day time frames when the algal cell count level exceeded 20,000 cells/ml over 30% or more of the open waters.[3] *All* of the open waters of the Western Basin were then declared impaired because *some* areas had more than three 10-day periods where they exceeded this standard in each of the past six years.[4] There is no explanation in the report showing how Ohio EPA developed this methodology.

This methodology, which Ohio EPA has not used previously to support any nutrient-based impairment listing of Ohio's waters, has not been subjected to meaningful notice and opportunity for engagement by interested stakeholders. 40 CFR 25.5(b)(2), which prescribes the overarching public involvement requirements for state environmental agencies, requires that agencies provide the public with the relevant information "at the earliest practical time," and states that fact sheets and other data summaries "shall not be a substitute for public access to the full documents."

Ohio EPA's process for listing impaired waters, including the public engagement aspect, has unfortunately lagged behind its TMDL process. Whereas HB 49 and OAC 3745-2-12 prescribe detailed procedures for the development of TMDLs, Ohio EPA does not have a rule that defines the procedures the Agency must follow when developing a listing of impaired waters under Section 303(d) of the Clean Water Act. Nor does Ohio EPA have a rule setting forth the data and information that must be reviewed and shared with the public to support determinations of potential impairment.

Ohio EPA does not have a methodology to comply with 40 CFR 130.7(a), which requires that "the process for developing section 303(d) lists **and public participation** be described in the state's continuing planning process under section 303(e)." *Guidance for 1994 303(d) Lists,* November 26, 1993. (Emphasis added). U.S. EPA's guidance regarding the need to timely and fully engage the public in impairment decision-making was updated as recently as January 23, 2018, where the Agency reaffirmed the mandate that "EPA and the states actively engage the public…as demonstrated by documented, inclusive, transparent, and consistent communication. [5]

Ohio EPA's engagement with the public on the proposed impairment designation of the open waters of the Western Lake Erie Basin is insufficient. The Draft 2018 Integrated Report itself acknowledges that only "**much** of the data used in the report have been presented to the public." It does not say "all," or even "most." The report does not provide any of the NOAA satellite data (or indicate where it is available), does not indicate Ohio EPA's basis for concluding that the (post-2012) data meets level 3 credible data

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[2] Draft Integrated Report, Section F.4, page F-34
[3] Draft Integrated Report, Section F.4, page F-36
[4] *Id.*
[5] Impaired Waters and TMDLs: Working with Partners and Stakeholders. January 23, 2018.

standards, and does not describe the basis for the Agency's adoption of the 20,000 cells/ml, 30% coverage for 10 days metric. The lack of communication on these (and other) critical components of Ohio EPA's decision-making compromises the ability of the public to meaningfully participate in the process.

Developing Satellite-Based Numeric Water Quality Standards to Define Nutrient Impairment in the Open Waters of the Western Basin of Lake Erie Should be Preceded by Rulemaking.

Developing a new numeric 10-day algal cell count/density metric as the standard to define nutrient impairment for the open waters of Lake Erie constitutes the *de facto* establishment of a new nutrient-based, numeric water quality standard for the Lake. Yet this standard has not undergone notice and comment rulemaking, as required by RC 6111.041 and RC Chapter 119.

RC 6111.56(C) states that narrative standards are to be established when numeric standards *cannot* be established or to *supplement* existing numeric standards. U.S. EPA's rules provide the same limitation. 40 CFR 131.11(b). Ohio EPA's existing narrative "free from" standards (OAC 3745-1-04) do not shield the Agency from the requirement to develop numeric standards when possible, using proper notice and comment procedures for rulemaking. Were the law otherwise, Ohio (and other states) could circumvent the protections of notice and comment rulemaking for numeric standards by relying solely upon vague narrative standards, implemented using numeric water quality criteria documents as "guidance" or "interpretation."

The development of a new, satellite-based, algal cell count/density numeric standard for defining impairment in the Lake Erie open waters constitutes the establishment of a new standard. However, under Ohio law (R.C. 6111.56(B)), such impairment decisions must be based on actual or threatened nonattainment of *existing* water quality standards, not on actual or threatened nonattainment of *new, unpromulgated* standards that are an "interpretation" of narrative standards promulgated many decades ago before scientific improvements enabled numeric standards to be developed.

Ohio EPA's new satellite-based, algal cell count/density numeric standard should undergo the rulemaking procedures set forth in RC Chapter 119 before the standard is used to assess the impairment status of the open waters of the Western Basin. That is the rule of law established by the Ohio Supreme Court in *Fairfield Cty. Bd. of Comrs. v. Nally,* 143 Ohio St.3d 93 (2015). That case involved the same enigmatic narrative water quality standard — "waters shall be free from nutrients…in concentration that create nuisance growths of [algae]" (OAC 3745-1-04) —that is putatively being used as the basis for the Agency's proposed Lake Erie open water impairment designation. In that case, Ohio EPA asserted that non-rule derived numeric standards for phosphorus, taken from a 1999 guidance document, were a lawful basis for regulatory decisions.

It is important to note that the Court's holding in *Fairfield County* had two independent bases: the establishment of a numeric nutrient standard triggers Ohio EPA's obligation to promulgate a rule under *both* R.C. Chapter 119 *and* R.C. 6111.041. As regards Chapter 119, there can be no dispute that the proposed Lake Erie designation has a far broader application than the phosphorus standard at issue in *Fairfield County*—which applied only to point sources in the Big Walnut Creek watershed— but which the Court nevertheless found to have the general and uniform effect of a rule. Furthermore, just as in *Fairfield County*, Ohio EPA's new 10-day algal cell count/density metric "does more than simply aid in the interpretation of existing rules and statutes. Instead, it prescribes a legal standard that did not previously exist." Also, as in *Fairfield County*, this new standard has a general and uniform effect even though it will not be implemented until a TMDL and NPDES permit, nutrient management plan, or other regulatory steps are taken.

The parallels of the proposed Lake Erie open waters designation with the second basis of the Supreme Court's holding in *Fairfield County*—R.C. 6111.041 requires Ohio EPA to promulgate water quality standards as rules—are even closer. Acknowledging that it had never promulgated a numeric standard for phosphorus, Ohio EPA nevertheless utilized a number taken from a technical guidance document (*Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams* (Ohio EPA, 1999) to develop a *de facto* phosphorus WQS (0.11 mg/L) that it applied to the Big Walnut Creek watershed. The Supreme Court held that such a "target value" for all water bodies in the Big Walnut Creek watershed "clearly constitutes a standard of water quality' for 'waters of the state of Ohio' within the meaning of R.C. 6111.041," and was, therefore, first required to be promulgated as a rule.

The 10-day algal cell count/density metric utilized in the Draft 2018 Integrated Report is a water quality standard, just as was the phosphorus target value of 0.11 mg/l taken from the 1999 Association Report. Unless and until it is formally promulgated by Ohio EPA as a rule, it is not appropriate or lawful for the Agency to use it as such. As the Supreme Court held in *Fairfield County*, when state agencies bypass formal rulemaking "affected persons are denied access to the process that the General Assembly intended them to have, *i.e.*, the early, informed, and meaningful opportunity to challenge the legality of the standards…and the underlying assumptions, data, logic, and policy choices that Ohio EPA made in developing the standard.

Total Maximum Daily Load (TMDL) Categories

The Draft 2018 Integrated Report discusses EPA's new 303(d) vision. This vision resulted from U.S. EPA's and states' frustration over perpetual litigation ("deadline suits") that were focused on churning out TMDLs at the expense of really assessing whether those TMDLs were the most effective way to achieve actual water quality improvements.[6] One particularly important aspect of U.S. EPA's new vision is the "Alternatives Goal." It states that "By 2018, States [should] use alternative approaches, in addition to TMDLs, that incorporate adaptive management and are tailored to specific circumstances where such approaches are better suited to implement priority watershed or water actions that achieve the water quality goals of each state, including identifying and reducing nonpoint sources of pollution."[7] According to U.S. EPA, because so many TMDLs have been litigation-driven, "States and EPA have not always had the opportunity to objectively evaluate whether a TMDL would be the most effective tool to promote and expedite attainment of State water quality standards."[8] This admirable goal thus envisions that States may give certain impaired waters a lower priority ranking for TMDL development so that alternatives designed to achieve water quality standards may be pursued in the near term. The waterbodies would remain on the 303(d) list and may ultimately require a TMDL if alternative approaches do not fully attain water quality standards.[9] But in the near term, the waterbodies would receive a "5-alternative" or "5-alt"

[6] *See* Draft Integrated Report at C-28.
[7] US EPA, A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program, at 9 (Dec. 2013).
[8] *Id.*
[9] *See id.*

designation and a lower priority ranking while the State pursues alternative approaches for restoring water quality.[10]

In furtherance of U.S. EPA's new vision, Ohio EPA prepared a 303(d) Vision Implementation Plan and submitted it to U.S. EPA for final concurrence in August 2015. Ohio's plan states that Ohio EPA plans to use alternative approaches to TMDLs "designed to address specific impairments caused by pollutants such as phosphorus[.]"[11] Potential alternative approaches include Nine Element Watershed Plans, National Pollutant Discharge Elimination System (NPDES) permit revisions, funding installation of BMPs, and supporting implementation of new rules.[12] Despite Ohio EPA's stated intent to use alternative approaches to address nutrients, the Draft 2018 Ohio Integrated Report admits that "Ohio does not have any [Assessment Units] listed under 5-alt in this report but anticipates using this subcategory in the future."[13] Ohio EPA's decision not to give a "5-alternative" designation to the open waters of Lake Erie is especially puzzling given that the State is already pursuing just the sorts of alternative approaches that it indicated it would pursue in its 2015 303(d) Vision Implementation Plan.

Specifically, the Draft 2018 Ohio Integrated Report explains that the State is addressing nutrient problems in Lake Erie using a variety of mechanisms, including nutrient TMDLs for tributaries; state initiatives to reduce nutrient loads in accordance with the Domestic Action Plan; and active participation in Annex 4 and other GLWQA efforts.[14] As the State recognizes, several "parallel planning and management efforts" are underway at the state, federal, and bi-national levels.[15] For the open waters in particular, "respecting and working through the bi-national governance framework is the appropriate process," and under that framework, "whole lake management plans are developed, implemented and tracked."[16]

Multi-state and bi-national efforts are not limited to the GLWQA. Recognizing that Annex 4 does not specify timeframes for implementation and restoration goals, Ohio entered into the Lake Erie Collaborative Agreement with Michigan and Ontario in 2015.[17] This important development allows the signatories to "get a head start on the Annex 4 process and hasten efforts to improve water quality in Lake Erie."[18] To that end, Ohio is striving to meet the Collaborative Agreement's phosphorus reduction goals of 20 percent and 40 percent by 2020 and 2025 respectively.[19] Finally, Ohio EPA has already completed TMDLs for 22 of the 32 watersheds that feed into Lake Erie, and TMDLs for the remaining 10 watersheds are under development.

The Draft 2018 Integrated Report also catalogs the various State-based nutrient reduction efforts, which include implementation of the Statewide Nutrient Reduction Strategy; nutrient reduction projects utilizing $13.9 million in grants; three separate pieces of legislation aimed at POTWs, fertilizer and manure application and education, sewage sludge application, and reporting of nutrient loadings; and various workgroup and task force efforts.

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[10] *See* Draft Integrated Report at J-1.
[11] Plan at 11.
[12] *See id.*
[13] Draft Integrated Report at J-1.
[14] *See id.* at J-10.
[15] *See id.*
[16] *Id.* at J-10 to J-11.
[17] *See id.* at J-11.
[18] *Id.*
[19] *Id.*

In light of these extensive approaches to addressing impairments caused by phosphorus, the State should consider designating the open waters of Lake Erie as "5-alternative" and assigning a lower priority ranking for those waters. While there is more work to be done to restore water quality, the State should employ an adaptive management approach and allow these alternative approaches a chance to achieve water quality goals. It should not reflexively head straight down the TMDL path.

We believe that Ohio EPA should provide additional information to the public prior to using the new satellite data – based methodology to determine that the open lake waters are impaired. We request that the data and associated analysis used in this determination be made publicly available for all interested stakeholders. We also request a technical analysis of the interconnectedness between this new method and the state's obligation under Annex 4 of the GLWQA. Ohio EPA's engagement with the public on the proposed impairment needs additional time prior to the finalization of the Draft 2018 Integrated Report.

Thank you for your consideration of these comments.

Kirk Merritt
Executive Director
Ohio Soybean Association

Tadd Nicholson
Executive Director
Ohio Corn and Wheat

Christopher Henney
President and CEO
Ohio Agribusiness Association

Explore. Discover. Understand. Act 3□28 N. High St., Suite F

FLOW

May 4th, 2018

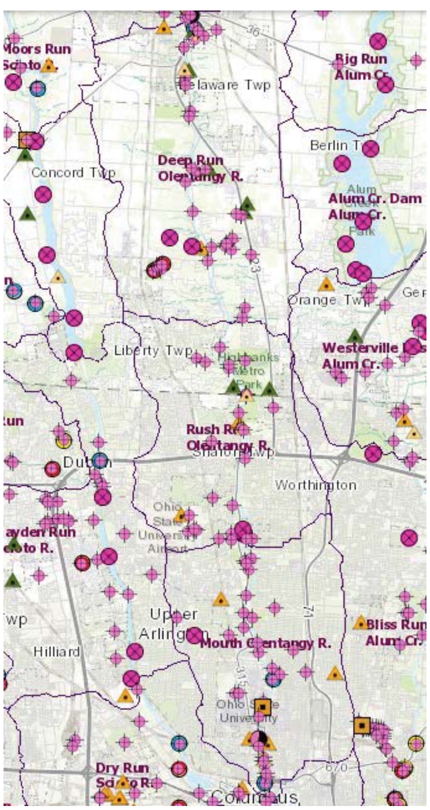
Ms. Tiffani Kavalec
Chief, Division of Surface Water
Lazarus Government Center
□0 W. Town St., Suite 700
P.O. Box 1049
Columbus, Ohio 43216-1049

Dear Ms. Kavalec,

The Friends of the Lower Olentangy Watershed (FLOW) have reviewed the draft 2018 Integrated Assessment Report and continue to have concerns about the treatment of historical data and how its arbitrary omission or inclusion affects the impression of actual water quality in a watershed.

1. Per page G-1 (Background and Rationale), FLOW understands that Ohio EPA has limited resources and cannot study every watershed on a 10 year rotation. We also acknowledge that using historical data as stated "some earlier data collected between 2003-2006 were retained for specific watershed and large river assessments" is necessary and "can be used if the director has identified compelling reasons as to why data are credible".

FLOW requests that Ohio EPA continue to utilize historical Olentangy River Data in Integrated Reports unless newer data to replace it is available. Of all the 2003-2004 Olentangy watershed data, Ohio EPA chose to use include only one data point (V04Q0□ Downstream of Bill Moose Run).



All the sites from Ohio EPA's monitoring efforts in the Deep Run, Rush Run and Mouth of the Olentangy River 12 Digit HUCs from the 2003-2004 Technical Support Document could have been included in this report. The lack of data on the Olentangy Tributaries gives a misleading picture of the health of the watershed.

The omission of data has resulted in a misleading report of the water quality of the Olentangy based on previous Ohio EPA reports. Previously the Deep Run HUC had the highest water quality as a designated Exceptional Warmwater Habitat and a State Scenic River, this portion of the Olentangy needed minor restoration. Using Ohio EPA's 2018 Integrated Assessment Report would lead some to prioritize their efforts soley in this Hydrologic Unit Code (HUC).

We appreciate all that Ohio EPA's Division of Surface Water is doing to improve water quality and request that you conduct a reassessment of the IR 2018 for the Olentangy to include all the 2003-2004 data. And possibly include the 1999 sampling data as well.

2. FLOW also requests that you return the water quality app to the Georgraphic Information System service so that we can have access to all Ohio EPA data again. This will be helpful to FLOW and our partners in assessing priorities for projects for water quality improvements, many of which are needed in our urban tributaries.

3. FLOW noticed errors in how Ohio EPA is assigning priority points in the list of Assessment Units in Section L. Specifically our concern is about how priority points, listed in Table J-3 (page 241) for Aquatic Life Use and Recreational Use are assigned.

1 point for scores between 0-25
2 points for scores between 75.1-100 should have 4 points
3 points for scores between 25.1-50 should have 2 points
4 points for scores between 50.1- 75 should have 3 points

Are these merely typos in the report or were the priority points for each assessment unit miscalculated?

4. Please explain what "Category 4c Impaired not a pollutant" means? Specifically, FLOW is concerned about what this means for Brandige Run- Olentangy River 4 Ch.

5. Based on the Slide Presentation on April 25, 2018 shouldn't the Olentangy River be considerered a large river since it is over 32 miles long and has a drainage area greater than 500 square miles?

6. Rush Run HUC (05060001 11 02) is listed on page L-27 as Category 1it for Aquatic Life Use. Since there is no date for this 12 digit HUC, shouldn't the category be 3it (Use attainment unknown, TMDL conducted at HUC 11, not enough data to assess this Assessment Unit (AU)?

7. FLOW requests an estimate of the financial and staff resources that Ohio EPA would need to return to a 10 year watershed assessment schedule. The data that Ohio EPA produces is invaluable and is needed by watershed groups and municipalities to prioritize restoration efforts. We believe the public should know how the current resource situation will affect Ohioan's long term water quality improvements.

Thanks to all the unsung heroes in the Division of Surface Water for their help in protecting our water quality

Sincerely,

Laura Fay

Laura Fay
FLOW Science Committee, Chairwoman

From: Eric Paetz
To: EPA TMDL
Subject: comments on the draft list of impaired water bodies
Date: Wednesday, April 25, 2018 6:46:47 PM

My wife and I are an Ohio residents and have been living along Lake Erie our entire lives. We have been spending our Summers since 1980 on the shores of the Western Lake Erie Basin. We are both active and spend significant time on the Lake during the warm weather.

We have have personally observed the positive effects of efforts made over the last 30-40 years in cleaning up the lake. We've also watched over the last 10 years the onset of the Summer algae season destroy that work. It starts as early as mid-July with the water turning a pale green as the little algae spoors begin to drift eastward from the western portion of the lake.

Usually by early August, the lake has turned a consistency of pea soup due to the high concentration of algae in the Western Basin. That is not an exaggeration. The depth of the green soup varies but I'd say it it's as deep as 4-6 feet. I stopped immersing in the lake during algae season after I became aware of the toxins in the water. We do not allow any of our children or pets into the water, usually from late July through the end of the October, until the advent of cold weather kills the algae.

The thick green mats of algae form on all of the beaches, and the rest sinks to the bottom of the lake every season. A few years ago the Toledo water system was impacted significantly. Our enjoyment of the lake during the best days of the year is limited from late May through the end of June due to the recurring bloom. Our water bill and heath are impacted by the chemicals my municipal water system introduces to kill the algae.

This problem is not recent. We remember growing up in Cleveland and the bad taste in the water during the summer because of the treatment of the water due to algae. The human and economic costs of this man-made issue are significant and I believe that we can afford to spread the costs of mitigating the issue, for both farmers, municipal sewer systems and state residents.

We hope that this issue can be addressed at the regional level to include the other States that contribute to the algae growth and also our neighbor Canada. In the mean time we applaud your recognition of this issue and hope that you can solve it. However, if you should bend to the will of fertilizer lobbyists or fail in your effort, we'll be petitioning our members of Congress and the Federal EPA to take over the job of cleaning up this disgusting and unhealthy problem.

Good luck and you have our full support (for now).

Yours Sincerely,
Catherine and Eric Paetz
3237 Chadbourne Road
Shaker Heights, Ohio
44120

From:	William Ringo
To:	EPA TMDL
Subject:	Comment Ohio Integrated Report
Date:	Friday, May 04, 2018 1:28:51 PM

RE: Comment on Ohio Integrated Report 2018

Grand Lake St. Marys(GLSM) is the largest inland lake and is in the most degraded watershed in Ohio. Ohio lists GLSM as impaired and has conducted a TMDL that was completed in 2009. In addition, in 2011 the GLSM watershed was labeled as "distressed", a designation it shared alone.

The Clean Water Act requires that once there is a TMDL, there is to be an implementation plan developed that shows measureable progress(or lack there of) that would assure the eventual delisting of GLSM as impaired. Moreover, to be examined for progress after 10 years.

Ohio elected to substitute the Implementation Plan to a "distressed watershed" designation, which Ohio claimed would work better than the Implementation Plan.

Since then GLSM continues to be posted for "NO CONTACT" with the water! It now is clear that it was a mistake for the USEPA to approve Ohio's deviation from the CWA/Implementation Plan process. Ohio needed to make the "distressed watershed" as part of the Implementation Plan with the requirement to report progress or failure and to take additional steps to reduce nutrient loadings into GLSM, especially animal manure.

Monitoring data, collected for OEPA at the city of Celina's PWS raw water intake, demonstrates the continued increase in pollution. The Ohio Department of Health's threshold for posting a health advisory for microsystin(HAB's) is 6ppb. In the summer of 2017 toxic algae counts reached a level over 196ppb.
It must be pointed out that GLSM is the public drinking water source for the citizens of Celina at and ever increasing cost to purify.

There is much economic, quality of life, and environmental consequences to the continuing toxic algae problems in GLSM. The current approaches to reduce these threats is not viable or acceptable.

We are requesting the USEPA revisit and require a CWA Implementation Plan for the GLSM watershed that will provide for the recommended reductions(measureable) in all pollutants into GLSM.

Respectfully,

Bill Ringo, Treasurer
Guardians of GLSM

From: Sheelagh McCarthy
To: EPA TMDL
Cc: Bill McCarthy; Debbie McCarthy; brodrick coval
Subject: Public Comment regarding Lake Erie"s impaired status
Date: Thursday, May 03, 2018 9:48:42 PM

I would like to express my support to the Governor and Ohio EPA for taking this crucial step to bring attention to the impaired state of Lake Erie. Although many locals and non-locals have been aware of the disheartening polluted state of Lake Erie for some time, listing the western basin of Lake Erie as impaired waters will help to bring this issue to national attention. This issue can no longer be ignored by those that need to be held responsible.

Growing up in Michigan, my summers were defined by days spent swimming, sailing, and enjoying the Great Lakes, and particularly Lake Erie. Time spent with my family and friends on the shores and waters of Lake Erie helped to instill a love for the beauty and activities this lake had to offer, along with a curiosity for how these ecosystems work. It also brought an alarming attention to the detrimental effects harmful algal blooms caused by excessive nutrient pollution can have on such a beloved place.

I transferred my love of the Great Lakes to my undergraduate geology and environmental science studies at Michigan State, and again during my graduate studies at Michigan Tech, where I was lucky to research the Great Lakes on a deeper level. My research allowed me the opportunity to study Lake Superior and the rest of the Great Lakes from docks, shorelines, research vessels, classrooms, labs, and computer models. Ultimately, I worked to calibrate a model that simulated temperature, phosphorus cycling, and algal growth in offshore Lake Superior. Through this work, I recognized the importance of the balance of these Great Lakes systems and how vulnerable these systems are to anthropogenic influence.

The effects of nutrient pollution and non-point runoff are well understood and documented throughout the academic and Great Lakes community. Why then, is Lake Erie *still* so polluted? I've witnessed firsthand on my drive from Detroit to Marblehead, all of the agricultural runoff entering ditches that ultimately feed into the Maumee River and Lake Erie. How can we let this happen?

The facts and data are there, the regulation of point sources is there, the support and love of citizens of the Great Lakes community is there, and yet this problem won't be fixed by wishful thinking on voluntary actions. Large steps, in the form of regulations, nutrient reductions, and nutrient limits for non-point and agricultural sources, are necessary to clean up the lake.

We need to hold those that are degrading the quality of Lake Erie accountable. Large-scale agriculture and non-point sources needs to be held responsible, and we need the support and action of local, state, and federal governments in order to achieve this.

Although my career path as a water quality scientist has taken me out of the Great Lakes region for now, I attribute my passion for studying and protecting the quality of our nation's waters to my time spent on the Great Lakes. I look forward to my trips back home that are strategically scheduled during the summer so I can enjoy time with my family in our favorite place in Marblehead on Lake Erie. I want to continue these trips without the bewildered looks of my colleagues and friends on the West Coast, as I try to explain that there is more to Lake Erie than all of the pollution they see and hear about on the news.

Water is life, and we owe it to ourselves and our future generations to provide water that is fishable, swimmable, and drinkable.

Make the Great Lakes great again.

Sheelagh McCarthy

From: hope taft
To: EPA TMDL; hope taft
Subject: TMDL guidelines
Date: Thursday, May 03, 2018 9:50:46 AM

To Whom it may concern:

Since Bob and I moved to Greene County in 2007 and live in a house on the Little Miami River, I have become very interested in this particular river and all water sources in general. As you know, he worked hard to preserve the Great Lakes as governor, so that part of these proposed regulations also are of interest to us.

Living on the banks of the Little Miami river has taught me a lot. I hear the river speaking to us everyday for every day it is different and its mood can change instantly. At high water, it is telling at us to help save it from the destruction caused by the first flushes of sediment and pollution. It is eating the land it runs through an dkilling aquatic life and changing the enviroments of others. At the end of summer when it is barely more than a creek, it is hoping that the WWTP have released clean water, but it knows that medications are not handled well by them and that its waters are used for recreational purposes long after the change in rules for emissions in October. It is suffering the same as bees from the pesticides we humans use.

This leads me to believe that testing the water for pollutants and TMDL often is very important. The health of the rivers is a key to the health of the population whether you live on the river or not.

They are used for drinking water, for recreation, for aquatic food sources, and life giving nutrients to people and wildlife.

Please return to testing the waters of the state to a regular and consistent basis so the data we share with others less interested in the water's quality can know what is happening to them.

This is the 50th anniversary year of the Ohio Scenic Rivers Act. We have managed to keep these few river sections in pretty good shape, but as urbanization continues to unfold, the next 50 years may have a different story. OEPA is the finger in the dike. Please test the waters more often and report the findings more frequently so we can be alerted to major problems before it is too late.

It is hard to get people concerned over data that is derived from testing in years past. Please do all you can to raise the priority of this issue. and protect our waters.

People can live longer without food than they can without clean water, and as climate change continues to unfold, water will become even more important to life. Ohio is blessed to have so much, but it will be useless, if it is not taken care of and protected.

Thank you for doing what is best for the vast majority of Ohioans that you will never hear from.

Sincerely,

Hope Taft

Hope Taft, co chair, Little Miami river Kleeners and Little Miami Watershed Network, 2933 Lower Bellbrook Rd., Spring Valley, OH 45370, 937-848-2993, ohiohoper@yahoo.com

From:	Chris Steffen
To:	Chris Steffen; Dean, Donald; EPA TMDL
Subject:	TMDL report public comment
Date:	Friday, May 04, 2018 3:43:07 PM

The OH council of Trout Unlimited is encouraged by your recent report that declared the Lake Erie western basin as impaired. The first step in solving the problem is establishing an evidence-driven argument that the problem exists. We look forward to continued monitoring and proposed mitigation plans to restore this special resource. Many of our 3100 Ohio members rely upon the health of Lake Erie for both recreational fishing and our source of drinking water. We look forward to progress on resolving the algal bloom issue and partnering with other stakeholders to create a lasting solution.

Chris Steffen, Jr.
National Leadership Council Representative
Ohio Council of Trout Unlimited

Donald Dean, President
Ohio Council of Trout Unlimited

From: Ed Thomas
To: EPA TMDL
Subject: 2018 IR Report
Date: Wednesday, April 25, 2018 2:55:59 PM

Can you provide the background methodologies, data, and scientific studies that you relied upon to make the Western lake erie open waters impairment finding?

Regards, Ed Thomas

****

Ed Thomas
Director, Regulatory Affairs
The Fertilizer Institute
425 Third Street, SW Suite 950
Washington, DC 20024

(p) 202-515-2714
(c) 443-739-1358

From:	Bill McCarthy
To:	EPA TMDL
Cc:	Debbie McCarthy; Sheelagh McCarthy
Subject:	Western Lake Erie Water Condition
Date:	Thursday, April 26, 2018 4:54:51 PM

First, I applaud the Governor for taking the action to declare the waters of Western Lake Erie impaired. This is an important first step.

I have had the great fortune to have lived my entire life in the Great Lakes region and have enjoyed using this treasured resource. Summer Camp as a youth on Lake Huron. I remember summering on Lake Erie in Ontario in the early 70's when Lake Erie was proclaimed dead and thus was a partial impetus to start the EPA. I have lived in Houghton, Mi and enjoyed the majesty of Lake Superior. My wife and I lived 7 years in Holland, Mi and were in awe of the beauty of Lake Michigan.

Our family migrated back southeast Michigan and discovered the Lake Erie Islands. We were so taken with the lake and the beauty of the region we bought our summer homes here beginning in 2003. It was the algae bloom caused by the blackout in 2003 which really prompted us to move our summer boating activities from Monroe to Ohio. We remarked at the clarity of the water, which our family has thoroughly enjoyed in the summer months.

As someone who is involved in the construction industry, and abides by the stringent requirements for proper storm water management both during and after the course of construction, I am sick to my stomach as I witness farm practices which dump/pump runoff right into waterways. They farm to the edge of the ditch and pump flooded fields into the ditches. I witnessed this practice firsthand while constructing projects in NW Ohio, which are part of the Maumee watershed. This practice can readily observed on any trip along Route 2, from Oregon to Lake Erie. It is no wonder that the gains made in the 80's, 90's and early 2000's have been eradicated by the selfish practice of over fertilization and improper storm water management. Most industries would be fined for dumping chemicals/nutrients direct like this into our waters.

The Agricultural Industry needs to be mandated to adhere to proper management of their discharges. Non-mandated encouragement will yield some results-but I am afraid not significant enough to create the changes that are desperately needed. It is the EPA's charge to enforce. If the closure of freshwater intakes for Community drinking water doesn't alarm offenders enough to change practices, only mandates will.

Our Lake House is in Marblehead. We thoroughly enjoy the region and love the Lake dearly. We are saddened when we start to see the particulate arrive in late summer. It is very distressing to see the Lake covered in a pea soup mixture.

We in the Great Lakes region are fortunate to be near the greatest natural resource of all-Fresh Water. This is our regions life blood. All with in the region need to treat it with the utmost respect.

What can we do to be of help?

Sincerely,

William T. McCarthy
8399 Reserveway
Marblehead, OH

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From: Tyler Bender
To: EPA TMDL
Subject: Dear Director Butler,
Date: Tuesday, May 01, 2018 10:11:06 PM

Dear Director Butler,

As a concerned citizen of Ohio for the water quality of our Great Lake, I want to express my support for the Ohio Environmental Protection Agency in designating the Lake Erie western basin shoreline region as impaired in all four categories. I fully support the draft 2018 water quality report's list of impaired water bodies that includes the Lake Erie Western Basin Shoreline and Open Waters as impaired. I also support the new methodology designed to analyze the Lake Erie, especially for algal blooms, and use of scientific methods to determine its water quality. Please continue Ohio EPA's efforts to improve the water quality of our Great Lake and address the critical issue of algal blooms around the state.

Sincerely,
Tyler Bender

From: Flasco, Ray
To: EPA TMDL
Cc: Ramey, Basil
Subject: Integrated Report of Water Quality in Ohio waters
Date: Thursday, April 26, 2018 7:38:06 AM

In regard to yesterday's webinar, is or has OH EPA been collecting data on emerging contaminants such as pharmaceuticals, endocrine disruptors, personal care products, Teflon, micro-plastics and etc. in Ohio's lakes, rivers and streams? Will these be included in future Integrated Reports, or are historical trends of these contaminants being tabulated separately?

Ray Flasco

From: Folk-Axe, Kim
To: EPA TMDL
Subject: Comment on Integrated Report required by close of business day 5/4/18
Date: Friday, May 04, 2018 2:58:42 PM

According the Clean Water Act { section 502(6)} agricultural waste discharged into water is considered a “pollutant.” In the Clean Water Act {section 512 (14)} Concentrated Animal Feeding Operations are listed as point sources which should require an NPDES permit.

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From: Jared Bartley
To: EPA TMDL
Subject: 303(d) comments
Date: Tuesday, May 01, 2018 12:54:32 PM

I'd like to submit the following comment regarding the draft 2018 Integrated Report:

- The Assessment Unit Summary for HUC 04110001 02 03 (Rocky River) indicates that the Designated Aquatic Life Use for portions of Abram Creek is "Modified Warmwater Habitat – Channel Modified." In fact, per OAC 3745-1-20, the Designated Aquatic Life Use for Abram Creek is "Warmwater Habitat." Ohio EPA had proposed to change the Abram Creek designation to MWH-CM, but ceded to local requests to maintain the WWH designation. This designation and associated Attainment Status should be accurately reflected in the Assessment Unit Summary for HUC 04110001 02 03 in the 2018 Integrated Report.

Thank you,
Jared

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From: Marj Mulcahy
To: EPA TMDL
Subject: 2018 Integrated Report
Date: Friday, May 04, 2018 9:24:45 AM

In studying the Integrated Report I would first like to commend Ohio EPA for taking the step of including the Western Lake Erie Basin (WLEB) in the 303d list of impaired waters. By officially recognizing the serious decline of water quality in Lake Erie, Ohioans have been given hope that substantial improvements will be made. This is greatly appreciated.

Using the TMDL process as defined by US EPA is extremely important in developing hard and meaningful nutrient water quality standards for the WLEB. This is the only way that the sources of pollution can be identified and held accountable to change their business practices. This process is the most reliable process to eliminate the harm caused to the citizens of Northwest Ohio and all people who use Lake Erie for swimming, fishing and most importantly, the 11 million people who us it as their drinking water source.

The 2016 Mass Balance Report documents that runoff from agricultural fields is the cause of 84% of the phosphorus pollution and 90% in the WLEB watershed resulting nutrients that feed the harmful algal booms in Lake Erie and sometimes the Maumee River. In view of this I am astounded that there are 201 permitted CAFOs in Ohio but only 28 of those CAFOs have NPDES permits.

How can this situation be allowed by the State of Ohio in the face of these facts? Beyond doubt, mandatory reforms must be implemented.

I do hope in future Integrated Reports changes can be made in the format to make it more understandable. It's a very difficult read for the public (of which I am a part). Making it more interactive by linking maps and reports, etc. would be so helpful and I am sure there many tech savvy Ohio EPA personnel who would love take on the challenge.

Sincerely,

Marjorie Mulcahy
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From:	Lehmann, Adam
To:	EPA TMDL
Subject:	2018 Integrated report comments
Date:	Thursday, May 03, 2018 8:58:26 AM

In reviewing the *Draft 2018 Integrated Water Quality Monitoring and Assessment Report,* I was struck by the absence of much of the tabular and graphical analysis in Section G that has been so useful for interpreting results in past years (e.g. Tables G-2, G-3, and G-4 from the 2016 report are missing). I feel particularly strongly that the information in table G-4 from the 2016 report ("Prevalence of the top five causes of aquatic life impairment in watershed and LRAUs"), be included as it is quite useful for prioritizing efforts for watershed management strategies statewide. I would further encourage the Agency to conduct and present this analysis on an Ecoregion basis to facilitate more localized regional watershed management planning. Ideally, two summary tables (one with state-wide data and one broken-down by ecoregion) would be provided identifying number of instances for ALL "causes" of non-attainment of ALU.

Thank you for considering my comment.

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Section

E

Evaluating Beneficial Use: Human Health (Fish Consumption)

E1. Background

The State of Ohio has operated a formal Fish Consumption Advisory (FCA) Program since 1993. Since July 2002, the program's technical and decision-making expertise has been housed at the Ohio Environmental Protection Agency (Ohio EPA). The risk assessment protocols used were developed in the early 1990s under the auspices of the Great Lakes Governors Association.

Ohio has adopted human health water quality standards (WQS) criteria to protect the public from adverse impacts, both carcinogenic and non-carcinogenic, due to exposure via drinking water (applicable at public water supply intakes) and to exposure from the contaminated flesh of sport fish (applicable in all surface waters). The purpose of the water quality criteria for the protection of human health [fish consumption] is to ensure levels of a chemical in water do not bioaccumulate in fish to levels harmful to people who catch and eat the fish. The relationship of the fish consumption human health criterion to the FCA risk assessment protocols is explained below.

E2. Rationale and Evaluation Method

U.S. EPA's guidance for preparing the 2006 Integrated Report (IR) states:

> *Although the CWA [Clean Water Act] does not explicitly direct the use of fish and shellfish consumption advisories or NSSP [National Shellfish Sanitation Program] classifications to determine attainment of water quality standards, states are required to consider all existing and readily available data and information to identify impaired segments on their section 303(d) lists. For purposes of determining whether a segment is impaired and should be included on a section 303(d) list, EPA considers a fish or shellfish consumption advisory, a NSSP classification, and the supporting data to be existing and readily available data and information that demonstrates non-attainment of a section 101(a) "fishable" use when:*
>
> - *the advisory is based on fish and shellfish tissue data,*
> - *a lower than "Approved" NSSP classification is based on water column and shellfish tissue data (and this is not a precautionary "Prohibited" classification or the state water quality standard does not identify lower than "Approved" as attainment of the standard),*
> - *the data are collected from the specific segment in question, and*
> - *the risk assessment parameters (e.g., toxicity, risk level, exposure duration and consumption rate) of the advisory or classification are cumulatively equal to, or less protective than those in the State's WQS" (U.S. EPA, 2005).*

Ohio's WQS regulations do not describe human consumption of sport fish as an explicit element of aquatic life protection. However, the WQS do include human health criteria that are applicable to all surface waters of the State. Certain of these criteria are derived using assumptions about the bioaccumulation of chemicals in the food chain, and the criteria are intended to protect people from adverse health impacts that could arise from consuming fish caught in Ohio's waters. To determine when and how waters should be listed as impaired because of FCAs, the risk assessment parameters on which the human health WQS criteria are based were compared with those used in the Ohio FCA program. If the State has issued an advisory for a specific water body and that advisory is equal to or less protective than the State's WQS, then one can assume there is an exceedance of the WQS. On the other hand, if the advisory is more protective than the WQS, one cannot assume that the issuance of the advisory indicates an exceedance of the WQS. Figure E-1 illustrates this point.

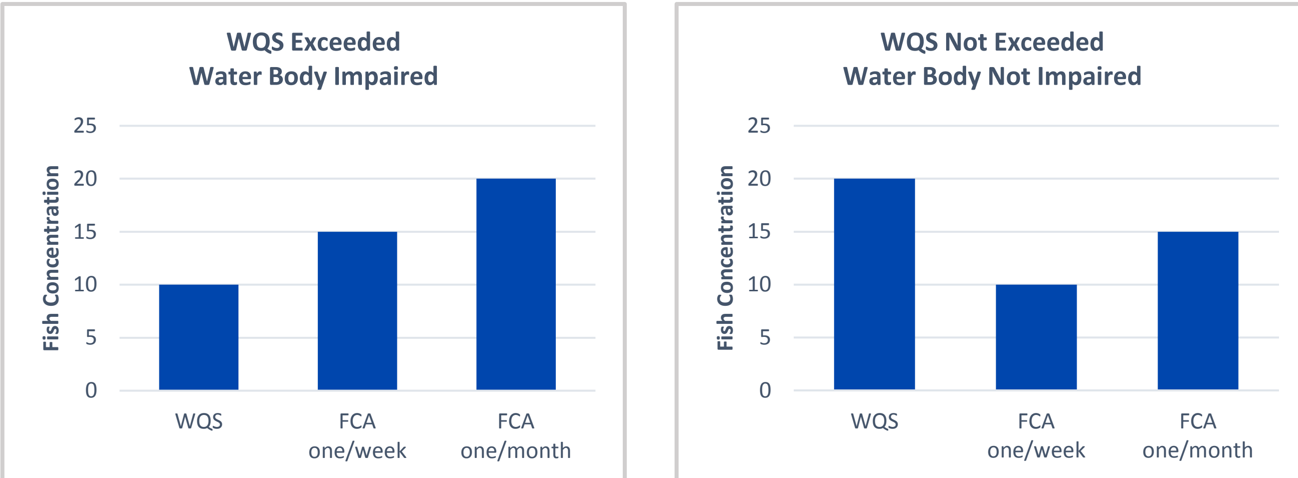


Figure E-1 — Illustration of the relationship among the WQS values, the values that trigger issuance of FCAs and the resulting decision regarding water body impairment associated with an FCA.

A fish consumption advisory is determined based on the quantity of a chemical in fish, such as micrograms of chemical per kilogram of fish tissue (µg/kg). WQS, on the other hand, are expressed as the quantity of chemical in water, such as micrograms of chemical per liter of water (µg/L). The information used to calculate the human health fish consumption WQS criterion can be used to calculate a maximum safe fish concentration. The fish concentration value can then be directly compared to the FCA program values to determine whether the advisory is less or more protective than the WQS criterion. The values in Table E-1 make this comparison for chemicals for which there are both an FCA and an Ohio human health fish consumption water criterion. Because Ohio human health criteria differ between the Lake Erie and Ohio River basins, separate comparisons are presented.

The constituents shown in Table E-1 were chosen based on U.S. EPA's recommendations on page 53 of its 2006 IR Guidance (***epa.gov/sites/production/files/2015-10/documents/2006irg-report.pdf***; U.S. EPA, 2006a). Hexachlorobenzene and mirex were added because of historic fish tissue contamination with those contaminants.

Table E-1 demonstrates that the levels of fish tissue contaminants that trigger a fish advisory have little obvious relation to the levels of fish tissue contaminants on which the WQS criteria are based. This discrepancy exists because different assumptions about fish consumption rates are made in calculating water quality standards than in issuing fish advisories. For example, the fish consumption rate used to calculate the Ohio River Basin WQS criteria is 17.5 grams per day. The fish consumption rate used to calculate a "one meal per week" advisory recommendation is 32.6 grams per day. These values are not the same because the WQS criteria fish consumption rates are based on nutritional studies that attempt to capture approximately how much sport caught fish people are eating, whereas the fish consumption advisory rates are meant to advise people how much fish they can safely consume.

Table E-1 — Comparison between fish concentration values and FCA program values.

Basin/Parameter	Fish concentration on which the WQS is based [1]	Range of fish concentrations triggering an “eat no more than one meal per week” advisory	Range of fish concentrations triggering an “eat no more than one meal per month” advisory
Lake Erie/PCB	23 µg/kg	**50 - 220 µg/kg**	**221 - 1,000 µg/kg**
Ohio River/PCB	54 µg/kg	**50 - 220 µg/kg**	**221 - 1,000 µg/kg**
Lake Erie/mercury	350 µg/kg	110 - 220 µg/kg	221 - 1,000 µg/kg
Ohio River/mercury	1,000 µg/kg	110 - 220 µg/kg	221 - 1,000 µg/kg
Lake Erie/DDT	140 µg/kg	**500 - 2,188 µg/kg**	**2,189 – 9,459 µg/kg**
Ohio River/DDT	320 µg/kg	**500 - 2,188 µg/kg**	**2,189 – 9,459 µg/kg**
Lake Erie/Chlordane	130 µg/kg	**500 - 2,188 µg/kg**	**2,189 – 9,459 µg/kg**
Ohio River/Chlordane	310 µg/kg	**500 - 2,188 µg/kg**	**2,189 – 9,459 µg/kg**
Lake Erie/Hexachlorobenzene	29 µg/kg	**800 - 3,499 µg/kg**	**3,500 - 15,099 µg/kg**
Ohio River/hexachlorobenzene	67 µg/kg	**800 - 3,499 µg/kg**	**3,500 - 15,099 µg/kg**
Lake Erie/mirex	88 µg/kg	**200 - 874 µg/kg**	**875 - 3,783 µg/kg**
Ohio River/mirex	200 µg/kg	**200 - 874 µg/kg**	**875 - 3,783 µg/kg**

Key	
Values	Advisory is less protective than the WQS criterion, WQS exceeded, water body impaired
Values	Advisory is more protective than WQS criterion, WQS not exceeded, no impairment from FCA
Values	Advisory may be more, or less, protective than WQS criterion

U.S. EPA stipulates that the risk assessment parameters used to categorize fish tissue contaminant data must be at least as protective as those used in the WQS-based fish concentrations. Fish advisory contaminant levels are not directly related to the WQS criteria contaminant levels and, in some cases, are not as protective. Therefore, Ohio EPA has elected to directly compare fish tissue data with the WQS criteria calculations shown in the above table, instead of using advisory-based categorizations.

The following steps were utilized to determine a 303(d) list category for waters based on fish tissue contaminant data.

Step 1: Determine available data

All data in the fish tissue database were evaluated for the 2018 IR. The most recent 10-years of data collections, 2007-2016, were used for making category 1 (unimpaired) and category 5 (impaired) determinations. In cases where multiple years of data were available in that 10-year window, all data were weighted equally. In cases where the only data available were older than 2007, the category determined by those data became historical (impaired-historical or unimpaired-historical).

Ohio’s Credible Data Law states that all data greater than five years in age will be considered historical and that it can be used if the director has identified compelling reasons as to why the data are credible. In the case of fish tissue, the use of data older than five but ten or fewer years old is necessary. This is because not enough fish tissue samples are gathered from enough locations each year to conduct a thorough assessment of contaminant levels in fish tissue across the state. Frequently, multiple sampling years are needed to determine whether to issue or rescind an advisory. Owing to limited staff time and budget resources, it sometimes takes more than five years to revisit a location and collect more fish tissue samples. A more complete picture of contaminants in fish tissue is presented when data are utilized that reach back 10 years.

[1] See Section E4 for an explanation of how these concentrations were calculated.

Step 2: Determine fish tissue contaminant concentrations

For streams in each assessment unit (AU)[2], a weighted average based on species and trophic level was calculated for each contaminant. One year of data was considered adequate to categorize the fish as category 5 (impaired) or category 1 (unimpaired). Inland lakes are considered a component of the assessment unit(s) in which they are geographically located, so sample results may affect the assessment status of the AU(s) and the index scores for the AU(s). Inland lakes are also analyzed individually; results are displayed in Table E-12.

Step 3: Determine adequate species data

In order to assess an AU as category 1 or 5, at least four samples from that AU are needed, with at least two samples from each of trophic levels three and four. An exception was made for AUs with 10 or more samples from one trophic level and only one sample from the other trophic level.

A geometric mean was calculated for each species and then a weighted average was calculated for each trophic level. A weighted average for each AU was then calculated using the consumption rates found in the water quality criteria calculations. That weighted average was then compared against the contaminant levels listed in Table E-1 and categorized as category 1 or 5.

In cases where those data requirements were not met, an AU was classified as category 3i. In cases where no data were available, an AU was classified as category 3.

This calculation methodology is derived from the methodology described in Section 4.3.2 of the document *Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion*, Final, U.S. EPA Office of Science and Technology, EPA-823-R-09-002, January 2009 (***epa.gov/wqc/human-health-criteria-methylmercury***).

Table E-2 — Example data for calculating a weighted average fish tissue value.

Species	Trophic Level	Number of Samples	Geometric mean mercury concentration (mg/kg)
Black Crappie (*Pomoxis nigromaculatus*)	3	1	0.085
Bluegill Sunfish (*Lepomis macrochirus*)	3	2	0.098
Channel Catfish (*Ictalurus punctatus*)	3	2	0.145
Common Carp (*Cyprinus carpio*)	3	3	0.120
Largemouth Bass (*Micropterus salmoides*)	4	3	0.212
Smallmouth Bass (*Micropterus dolomieu*)	4	1	0.421
Spotted Bass (*Micropterus punctulatus*)	4	1	0.347

[2] Assessment units include watershed assessment units (12-digit hydrologic units); large river assessment units (generally rivers that drain more than 500 square miles of landscape); and Lake Erie assessment units.

For the Lake Erie Basin:

$$C_{avgLEB} = \frac{3.6*C_3+11.4*C_4}{15} = 0.27\ mg/kg$$

For the Ohio River Basin:

$$C_{avgORB} = \frac{11.8*C_3+5.7*C_4}{17.5} = 0.18\ mg/kg$$

Where:

C_3 = average concentration for trophic level 3

C_4 = average concentration for trophic level 4

Step 4: Determine appropriate assessment unit divisions

It should be recognized that in determining impairment status based on AUs instead of individual water bodies, extrapolations to water bodies without data are made. In some cases, water bodies that have no data will be categorized as impaired if they are within an impaired AU.

Inland lakes are treated as individual water bodies for impairment purposes regardless of whether they are entirely contained within an AU or straddle more than one AU and results for individual lakes are shown in Table E-12. In addition, any AU containing all or part of an impaired inland lake was considered to be not supporting the beneficial use (see Step 2 above for further explanation).

Step 5: Categorize water bodies within assessment units

Category 5 – Impaired

Any AU meeting the data requirements in step 3 with a weighted average fish tissue concentration of PCBs, mercury, DDT, chlordane, mirex or hexachlorobenzene above the WQS-based fish tissue concentration is placed into category 5. When the data indicating impairment are older than 10 years, the AU remains impaired but is considered impaired-historical, category 5h[3].

Category 1 – Not Impaired

To be categorized as category 1, not impaired, an AU must meet the data requirements in step 3 and the weighted average concentration of a contaminant must be below the threshold that would trigger an impairment. AUs that had previously been considered category 1, but with no data since 2007, are reclassified as category 1h[3].

Category 3 – Insufficient or No Data

Any AU in which current data are available but those data are insufficient according to step 3 (to categorize the AU as category 1 or 5), the AU is listed as category 3i. If no data is available for an AU, the category is listed as 3. If an AU had previously been classified as category 3 or 3i, and there is no data in the AU since 2007, the AU is classified as category 3.

[3] An "h" subcategory could indicate one of two possibilities. In IRs prior to 2010, when Ohio reported on the larger assessment units, categories were assigned based on data collected anywhere in that unit. For the 2010 analysis, the 2008 category was assigned to each of the new, smaller units. If the original data were collected before 1999, a re-analysis of the data could not be completed for the 2010 report, so the smaller units retained the category of the larger unit. In some cases, the data were collected within the smaller assessment unit and in other cases they were not. For the older data, a distinction between the two could not be made for this report. In addition, data collected prior to 2007 are considered historical in the 2018 analysis.

E3. Results

Fish tissue data for six contaminants were reviewed to determine an IR attainment status. The methodology for selecting, reviewing and categorizing fish tissue data is given in Section E2. The six parameters monitored were mercury, PCBs, chlordane, DDT, mirex and hexachlorobenzene. These parameters were chosen for review based on current and recent fish consumption advisories in Ohio caused by these contaminants, as well as existing human health WQS criteria for the six parameters.

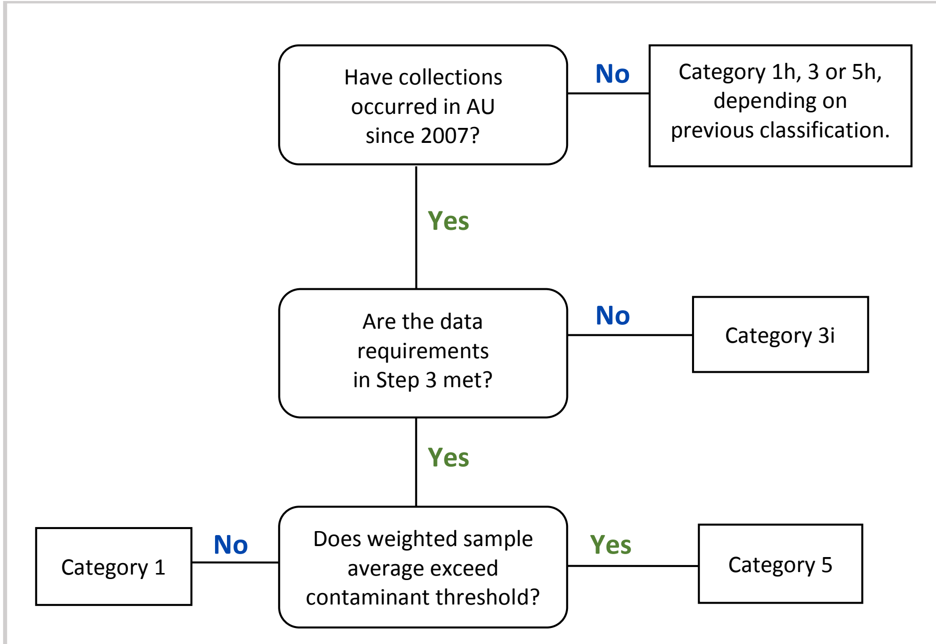


Figure E-2 — Flow chart for the categorization of fish tissue data for the IR.

There was a total of 122 changes to the human health attainment statuses of assessment units for the 2018 IR which are summarized in Table E-3. The primary reasons for change in status include data having become historical and the collection and analysis of new information.

Table E-3 — A summary of changes in attainment status from 2016 to 2018 IR.

Reason for change		Changes	
Data have become historical			55
	Category 1 to 1h	26	
	Category 3i to 3	15	
	Category 5 to 5h	14	
New data			67
	Became category 1	29	
	Became category 3i	13	
	Became category 5	25	
Total changes			122

Detailed results are presented in Table E-4 through E-13. Detailed information on specific fish consumption advisories including geographic extent of the advisory; type and size of fish affected; and consumption advice can be found at ***epa.ohio.gov/dsw/fishadvisory/index.aspx***.

Table E-4 lists waters impaired because fish tissue levels of PCBs or mercury exceed the threshold level upon which the WQS criterion is based, while Table E-5 includes those not impaired. Table E-6 lists water bodies identified as impaired for this use on a previous 303(d) list that are no longer considered impaired, either because of new data or the updated methodology described in Section E1. There is one WAU in Ohio with significant pollution resulting in 303(d) listings from other contaminants that affect fish tissue, as shown in Table E-7. In Table E-8 and Table E-9, the data for all these locations have become historical and new data would need to be collected before a current impairment status can be determined. Since age of data alone is not a reason for delisting, the water bodies in Table E-9 remain on the 303(d) list. Table E-10 lists waters with current fish tissue data where inadequate samples exist to determine level of impairment. Sites in Table E-10 have never had sufficient data for assessment, now or in the past. Table E-11 lists large rivers and their impairment status. Table E-12 lists inland lake impairment status. Table E- 13 lists Lake Erie assessment units and their impairment status.

Table E-4 — Waters not supporting the human health use because levels of PCBs or mercury in fish tissue exceed the threshold level upon which the WQS criterion is based. These waters are category 5.

Water Body (Category 5: Impaired)	Assessment Unit	Pollutant
Heldman Ditch-Ottawa River	04100001 03 07	PCBs
Sibley Creek-Ottawa River	04100001 03 08	PCBs
West Branch St Joseph River	04100003 02 04	PCBs
Cogswell Cemetery-St Joseph River	04100003 03 02	PCBs
Willow Run-St Joseph River	04100003 05 05	PCBs, Mercury
Fourmile Creek-St Marys River	04100004 01 06	PCBs
Prairie Creek-St Marys River	04100004 02 05	PCBs
Yankee Run-St Marys River	04100004 03 03	PCBs
Flat Run-Tiffin River	04100006 03 03	Mercury
Village of Stryker-Tiffin River	04100006 05 03	PCBs
Sixmile Creek-Auglaize River	04100007 02 04	PCBs
Lima Reservoir-Ottawa River	04100007 03 06	PCBs
Dog Creek	04100007 08 01	PCBs
Lower Town Creek	04100007 08 04	PCBs
Big Run-Flatrock Creek	04100007 12 06	PCBs
City of Findlay Riverside Park-Blanchard River	04100008 02 05	PCBs
Cutoff Ditch	04100009 05 07	PCBs
Lower Beaver Creek	04100009 05 09	PCBs
Heilman Ditch-Swan Creek	04100009 08 04	PCBs
Rhodes Ditch-South Branch Portage River	04100010 02 04	PCBs
North Branch Portage River	04100010 03 01	PCBs
Portage River	04100010 05 02	PCBs
Lower Toussaint Creek	04100010 06 03	PCBs
Town of Lindsey-Muddy Creek	04100011 14 04	PCBs
Mouth Vermilion River	04100012 02 04	PCBs
Mouth West Branch Huron River	04100012 05 06	PCBs
Mouth East Branch Huron River	04100012 06 04	PCBs
Huron River-Frontal Lake Erie	04100012 06 06	PCBs
Baker Creek-West Branch Rocky River	04110001 01 08	PCBs
Rocky River	04110001 02 03	PCBs
Salt Creek-East Branch Black River	04110001 04 02	Mercury
Jackson Ditch-East Branch Black River	04110001 04 04	Mercury
Lower West Branch Black River	04110001 05 06	PCBs
Black River	04110001 06 02	PCBs
Ladue Reservoir-Bridge Creek	04110002 01 04	PCBs
Lake Rockwell-Cuyahoga River	04110002 02 03	PCBs
Wingfoot Lake Outlet-Little Cuyahoga River	04110002 03 03	PCBs
Boston Run-Cuyahoga River	04110002 04 05	PCBs
Lower Ashtabula River	04110003 01 05	PCBs
Plumb Creek-Grand River	04110004 03 05	Mercury
Town of Jefferson-Mill Creek	04110004 04 03	Mercury
Bronson Creek-Grand River	04110004 05 02	PCBs, Mercury

Water Body (Category 5: Impaired)	Assessment Unit	Pollutant
Long Run-Yellow Creek	05030101 07 04	PCBs
Hollow Rock Run-Yellow Creek	05030101 08 04	PCBs
Lower Cross Creek	05030101 10 05	PCBs
Fish Creek-Mahoning River	05030103 01 03	PCBs
Kirwin Reservoir-West Branch Mahoning River	05030103 03 04	PCBs
Charley Run Creek-Mahoning River	05030103 03 06	PCBs
Lower Mosquito Creek	05030103 05 03	PCBs
Coffee Run-Mahoning River	05030103 08 09	PCBs
Dry Fork-Short Creek	05030106 02 07	PCBs
Cox Run-Wheeling Creek	05030106 03 03	PCBs
Lower McMahon Creek	05030106 07 04	PCBs
Pea Vine Creek-Captina Creek	05030106 09 05	PCBs
Eightmile Creek-Little Muskingum River	05030201 07 05	PCBs
Sugar Creek-Duck Creek	05030201 09 04	PCBs
Portage Lakes-Tuscarawas River	05040001 01 05	PCBs
Portage Lakes-Tuscarawas River	05040001 01 05	PCBs
Headwaters Sandy Creek	05040001 04 06	PCBs
City of Canton-Middle Branch Nimishillen Creek	05040001 05 04	PCBs
Sherrick Run-Nimishillen Creek	05040001 05 05	PCBs
Town of East Sparta-Nimishillen Creek	05040001 05 06	PCBs
Armstrong Run-Sandy Creek	05040001 06 05	PCBs
Beal Run-Sandy Creek	05040001 06 07	PCBs, Hexachlorobenzene
Charles Mill-Black Fork Mohican River	05040002 02 05	PCBs
Headwaters Clear Fork Mohican River	05040002 03 01	PCBs
Switzer Creek-Clear Fork Mohican River	05040002 04 05	PCBs
Town of Perrysville-Black Fork Mohican River	05040002 08 02	PCBs
Big Run-Black Fork Mohican River	05040002 08 03	PCBs
Delano Run-Kokosing River	05040003 03 04	PCBs
Big Run-Walnut Creek	05060001 18 05	PCBs
Greenbrier Creek-Big Darby Creek	05060001 22 03	PCBs
Lizard Run-Big Darby Creek	05060001 22 04	PCBs
Scippo Creek	05060002 04 05	PCBs
Lick Run-Scioto River	05060002 05 03	PCBs
Queer Creek	05060002 09 02	PCBs
Poe Run-Salt Creek	05060002 09 06	PCBs
Pee Pee Creek	05060002 11 04	PCBs
Leeth Creek-Sunfish Creek	05060002 12 06	PCBs
Dividing Branch-Greenville Creek	05080001 11 03	PCBs
Dry Run-Wolf Creek	05080002 01 03	PCBs
Ice Creek	05090103 01 03	PCBs
Wards Run-Little Scioto River	05090103 06 05	PCBs
Soldiers Run-Ohio Brush Creek	05090201 05 06	PCBs
Newman Run-Little Miami River	05090202 05 04	PCBs
West Fork-Mill Creek	05090203 01 05	PCBs
Grand Lake-St Marys	05120101 02 04	PCBs

Table E-5 — Waters fully supporting the human health use because fish tissue levels of PCBs or mercury are below the threshold level upon which the WQS criterion is based. These waters are category 1.

Water Body (Category 1: Unimpaired)	Assessment Unit
Clear Fork-East Branch St Joseph River	04100003 01 06
Nettle Creek	04100003 03 01
Town of Willshire-St Marys River	04100004 03 05
Bates Creek-Tiffin River	04100006 03 01
Village of Buckland-Auglaize River	**04100007 02 02**
Sims Run-Auglaize River	04100007 02 03
Lost Creek	04100007 03 05
Wolf Ditch-Little Auglaize River	04100007 06 03
Dry Fork-Little Auglaize River	04100007 06 04
West Branch Prairie Creek	04100007 07 02
Prairie Creek	04100007 07 03
Burt Lake-Little Auglaize River	04100007 08 06
Big Run-Auglaize River	**04100007 09 04**
Lower Bad Creek	04100009 03 02
North Turkeyfoot Creek	04100009 04 02
East Branch Portage River	04100010 02 02
Green Creek	04100011 12 03
New London Upground Reservoir-Vermilion River	04100012 01 04
Walnut Creek-West Branch Huron River	04100012 04 03
Peru Township-West Branch Huron River	04100012 04 05
City of Medina-West Branch Rocky River	04110001 01 05
Cossett Creek-West Branch Rocky River	**04110001 01 06**
Headwaters East Branch Rocky River	04110001 02 01
Baldwin Creek-East Branch Rocky River	04110001 02 02
Town of Litchfield-East Branch Black River	**04110001 04 01**
Wellington Creek	04110001 05 03
East Branch Reservoir-East Branch Cuyahoga River	04110002 01 01
Mogadore Reservoir-Little Cuyahoga River	04110002 03 02
Town Fork	05030101 08 01
Pymatuning Reservoir	05030102 01 05
Booth Run-Pymatuning Creek	05030102 03 04
Deer Creek	05030103 02 01
Town of Newton Falls-West Branch Mahoning River	05030103 03 05
Mouth Eagle Creek	**05030103 04 05**
Middle Mosquito Creek	05030103 05 02
Lower Meander Creek	05030103 07 03
Andersons Run-Mill Creek	05030103 08 03
Upper McMahon Creek	05030106 07 02
South Fork Captina Creek	05030106 09 02
Wingett Run-Little Muskingum River	05030201 07 03
Headwaters Little Rush Creek	05030204 02 01
Turkey Run-Rush Creek	05030204 02 04
Clear Fork	05030204 06 01
Nimisila Reservoir-Nimisila Creek	05040001 03 02
Sippo Creek	05040001 03 08
Pleasant Valley Run-Indian Fork	05040001 08 02
Buttermilk Creek-Stillwater Creek	05040001 13 04
Brushy Fork	05040001 14 02
Craborchard Creek-Stillwater Creek	05040001 14 03

Water Body (Category 1: Unimpaired)	Assessment Unit
Upper Little Stillwater Creek	05040001 15 03
Weaver Run-Stillwater Creek	05040001 16 03
Headwaters North Branch Kokosing River	05040003 01 01
East Branch Kokosing River	05040003 01 02
Indianfield Run-Kokosing River	05040003 03 07
Little Jelloway Creek	05040003 04 01
Brush Run-Kokosing River	05040003 04 03
Big Run-Killbuck Creek	05040003 08 04
Bucklew Run-Killbuck Creek	05040003 08 05
Reasoners Run-Olive Green Creek	05040004 11 04
Trail Run-Wills Creek	05040005 02 07
Beeham Run-Salt Fork	05040005 04 06
Wills Creek Dam-Wills Creek	05040005 06 04
Buckeye Lake	05040006 04 03
Rocky Fork	05040006 05 03
Dillon Lake-Licking River	05040006 06 03
Town of La Rue-Scioto River	05060001 04 05
Lower Mill Creek	05060001 06 04
Brush Run-Bokes Creek	05060001 07 02
Smith Run-Bokes Creek	05060001 07 03
O’Shaughnessy Dam-Scioto River	05060001 12 02
Hayden Run-Scioto River	05060001 12 04
Hoover Reservoir-Big Walnut Creek	05060001 13 08
Alum Creek Dam-Alum Creek	05060001 14 04
Town of Carroll-Walnut Creek	05060001 17 05
Spain Creek-Big Darby Creek	05060001 19 02
Robinson Run-Big Darby Creek	05060001 19 05
Barron Creek-Little Darby Creek	05060001 20 05
Thomas Ditch-Little Darby Creek	05060001 20 06
Worthington Ditch-Big Darby Creek	05060001 21 01
Silver Ditch-Big Darby Creek	05060001 21 02
Richmond Ditch-Deer Creek	05060002 01 02
Turkey Run-Deer Creek	05060002 01 06
Town of Mount Sterling-Deer Creek	05060002 02 04
Deer Creek Lake-Deer Creek	05060002 02 05
Stony Creek-Scioto River	05060002 10 05
Headwaters Morgan Fork	05060002 12 02
Cliff Creek-Paint Creek	05060003 06 03
Indian Lake-Great Miami River	05080001 01 03
Stoney Creek	05080001 04 03
Lake Loramie-Loramie Creek	05080001 05 03
Mosquito Creek	05080001 07 02
Headwaters Greenville Creek	05080001 10 04
Bridge Creek-Greenville Creek	05080001 11 02
Town of Covington-Stillwater River	05080001 12 05
Ludlow Creek	05080001 14 02
Rush Run-Sevenmile Creek	05080002 05 04
Acton Lake Dam-Four Mile Creek	05080002 06 04
Robinson Run-Raccoon Creek	05090101 05 04
Camp Creek-Symmes Creek	05090101 09 03
Pigeon Creek-Symmes Creek	05090101 10 03
Aaron Creek-Symmes Creek	05090101 10 04

Water Body (Category 1: Unimpaired)	Assessment Unit
Storms Creek	05090103 01 04
Howard Run-Pine Creek	05090103 02 04
Lick Run-Pine Creek	05090103 02 05
Headwaters Turkey Creek	05090201 02 01
Little East Fork-Ohio Brush Creek	**05090201 05 01**
Lick Fork	05090201 05 02
Bundle Run-Ohio Brush Creek	05090201 05 03
Middle Caesar Creek	05090202 04 04
Lower Caesar Creek	05090202 04 06
Wilson Creek-Cowan Creek	05090202 06 05
Headwaters East Fork Little Miami River	05090202 10 02
Lucy Run-East Fork Little Miami River	05090202 12 03
Headwaters Stonelick Creek	05090202 13 01
Lick Fork-Stonelick Creek	05090202 13 04
Salt Run-East Fork Little Miami River	05090202 13 05

BOLD rows indicate WAUs that would be impaired if the U.S. EPA mercury criterion of 0.3 mg/kg were effective.

Table E-6 — Waters fully supporting the human health use because fish tissue levels of PCBs or mercury are below the threshold level upon which the WQS criterion is based, and which were categorized as impaired in the 2016 IR. These waters have become category 1 with the current assessment.

Water Body (Newly Unimpaired for 2018)	Assessment Unit	Reason for delisting
New London Upground Reservoir-Vermilion River	04100012 01 04	New data
Deer Creek	05030103 02 01	Reevaluation
Lower Meander Creek	05030103 07 03	New data
Sippo Creek	05040001 03 08	New data
Dillon Lake-Licking River	05040006 06 03	Reevaluation
Deer Creek Lake-Deer Creek	05060002 02 05	Reevaluation
Storms Creek	05090103 01 04	Reevaluation

Table E-7 — Waters with contaminants other than PCBs and mercury that affect fish tissue (included on the 303(d) list). These waters are category 5.

Water Body (Impaired by Other Pollutants)	Assessment Unit	Pollutant
Beal Run-Sandy Creek	05040001 06 07	Hexachlorobenzene

Table E-8 — Waters for which the existing unimpaired status cannot be confirmed because data have become historical and not enough new data are available. These waters are category 1h.

Water Body (Category 1h: Unimpaired based on Historic Data)	Assessment Unit
Headwaters Tenmile Creek	04100001 03 04
Mud Creek	04100006 06 02
Mouth Tymochtee Creek	04100011 06 05
Little Sandusky River	04100011 07 01
Norwalk Creek	04100012 06 03
Coon Creek-East Branch Black River	04110001 03 03
Charlemont Creek	04110001 05 01
Sawyer Brook-Cuyahoga River	04110002 01 06
Mud Brook	04110002 04 01
Middle Ashtabula River	04110003 01 04
Middle Rock Creek	04110004 02 02
Griggs Creek	04110004 04 01
Peters Creek-Mill Creek	04110004 04 02

Water Body (Category 1h: Unimpaired based on Historic Data)	Assessment Unit
McIntyre Creek	05030101 10 04
Little Yellow Creek	05030101 11 02
Carpenter Run-Ohio River	05030101 11 03
Hardin Run-Ohio River	05030101 11 06
North Fork Captina Creek	05030106 09 01
Headwaters West Fork Duck Creek	05030201 09 01
Forked Run-Ohio River	05030202 04 04
Groundhog Creek-Ohio River	05030202 08 02
Oldtown Creek-Ohio River	05030202 08 03
West Creek-Ohio River	05030202 08 04
Broad Run-Ohio River	05030202 08 05
Center Branch	05030204 01 01
Headwaters Hocking River	05030204 04 01
East Branch Sunday Creek	05030204 07 01
Willow Creek-Hocking River	05030204 10 01
Fourmile Creek	05030204 10 03
Seymour Run-Black Fork	05040002 02 02
Jug Run-Wakatomika Creek	05040004 01 04
Town of Frazeysburg-Wakatomika Creek	05040004 02 04
Wolf Run-Wills Creek	05040005 05 08
Bacon Run	05040005 06 01
Twomile Run-Wills Creek	05040005 06 02
White Eyes Creek	05040005 06 03
Mouth Wills Creek	05040005 06 05
Big Run	05040006 06 02
Gander Run-Scioto River	05060001 04 01
Headwaters Olentangy River	05060001 08 01
Headwaters Whetstone Creek	05060001 09 02
Claypool Run-Whetstone Creek	05060001 09 03
Beaver Run-Olentangy River	05060001 10 03
Brandige Run-Olentangy River	05060001 10 05
Indian Run-Olentangy River	05060001 10 06
Delaware Run-Olentangy River	05060001 10 07
Deep Run-Olentangy River	05060001 11 01
Rush Run-Olentangy River	05060001 11 02
Mouth Olentangy River	05060001 11 03
West Branch Alum Creek	05060001 14 01
Headwaters Alum Creek	05060001 14 02
Big Run-Alum Creek	05060001 14 03
Headwaters Walnut Creek	05060001 17 02
Hellbranch Run	05060001 22 01
Blue Creek-Salt Creek	05060002 06 05
Little Beaver Creek-Big Beaver Creek	05060002 13 03
Town of Washington Court House-Paint Creek	05060003 01 03
South Fork Rocky Fork	05060003 05 01
Clear Creek	05060003 05 02
Headwaters Rocky Fork	05060003 05 03
Rocky Fork Lake-Rocky Fork	05060003 05 04
Franklin Branch-Rocky Fork	05060003 05 05
Mud Run-North Fork Paint Creek	05060003 08 05
North Fork Great Miami River	05080001 01 01
South Fork Great Miami River	05080001 01 02

Water Body (Category 1h: Unimpaired based on Historic Data)	Assessment Unit
Garbry Creek-Great Miami River	05080001 07 05
South Fork Stillwater River	05080001 09 01
Headwaters Stillwater River	05080001 09 02
North Fork Stillwater River	05080001 09 03
Boyd Creek	05080001 09 04
Woodington Run-Stillwater River	05080001 09 05
Town of Beamsville-Stillwater River	05080001 09 06
Indian Creek	05080001 12 01
Swamp Creek	05080001 12 02
Trotters Creek	05080001 12 03
Harris Creek	05080001 12 04
Clarence J Brown Lake-Buck Creek	05080001 17 05
Lesley Run-Twin Creek	05080002 02 05
Town of Gratis-Twin Creek	05080002 03 04
Town of Germantown-Twin Creek	05080002 03 06
Headwaters Sevenmile Creek	05080002 05 01
Paint Creek	05080002 05 02
Beasley Run-Sevenmile Creek	05080002 05 03
Ninemile Creek-Sevenmile Creek	05080002 05 05
Headwaters Four Mile Creek	05080002 06 01
Little Four Mile Creek	05080002 06 02
East Fork Four Mile Creek-Four Mile Creek	05080002 06 03
Cotton Run-Four Mile Creek	05080002 06 05
Town of Zaleski-Raccoon Creek	05090101 02 05
Headwaters Little Raccoon Creek	05090101 04 01
McDowell Creek-Little Scioto River	05090103 05 04
McConnel Creek-Rocky Fork	05090103 06 03
North Branch Caesar Creek	05090202 04 01
Upper Caesar Creek	05090202 04 02
South Branch Caesar Creek	05090202 04 03
Flat Fork	05090202 04 05
Dutch Creek	05090202 06 01
Headwaters Todd Fork	05090202 06 02
Lytle Creek	05090202 06 03
Headwaters Cowan Creek	05090202 06 04
Little Creek-Todd Fork	05090202 06 06
Turtle Creek	05090202 10 01
Headwaters Dodson Creek	05090202 10 03
Anthony Run-Dodson Creek	05090202 10 04
West Fork East Fork Little Miami River	05090202 10 05
Glady Creek-East Fork Little Miami River	05090202 10 06
Solomon Run-East Fork Little Miami River	05090202 11 01
Fivemile Creek-East Fork Little Miami River	05090202 11 02
Todd Run-East Fork Little Miami River	05090202 11 03
Poplar Creek	05090202 12 01
Cloverlick Creek	05090202 12 02
Backbone Creek-East Fork Little Miami River	05090202 12 04
Brushy Fork	05090202 13 02
Moores Fork-Stonelick Creek	05090202 13 03

Table E-9 — Waters for which the existing impaired status cannot be confirmed because data have become historical and not enough new data are available. These waters are category 5h.

Note: The waters remain on the 303(d) list.

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Shantee Creek	04100001 03 01
Halfway Creek	04100001 03 02
Prairie Ditch	04100001 03 03
North Tenmile Creek	04100001 03 05
Tenmile Creek	04100001 03 06
Eagle Creek	04100003 03 03
Village of Montpelier-St Joseph River	04100003 03 04
Bear Creek	04100003 03 05
West Buffalo Cemetery-St Joseph River	04100003 03 06
Bluff Run-St Joseph River	04100003 05 01
Big Run	04100003 05 02
Russell Run-St Joseph River	04100003 05 03
Sol Shank Ditch-St Joseph River	04100003 05 06
Muddy Creek	04100004 01 01
Center Branch St Marys River	04100004 01 02
East Branch St Marys River	04100004 01 03
Kopp Creek	04100004 01 04
Sixmile Creek	04100004 01 05
Hussey Creek	04100004 02 01
Eightmile Creek	04100004 02 02
Blierdofer Ditch	04100004 02 03
Twelvemile Creek	04100004 02 04
Little Black Creek	04100004 03 01
Black Creek	04100004 03 02
Duck Creek	04100004 03 04
Leatherwood Creek	04100006 03 02
Beaver Creek	04100006 05 01
Brush Creek	04100006 05 02
Buckskin Creek-Tiffin River	04100006 06 04
Headwaters Auglaize River	04100007 01 01
Blackhoof Creek	04100007 01 02
Wrestle Creek-Auglaize River	04100007 01 03
Pusheta Creek	04100007 01 04
Two Mile Creek	04100007 02 01
Upper Hog Creek	04100007 03 01
Middle Hog Creek	04100007 03 02
Little Hog Creek	04100007 03 03
Lower Hog Creek	04100007 03 04
Little Ottawa River	04100007 04 01
Dug Run-Ottawa River	04100007 04 02
Honey Run	04100007 04 03
Pike Run	04100007 04 04
Leatherwood Ditch	04100007 04 05
Beaver Run-Ottawa River	04100007 04 06
Sugar Creek	04100007 05 01
Plum Creek	04100007 05 02
Village of Kalida-Ottawa River	04100007 05 03
Upper Jennings Creek	04100007 09 01
West Jennings Creek	04100007 09 02

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Lower Jennings Creek	04100007 09 03
Prairie Creek	04100007 09 06
Cessna Creek	04100008 01 01
Headwaters Blanchard River	04100008 01 02
The Outlet-Blanchard River	04100008 01 03
Potato Run	04100008 01 04
Ripley Run-Blanchard River	04100008 01 05
Brights Ditch	04100008 02 01
The Outlet	04100008 02 02
Findlay Upground Reservoirs-Blanchard River	04100008 02 03
Lye Creek	04100008 02 04
Upper Eagle Creek	04100008 03 01
Lower Eagle Creek	04100008 03 02
Aurand Run	04100008 03 03
Howard Run-Blanchard River	04100008 03 04
Tiderishi Creek	04100008 05 01
Ottawa Creek	04100008 05 02
Moffitt Ditch	04100008 05 03
Dukes Run	04100008 05 04
Dutch Run	04100008 05 05
Town of Pemberville-Portage River	04100010 03 02
Sugar Creek	04100010 04 01
Larcarpe Creek Outlet #4-Portage River	04100010 04 02
Little Portage River	04100010 05 01
Upper Toussaint Creek	04100010 06 01
Packer Creek	04100010 06 02
Headwaters Paramour Creek-Sandusky River	04100011 04 01
Loss Creek-Sandusky River	04100011 04 02
Headwaters Middle Sandusky River	04100011 04 03
Grass Run	04100011 04 04
Headwaters Lower Sandusky River	04100011 04 05
Town of Upper Sandusky-Sandusky River	04100011 07 02
Negro Run	04100011 07 03
Cranberry Run-Sandusky River	04100011 07 04
Sugar Run-Sandusky River	04100011 07 05
Clear Creek-Vermilion River	04100012 01 01
Buck Creek	04100012 01 02
Southwest Branch Vermilion River	04100012 01 03
Indian Creek-Vermilion River	04100012 01 05
East Branch Vermilion River	04100012 02 01
East Fork Vermilion River	04100012 02 02
Town of Wakeman-Vermilion River	04100012 02 03
Plum Creek	04110001 01 01
North Branch West Branch Rocky River	04110001 01 02
Headwaters West Branch Rocky River	04110001 01 03
Mallet Creek	04110001 01 04
Plum Creek	04110001 01 07
East Fork of East Branch Black River	04110001 03 01
Headwaters West Fork East Branch Black River	04110001 03 02
Willow Creek	04110001 04 03
Upper West Branch Black River	04110001 05 02
Middle West Branch Black River	04110001 05 04

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Plum Creek	04110001 05 05
French Creek	04110001 06 01
West Branch Cuyahoga River	04110002 01 02
Tare Creek-Cuyahoga River	04110002 01 03
Black Brook	04110002 01 05
Potter Creek-Breakneck Creek	04110002 02 01
Feeder Canal-Breakneck Creek	04110002 02 02
Plum Creek	04110002 03 01
City of Akron-Little Cuyahoga River	04110002 03 04
Fish Creek-Cuyahoga River	04110002 03 05
Yellow Creek	04110002 04 02
Furnace Run	04110002 04 03
Brandywine Creek	04110002 04 04
Pond Brook	04110002 05 01
Headwaters Tinkers Creek	04110002 05 02
Headwaters Chippewa Creek	04110002 05 03
Town of Twinsburg-Tinkers Creek	04110002 05 04
East Branch Ashtabula River	04110003 01 01
West Branch Ashtabula River	04110003 01 02
Upper Ashtabula River	04110003 01 03
Griswold Creek-Chagrin River	04110003 04 02
Dead Branch	04110004 01 01
Headwaters Grand River	04110004 01 02
Baughman Creek	04110004 01 03
Swine Creek	04110004 01 06
Upper Rock Creek	04110004 02 01
Lower Rock Creek	04110004 02 03
Phelps Creek	04110004 03 01
Hoskins Creek	04110004 03 02
Mill Creek-Grand River	04110004 03 03
Mud Creek	04110004 03 04
Three Brothers Creek-Grand River	04110004 05 01
East Branch Middle Fork Little Beaver Creek	05030101 04 01
Headwaters Middle Fork Little Beaver Creek	05030101 04 02
Stone Mill Run-Middle Fork Little Beaver Creek	05030101 04 03
Lisbon Creek-Middle Fork Little Beaver Creek	05030101 04 04
Elk Run-Middle Fork Little Beaver Creek	05030101 04 05
Longs Run	05030101 06 01
Honey Creek	05030101 06 02
Headwaters North Fork Little Beaver Creek	05030101 06 03
Little Bull Creek	05030101 06 04
Headwaters Bull Creek	05030101 06 05
Leslie Run-Bull Creek	05030101 06 06
Dilworth Run-North Fork Little Beaver Creek	05030101 06 07
Brush Run-North Fork Little Beaver Creek	05030101 06 08
Rough Run-Little Beaver Creek	05030101 06 09
Bieler Run-Little Beaver Creek	05030101 06 10
Headwaters Yellow Creek	05030101 07 01
Elkhorn Creek	05030101 07 02
Upper North Fork	05030101 07 03
Headwaters North Fork Yellow Creek	05030101 08 02
Salt Run-North Fork Yellow Creek	05030101 08 03

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Upper Cross Creek	05030101 10 01
Salem Creek	05030101 10 02
Middle Cross Creek	05030101 10 03
Frontal Pymatuning Reservoir	05030102 01 04
Willow Creek	05030103 02 02
Mill Creek	05030103 02 03
Island Creek-Mahoning River	05030103 02 04
Kale Creek	05030103 03 01
Headwaters West Branch Mahoning River	05030103 03 02
Barrel Run	05030103 03 03
Headwaters Eagle Creek	05030103 04 01
South Fork Eagle Creek	05030103 04 02
Camp Creek-Eagle Creek	05030103 04 03
Tinkers Creek	05030103 04 04
Burgess Run-Yellow Creek	05030103 08 06
Crabapple Creek	05030106 03 01
Headwaters Wheeling Creek	05030106 03 02
Flat Run-Wheeling Creek	05030106 03 04
Buffalo Run-West Fork Duck Creek	05030201 09 02
New Years Creek-Duck Creek	05030201 09 03
Horse Cave Creek	05030202 03 01
Headwaters East Branch Shade River	05030202 03 02
Big Run-East Branch Shade River	05030202 03 03
Spruce Creek-Shade River	05030202 03 04
Baldwin Run	05030204 04 02
Pleasant Run	05030204 04 03
Tarhe Run-Hocking River	05030204 04 04
Buck Run-Hocking River	05030204 04 05
Scott Creek	05030204 06 02
Oldtown Creek	05030204 06 03
Fivemile Creek	05030204 06 04
Headwaters Tuscarawas River	05040001 01 01
Pigeon Creek	05040001 01 02
Hudson Run	05040001 01 03
Wolf Creek	05040001 01 04
Headwaters Chippewa Creek	05040001 02 01
Hubbard Creek-Chippewa Creek	05040001 02 02
Little Chippewa Creek	05040001 02 03
River Styx	05040001 02 04
Tommy Run-Chippewa Creek	05040001 02 05
Red Run	05040001 02 06
Silver Creek-Chippewa Creek	05040001 02 07
Pancake Creek-Tuscarawas River	05040001 03 01
Lake Lucern-Nimisila Creek	05040001 03 03
Fox Run	05040001 03 04
Headwaters Newman Creek	05040001 03 06
Town of North Lawrence-Newman Creek	05040001 03 07
Conser Run	05040001 04 01
Middle Branch Sandy Creek	05040001 04 02
Pipes Fork-Still Fork	05040001 04 03
Muddy Fork	05040001 04 04
Reeds Run-Still Fork	05040001 04 05

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Swartz Ditch-Middle Branch Nimishillen Creek	05040001 05 01
East Branch Nimishillen Creek	05040001 05 02
West Branch Nimishillen Creek	05040001 05 03
Hugle Run	05040001 06 01
Pipe Run	05040001 06 02
Black Run	05040001 06 03
Little Sandy Creek	05040001 06 04
Indian Run-Sandy Creek	05040001 06 06
Village of Pavonia-Black Fork Mohican River	05040002 02 01
Headwaters Rocky Fork	05040002 02 03
Outlet Rocky Fork	05040002 02 04
Headwaters Wakatomika Creek	05040004 01 01
Winding Fork	05040004 01 02
Brushy Fork	05040004 01 03
Black Run-Wakatomika Creek	05040004 02 01
Mill Fork	05040004 02 02
Little Wakatomika Creek	05040004 02 03
Claylick Creek	05040006 05 01
Lost Run	05040006 05 02
Dudley Run-Rush Creek	05060001 02 03
Rock Fork	05060001 03 01
Honey Creek-Little Scioto River	05060001 03 04
Panther Creek	05060001 04 02
Wolf Creek-Scioto River	05060001 04 03
Wildcat Creek	05060001 04 04
Glade Run-Scioto River	05060001 04 06
Mud Run	05060001 08 02
Flat Run	05060001 08 03
Town of Caledonia-Olentangy River	05060001 08 04
Shaw Creek	05060001 09 01
Otter Creek-Olentangy River	05060001 10 01
Grave Creek	05060001 10 02
Qu Qua Creek	05060001 10 04
Pawpaw Creek	05060001 17 01
Poplar Creek	05060001 17 03
Sycamore Creek	05060001 17 04
Georges Creek	05060001 18 01
Tussing Ditch-Walnut Creek	05060001 18 02
Turkey Run	05060001 18 03
Little Walnut Creek	05060001 18 04
Mud Run-Walnut Creek	05060001 18 06
Headwaters Big Darby Creek	05060001 19 01
Buck Run	05060001 19 03
Sugar Run	05060001 19 04
Headwaters Treacle Creek	05060001 20 01
Proctor Run-Treacle Creek	05060001 20 02
Headwaters Little Darby Creek	05060001 20 03
Spring Fork	05060001 20 04
Gay Run-Big Darby Creek	05060001 22 02
Grove Run-Scioto River	05060001 23 04
Hargus Creek	05060002 04 01
Yellowbud Creek	05060002 04 02

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Congo Creek	05060002 04 04
Beech Fork	05060002 06 01
Headwaters Salt Creek	05060002 06 02
Laurel Run	05060002 06 03
Pine Creek	05060002 06 04
Sour Run-Little Salt Creek	05060002 08 05
East Fork Queer Creek	05060002 09 01
Pretty Run	05060002 09 03
Pike Run	05060002 09 04
Village of Eagle Mills-Salt Creek	05060002 09 05
Indian Creek	05060002 10 01
Dry Run	05060002 10 02
Headwaters Walnut Creek	05060002 10 03
Lick Run-Walnut Creek	05060002 10 04
Big Run-Scioto River	05060002 16 02
Headwaters Paint Creek	05060003 01 01
East Fork Paint Creek	05060003 01 02
Indian Creek-Paint Creek	05060003 06 01
Farmers Run-Paint Creek	05060003 06 02
Cherokee Mans Run	05080001 03 01
Rennick Creek-Great Miami River	05080001 03 02
Rum Creek	05080001 03 03
Blue Jacket Creek	05080001 03 04
Bokengehalas Creek	05080001 03 05
Brandywine Creek-Great Miami River	05080001 03 06
McKees Creek	05080001 04 01
Lee Creek	05080001 04 02
Indian Creek	05080001 04 04
Plum Creek	05080001 04 05
Turkeyfoot Creek-Great Miami River	05080001 04 06
Machochee Creek	05080001 15 01
Headwaters Mad River	05080001 15 02
Kings Creek	05080001 15 03
Glady Creek-Mad River	05080001 15 04
Muddy Creek	05080001 16 01
Dugan Run	05080001 16 02
Nettle Creek	05080001 16 03
Anderson Creek	05080001 16 04
Storms Creek	05080001 16 05
Chapman Creek	05080001 16 06
Bogles Run-Mad River	05080001 16 07
Moore Run	05080001 18 01
Pondy Creek-Mad River	05080001 18 02
Mill Creek	05080001 18 03
Donnels Creek	05080001 18 04
Rock Run-Mad River	05080001 18 05
Jackson Creek-Mad River	05080001 18 06
Mud Creek	05080001 19 01
Mud Run	05080001 19 02
Poplar Creek-Great Miami River	05080001 20 05
North Branch Wolf Creek	05080002 01 01
Headwaters Wolf Creek	05080002 01 02

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Holes Creek	05080002 01 04
Millers Fork	05080002 02 01
Headwaters Twin Creek	05080002 02 02
Swamp Creek	05080002 02 03
Price Creek	05080002 02 04
Bantas Fork	05080002 03 01
Aukerman Creek	05080002 03 02
Toms Run	05080002 03 03
Little Twin Creek	05080002 03 05
Elk Creek	05080002 07 01
Shaker Creek	05080002 07 03
Dicks Creek	05080002 07 04
Gregory Creek	05080002 07 05
Beals Run-Indian Creek	05080002 08 03
Pleasant Run	05080002 09 01
Paddys Run	05080002 09 03
Taylor Creek	05080002 09 05
Hales Creek	05090103 02 01
Headwaters Pine Creek	05090103 02 02
Little Pine Creek	05090103 02 03
Big Threemile Creek	05090201 06 04
Headwaters Little Miami River	05090202 01 01
North Fork Little Miami River	05090202 01 02
Buffenbarger Cemetery-Little Miami River	05090202 01 03
Yellow Springs Creek-Little Miami River	05090202 01 04
North Fork Massies Creek	05090202 02 01
South Fork Massies Creek	05090202 02 02
Massies Creek	05090202 02 03
Little Beaver Creek	05090202 02 04
Beaver Creek	05090202 02 05
Shawnee Creek-Little Miami River	05090202 02 06
Sugar Creek	05090202 05 01
Town of Bellbrook-Little Miami River	05090202 05 02
Glady Run	05090202 05 03
East Fork Mill Creek-Mill Creek	05090203 01 01
West Fork Mill Creek	05090203 01 02
Sharon Creek-Mill Creek	05090203 01 03
Congress Run-Mill Creek	05090203 01 04
Chickasaw Creek	05120101 02 01
Headwaters Beaver Creek	05120101 02 02
Coldwater Creek	05120101 02 03

Table E-10 — Waters with current fish tissue data where inadequate samples exist to determine impairment status. These waters are category 3i.

Water Body (Category 3i: Insufficient Data)	Assessment Unit
Cornell Ditch-Fish Creek	04100003 04 06
Lower Lick Creek	04100006 04 04
Dry Run-Auglaize River	04100007 01 05
Middle Creek	04100007 08 05
Lower Blue Creek	04100007 10 04
Upper Powell Creek	04100007 11 02
Lower Powell Creek	04100007 11 03

Water Body (Category 3i: Insufficient Data)	Assessment Unit
Middle South Turkeyfoot Creek	04100009 01 04
Lower South Turkeyfoot Creek	04100009 01 06
Lower Yellow Creek	04100009 05 06
Middle Beaver Creek	04100009 05 08
Delaware Creek-Maumee River	04100009 09 04
Town of Bloomdale-South Branch Portage River	04100010 02 03
Mills Creek	04100011 01 03
Pickerel Creek	04100011 02 03
Raccoon Creek	04100011 02 04
Beaver Creek	04100011 12 02
Muskellunge Creek	04100011 13 01
Red Creek-Grand River	04110004 06 07
Piney Creek-Captina Creek	05030106 09 04
Cat Run-Captina Creek	05030106 09 06
Lower Sunfish Creek	05030201 01 04
Mouth Clear Creek	05030204 03 02
Dog Run-Conotton Creek	05040001 08 05
Boggs Fork	05040001 13 03
Town of Uhrichsville-Stillwater Creek	05040001 16 04
Evans Creek	05040001 19 01
Jerome Fork-Mohican River	05040002 06 05
Job Run-North Branch Kokosing River	05040003 01 03
Granny Creek-Kokosing River	05040003 02 03
Buckeye Fork	05040004 04 04
Painter Creek-Jonathon Creek	05040004 04 07
Manns Fork Salt Creek	05040004 06 05
Depue Run-Seneca Fork	05040005 01 04
Chapman Run	05040005 02 06
Salt Fork Lake-Sugartree Fork	05040005 04 05
Sarchet Run-Wills Creek	05040005 05 04
Headwaters Little Scioto River	05060001 03 02
City of Marion-Little Scioto River	05060001 03 03
Eversole Run	05060001 12 01
Deer Creek Dam-Deer Creek	05060002 02 07
State Run-Deer Creek	05060002 03 04
Buckeye Creek	05060002 08 02
Horse Creek-Little Salt Creek	05060002 08 03
Big Branch-Rattlesnake Creek	05060003 04 07
Dismal Creek	05080001 10 01
Sinking Creek	05080001 17 03
Town of New Miami-Great Miami River	05080002 07 06
Banklick Creek-Great Miami River	05080002 09 02
Flat Run-Raccoon Creek	05090101 03 04
Meadow Run-Little Raccoon Creek	05090101 04 03
Deer Creek-Little Raccoon Creek	05090101 04 04
Flatlick Run-Raccoon Creek	05090101 05 03
McKinney Creek-Symmes Creek	05090101 10 05
Bear Creek-Ohio River	05090201 11 06
Mouth Anderson Fork	05090202 03 03
East Fork Todd Fork	05090202 07 01

Table E-11 — Large rivers and their impairment status.

Water Body (Large Rivers)	Assessment Unit	Impairment Status
Auglaize River Mainstem (Ottawa River to mouth); excluding Defiance Power Dam Reservoir	**04100007 90 01**	**Impaired (PCBs)**
Blanchard River Mainstem (Dukes Run to mouth)	**04100008 90 01**	**Impaired (historical)**
Cuyahoga River Mainstem (Brandywine Cr. to mouth); including old channel	**04110002 90 01**	**Impaired (PCBs)**
Grand River Mainstem (Mill Creek to mouth)	**04110004 90 01**	**Impaired (PCBs)**
Great Miami River Mainstem (Four Mile Creek to Ohio River)	**05080002 90 02**	**Impaired (PCBs)**
Great Miami River Mainstem (Mad River to Four Mile Creek)	**05080002 90 01**	**Impaired (PCBs)**
Great Miami River Mainstem (Tawawa Creek to Mad River)	**05080001 90 01**	**Impaired (PCBs)**
Hocking River (Margaret Creek to Ohio River)	05030204 90 02	Not impaired
Hocking River Mainstem (Scott Creek to Margaret Creek)	05030204 90 01	Not impaired
Licking River Mainstem (entire length); excluding Dillon Lake	**05040006 90 01**	**Impaired (PCBs)**
Little Miami River Mainstem (Caesar Creek to O'Bannon Creek)	**05090202 90 01**	**Impaired (historical)**
Little Miami River Mainstem (O'Bannon Creek to Ohio River)	**05090202 90 02**	**Impaired (PCBs)**
Mad River Mainstem (Donnels Creek to mouth)	**05080001 90 03**	**Impaired (PCBs)**
Mahoning River Mainstem (Eagle Creek to Pennsylvania Border)	**05030103 90 01**	**Impaired (PCBs)**
Maumee River Mainstem (Beaver Creek to Maumee Bay)	**04100009 90 02**	**Impaired (PCBs)**
Maumee River Mainstem (IN border to Tiffin River)	**04100005 90 01**	**Impaired (PCBs)**
Maumee River Mainstem (Tiffin River to Beaver Creek)	**04100009 90 01**	**Impaired (PCBs)**
Mohican River Mainstem (entire length)	**05040002 90 01**	**Impaired (PCBs)**
Muskingum River Mainstem (Licking River to Meigs Creek)	**05040004 90 02**	**Impaired (PCBs)**
Muskingum River Mainstem (Meigs Creek to Ohio River)	**05040004 90 03**	**Impaired (PCBs)**
Muskingum River Mainstem (Tuscarawas/Walhonding confluence to Licking River)	**05040004 90 01**	**Impaired (PCBs)**
Paint Creek Mainstem (Rocky Fork to mouth)	**05060003 90 01**	**Impaired (historical)**
Raccoon Creek Mainstem (Little Raccoon Creek to mouth)	05090101 90 01	Not impaired
Sandusky River Mainstem (Tymochtee Creek to Wolf Creek)	**04100011 90 01**	**Impaired (PCBs, Mercury)**
Sandusky River Mainstem (Wolf Creek to Sandusky Bay)	**04100011 90 02**	**Impaired (PCBs)**
Scioto River Mainstem (Big Darby Creek to Paint Creek)	**05060002 90 01**	**Impaired (PCBs)**
Scioto River Mainstem (L. Scioto R. to Olentangy R.); excluding O'Shaughnessy and Griggs reservoirs	**05060001 90 01**	**Impaired (PCBs)**
Scioto River Mainstem (Olentangy River to Big Darby Creek)	**05060001 90 02**	**Impaired (PCBs)**
Scioto River Mainstem (Paint Creek to Sunfish Creek)	**05060002 90 02**	**Impaired (PCBs)**
Scioto River Mainstem (Sunfish Creek to Ohio River)	**05060002 90 03**	**Impaired (PCBs)**
Stillwater River Mainstem (Greenville Creek to mouth)	05080001 90 02	Not impaired
Tiffin River Mainstem (Brush Creek to mouth)	**04100006 90 01**	**Impaired (PCBs)**
Tuscarawas River Mainstem (Chippewa Creek to Sandy Creek)	**05040001 90 01**	**Impaired (historical)**
Tuscarawas River Mainstem (Sandy Creek to Stillwater Creek)	**05040001 90 02**	**Impaired (historical)**
Tuscarawas River Mainstem (Stillwater Creek to Muskingum River)	**05040001 90 03**	**Impaired (historical)**
Walhonding River Mainstem (entire length)	05040003 90 01	Not impaired
Whitewater River Mainstem (entire length)	**05080003 90 01**	**Impaired (PCBs)**
Wills Creek Mainstem (Salt Fork to mouth); excluding Wills Creek Lake	05040005 90 01	Not impaired

BOLD text indicates impaired rivers.

Table E-12 — Inland lakes and their impairment status.

Water Body (Inland Lakes)	Impairment status (cause)
Acton Lake	Not impaired
Adams Lake	Insufficient information
Alum Creek Lake	Not impaired
Apple Valley Lake	Not impaired
Archibold Reservoir #2	Insufficient information
Atwood Lake	Not impaired
Barnesville Reservoir #1	Insufficient information
Barnesville Reservoir #2	Insufficient information
Barnesville Reservoir #3	Insufficient information
Belmont Lake	Not impaired
Buckeye Lake	Not impaired
Caesar Creek Lake	Not impaired
Caldwell Lake	Insufficient information
Charles Mill Lake	Insufficient information
Chippewa Lake	Insufficient information
CJ Brown Reservoir	Insufficient information
Clark Lake	Insufficient information
Clear Fork Reservoir	**Impaired (PCBs)**
Clendening Lake	Not impaired
Cowan Lake	Not impaired
Cutler Lake	Insufficient information
Deer Creek Lake	Not impaired
Delphos Reservoir	Insufficient information
Delta Reservoir #2	Not impaired
Dillon Lake	Not impaired
East Branch Reservoir	Not impaired
East Fork Lake	Not impaired
East Reservoir	Insufficient information
Ferguson Reservoir	Not impaired
Findley Lake	Not impaired
Findley Reservoir #2	**Impaired (PCBs)**
Friendship Park Lake	Insufficient information
Grand Lake St Marys	Insufficient information
Griggs Reservoir	Not impaired
Hammertown Lake	Insufficient information
Hargus Lake	Insufficient information
Hinckley Lake	Insufficient information
Hoover Reservoir	Not impaired
Indian Lake	Not impaired
Jackson Lake	Insufficient information
Jefferson Lake	Not impaired
Kiser Lake	Not impaired
Knox Lake	Not impaired
LaDue Reservoir	**Impaired (PCBs)**
Lake Glacier	Not impaired
Lake Isabella	Insufficient information
Lake Jisco	Insufficient information
Lake Katherine	Insufficient information
Lake Logan	Not impaired
Lake Loramie	Not impaired
Lake Milton	**Impaired (PCBs)**

Water Body (Inland Lakes)	Impairment status (cause)
Lake Nesmith	**Impaired (PCBs)**
Lake Olander	Insufficient information
Lake Rockwell	**Impaired (PCBs)**
Lake Vesuvius	Not impaired
Lake White	Not impaired
Long Lake	Insufficient information
Madison Lake	Insufficient information
Marysville Reservoir	Insufficient information
Meadowbrook Lake	Insufficient information
Metzger Reservoir	Insufficient information
Mogadore Reservoir	Not impaired
Mosquito Creek Lake	Not impaired
Nettle Lake	Insufficient information
New London Reservoir	Not impaired
Nimisila Reservoir	Not impaired
North Fork Kokosing Reservoir	Not impaired
O'Shaughnessy Reservoir	Not impaired
Paint Creek Lake	Not impaired
Piedmont Lake	Not impaired
Pike Lake	Not impaired
Pleasant Hill Lake	Not impaired
Pymatuning Reservoir	Not impaired
Rose Lake	**Impaired (PCBs)**
Rush Creek Lake	Not impaired
Rush Run Lake	Not impaired
Salt Fork Reservoir	Not impaired
Seneca Lake	Insufficient information
Sippo Lake	Not impaired
Stewart Lake	Insufficient information
Stonelick Lake	Not impaired
Summit Lake	**Impaired (PCBs)**
Swift Run Lake	Insufficient information
Tappan Lake	Not impaired
Turkey Creek Lake	Not impaired
Van Wert Reservoir #1	Insufficient information
Van Wert Reservoir #2	Insufficient information
Veteran's Memorial Reservoir	Not impaired
Wellington Upground Reservoir	Insufficient information
West Branch Reservoir	**Impaired (PCBs)**
Westville Lake	**Impaired (PCBs)**
Wills Creek Reservoir	Not impaired
Wingfoot Lake	Not impaired

BOLD text indicates impaired lakes.

Table E- 13 — Lake Erie assessment units and their impairment status.

Lake Erie Assessment Unit	Assessment Unit	Impairment Status
LE Central Basin Shoreline	**041202000203**	**Impaired (PCBs)**
LE Central Basin Open Water	041202000303	Insufficient information[4]
LE Islands Shoreline	**041202000101**	**Impaired (PCBs)**
LE Sandusky Basin Shoreline	**041202000202**	**Impaired (PCBs)**
LE Sandusky Basin Open Water	041202000302	Insufficient information
LE Western Basin Shoreline	**041202000201**	**Impaired (PCBs)**
LE Western Basin Open Water	041202000301	Insufficient information

BOLD text indicates impaired units.

E4. Supplemental Information

E4.1 Calculation of Fish Concentrations from Water Quality Standards Inputs

For carcinogens:

$$Fish\ Concentration\ (mg/kg) = \frac{\left[\dfrac{Cancer\ Risk\ Level}{q1^*\left((mg/kg/d)^{-1}\right)}\right] \times Body\ Weight\ (kg)}{Fish\ Consumption\ (kg/d)}$$

For noncarcinogens:

$$Fish\ Concentration\ (mg/kg) = \frac{RfD\ (mg/kg/d) \times Body\ Weight\ (kg) \times RSC}{Fish\ Consumption\ (kg/d)}$$

For wildlife:

$$Fish\ Concentration\ (mg/kg) = Wildlife\ WQC\ (mg/L) \times BAF\ TL_n\ (L/kg)$$

[4] A revised assessment method for the new Lake Erie units is scheduled for development, including collaboration with Ohio Department of Natural Resources data collectors to evaluate appropriate sampling locations and frequencies.

Lake Erie Drainage Basin

	Mercury	Chlordane	DDT	PCBs	Hexachloro-benzene	Mirex
HHWQC	3.1 ng/L	2.4 µg/L	0.15 ng/L	0.026 ng/L	0.45 ng/L	0.074 ng/L
Wildlife Criteria	1.3 ng/L	N/A	0.011 ng/L	0.12 ng/L	N/A	N/A
The following inputs on which the WQS are based are used to calculate fish concentrations:						
Reference Dose (RfD)	1E-04 mg/kg/d	N/A	N/A	N/A	N/A	N/A
Slope Factor (q1*)	N/A	0.35 $(mg/kg/d)^{-1}$	0.34 $(mg/kg/d)^{-1}$	2.0 $(mg/kg/d)^{-1}$	1.6 $(mg/kg/d)^{-1}$	0.53 $(mg/kg/d)^{-1}$
Cancer Risk Level	N/A	1E-05	1E-05	1E-05	1E-05	1E-05
Body Weight	65 kg	70 kg	70 kg	70 kg	70 kg	70 kg
Trophic Level Three Bioaccumulation Factor ($BAF\ TL^3$)	27,900	116,600	376,400	520,900	43,690	353,000
Trophic Level Four Bioaccumulation Factor ($BAF\ TL^4$)	140,000	154,200	1,114,000	1,871,000	71,080	1,461,000
Fish Consumption	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d
Relative Source Contribution Factor (RSC)	0.8	N/A	N/A	N/A	N/A	N/A

Source: U.S. EPA. 1995. Great Lakes Water Quality Initiative Criteria Documents for the Protection of Human Health. EPA-820-B-95-006. March 1995.

Derivation of Concentrations

Lake Erie Drainage Basin Mercury Human Health Fish Concentration

$$\frac{1E-04\left(mg/kg/d\right)\times 65\left(kg\right)\times 0.8}{0.015\left(kg/d\right)}=0.35\left(mg/kg\right)=350\left(\mu g/kg\right)$$

Lake Erie Drainage Basin Mercury Wildlife Fish Concentration

<u>Trophic Level 3:</u>

$$1.3E-06\left(mg/L\right)\times 27{,}900\left(L/kg\right)=0.036\left(mg/kg\right)=36\left(\mu g/kg\right)$$

<u>Trophic Level 4:</u>

$$1.3E-06\left(mg/L\right)\times 140{,}000\left(L/kg\right)=0.18\left(mg/kg\right)=180\left(\mu g/kg\right)$$

Lake Erie Drainage Basin Chlordane Human Health Fish Concentration

$$\frac{\left[\dfrac{1E-05}{0.35\left(mg/kg/d\right)^{-1}}\right]\times 70\left(kg\right)}{0.015\left(kg/d\right)}=0.13\left(mg/kg\right)=130\left(\mu g/kg\right)$$

Lake Erie Drainage Basin DDT Human Health Fish Concentration

$$\frac{\left[\dfrac{1E-05}{0.34\left(mg/kg/d\right)^{-1}}\right]\times 70\left(kg\right)}{0.015\left(kg/d\right)}=0.14\left(mg/kg\right)=140\left(\mu g/kg\right)$$

Lake Erie Drainage Basin DDT Wildlife Fish Concentration

Trophic Level 3:

$$1.1E-08\,(mg/L)\times 376{,}400\,(L/kg)=0.0041\,(mg/kg)=4.1\,(\mu g/kg)$$

Trophic Level 4:

$$1.1E-08\,(mg/L)\times 1{,}140{,}000\,(L/kg)=0.012\,(mg/kg)=12\,(\mu g/kg)$$

Lake Erie Drainage Basin PCB Human Health Fish Concentration

$$\frac{\left[\dfrac{1E-05}{2.0\,(mg/kg/d)^{-1}}\right]\times 70\,(kg)}{0.015\,(kg/d)}=0.023\,(mg/kg)=23\,(\mu g/kg)$$

Lake Erie Drainage Basin PCB Wildlife Fish Concentration

Trophic Level 3:

$$1.2E-07\,(mg/L)\times 520{,}900\,(L/kg)=0.062\,(mg/kg)=62\,(\mu g/kg)$$

Trophic Level 4:

$$1.2E-07\,(mg/L)\times 1{,}871{,}000\,(L/kg)=0.22\,(mg/kg)=220\,(\mu g/kg)$$

Lake Erie Drainage Basin Hexachlorobenzene Human Health Fish Concentration

$$\frac{\left[\dfrac{1E-05}{1.6\,(mg/kg/d)^{-1}}\right]\times 70\,(kg)}{0.015\,(kg/d)}=0.029\,(mg/kg)=29\,(\mu g/kg)$$

Lake Erie Drainage Basin Mirex Human Health Fish Concentration

$$\frac{\left[\dfrac{1E-05}{0.53\,(mg/kg/d)^{-1}}\right]\times 70\,(kg)}{0.015\,(kg/d)}=0.088\,(mg/kg)=88\,(\mu g/kg)$$

Ohio River Drainage Basin

	Mercury	Chlordane	DDT	PCBs	Hexachloro-benzene	Mirex
HHWQC	12 ng/L*	21 ng/L	5.9 ng/L	1.7 ng/L	7.5 ng/L	0.11 ng/L
The following inputs on which the WQS are based are used to calculate fish concentrations:						
Reference Dose (RfD)	N/A	N/A	N/A	N/A	N/A	N/A
Slope Factor (q1*)	N/A	0.35 $(mg/kg/d)^{-1}$	0.34 $(mg/kg/d)^{-1}$	2.0 $(mg/kg/d)^{-1}$	1.6 $(mg/kg/d)^{-1}$	0.53 $(mg/kg/d)^{-1}$
Cancer Risk Level	N/A	1E-05	1E-05	1E-05	1E-05	1E-05
Body Weight	N/A	70 kg	70 kg	70 kg	70 kg	70 kg
Fish Consumption	N/A	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d
Relative Source Contribution Factor (RSC)	N/A	N/A	N/A	N/A	N/A	N/A

* Based on the FDA action level of 1 mg/kg divided by the BCF of 83,333 L/kg.

Ohio River Drainage Basin Mercury Fish Concentration

1 mg/kg based on FDA action level

Ohio River Drainage Basin Chlordane Fish Concentration

$$\frac{\left[\dfrac{1E-05}{0.35\left(mg/kg/d\right)^{-1}}\right]\times 70\left(kg\right)}{0.0065\left(kg/d\right)}=0.31\left(mg/kg\right)=310\left(\mu g/kg\right)$$

Ohio River Drainage Basin DDT Fish Concentration

$$\frac{\left[\dfrac{1E-05}{0.34\left(mg/kg/d\right)^{-1}}\right]\times 70\left(kg\right)}{0.0065\left(kg/d\right)}=0.32\left(mg/kg\right)=320\left(\mu g/kg\right)$$

Ohio River Drainage Basin PCB Fish Concentration

$$\frac{\left[\dfrac{1E-05}{2.0\left(mg/kg/d\right)^{-1}}\right]\times 70\left(kg\right)}{0.0065\left(kg/d\right)}=0.054\left(mg/kg\right)=54\left(\mu g/kg\right)$$

Ohio River Drainage Basin Hexachlorobenzene Fish Concentration

$$\frac{\left[\dfrac{1E-05}{1.6\left(mg/kg/d\right)^{-1}}\right]\times 70\left(kg\right)}{0.0065\left(kg/d\right)}=0.067\left(mg/kg\right)=67\left(\mu g/kg\right)$$

Ohio River Drainage Basin Mirex Fish Concentration

$$\frac{\left[\dfrac{1E-05}{0.53\left(mg/kg/d\right)^{-1}}\right]\times 70\left(kg\right)}{0.0065\left(kg/d\right)}=0.20\left(mg/kg\right)=200\left(\mu g/kg\right)$$

Fish Tissue Concentrations for Determining Impairment for the 2018 IR (µg/kg)

	Lake Erie HH	Lake Erie – wildlife TL3	Lake Erie – wildlife TL4	Ohio River
Mercury	350	36	180	1000
Chlordane	130	N/A	N/A	310
DDT	140	4.1	12	320
PCBs	23	62	220	54
Hexachlorobenzene	29	N/A	N/A	67
Mirex	88	N/A	N/A	200

E4.2 What's the difference between the Fish Consumption Advisory decision and the impairment decision?

Some question may arise as to how the methodology for determining impairment status for the 2018 IR for fish tissue relates to the fish advisories issued by the State of Ohio. Rather than building on FCA decisions, the revised methodology draws directly from the fish tissue contaminant database. This change was possible because of better accessibility to the raw data.

In short, the basis for determining impairment for the IR for fish tissue is similar but unrelated to the basis for determining advisories. The WQS calculations assume a certain amount of fish consumption and ensure that level of consumption is safe. The advisory calculations determine what level of fish consumption is safe. Therefore, both are protective of human health. However, advisories and IR impairment status are not directly related.

Advisory thresholds are given as one meal per week, one meal per month, one meal every other month and do not eat. Each threshold is associated with a particular contaminant concentration that is based on consuming an 8-ounce meal. For both PCBs and mercury, those thresholds are 50 parts per billion (ppb) for one meal per week, 220 ppb for one meal per month, 1,000 ppb for one meal every other month and 2,000 ppb for do not eat.

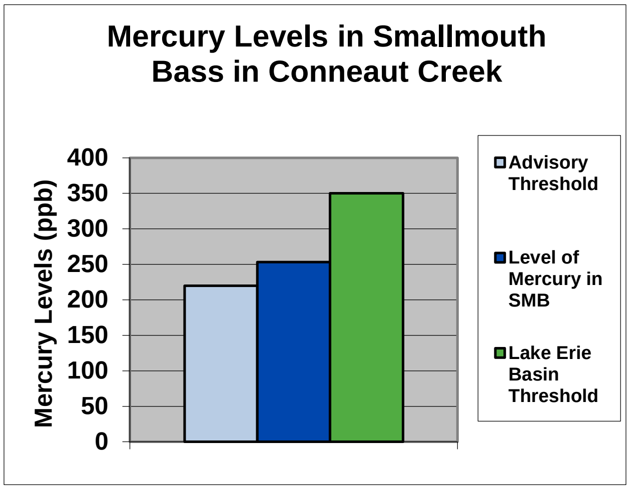
The thresholds used for determining IR categories are based on water quality standards for human health. The water quality standards assume that people are eating a certain quantity of different types of fish over time. The Lake Erie basin WQS calculations for mercury and PCBs assume that people are eating 15 grams of fish per day. The Ohio River basin calculations for PCBs and mercury assume that people are eating 6.5 grams of fish per day.

Advisory thresholds are prescriptive, indicating to people how much fish is safe to eat given a certain level of fish contamination. Water quality standard-based thresholds are descriptive, indicating how much contamination is acceptable in fish given that people are eating a certain amount of certain types of fish. In other words, the advisories tell people how much fish they can safely eat and the water quality standards assume how much fish people are eating and use that information to calculate a "safe" level of contamination in fish.

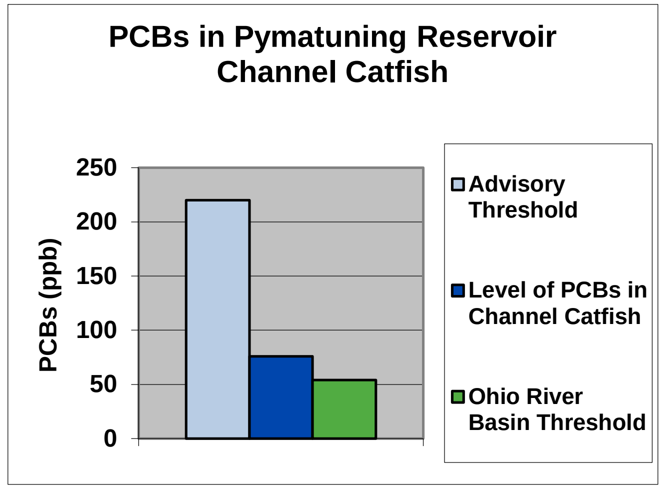
U.S. EPA, in its guidance on developing the IR, indicates that water quality standards are to be used as the basis for determining impairment categories for fish tissue. Because the assumptions used to calculate the advisories are different than the assumptions used to calculate the WQS, this results in cases where some water bodies have advisories against fish consumption, but are not listed as impaired; and some water bodies are listed as impaired, but no fish advisory is in place. This situation is demonstrated in the following table:

Parameter	Lake Erie Basin	Ohio River Basin	One meal per week advisory	One meal per month advisory
Fish Consumed	15 grams/day	6.5 grams/day	32.6 grams/day	7.6 grams/day
Maximum Allowable Fish Concentration				
PCB Threshold	23 ppb	54 ppb	50 ppb	220 ppb
Mercury Threshold	350 ppb	1000 ppb	50 ppb	220 ppb

The reason the thresholds are different between the two basins is that the assumed fish consumption levels are different. And the reason the water quality standard thresholds are different from the advisory thresholds is both because the fish consumption levels are different, and because for PCBs, a cancer slope factor is used to calculate the water quality standard criteria, which is stricter than the health protection value used to calculate the advisory threshold.



Data for smallmouth bass in Conneaut Creek provide an example where there is an advisory, but the water body is not impaired.



Channel catfish in Pymatuning Reservoir show a case where there is no advisory, but the water is listed as impaired.

Section

F

Evaluating Beneficial Use: Recreation

F1. Background *(Bacteria)*

Prior to the 2002 Integrated Report (IR), the reporting of recreation use (RU) impairment in Ohio was sporadic. Clean Water Act (CWA) Section 305(b) reports (1998 and earlier) may have included an indication of the potential for RU impairment in various streams, but a comprehensive listing of recreational use impairment was not included. The 2002 IR employed a uniform methodology to examine readily available data on fecal coliform counts. This approach was based on counting the number of exceedances of the secondary contact RU maximum criterion [5,000 colony forming units (cfu)/100 mL fecal coliform or 576 cfu/100 mL *Escherichia coli (E. coli)]*. Any assessment unit with five or more samples over the last five years above these values was listed as having an impaired RU.

The 2004 IR adopted a more statistically robust methodology for assessing the RU attainment of the state's surface waters linked more directly to the applicable water quality standards (WQS). The methodology adopted in 2004 continued to be used through the 2008 IR. The 2008 IR also included a preview of changes anticipated at the time for the 2010 report based on the expectation that the watershed assessment unit (WAU) would change from a larger watershed size (11-digit HUC) to a smaller watershed size (12-digit HUC) and on four anticipated revisions to the water quality standards: 1) dropping the fecal coliform criteria; 2) creation of a tiered set of classes of primary contact recreation waters based on RU intensity; 3) revision of the geometric mean averaging period; and 4) extension of the recreation season. Revisions to the water quality standards pertaining to the RU were adopted on Dec. 15, 2009. The RU assessment method employed in the 2010, 2012, 2014 and 2016 IRs was essentially consistent throughout this time.

A more recent revision to Ohio's water quality standards became effective in January 2016. This revision included updates to the recreational water quality standards to make them consistent with U.S. EPA's November 2012 section 304(a) recommendations. These substantial revisions to Ohio's recreation use WQS included changes to the applicable numeric criteria and a change in the geometric mean averaging period from a seasonal basis to a 90-day period. Furthermore, the tiered set of primary contact recreational use classes adopted in 2010 were collapsed back into a single use as part of these revisions. The revised WQS were approved by U.S. EPA in April 2016. A subsequent revision to Ohio's WQS resulted in the movement of the water quality criteria for the protection of recreational uses from OAC 3745-1-07 to OAC 3745-1-37. The revision that reorganized the content of the WQS became effective in February 2017 and was approved by U.S. EPA in June 2017. The linkage of the assessment methodology to the Ohio WQS is summarized in Table F-1 and detailed in subsequent text.

Table F-1 — Summary of the RU assessment methods.

Bathing Waters		
Indicator	**Criterion (Table 37-2, OAC 3745-1-37)**	**Assessment Method Summary**
E. coli	Geometric mean *E. coli* content* based on samples collected within a 90-day period during the recreation season within a calendar year is 126 cfu/100 mL; statistical threshold value (STV) is 410 cfu/100 mL.	Applied to the four Lake Erie shoreline assessment units and inland lake beaches, exceedance of the geometric mean bathing water criterion or an exceedance of the STV in more than 10 percent of the samples collected during a 90-day period is considered an impairment of the bathing water use, where sufficient data are available**.
Primary Contact and Secondary Contact		
Indicator	**Criterion (Table 37-2, OAC 3745-1-37)**	**Assessment Method Summary**
E. coli	Geometric mean *E. coli* content* based on samples collected within a 90-day period during the recreation season within a calendar year is as follows: Primary Contact Waters 90-day Geometric Mean: 126 cfu/100 mL STV: 410 cfu/100 mL Secondary Contact Waters 90-day Geometric Mean: 1,030 cfu/100 mL STV: 1,030 cfu/100 mL	Applied to streams and inland lake non-beach sites. Data collected within a 90-day period in the recreation season are assessed on a site-by-site basis and compared to the applicable geometric mean and STV *E. coli* criteria whenever sufficient data** are available for the site. Assessment units (AUs) are in full attainment if all sites assessed within the AU meet both the applicable geometric mean and STV criteria and in non-attainment if one or more sites assessed within the AU exceed the applicable geometric mean or STV criteria.

**E. coli* concentrations are expressed in colony forming units (cfu) per 100 milliliters (mL)

** Five or more samples collected within a 90-day period.

F2. Evaluation Method (*Bacteria*)

Lake Erie (Shoreline)

Attainment of the RU designation for the four shoreline Lake Erie assessment units (LEAUs) as delineated in Section D-1 of this report and depicted in Figure D-3 of this report was based upon examination of *E. coli* data from public bathing beaches provided by the Ohio Department of Health (ODH). Routine bacteria monitoring is performed by local health districts, ODH and the Northeast Ohio Regional Sewer District (NEORSD) to monitor bacteria levels at public bathing beaches and advise the public when elevated bacteria are present that represent an increased risk of contracting waterborne illness resulting from exposure to pathogens while recreating in the water. This monitoring takes place at 65 public beaches in Ohio's eight coastal counties. The public can access the ODH Beachguard website to view beach advisory postings and bacteria monitoring data from monitored beaches. The website, available at ***http://publicapps.odh.ohio.gov/BeachGuardPublic/Default.aspx***, is updated daily during the summer recreation season.

Since 2006, beach advisory recommendations have been based upon exceedance of the single sample maximum *E. coli* criterion of 235 cfu/100 mL, consistent with provisions of the 2004 federal Beaches Environmental Assessment and Coastal Health (BEACH) Act rule and the *E. coli* criterion applicable for bathing waters in Ohio's water quality standards. Bacteria data collected by local or state health agencies at public beaches during the recreation season from 2013 through 2017 were included in the analysis. Ohio's water quality standards define the recreation season as May 1 through October 31, though Lake Erie beach monitoring typically is focused between the Memorial Day and Labor Day weekends.

Each of the 22 public beaches that have traditionally been sampled as part of the Lake Erie bathing beach monitoring program (Figure F-1) was individually analyzed to evaluate the percentage of recreation days during which the bathing water beach action value (BAV) of 235 cfu/100 mL was exceeded, since this is the value used by health departments to post a health advisory at a given beach. The frequency of beach advisory postings is a direct measure of RU impairment, since potential users may be discouraged from utilizing a beach on days when a health advisory is posted or to avoid certain beaches altogether that are prone to frequent advisories. The locations of beaches in Erie and Sandusky Counties are depicted in Figure F-2, while those beaches located in Cuyahoga and Lorain Counties are depicted in Figure F-3.

As of Oct. 1, 2013, there were 169 public access locations in the eight coastal counties along Ohio's Lake Erie coastline. These public access points do not all include a swimming beach, as some are for boat access, fishing access, parks, wildlife viewing areas, etc. The Ohio Department of Natural Resources (ODNR) publishes a *Lake Erie Public Access Guide* available at ***coastal.ohiodnr.gov/gocoast***. This report used data collected from 65 different beaches along the coast as depicted in Figure F-1 through Figure F-3.

The total number of recreation days in a recreation season for each beach was determined by adding the number of days beginning with the first day of sampling and ending with Labor Day, or the date the final sample was collected (whichever was later). The total number of days that a beach exceeded the BAV of 235 cfu/100 mL during the recreation season (as defined above) was tallied. A measured exceedance was assumed to continue until a subsequent sample documented that the BAV was not exceeded. Similarly, a beach was presumed to meet the BAV following a measurement that met the BAV until a subsequent sample was found to exceed the BAV. Sampling frequency varied from year-to-year and from beach-to-beach. A sampling frequency of four times per week was typical, though some beaches were sampled daily while the two beaches in the Lake Erie Islands AU were sampled only once per week.

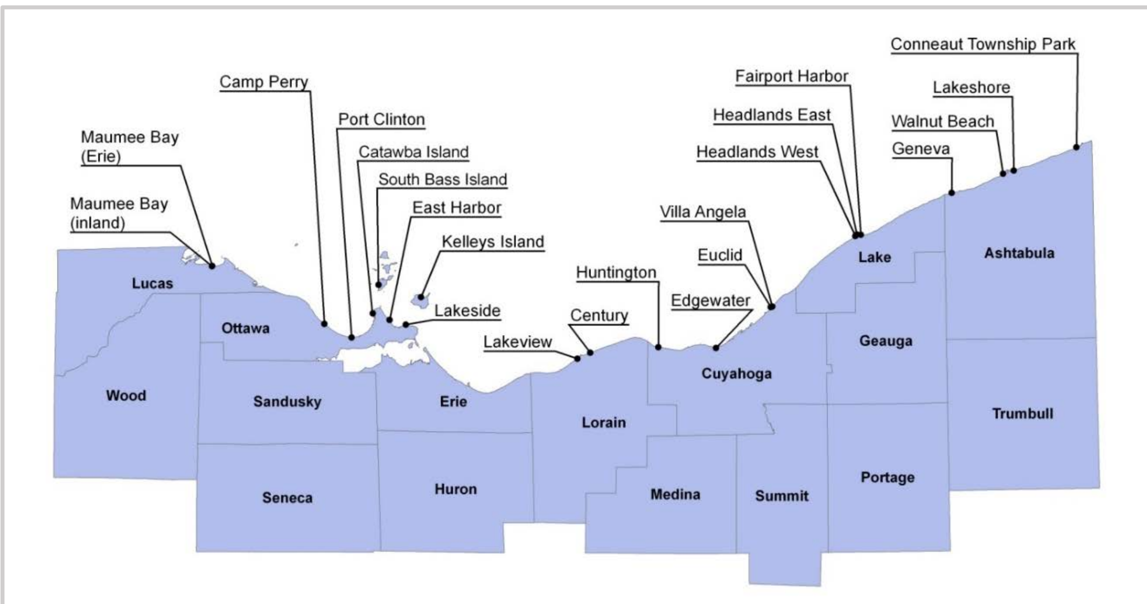


Figure F-1 — Lake Erie public beaches sampled under Ohio's bathing beach monitoring program.

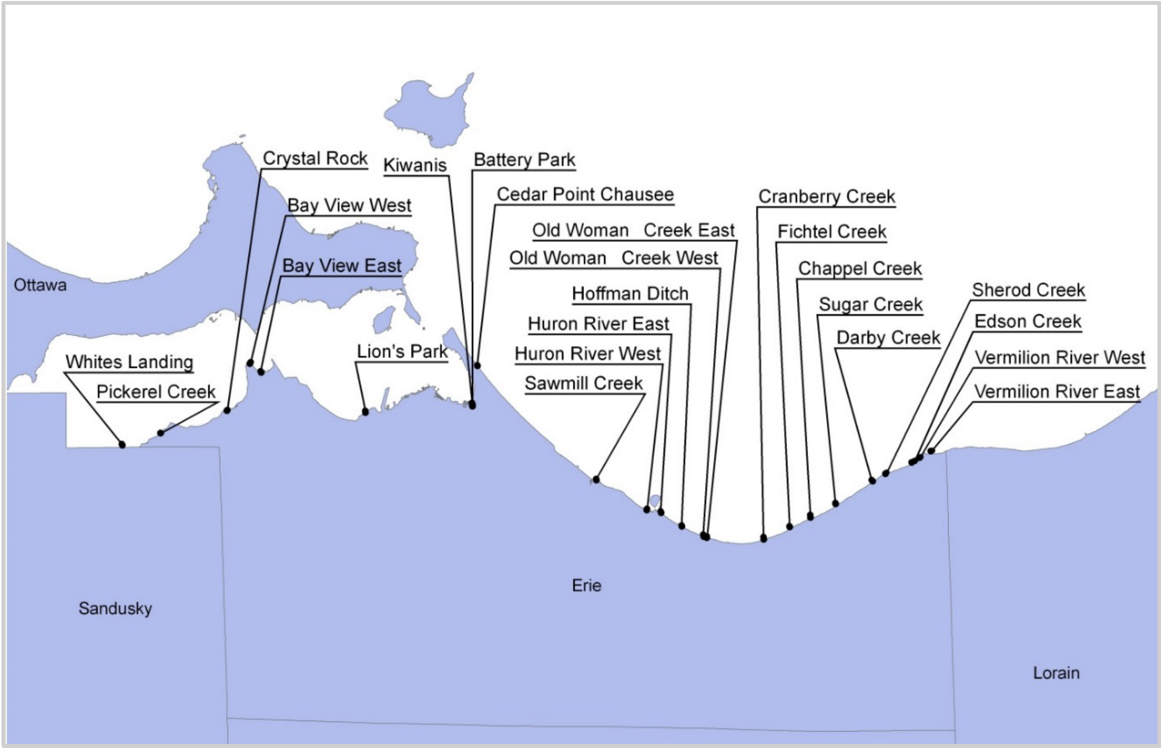


Figure F-2 — Erie and Sandusky County public beaches sampled under Ohio's bathing beach monitoring program.

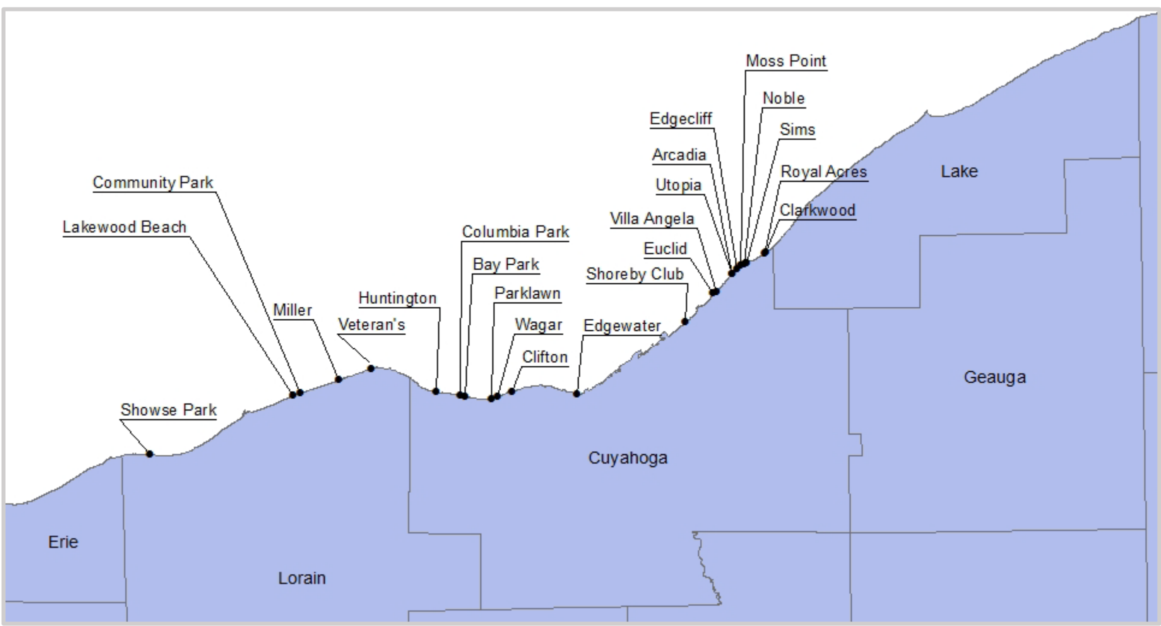


Figure F-3 — Cuyahoga and Lorain County public beaches sampled under Ohio's bathing beach monitoring program.

The exceedance frequency of the bathing water criteria was determined for each beach over a five-year period (2013-2017) on an annual basis. Individual beaches were evaluated for exceedances of both the geometric mean and STV of data collected within 90-day intervals during the recreation season. Results for each individual beach were sorted into the corresponding shoreline LEAU for determining the attainment status of each of the four shoreline LEAUs. The assessment status for each LEAU was based upon whether the frequency of exceedance of the STV was greater than 10 percent for any 90-day period or if the bathing water geometric mean criterion was exceeded within any 90-day period, as described in Table F-2 below.

Table F-2 — Determining assessment status of Lake Erie shoreline AUs.

LEAU Status	Attainment Status of Individual Beaches
Full	Exceedance frequency of the STV is less than 10 percent and the geometric mean is less than 126 cfu/100 ml based on the samples collected within all 90-day intervals during the recreation season for all the beaches in the AU for all years assessed.
Non	Exceedance frequency of the STV is more than 10 percent or the geometric mean is greater than 126 cfu/100 ml based on the samples collected within all 90-day intervals during the recreation season for one or more of the beaches in the AU for one or more of the years assessed.

A 10 percent exceedance frequency was used as the threshold for attainment determination in the last five assessment cycles and has its origins in the WQS applicable at the time as well as Ohio's 1998 *State of the Lake Report* prepared by the Ohio Lake Erie Commission (Ohio LEC 1998). While the stated goal in the *State of the Lake* report for beaches was to have clean beaches all the time (no days under advisement), the report considered having 10 or fewer days under advisement to be excellent (note that 10 days translates to 10 percent of the season based on a 100-day season). The Ohio Lake Erie Commission last published a *State of the Lake Report* (Ohio LEC 2004). That report continued to use these benchmarks in rating the swimmability of Lake Erie beaches along Ohio's 312-mile shoreline. While the 2018 IR continued to track these statistics, which are included in Table F-5 and Table F-6 (pages F-11 through F-13) for individual beaches and further summarized in Table F-7 through Table F-11 (pages F-14 through F-17) and Figure F-5 on page F-16 to provide more detail and allow performance comparisons among individual beaches, the method to determine recreation use status as described above in Table F-2 was revised to reflect the changes to the WQS that became effective in January 2016 (Table F-11).

Rivers and Streams

The 2018 RU impairment list was developed using ambient *E. coli* survey data collected from May 2016 through October 2017 by Ohio EPA as well as from ambient stream data provided by municipal dischargers that were collected at upstream and downstream monitoring stations relative to their primary discharge location as required by their National Pollutant Discharge Elimination System (NPDES) permit and reported in the Surface Water Information Management System (SWIMS) database. *E. coli* data from dischargers, while previously limited in quantity since permits had historically been based on monitoring for fecal coliform, has become more numerous as *E. coli* monitoring has replaced fecal coliform monitoring in most NPDES permits.

Over 2,300 *E. coli* bacteria records were evaluated in this analysis. Data were sorted into their respective 12-digit WAUs and large river assessment units (LRAUs) using a geo-spatial analysis of the latitude/longitude data (and other geographical data if needed) associated with each *E. coli* value. Data within a WAU were further sorted by sampling location and date (calendar year) on which they were collected. Figure F-4 demonstrates the sampling coverage that would be typical for part of a study area. In this case, there are five 12-digit WAUs depicted that drain to one LRAU, the Walhonding River. Each of the five WAUs was sampled in 2010 at one location (depicted by yellow dots) toward the downstream end of the primary tributary in the WAU. Four sampling locations (green dots) are dispersed along the 16-mile stretch of the Walhonding River depicted for an average sampling density of one site per four miles of river length for the Class A primary contact recreation water. Sites were sampled on at least five different occasions over the course the 2010 recreation season, though some sites were sampled more frequently. For example, sample collections on some of the LRAU segments such as the Tuscarawas River and Cuyahoga River in 2017 occurred 10 times. Samples were collected within 90-day sample windows during the recreation season to facilitate data evaluation. RU assessment determinations for rivers and streams are based on the following two-step process: site-by-site analysis and assessment unit analysis, as described below.

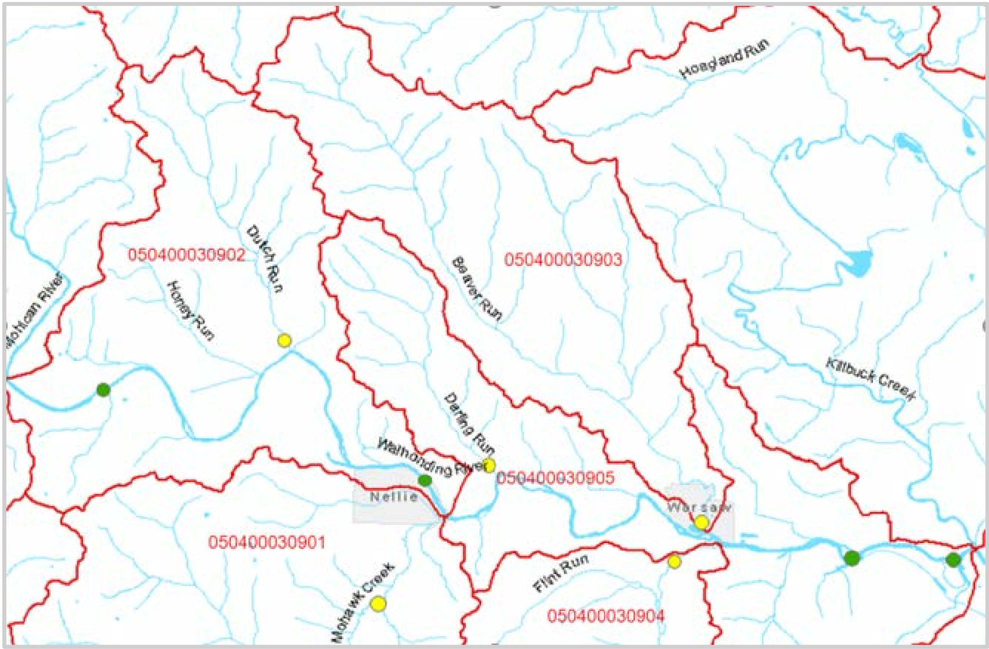


Figure F-4 — Example of bacteria sampling locations, upper Walhonding River study area (2010).

1. Site-by-Site Analysis

E. coli data from each site were compared to the geometric mean *E. coli* criterion and STV. The geometric mean was calculated using the "geomean" function in Microsoft Excel 2016® on a site-by-site basis using the pooled dataset of all *E. coli* data (minimum of five data points required) from the site within a 90-day window during a single recreation season. When data were available for multiple recreation seasons, the data from each season were independently analyzed for each recreation season to determine the 90-day geometric mean for each season. Similarly, comparisons were made of the *E. coli* data to the STV to assess sites where the STV was exceeded in more than 10 percent of the samples collected within a 90-day period. Sites in which either the geometric mean or the STV was exceeded did not fully support the recreation use. Further details are listed as follows:

- Data collected outside of the recreation season as defined in Ohio's WQS (May 1 through October 31) were excluded from the analysis.
- Assessments were only made where there were at least five samples within a 90-day period.
- Certain qualified values, such as sample results that exceeded proper holding time or those that have otherwise been indicated to have significant quality assurance deficiencies, were also excluded from the analysis.
- Values reported as too numerous to count (TNTC) were used in the analysis when it was possible to estimate a value based on the dilutions used and/or the maximum reporting limits.
- Values reported as greater than were also used in the analysis. A geometric mean calculated using one or more greater than or TNTC values in the data set was reported as a greater than geometric mean.
- Values reported as less than values of greater than 50 were excluded since acceptable test methods can detect much lower concentrations when appropriate dilutions are used in the analysis. Values reported as 50 or less were used in the analysis. The value used in statistical analysis was one-half

the reported less than value. A value of one was substituted for computing the geometric mean in any case where a value of less than one was reported. Geometric means cannot be calculated using data sets that contain a value of zero.

- Results from duplicate B were used for calculation of the geometric mean in cases where duplicate sample results were reported, except if the *E. coli* densities of the duplicate samples were more than five times apart from one another, in which case both values were rejected.

2. Assessment Unit Analysis

In the second step of the analysis, the assessment status of the WAU or LRAU was determined based on the attainment status of all the individual sites within the assessment unit and within the assessment period (2013-2017) as described in Table F-3 below.

Table F-3 — Determining assessment status of WAUs and LRAUs.

AU Assessment Status	Attainment Status of Individual Locations
Full (Category 1)	Sufficient data exist to assess at least one location within the WAU (or a minimum of one site for every ~5-7 river miles of a LRAU); the geometric mean criteria and STVs are attained at all assessed sites within the AU
Non (Category 5)	Sufficient data exist to assess at least one location within the WAU (or a minimum of one site for every ~5-7 river miles of a LRAU); the geometric mean or STV is exceeded at one or more assessed sites within the AU
Insufficient Data (Category 3)	No data (category 3) or insufficient data (category 3i) to calculate a geometric mean for any site within the WAU (or for a minimum of one site for every ~5-7 river miles of a LRAU)

Inland Lakes

Inland lakes were assessed in a manner like that described above for the rivers and streams. Inland lake data were analyzed on a site-by-site basis, with each resulting geometric mean value compared to the geometric mean criterion applicable to each site. Lake sampling locations generally included a beach and/or open water sites, with five to 10 samples per location. Inland lakes are considered a component of the AU(s) in which they are geographically located, so sample results from lakes may affect the assessment status of the AU(s) and the index scores for the AU(s).

ODNR, as part of Ohio's Bathing Beach Monitoring Program, monitors *E. coli* levels during the summer at public beaches on lakes located in state parks. While Ohio EPA was unable to establish the level of credibility of these data for use in official listing determinations for this report, a summary of the advisory postings for the 68 beaches monitored in the program is included in Table F-19 on page F-31. Though like the beach monitoring program along Lake Erie, there are several differences. Notably, the sampling frequency is much lower at the inland lake beaches compared to the Lake Erie beaches because of funding disparity. Secondly, because of the large geographic area, beach samples from inland lakes are analyzed by a multitude of consulting laboratories across the state.

RU Attainment Index Score

The RU attainment index score provides a way to compare the relative difference between the *E. coli* concentrations at sites sampled within and between AUs and the RU geometric mean criterion that applies to each of the sampled sites. Those AUs having *E. coli* concentrations that tend to be much greater than the applicable criteria had have the lowest scores, while those AUs having *E. coli* concentrations that attain the applicable criteria, or tend to only slightly exceed the applicable criteria, have the highest scores. An index score was assigned for each site having sufficient data to calculate a geometric mean (five or more samples) by comparing the geometric mean *E. coli* concentration at the site to the applicable geometric mean criterion based on the scale depicted in Table F-4.

Table F-4 — Recreation index score matrix.

Site Geometric Mean	Index Score
Meets criterion	100
Exceeds up to 2x criterion	75
Exceeds more than 2x up to 5x criterion	50
Exceeds more than 5x up to 10x criterion	25
Exceeds more than 10x criterion	0

An average index score is computed for AUs with multiple site index scores based on data from multiple sites and/or recreation seasons. Index scores are reported in Table F-15 on page F-21 for the LRAUs. When only one site index score is available for an AU, that index score is used to represent the assessment unit. The index score for the AU is based upon the same scale as described in Table F-4.

F3. Results (*Bacteria*)

Results for the RU attainment analysis are presented in this section and are based on the methodology outlined in the previous section and available *E. coli* data collected from 65 public beaches along Ohio's Lake Erie 312-mile shoreline (14,721 samples) and at more than 250 locations from Ohio's rivers and streams (2,346 samples) including four of Ohio's largest rivers. Samples used in this analysis were collected from 2013 through 2017 during the recreation season of May 1 through October 31.

F3.1 Lake Erie Public Beaches

Information about water quality conditions at Lake Erie public bathing beaches is summarized in Table F-5 through Table F-11 and Figure F-5. The locations of these beaches are shown in Figure F-1 through Figure F-3. The methodology used for assessing the beaches along Ohio's Lake Erie shoreline was consistent in the 2010, 2012, 2014 and 2016 reports. However, as described in section F2, some modifications to the methods for assessing the Lake Erie beach data were made to accommodate the revisions to the WQS that became effective in January 2016.

Table F-5 contains the seasonal geometric mean *E. coli* levels for 17 public beaches along the coast of Lake Erie's western basin for the past five recreational seasons (2013-2017) while Table F-6 contains the seasonal geometric mean *E. coli* levels for 48 public beaches along the coast of Lake Erie's central basin for the past five recreational seasons (2013-2017).

On a seasonal basis, the geometric mean *E. coli* criterion for bathing waters was exceeded at 22 beaches in 2013; 19 beaches in 2014; 16 beaches in 2015; seven beaches in 2016; and three beaches in 2017. The Bay View West and Lakeview beaches were the only beaches documented to exceed the geometric mean criterion on a seasonal basin each of the past five seasons. Not surprisingly, these beaches and others that frequently exceeded the geometric mean criterion on a seasonal basis had among the most days under a swimming advisory during the 2013-2017 reporting period. Highlighted cells in Table F-5 indicate exceedance of the geometric mean criterion on a seasonal basis or exceedance of the BAV more than 10 percent of season. The table also indicates the number of beach advisories for each beach based upon exceedance of the BAV of 235 cfu/100 mL. This is the threshold that triggers the issuance of beach advisories and has been used since 2006. Use of the BAV to post beach advisories complies with the BEACH Act rule (*Water Quality Standards for Coastal and Great Lakes Recreation Waters*, 69 FR 67217, Nov. 16, 2004), which became effective on Dec. 16, 2004.

In Table F-7 through Table F-11, the beaches are arranged alphabetically according to the LEAU in which they are geographically located. The tables indicate the number of days (and the percentage for all years) when Ohio's Lake Erie public beaches exceeded the BAV compared to the total number of days in the recreation season sampling period.

As depicted in Figure F-5, the frequency during which individual beaches were under a swimming advisory based on elevated bacteria levels above the advisory level for the entire five-year reporting period (2013-2017) ranged from near zero at Battery Park, East Harbor State Park, Lakeside and South Bass Island State Park to nearly 40 percent or more at Bay View West, Edson Creek, Euclid State Park, Lakeshore Park, Lakeview, Maumee Bay State Park (Erie), Sherod, Sims, Veteran's, Villa Angela State Park and White's Landing beaches. Considerable variation in the frequency of advisories was observed between beaches and from season-to-season at many beaches. However, several beaches stand out as consistently good performers over the past several recreation seasons, including Battery Park, Bay Park, Catawba Island, Conneaut, East Harbor State Park, Kelleys Island, Lakeside and South Bass Island State Park, which all had a cumulative exceedance frequency of less than 10 percent on a seasonal basis. These beaches infrequently exceeded 10 days per season under advisement. There were also several beaches that consistently performed poorly with three beaches, including Bay View West, Edson Creek and Lakeview under advisement more than 50 percent of the time during the past five recreation seasons on a cumulative basis. High variation in bacteria levels was also seen between seasons for some beaches. For example, Kiwanis beach was under advisement for 44 days in 2015, but under advisement for just seven days in 2016. Crystal Rock beach was under advisement for just two days in 2016, but under advisement for 20 days in 2017. The annual median number of days under advisement for all beaches by calendar year in this reporting cycle was highest in 2013 at 28 days compared to the rest of the reporting years, which had a median number of days under advisement ranging from 10-23 on an annual basis. The annual average geometric mean *E. coli* level for all beaches by year within this reporting cycle ranged from a low of 50.7 in 2017 to a high of 112.0 in 2014.

In previous IR cycles, impairment of the bathing water RU was determined by pooling data from beaches in each of the three LEAUs and calculating the percentage of days in the recreational season when the *E. coli* criterion was exceeded. A threshold of impairment was set at 10 days per season based on the Ohio Lake Erie Commission's evaluation system (Ohio LEC 1998). This translates to a seasonal exceedance frequency of 10 percent, as the recreation season at Lake Erie's beaches in Ohio typically runs from Memorial Day weekend through Labor Day weekend. Results are shown in Table F-11. As in previous assessment cycles, the 2018 assessment results indicate that the Lake Erie Islands assessment unit would fully support the RU on a seasonal basis while the Western basin and Central basin assessment units would not support the RU. The overall total recreation days in exceedance of the bathing waters criterion on a percentage basis was 19.7 percent in the western basin (15 beaches) and 25.8 percent (48 beaches) in the central basin compared to just 3.9 percent for the Lake Erie Islands (two beaches).

With the revision of Ohio's WQS effective Jan. 4, 2016, the averaging period was revised from a seasonal basis to a 90-day period. Furthermore, the revised WQS specify that the STV is not to be exceeded in more than 10 percent of the samples taken during any 90-day period. As such, the Lake Erie beach data were examined to ensure that all the beaches in each of the Lake Erie shoreline AUs during the reporting cycle of 2013-2017 also attained both the geometric mean and STV on a 90-day basis rather than the seasonal basis as has historically been done. As historically observed at numerous beaches in both the Western basin and Central basin on a seasonal basis, numerous beaches failed to attain the criteria on a 90-day basis as well (Table F-9). In fact, of the 65 total Lake Erie beaches monitored, only 23 attained the geometric mean criteria every year during the reporting cycle on a 90-day averaging period basis, while only three beaches attained both the geometric mean and STV criteria every year throughout the monitoring cycle, including

Battery Park, Lakeside, and East Harbor State Park. Kelleys Island State Park exceeded the 90-day geometric mean criterion in 2016 (geomean = 151.7 cfu/100 ml) and exceeded the STV in 2013, 2014, 2016 and 2017 with exceedance frequencies ranging from 11 percent up to 20 percent within 90-day periods. The beach on South Bass Island experienced no exceedances of the 90-day geometric mean criterion, but exceeded the STV in 2013, having an exceedance rate of 20 percent within a 90-day period. As such, the Lake Erie Islands assessment unit is no longer in support of the recreational use, joining the other three LEAUs in nonsupport status.

Table F-5 — Seasonal geometric mean *E. coli* levels and advisory postings at public Lake Erie shoreline beaches in the western basin (Sandusky Bay and west).

Beach	2013		2014		2015		2016		2017	
	Seasonal geomean	number of days posted	Seasonal geomean	number of days posted	Seasonal geomean	number of days posted	Seasonal geomean	number of days posted	Seasonal geomean	number of days posted
Battery Park	8	5	5	0	11	4	11	4	7	0
Bay View East	168	35	212	57	94	21	51	18	62	11
Bay View West	367	62	205	57	142	42	542	76	210	50
Camp Perry	42	9	155	14	84	26	125	13	76	19
Catawba Island	13	0	22	9	47	11	20	0	9	2
Crystal Rock	38	9	42	10	43	18	25	2	24	20
East Harbor	13	5	13	0	10	5	6	2	7	3
Kelleys Island	63	14	43	6	36	0	63	0	33	4
Kiwanis	145	25	98	20	141	44	67	7	38	10
Lakeside	17	4	15	1	12	7	8	0	9	4
Lion's Park	123	31	97	19	54	12	65	22	40	10
Maumee - Erie	97	35	105	40	167	45	150	39	122	34
Maumee - Inland	47	11	87	15	92	28	95	29	151	37
Pickerel Creek	53	12	36	10	68	24	33	13	29	13
Port Clinton	96	30	28	17	48	32	21	7	38	13
South Bass Island	10	4	6	0	7	2	18	0	15	0
Whites Landing	362	57	158	36	158	45	136	36	71	22

Shaded cells indicate exceedance of the geometric mean criterion on a seasonal basis *(seasonal geomean)* or exceedance of the BAV more than 10 percent of the time during a season. The beach season is defined for this analysis as the time *E. coli* monitoring commences, typically in late May though the end of the Labor Day weekend. The number of days posted is determined by counting the number of days the BAV was exceeded. Days for which no monitoring data were collected are presumed to be in exceedance if the preceding day's bacteria level exceeded the BAV. Unmonitored days are presumed to meet the BAV when preceded by a monitored day that was below the BAV. NS = Not Sampled.

Table F-6 — Seasonal geometric mean *E. coli* levels and advisory postings at public Lake Erie shoreline beaches in the central basin (east of Cedar Point).

Beach	2013		2014		2015		2016		2017	
	Seasonal geomean	number of days posted	Seasonal geomean	number of days posted	Seasonal geomean	number of days posted	Seasonal geomean	number of days posted	Seasonal geomean	number of days posted
Arcadia	141	34	209	34	279	39	53	4	82	28
Bay Park	31	14	40	2	59	13	45	3	20	4
Cedar Point	40	14	25	14	35	8	20	7	35	11
Century	36	15	61	33	110	34	19	10	43	13
Chappel Creek	137	46	160	50	110	27	53	26	62	19
Clarkwood	258	45	106	16	117	22	79	4	113	23
Clifton	67	25	112	28	49	22	34	11	44	6
Columbia Park	60	9	68	11	105	20	41	6	67	13
Community Park	NS	NS	105	41	108	29	23	16	36	9
Conneaut	52	21	32	8	24	3	28	2	17	4
Cranberry	54	34	40	28	39	20	21	4	21	17
Darby	182	40	242	66	86	30	56	16	72	22
Edgecliff	147	20	203	37	288	37	41	8	88	19
Edgewater	58	17	52	17	80	22	36	11	30	7
Edson	207	54	580	78	193	56	151	14	NS	NS
Euclid State Park	231	51	131	32	152	42	81	27	100	30
Fairport Harbor	83	26	77	23	96	28	44	23	58	20
Fichtel Creek	64	32	37	17	34	15	30	4	18	9
Geneva State Park	64	27	43	16	29	3	17	0	17	2
Headlands East	54	29	49	12	53	18	45	16	46	15
Headlands West	56	24	49	12	56	18	45	16	46	16
Hoffman Ditch	87	24	61	26	60	25	32	9	39	17
Huntington	71	26	52	34	68	30	38	15	36	12
Huron River East	72	29	62	18	57	28	64	33	54	16
Huron River West	119	46	102	38	161	28	75	11	106	33
Lakeshore Park	263	55	197	50	228	33	308	38	55	0
Lakeview	473	70	394	78	248	65	264	53	195	38
Lakewood Park	NS	NS	92	33	84	28	21	13	33	19
Miller Beach	45	14	76	23	82	19	32	10	39	15
Moss Point	140	33	200	30	113	21	113	11	27	4
Noble	131	35	296	37	96	25	80	10	45	6
Old Woman East	32	26	28	15	27	15	14	2	16	3

Beach	2013 Seasonal geomean	2013 number of days posted	2014 Seasonal geomean	2014 number of days posted	2015 Seasonal geomean	2015 number of days posted	2016 Seasonal geomean	2016 number of days posted	2017 Seasonal geomean	2017 number of days posted
Old Woman West	59	26	72	24	56	24	18	5	26	3
Parklawn	42	9	46	6	47	9	55	9	21	0
Royal Acres	236	46	124	11	104	13	69	6	126	24
Sawmill Creek	72	30	34	17	42	11	24	11	26	12
Sherod Creek	156	41	217	65	89	49	49	19	67	12
Shoreby Club	68	14	77	9	90	14	13	0	23	2
Showse	62	32	73	33	44	24	22	10	28	13
Sims	214	52	328	32	184	32	227	33	91	21
Sugar Creek	180	58	104	52	60	30	46	12	62	13
Utopia	77	22	104	14	235	34	43	2	54	10
Vermilion East	129	39	109	41	65	26	38	16	52	26
Vermilion West	192	45	192	49	143	46	52	9	51	6
Veteran's Beach	116	40	254	51	198	39	53	28	78	27
Villa Angela	231	55	160	40	231	54	122	39	114	39
Wagar	56	14	44	2	65	16	46	9	29	7
Walnut	29	11	32	15	16	14	22	2	10	2

Shaded cells indicate exceedance of the geometric mean criterion on a seasonal basis *(seasonal geomean)* or exceedance of the BAV more than 10 percent of the time during a season. The beach season is defined for this analysis as the time *E. coli* monitoring commences, typically in late May though the end of the Labor Day weekend. The number of days posted is determined by counting the number of days the BAV was exceeded. Days for which no monitoring data were collected are presumed to be in exceedance if the preceding day's bacteria level exceeded the BAV. Unmonitored days are presumed to meet the BAV when preceded by a monitored day that was below the BAV. NS = Not Sampled

Table F-7 — The number of days per season (and the percentage for all years) when Ohio Lake Erie public beaches exceeded the BAV relative to the total number of days in the sampling period, 2013 – 2017, for the central basin shoreline AU.

Beach	2013	2014	2015	2016	2017	All years (%)
Arcadia Beach	34/97	34/97	39/104	4/97	28/98	139/493 (28.2%)
Bay Park Beach	14/98	2/98	13/105	3/98	4/98	36/497 (7.2%)
Century Beach	15/98	33/106	34/113	10/106	13/106	105/529 (19.8%)
Clarkwood Beach	45/97	16/96	22/104	4/97	23/97	110/491 (22.4%)
Clifton Beach	25/98	28/98	22/105	11/98	6/98	92/497 (18.5%)
Columbia Park Beach	9/98	11/98	20/105	6/98	13/96	59/495 (11.9%)
Community Park Beach	NS	41/106	29/113	16/106	9/106	95/431 (22.0%)
Conneaut Township Park	21/98	8/102	3/92	2/76	4/92	38/460 (8.3%)
Edgecliff Beach	20/97	37/97	37/104	8/97	19/97	112/492 (22.7%)
Edgewater State Park	17/104	17/106	22/109	11/104	7/102	74/525 (14.1%)
Euclid State Park	51/104	32/106	42/109	27/104	33/109	185/532 (34.59%)
Fairport Harbor	26/100	23/102	28/112	23/102	20/106	120/522 (23.0%)
Geneva State Park	27/98	16/106	3/92	0/76	2/92	48/464 (10.3%)
Headlands State Park East	29/100	12/102	18/112	16/106	15/106	90/526 (17.1%)
Headlands State Park West	24/100	12/102	18/113	16/106	16/106	86/527 (16.3%)
Huntington Beach	26/116	34/106	30/113	15/106	12/106	117/547 (21.4%)
Lakeshore Park	55/98	50/102	33/92	38/76	0/92	176/460 (38.3%)
Lakewood Beach	NS	33/106	28/113	13/99	19/106	93/424 (21.9%)
Miller Beach	14/98	23/98	19/105	10/99	15/106	81/506 (16.0%)
Moss Point Beach	33/97	30/97	21/104	11/97	4/97	99/492 (20.1%)
Noble Beach	35/97	37/97	25/104	10/97	6/97	113/492 (23.0%)
Parklawn Beach	9/98	6/97	9/105	9/98	0/98	33/496 (6.7%)
Royal Acres Beach	46/97	11/97	13/104	6/97	24/97	100/492 (20.3%)
Shoreby Club Beach	14/97	9/97	14/104	0/97	2/97	39/492 (7.9%)
Sims Beach	52/97	32/97	32/104	33/97	21/97	170/492 (34.6%)
Utopia Beach	22/97	14/97	34/104	2/97	10/98	82/493 (16.6%)
Veteran’s Beach	40/98	51/98	39/105	28/99	27/106	185/506 (36.6%)
Villa Angela State Park	55/104	40/106	54/109	39/104	39/110	227/533 (42.6%)
Wagar Beach	14/98	2/98	16/105	9/98	7/92	48/491 (9.8%)
Walnut Beach	11/98	15/102	14/92	2/76	2/92	44/460 (9.6%)

Table F-8 — The number of days per season (and the percentage for all years) when Ohio Lake Erie public beaches exceeded the BAV relative to the total number of days in the sampling period, 2013 – 2017, for the western basin shoreline AU.

Beach	2013	2014	2015	2016	2017	All years (%)
Camp Perry	9/84	14/64	26/113	13/106	19/106	81/473 (17.1%)
Catawba Island State Park	0/84	9/106	11/113	0/106	2/104	22/513 (4.3%)
East Harbor State Park	5/84	0/106	5/113	2/106	3/106	15/515 (2.9%)
Lakeside	4/84	1/106	7/113	0/106	4/106	16/515 (3.1%)
Maumee Bay State Park (inland)	11/98	15/98	28/105	29/103	37/98	120/502 (23.9%)
Maumee Bay State Park (Erie)	35/98	40/98	45/105	39/103	34/98	193/502 (38.4%)
Port Clinton	30/84	17/106	32/113	7/106	13/106	99/515 (19.2%)

Table F-9 — The number of days per season (and the percentage for all years) when Ohio Lake Erie public beaches exceeded the BAV relative to the total number of days in the sampling period, 2013 – 2017, for the islands shoreline AU.

Beach	2013	2014	2015	2016	2017	All years (%)
Kelleys Island State Park	14/84	6/106	0/111	10/106	4/106	34/513 (6.6%)
South Bass Island State Park	4/84	0/106	2/113	0/106	0/104	6/513 (1.2%)

Table F-10 — The number of days per season (and the percentage for all years) when Ohio Lake Erie public beaches exceeded the BAV relative to the total number of days in the sampling period, 2013 – 2017, for the Sandusky basin shoreline AU.

Beach	2013	2014	2015	2016	2017	All years (%)
Battery Park	5/98	0/106	4/113	0/106	0/106	9/529 (1.7%)
Bay View East	35/97	57/106	21/113	18/106	11/105	142/528 (26.9%)
Bay View West	62/97	57/106	42/113	76/106	50/106	287/528 (54.4%)
Cedar Point Chausee	14/98	14/106	8/113	7/106	11/106	54/529 (10.2%)
Chappel Creek	46/98	50/106	27/113	26/106	19/106	168/529 (31.8%)
Cranberry Creek	34/98	28/106	20/113	4/106	17/106	103/529 (19.5%)
Crystal Rock	9/98	10/106	18/113	2/106	20/106	59/529 (11.2%)
Darby Creek	40/98	66/106	30/113	16/106	22/106	174/529 (32.9%)
Edson Creek	54/98	78/106	56/113	14/45	NS	202/362 (55.8%)
Fichtel Creek	32/98	17/106	15/113	4/106	9/106	77/529 (14.6%)
Hoffman Ditch	24/98	26/106	25/113	9/106	17/106	101/529 (19.1%)
Huron River East	29/98	18/106	28/113	33/106	16/106	114/529 (21.6%)
Huron River West	46/98	38/106	28/113	11/82	33/106	178/505 (35.2%)
Kiwanis	25/98	20/106	44/113	7/106	10/106	106/529 (20.0%)
Lakeview Beach	70/99	78/106	65/113	53/106	38/106	304/530 (57.4%)
Lion’s Park	31/98	19/106	12/113	22/106	10/106	94/529 (17.8%)
Old Woman Creek East	26/98	15/106	15/113	2/106	3/106	61/529 (11.5%)
Old Woman Creek West	26/98	24/106	24/113	5/106	3/106	82/529 (15.5%)
Pickerel Creek	12/98	10/106	24/113	13/106	13/106	72/529 (13.6%)
Sawmill Creek	30/98	17/106	11/113	11/106	12/106	81/529 (15.3%)
Sherod Creek	41/98	65/106	49/113	19/106	12/106	186/529 (35.2%)
Showse Park	32/98	33/106	24/113	10/106	13/105	112/528 (21.2%)
Sugar Creek	58/98	52/106	30/113	12/106	13/106	165/529 (31.2%)
Vermilion River East	39/98	41/106	26/113	16/106	26/106	148/529 (28.0%)
Vermilion River West	45/98	49/106	46/113	9/106	6/106	155/529 (29.3%)
Whites Landing	57/98	36/106	45/113	36/106	22/106	196/529 (37.1%)

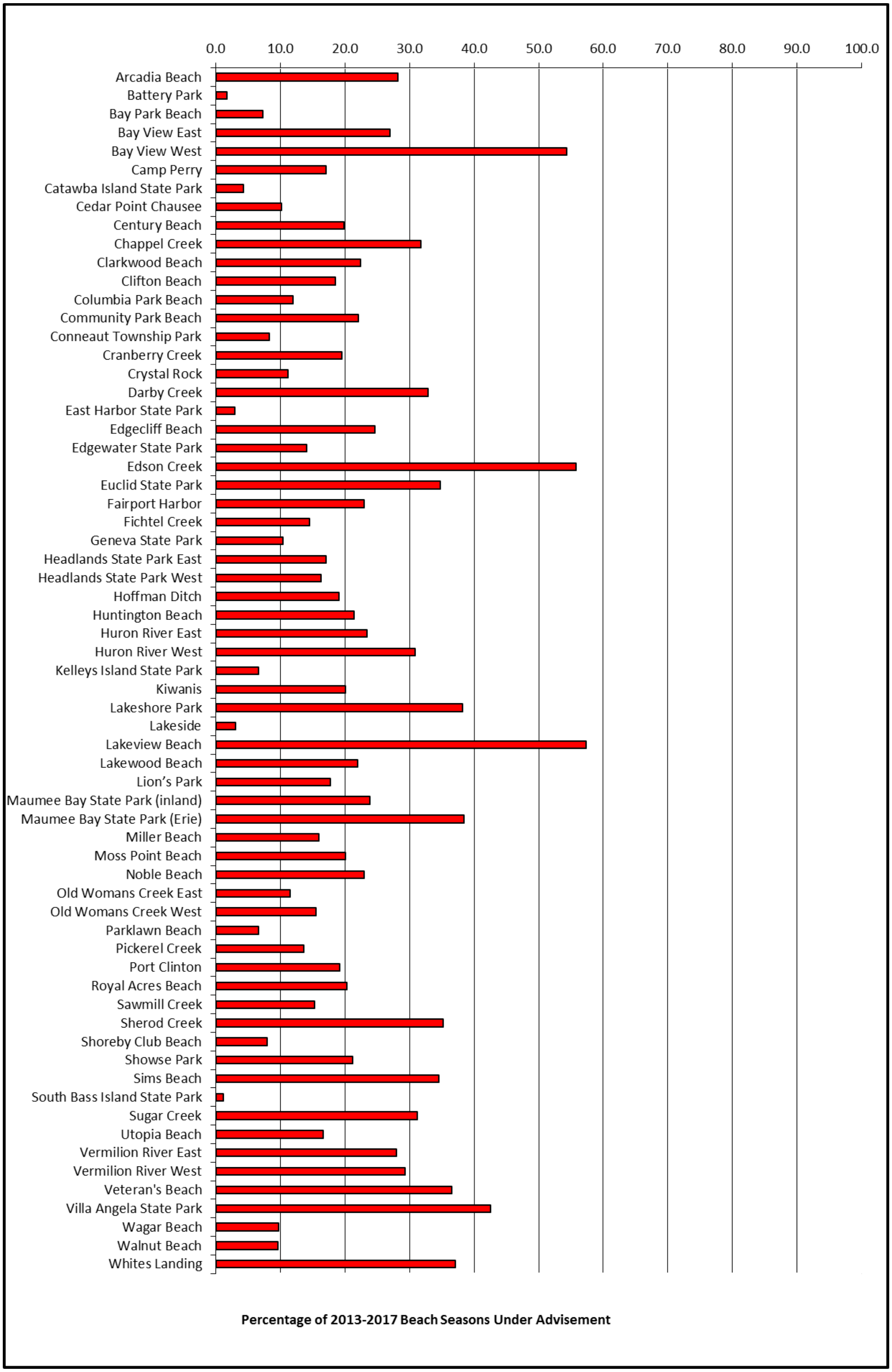


Figure F-5 — Frequency of advisory postings at Ohio's Lake Erie public beaches.

Table F-11 — Aggregated exceedance frequencies at 65 Lake Erie public beaches from 2013-2017 (pooled by Lake Erie shoreline AU to report use support).

	Western Basin	Central Basin	Sandusky Basin	Lake Erie Islands
Number of beaches	7	30	26	2
Total recreation days	3,535	14,857	13,561	1,026
Total days in exceedance	546	3,005	3,426	40
Percentage of days in exceedance	15.4%	20.2%	25.3%	3.9%
Total beach seasons[1]	35	148	129	10
Average # of days *E. coli* BAV exceeded per beach per season[2]	15.6	20.3	26.6	1.0
Number of beaches exceeding 90-d geomean one or more years during reporting cycle[3]	5	22	14	1
Number of beaches exceeding STV within a 90-day period in one or more years during the reporting cycle[3]	5	30	25	2
Attainment status	Does not support	Does not support	Does not Support	Does not Support

[1] The total number of beach seasons in a basin is equal to aggregated sum of the total number of beaches for which monitoring was conducted during each season for the 2013-2017 reporting period.
[2] Calculated by dividing the total days in exceedance in the basin by the total number of beach seasons in the basin.
[3] Used to determine attainment status.

F3.2 Rivers and Streams

Ohio's RU support analysis is based on an examination of *E. coli* data collected from Ohio's rivers, streams and inland lakes during the recreation season. Approximately 2,346 bacteria measurements were evaluated for the 2018 RU support analysis of streams, rivers and inland lakes in Ohio. This is down sharply from the 2016 assessment, in which 18,400 bacteria measurements were used. The primary reason for this decline was the revision of the recreational water quality standards, which now expresses the applicable criteria over a 90-day period rather than the entire recreation season (May 1-October 31) combined with the minimum data requirement of at least five or more samples to make an assessment starting with this reporting cycle. As a result, data from 2013-2015 were not useable for this reporting cycle. Assessments made based on data from 2013-2015, as well as data collected prior to 2013 are all considered historic. Therefore, assessments for this cycle consist of data collected by Ohio EPA in 2016 and 2017 and any discharger data from these years where there were five or more samples collected within a 90-day period. In anticipation of the revisions to the Ohio WQS as described above, Ohio EPA revised its bacteria sampling strategy beginning with the 2016 field season to collect data that would facilitate the recreational assessment of WAUs and LRAUs contained in the 2016 study areas. This transition was successfully executed and repeated in the 2017 field season resulting in data used to support the updates reported in this IR cycle. Data collected in subsequent field seasons will be consistent with this approach to support the recreational assessments for 2020 reporting cycle, which will be based on data collected from 2016 through 2019.

In the 2016 report, approximately 60 percent of the data used came from NPDES dischargers while the remaining 40 percent came from data collected by Ohio EPA. In the 2018 report, relatively little data came from NPDES dischargers. While much of the data collected from NPDES dischargers was useful for RU assessment purposes in previous IR cycles when the WQS were based on a seasonal averaging period, the *E. coli* data collection frequency is generally too dispersed across the recreation season and too infrequent to support its usage in the 2018 IR given the minimum data requirements and the new 90-day averaging period. In this report, approximately 20 percent of the data are from NPDES dischargers while the remaining 80 percent was generated by Ohio EPA.

Table F-12 provides a summary of Ohio EPA's RU monitoring effort and its translation to use assessment annually for the past seven recreation seasons. Sample collection in the 2016-2017 biennium was down by about one-third compared to the previous biennium.

Table F-12 — Annual Ohio EPA *E. coli* sampling effort and RU assessment (using Ohio EPA data) in Ohio streams, rivers and inland lakes, 2011-2017 recreation seasons.

	2011	2012	2013	2014	2015	2016	2017
Number of samples collected by Ohio EPA	1,674	1,173	1,635	1,423	1,231	926	900
Number of site geometric means computed	276	219	269	222	219	119	137
Number of unique WAUs assessed	130	92	131	121	115	83	73
Number of unique LRAUs assessed	3	5	2	1	0	1	5

The *E. coli* data used in this report collected by Ohio EPA staff was typically collected as part of routine ambient monitoring associated with annual drainage basin surveys conducted around the state. Using the methodology described in Section F2, it was possible to determine the RU attainment status of 164 of the 1,538 (11 percent) WAUs in Ohio based on current data (2016-2017). This figure includes those WAUs in which data were collected between 2016 and 2017, regardless of the category of the AU. Ohio has completed total maximum daily loads (TMDLs) for bacteria in 449 of the 1,538 WAUs in Ohio (29 percent), unchanged from the previous IR cycle. As previously estimated, Ohio's sampling effort will be sufficient to maintain a current assessment status for less than half of the WAU's in Ohio. In fact, the estimate is closer to 40 percent if the sampling effort from 2016 and 2017 becomes representative of future sampling effort.

The overall attainment and impairment rates and the changes between reporting years are summarized in Table F-13. Attainment and impairment rates in Table F-13 are based on the total number of watersheds for which sufficient data were available in the respective reporting cycle and not on the total number of assessment units in the state. For the 170 assessment units having sufficient data available to determine the RU assessment status in 2018, eight percent fully supported the use while 92 percent did not support the use. These results are comparable to the results from previous cycles that consistently show only a relatively small proportion of the state's watersheds demonstrate full support of the RU. Only 15 percent of the individual stream locations sampled by Ohio EPA in 2015 and 2016 were found to attain the applicable recreation criteria.

Table F-13 — Overall differences in the assessment of RU attainment, 2010-2018.

	2010 Report		2012 Report		2014 Report		2016 Report		2018 Report	
	No.	%	No.	%	No.	%	No	%	No	%
Total AUs[a]	1,576	100	1,576	100	1,576	100	1,576	100	1,576	100
Assessed	487	31	588	37	680	43	713	45	170	11
Not Assessed	1,089	69	988	63	896	57	863	55	1,406	89
Supporting Use[b]	65	13	88	15	130	19	73	10	14	8
Not Supporting Use[b]	422	87	500	85	550	81	640	90	156	92

[a] Includes LRAUs.

[b] Note: The percentage of AUs reported as supporting the RU and not supporting the RU are based on the total AUs that were assessed (e.g., 187 in the 2018 analysis).

RU Attainment Index Score

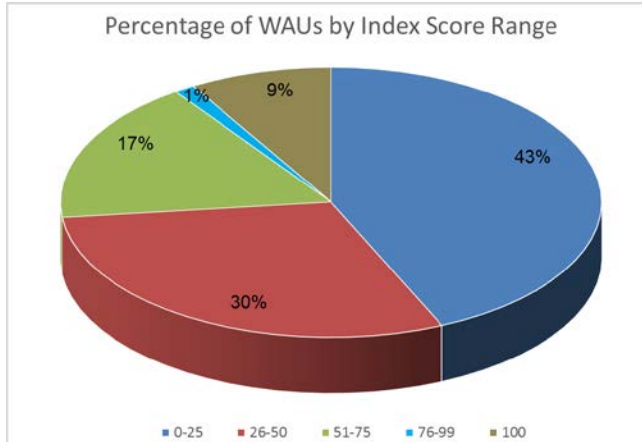


Figure F-6 — Histogram of RU index scores for Ohio's WAUs

Since assessment units can often be composed of monitoring sites having a range of *E. coli* geometric means and the range of impairment can be wide between assessment units, an RU index was developed to provide some differentiation between those assessment units composed of monitoring sites that greatly exceed the criteria versus those where exceedances are comparably low. The index scores also serve as a useful tool in the TMDL prioritization process (see Section J for more details). Index scores were only assigned to those assessment units for which sufficient *E. coli* monitoring data were available to assess the RU support as described in Section F2. Index scores range from 0-100 depending on the magnitude of exceedance of the site(s) from the applicable criterion within the AU. An index score of 100 indicates that all sites sampled within the AU fully attained the applicable geometric mean *E. coli* criterion, while lower scores indicate a progressively greater average level of exceedance from the criteria for monitored sites within the AU. Figure F-6 summarizes the index scores for the WAUs. The median WAU index score for the 2016 reporting cycle slipped to 63, slightly lower than the median WAU index score of 70 for the 2014 reporting cycle and very similar to the medians of 63 and 65 for the 2012 and 2010 reporting cycles, respectively. This underscores the observation that most sites assessed fail to meet the geometric mean by a significant margin, as opposed to narrowly missing the mark.

The RU attainment status of Ohio's 1,538 WAUs is summarized in Table F-14. This table differs slightly from the summary presented in Table F-13 as this table accounts for those watersheds for which TMDLs have been completed and placed into category 4A and it also includes historic categorizations carried over from previous reporting cycles. WAUs attaining the recreational WQS appear to have leveled off at around 10 percent while WAUs for which a TMDL has been completed have also held steady at just under 30 percent. WAUs not supporting the recreation use, and in need of a TMDL, increased to 50 percent. The number of WAUs that have never been assessed for recreational use attainment fell to just 12 percent. Bacteria data collected in support of the past five IR cycles clearly shows that the swimmable goal of the CWA is largely unsupported across Ohio with very little improvement evident in the data. Because of the ubiquitous nature of the problem, a statewide TMDL followed by more intense and substantial focus on implementation activities in cooperation with local partners to identify and address bacteria loading sources could be a logical option in moving more of the WAUs toward attainment goals. This should be coupled with continued monitoring to measure success.

Table F-14 — Summary assessment status of the RU in Ohio's WAUs by Assessment Cycle[1].

Assessment Category	Number of Assessment Units Categorized					Percentage of Assessment Units Categorized				
	2010	2012	2014	2016	2018	2010	2012	2014	2016	2018
1	59	103	141	153	141	4%	7%	9%	10%	9%
3	888	673	511	252	182	58%	44%	33%	16%	12%
4	266	341	425	449	449	17%	22%	28%	29%	29%
5	325	421	461	685	766	21%	27%	30%	45%	50%
Total	**1,538**	**1,538**	**1,538**	**1,538**	**1,538**	**100%**	**100%**	**100%**	**100%**	**100%**

In addition to Ohio's 1,538 WAUs, there are also 23 large rivers in Ohio, eight of which are further divided into two or more subdivisions for a total of 38 large river assessment units. Large river assessment units have drainage areas greater than 500 square miles and comprise, in total, 1,236 river miles in the state. The large river assessment units were analyzed independently of the WAUs through which they flow and LRAU data were not included in WAU assessments. Table F-15 summarizes the results of the analysis of *E. coli* data for the large river assessment units and the resulting RU support determinations and index scores. Sufficient data were available to determine the use support status for just six of the 38 LRAUs (16 percent) in the 2018 reporting cycle. While this appears to be less compared to the 2016 cycle (17 of 38 LRAUs or 45 percent) and the 2014 cycle (16 of 38 LRAUs or 42 percent), the assessments for this cycle are based on data collected over a two-year period, compared to five years for the 2014 and 2016 cycle. Projecting the 2016-2017 sampling effort over a five-year period would result in 15 of 38 LRAUs assessed or 39 percent, which would be similar to the two previous report cycles.

The six LRAU subdivisions evaluated in this cycle had an average spatial sampling frequency ranging from 1.8 to 7.5 stream miles. All six of the LRAUs evaluated in this cycle failed to support the recreation use. However, two of the lower Tuscarawas River segments came close, with one scoring a 94 and another having an index score of 82. It should be noted that the Huron River mainstem, although not an LRAU, was also documented to fully support the recreation use.

[1] See Section J for assessment category descriptions.

Table F-15 — Summary assessment status of the RU in Ohio's LRAUs.

LRAU	Length (miles)	Number Sampling Stations	Avg Length per station (miles)	Index Score	Assess. Category	Last Assess.
Auglaize River – Ottawa River to the mouth	12.86	0	n/a	n/a	1h	2012
Blanchard River – Dukes Run to the mouth	35.65	0	n/a	n/a	3	2005
Cuyahoga River – Brandywine Creek to the mouth	25.34	14	1.8	48	4Ax	2017
Grand River – Mill Creek to the mouth	41.28	0	n/a	n/a	4Ah	2004
Great Miami River – Tawawa Creek to Mad River	48.93	0	n/a	n/a	5h	2009
Great Miami River- Mad River to Fourmile Creek	43.10	0	n/a	n/a	5h	2010
Great Miami River – Fourmile Creek to the mouth	38.38	0	n/a	n/a	5h	2010
Hocking River – Scott Creek to Margaret Creek	32.58	0	n/a	n/a	5h	2004
Hocking River – Margaret Creek to the mouth	36.38	0	n/a	n/a	5h	2004
Licking River	23.21	0	n/a	n/a	5h	2008
Little Miami River – Caesar Creek to O'Bannon Cr.	26.92	0	n/a	n/a	4Ah	2007
Little Miami River – O'Bannon Creek to the mouth	24.00	0	n/a	n/a	4Ah	2007
Mad River – Donnels Creek to the mouth	18.38	0	n/a	n/a	5h	2003
Mahoning River – Eagle Cr. to Pennsylvania border	35.39	0	n/a	n/a	5h	2013
Maumee River – Indiana state border to Tiffin R.	42.11	0	n/a	n/a	5h	2012
Maumee River – Tiffin River to Beaver Creek	34.44	0	n/a	n/a	5h	2012
Maumee River – Beaver Creek to Maumee Bay	31.32	0	n/a	n/a	5h	2012
Mohican River	27.58	0	n/a	n/a	5h	2007
Muskingum River – Walhonding River to Licking R.	34.94	0	n/a	n/a	5h	2006
Muskingum River – Licking River to Meigs Creek	46.78	0	n/a	n/a	5h	2006
Muskingum River – Meigs Creek to the mouth	29.42	0	n/a	n/a	5h	2006
Paint Creek – Paint Creek Lake dam to the mouth	39.17	0	n/a	n/a	5h	2006
Raccoon Creek – Little Raccoon Creek to the mouth	37.55	5	7.5	40	5	2016
Sandusky River – Tymochtee Creek to Wolf Creek	43.00	0	n/a	n/a	4Ah	2009
Sandusky River – Wolf Creek to Sandusky Bay	22.73	0	n/a	n/a	4Ah	2009
Scioto River – Little Scioto River to Olentangy River	32.70	0	n/a	n/a	3i	2009
Scioto River – Olentangy River to Big Darby Creek	31.42	0	n/a	n/a	5h	2011
Scioto River – Big Darby Creek to Paint Creek	37.30	0	a/n	n/a	5h	2011
Scioto River – Paint Creek to Sunfish Creek	36.68	0	n/a	n/a	1h	2011
Scioto River – Sunfish Creek to mouth	26.82	0	n/a	n/a	3	2011
Stillwater River – Greenville Creek to the mouth	32.38	0	n/a	n/a	5h	2013
Tiffin River – Brush Creek to the mouth	19.67	0	n/a	n/a	5h	2013
Tuscarawas River – Chippewa Creek to Sandy Cr.	30.12	6	5.0	54	5	2017
Tuscarawas River – Sandy Creek to Stillwater Cr.	26.05	7	3.7	82	5	2017
Tuscarawas River – Stillwater Creek to mouth	47.05	9	5.2	94	5	2017
Walhonding River	23.19	0	n/a	n/a	1h	2010
Whitewater River – Indiana border to the mouth	8.26	3	2.8	58	5	2017
Wills Creek – Salt Fork to the mouth	44.06	0	n/a	n/a	5h	2014

Legend			
Last assessed in:	2017-2013	2012-2008	2007-2003
Number LRAU Segments	10	16	12
Percent LRAU Segments	26%	42%	32%

F3.3 Inland Lakes

Data availability for inland lakes is relatively limited compared to that for streams and rivers. A total of 424 samples were collected from 50 different lakes in the period 2013-2017. Lakes were typically sampled at an open water location (L-1), with some larger lakes sampled at multiple open water locations (L-2, L-3). Samples were also collected at beach locations for those lakes having a swimming beach. Samples were also sometimes collected at other locations of interest, such as boat ramps, marinas and water supply intakes. The revision of the recreational WQS that became effective on Jan. 4, 2016, revised the averaging period from seasonal to 90 days. As a result, *E. coli* monitoring has largely been dropped as part of the routine inland lakes sampling by Ohio EPA because the collection of five samples within the 90-day window is not compatible with the primary mission of inland lake sampling, which is assessment of the trophic condition of the lake. Ohio EPA's sampling of inland lakes normally occurs monthly during the warmer months of the year. ODNR maintains a sampling program at state park beaches described later in this section. Additional details on the inland lakes sampling program can be found on Ohio EPA's webpage at: ***epa.ohio.gov/dsw/inland_lakes/index.aspx***.

Table F-18 summarizes the *E. coli* data collected at inland lakes at selected sample locations. These data were not included as part of the assessment of the WAUs since sufficient sample collections did not occur within the 90-day averaging period, but they are reported to provide some indication of the performance at individual lakes. As in the past, geometric means were generally found to be very low both at open water locations and at beach or other locations sampled. Based on the geometric means, the inland lakes sampled in 2013-2017 were below the geometric mean of 126 cfu/100 mL at all locations sampled, although it is notable that bacteria levels were observed to occasionally spike above the 235 *E. coli*/100 mL water single sample criterion typically used as the threshold for posting a swimming advisory at a beach.

Table F-16 — Summary assessment status of the RU for inland lakes, 2013-2017.

Lake		Sample Location	Sample Year	Number of Samples	Geometric Mean	Maximum Value
Alum Creek	L-1	Open Water	2013	5	11	20
		Open Water	2014	5	24	60
	L-2	Open Water	2014	4	40	290
Amann Reservoir		Open Water	2016	5	12	30
Amicks Reservoir		Open Water	2016	5	10	10
Archbold Reservoir #3		Open Water	2013	5	3	6
		Open Water	2014	5	4	16
Atwood Lake	L-1	Open Water	2016	5	7	32
	L-2	Open Water	2016	3	1	2
	L-3	Open Water	2016	3	3	8
	L-4	Open Water	2016	4	10	740*
Barberton Reservoir	L-1	Open Water	2016	4	4	11
	L-2	Open Water	2016	4	3	6
	L-3	Open Water	2016	4	6	20
	L-4	Open Water	2016	4	124	360
Barton Lake		Open Water	2013	5	2	3
		Open Water	2014	5	5	130
Bucyrus Reservoir #4		Open Water	2016	5	10	10
Cambridge Reservoir		Open Water	2014	5	13	40
		Open Water	2015	4	7	5
Clendening Reservoir		Open Water	2013	5	10	10
Coe Lake		Open Water	2014	4	23	91
		Open Water	2015	4	14	72
Cutler Lake		Open Water	2017	5	11	20

Lake		Sample Location	Sample Year	Number of Samples	Geometric Mean	Maximum Value
Delaware Lake		Open Water	2016	5	30	560*
Delta Reservoir		Open Water	2015	5	2	2
Delphos Reservoir		Open Water	2014	5	2	8
		Open Water	2015	4	2	15
Evans Lake		Water Intake	2013	4	11	50
Findley Lake		Open Water	2013	4	4	14
		Beach	2013	4	18	120
Forked Run Lake		Open Water	2015	7	16	50
		Open Water	2016	5	18	50
Hoover Reservoir	L-1	Open Water	2013	4	32	500*
		Open Water	2014	5	23	200
	L-3	Open Water	2014	4	34	450*
Jackson Lake		Boat Ramp	2016	3	25	40
		Open Water	2016	2	205	300
Lake Alma		Boat Ramp	2016	3	62	180
		Open Water	2016	2	10	10
Lake Hamilton		Water Intake	2013	3	8	69
Lake Hope		Open Water	2016	5	12	30
Lake Rupert		Boat Ramp	2016	3	10	10
		Open Water	2016	2	10	40
Lake Waynoka		Open Water	2016	4	4	11
		Beach	2016	4	10	43
Leesville Lake	L-1	Open Water	2016	5	1	4
	L-2	Open Water	2016	5	1	2
	L-3	Open Water	2016	4	1	3
McKelvey Lake		Water Intake	2013	4	9	28
McKarns Lake		Open Water	2013	5	2	3
		Open Water	2014	5	2	2
Meander Reservoir		Water Intake	2013	5	6	15
Mosquito Creek Reservoir	L-1	Open Water	2013	4	9	30
		Open Water	2014	3	4	21
	L-2	Open Water	2013	4	4	5
		Open Water	2014	5	4	21
	L-3	Open Water	2013	4	5	10
		Open Water	2014	4	4	10
	Dam	Open Water	2013	3	83	230
		Open Water	2014	4	23	190
Nettle Lake		Open Water	2013	5	3	8
		Open Water	2014	5	5	10
New Concord Reservoir		Open Water	2014	5	12	30
		Open Water	2015	5	8	10
Norwalk Reservoir		Open Water	2016	3	7	20
Piedmont Reservoir		Open Water	2013	6	10	10
		Essex Bay	2013	5	14	30
Salt Fork Lake	L-1	Open Water	2014	6	22	100
		Open Water	2015	5	31	350
	L-2	Open Water	2014	6	10	10
		Open Water	2015	5	11	20
Senecaville Lake		Open Water	2014	6	13	50
		Open Water	2015	4	26	40
Stonelick Reservoir		Open Water	2013	5	28	5,820*

Lake	Sample Location	Sample Year	Number of Samples	Geometric Mean	Maximum Value
Summit Lake	Open Water	2013	7	33	96
Timber Ridge Lake	Open Water	2017	5	10	10
Tappan Lake	Open Water	2013	5	11	20
	Beach	2013	4	24	80
Tycoon Lake	Boat Ramp	2016	3	10	10
Van Wert Reservoir #2	Open Water	2014	5	2	5
	Open Water	2015	4	7	140
Veto Lake	Open Water	2015	3	15	70
		2016	5	21	110
Veto Lake-Plum Run Arm	Open Water	2015	8	59	2,500*
Wallace Lake	Open Water	2014	4	33	110
	Open Water	2015	2	30	37
Waynoka Lake	Open Water	2015	5	6	28
	Beach	2015	3	18	44
Wellington Reservoir	Boat Ramp	2013	4	14	49
	Open Water	2013	5	2	6
Wills Creek Reservoir	Open Water	2014	5	25	100
	Open Water	2015	3	37	130
Winton Lake	Campground	2013	5	40	326
	Campground	2014	5	43	1,120*
Woodsfield Reservoir	Open Water	2016	5	25	200

*Value exceeds the STV of 235 cfu/100mL.
**Value exceeds the geometric mean bathing water criterion of 126 cfu/100mL.

ODNR's Division of Parks and Recreation also conducts routine bacteria sampling of public bathing beaches at inland state park beaches pursuant to Ohio Revised Code sections 1541.032 and 3701.18. Advisory signs are posted whenever notified by the director of the Ohio Department of Health that the bacteria levels in the waters tested present a possible health risk to swimmers. Advisory postings are recommended whenever the *E. coli* density of a water sample exceeds the bathing water BAV of 235 cfu/100 mL. Sampling frequency at the inland state park beaches is generally once every two weeks. This sampling frequency is much less intense compared to sampling frequency at many of the Lake Erie beaches, which typically occurs at a frequency of four or more days per week.

Table F-17 summarizes the advisory postings from 2013 through 2017 at 51 of the state's inland state park beaches. Beaches at which more than 10 percent of the samples collected over a recreation season exceeded the BAV of 235 cfu/100 mL are highlighted. The inland lake data from ODNR are presented in the IR for informational purposes and not for official use support determinations since the level of data credibility was indeterminate at the publication of this report. Its inclusion here is intended to notify readers of the existence of this sampling program for these popular recreational resources in Ohio and to provide some information as to the relative amount of data and relative water quality conditions with respect to bacteria indicators. Should Ohio EPA affirm the data as Level 3 credible data in the future, it will be considered in the process for making official use support determinations.

Table F-17 — Swimming advisory postings at Ohio's inland lake public beaches (2013-2017).

Park	Beach	County	2013[a]	2014[a]	2015[a]	2016[a]	2017[a]	Total[a]
Alum Creek	Main	Delaware	2/10	3/10	2/9	2/10	3/11	12/50
	Camp	Delaware	0/9	2/10	1/8	0/8	0/8	3/43
Atwood Lake		Carroll	--	--	--	17/44	3/28	20/82
Barkcamp		Belmont	1/8	0/8	0/12	0/9	0/7	1/44
Blue Rock		Muskingum	0/8	2/10	2/10	4/10	0/7	8/45
Buck Creek	Main	Clark	8/51	0/8	1/9	2/9	0/8	11/85
	Camp	Clark	0/5	0/9	0/8	0/7	0/8	0/37
Buckeye Lake	Crystal Beach	Fairfield	3/8	10/15	3/4	0/1	5/7	21/35
	Fairfield Beach	Fairfield	0/8	8/14	3/4	--	2/7	13/33
	Brooks Park	Fairfield	8/12	8/14	3/3	--	--	19/29
Burr Oak	Main	Athens	0/9	0/7	1/10	0/9	0/8	1/43
	Lodge	Athens	--	--	0/4	0/2	--	0/6
Caesar Creek	North	Warren	0/7	0/8	3/11	1/9	0/8	4/43
	South	Warren	6/10	3/9	1/11	3/9	4/10	17/49
Charles Mill Lake		Ashland	--	--	--	0/1	7/23	7/24
Cowan Lake	Main (S)	Clinton	0/7	0/8	2/11	0/7	0/8	4/42
	Camp (N)	Clinton	0/7	1/9	1/10	0/7	0/8	2/41
Deer Creek		Pickaway	0/8	0/8	0/10	0/7	5/10	5/41
Delaware		Delaware	0/6	2/7	3/9	4/10	3/10	6/36
Dillon		Muskingum	4/10	5/12	6/11	1/9	4/10	20/52
East Fork	Main	Clermont	0/14	0/7	0/16	0/15	2/16	2/68
	Camp	Clermont	0/14	0/10	0/16	0/15	--	0/55
Findlay		Lorain	0/6	0/8	0/9	0/8	0/5	0/36
Forked Run		Meigs	0/8	0/7	2/12	1/7	1/7	4/41
Grand Lake St. Marys	Main East	Auglaize	1/7	2/10	2/9	3/9	0/9	8/44
	Main West	Auglaize	4/8	4/11	3/11	2/9	0/9	13/48
	Camp	Auglaize	1/7	3/10	1/9	4/11	3/10	12/47
	Windy Point	Auglaize	2/8	1/9	4/10	2/8	2/9	11/44
Guilford Lake	Main	Columbiana	1/7	1/8	0/7	0/6	0/8	2/36
	Camp	Columbiana	0/7	1/8	0/7	0/6	1/8	2/36
Harrison Lake		Fulton	0/3	1/9	1/10	2/9	1/8	5/39
Hueston Woods		Preble	1/12	2/13	1/9	0/8	0/8	4/50
Indian Lake	Fox Island	Logan	0/7	0/3	0/9	2/10	1/9	3/38
	Camp	Logan	0/7	0/3	1/9	0/8	2/9	3/36
	Oldfield	Logan	1/8	0/3	1/9	0/8	0/8	2/36
Jackson Lake		Jackson	1/6	1/9	2/10	2/8	1/8	7/41
Jefferson Lake		Jefferson	0/6	1/9	1/8	0/8	0/8	2/39
Kiser Lake		Champaign	0/7	2/8	2/9	1/9	1/8	6/41
Lake Alma	#1-West	Vinton	0/7	1/9	0/6	0/8	0/8	1/38
Lake Hope		Vinton	2/8	0/7	0/8	0/8	1/8	3/39
Lake Logan		Hocking	0/8	1/11	0/8	0/7	3/11	4/45
Lake Loramie		Shelby	2/10	1/7	5/12	3/11	1/10	12/50
Lake Milton		Mahoning	0/5	2/11	0/8	1/9	0/6	3/39
Lake White		Pike	0/7	0/7	--	--	--	0/14
Madison Lake		Madison	1/7	1/9	6/12	5/11	5/10	18/49
Mosquito		Trumbull	3/8	0/7	3/9	2/7	0/8	8/39
Munroe Falls		Summit	--	--	--	0/10	--	0/10
Paint Creek		Ross	0/7	1/8	0/8	1/9	1/8	3/40
Pike Lake		Pike	1/8	--	2/7	3/9	7/11	13/35
Pleasant Hill		Richland	--	--	--	0/1	0/24	0/25

Park	Beach	County	2013[a]	2014[a]	2015[a]	2016[a]	2017[a]	Total[a]
Portage Lakes	Main	Summit	0/8	0/8	1/9	2/10	0/8	3/43
	Camp	Summit	0/8	0/8	1/ 4	--	--	1/20
Punderson		Geauga	0/1	0/5	0/7	0/8	1/8	1/29
Pymatuning	Main	Ashtabula	2/9	--	0/7	1/6	1/9	4/31
	Camp	Ashtabula	0/8	--	1/7	0/6	0/9	1/30
	Cabins	Ashtabula	0/8	--	0/6	0/6	0/9	0/29
Rocky Fork	North Shore	Highland	0/7	0/8	1/8	1/9	0/8	2/40
	South Shore	Highland	0/7	1/9	1/8	1/9	1/9	4/42
Salt Fork	Main	Guernsey	0/8	1/9	0/8	0/9	1/9	2/43
	Camp	Guernsey	0/8	0/8	0/8	0/9	0/8	0/41
	Cabins	Guernsey	0/8	0/8	0/8	0/9	--	0/33
Scioto Trail		Ross	0/6	6/11	1/8	0/7	1/8	8/40
Seneca Lake		Noble	--	--	--	14/45	5/25	19/70
Shawnee	Turkey Cr Lodge	Scioto	0/6	2/9	1/9	0/7	0/9	3/39
	Roosevelt-Camp	Scioto	1/6	--	0/6	2/8	0/9	3/29
Silver Creek		Summit	--	--	--	1/10	--	1/10
Stonelick		Clermont	0/14	0/8	0/16	0/15	5/18	5/71
Strouds Run		Athens	0/8	0/7	2/10	0/8	0/7	2/40
Tappan Lake		Harrison	--	--	--	16/46	3/25	19/71
Tar Hollow	Main	Ross	0/6	1/9	2/9	0/7	0/8	3/39
	Camp	Ross	2/9	0/9	1/8	1/8	0/8	4/42
West Branch	Main	Portage	1/5	2/12	0/8	0/9	1/9	4/43
	Camp	Portage	--	2/11	0/8	0/9	0/8	2/36
Wolf Run		Noble	0/8	0/7	0/8	1/8	0/7	1/38
	Total Advisory Postings[a]		59	85	81	108	88	421/ 3,062

[a] Indicates the number of advisories posted, based on a measured *E. coli* density exceeding 235 cfu/100 mL, followed by the number of samples collected.

Beaches at inland state park lakes are tested for bacteria less frequently compared to those beaches along Lake Erie. Sampling was most frequent at Seneca Lake (2016-2017), Atwood Lake (2016-2017) and Tappan Lake (2016-2017). Even at these beaches, the sampling frequency is roughly only half as intense as that of many Lake Erie beaches (Table F-7).

The sample results in Table F-17 indicate that at most inland lake beaches, the BAV of 235 cfu/100mL is not frequently exceeded, resulting in fewer postings compared to some of the beaches along Lake Erie. There were 46 inland lake beaches where the overall exceedance frequency was less than 10 percent for the five-year reporting period. Overall, the frequency of exceedances for all the inland lake beaches during the five-year reporting period was 13.8 percent, slightly higher than the 12.4 percent rate reported in the 2011-2015 cycle, which in turn was slightly higher than the 10.5 percent reported in the 2008-2012 reporting period. There were 28 inland lake beaches where the aggregated exceedance frequency was more than 10 percent. The highest aggregated exceedance frequency of 66 percent was found at the Brooks Park beach at Buckeye Lake followed closely by Buckeye Lake's Crystal Beach at 60 percent. Thirteen beaches exceeded the BAV 25 percent or more of the time over the five-year reporting period total: Buckeye Lake's Brooks Park, Fairfield and Crystal beaches; Caesar Creek Lake (south beach); Charles Mill Lake; Dillon Reservoir; Grand Lake St. Marys' camp, Windy Point and main beaches (west); Madison Lake; Pike Lake; Seneca Lake; and Tappan Lake.

Sample results at some inland lake beaches indicated a need for posting an advisory much more frequently during certain years. For example, five of 18 (28 percent) of the samples collected at Stonelick Lake exceeded the BAV in 2017 while none of the 15 samples exceeded the BAV in 2016 at Stonelick Lake. More frequent sampling, particularly at beaches where previous sampling data indicates an increased likelihood of exceeding the recreation criteria, should be considered by beach managers so that the public can be adequately informed of actual water quality conditions at the time of their visit. Sampling results at other lakes appear remarkably consistent, such as Alum Creek Lake's main beach, where from 2013-2017 the annual exceedance rate of the BAV ranged from 20 to 30 percent per year or Findlay Lake, where no exceedances were observed during annual sampling over the past five years.

F.4 Recreation Assessment for Algae in Western Lake Erie

F.4.1 Background

A healthy Lake Erie is a vital component of Ohio's economic and ecological health. Funding under the Great Lakes Restoration Initiative (GLRI) and other sources has led to the availability of new data and opportunities to expand assessment and reporting of water quality conditions in Lake Erie. These combined data sets, along with advances in the use of satellite imagery to detect, quantify and track algal blooms, have allowed Ohio to include in this report the first phase of a method to assess the open waters of Lake Erie for impairment caused by algae.

This section outlines a framework for assessing and listing impairment in Lake Erie, including:

- Assessment Unit (AU) definitions/boundaries;
- data availability relative to the AUs, including quantity, type and source of data generated; and
- an assessment method for impairment caused by algae for the western basin units.

Regarding data availability, it is important to keep in mind that Ohio's credible data law (ORC 6111.50 to 6111.56) requires Level 3 credible data for impairment assessments and decisions. However, Ohio EPA cannot compel data collectors to apply for Level 3 status. Thus, while many parties may be collecting data in Lake Erie, much of it is not currently useable in IR assessments. Data requirements and the credible data law are also discussed in Section D3 of this report.

F.4.2 Rationale and Evaluation Method

Defining AUs

In the past several IR cycles, Ohio EPA has evaluated Lake Erie using three AUs that cover the shallow waters along Ohio's coast: western basin; central basin; and Lake Erie Islands as measured from the shoreline to 100 meters lakeward; as well as the area within a 500-yard radius of active public drinking water supply intake structures. For 2018, Ohio EPA has refined these AUs to follow the topography (bathymetry) of the lake (100 meters lakeward is now recommended as a three-meter depth contour) and add the open water areas (Ohio waters beyond the three-meter depth). Due to the Maumee River, Detroit area and Sandusky River influences, there is tremendous variability across the western and Sandusky basins and segregating the shoreline waters into individual units will provide more refined assessments. The Sandusky Bay open water area of Lake Erie is also differentiated to capture the unique characteristics of the transitional waters between the western and central basins as influenced by the Sandusky Bay and lake circulation patterns.

Under this framework, Lake Erie AUs have increased from three (western, island and central shorelines) to seven units (Table F-18 and Figure F-7). This will allow assessments to be conducted on individual areas of more uniform characteristics so the targets for attaining the use designations can be set at the most appropriate levels for the given area. In addition, the public water supply intakes can now be included in the AU where they are physically located, rather than associated with nearest shoreline AU.

Table F-18 describes the proposed AUs and the identifying codes assigned to them (tied to the HUC codes for the lake); Figure F-7 depicts the AU boundaries on Lake Erie.

Table F-18 — Proposed Ohio Lake Erie AUs.

AU Code	AU Name	Description
041202000201	Western Basin Shoreline (W1)	Lake Erie shoreline from the MI/OH state line to the west side of Catawba Island at depths ≤3m, including Maumee Bay
041202000301	Western Basin Open Waters (W2)	Lake Erie open water from the MI/OH state line to a line between the Marblehead Lighthouse and Pelee Point at depths >3m (U.S. waters only)
041202000100	Islands Shoreline (I1)	Lake Erie island shorelines from the west side of Catawba Island to the Marblehead Lighthouse at depths ≤3m and including, but not limited to the following Islands; West Sister, Bass and Kelleys
041202000202	Sandusky Basin Shoreline (S1)	Lake Erie shoreline from the Marblehead Lighthouse to the Black River at depths ≤3m, including Sandusky Bay
041202000302	Sandusky Basin Open Waters (S2)	Lake Erie open water from a line between the Marblehead Lighthouse and Pelee Point to the Lorain Ridge at depths >3m (U.S. waters only)
041202000203	Central Basin Shoreline (C1)	Lake Erie shoreline from the Black River to the OH/PA state line at depths ≤3m
041202000303	Central Basin Open Waters (C2)	Lake Erie open water from the Lorain Ridge to the OH/PA state line at depths >3m (U.S. waters only)

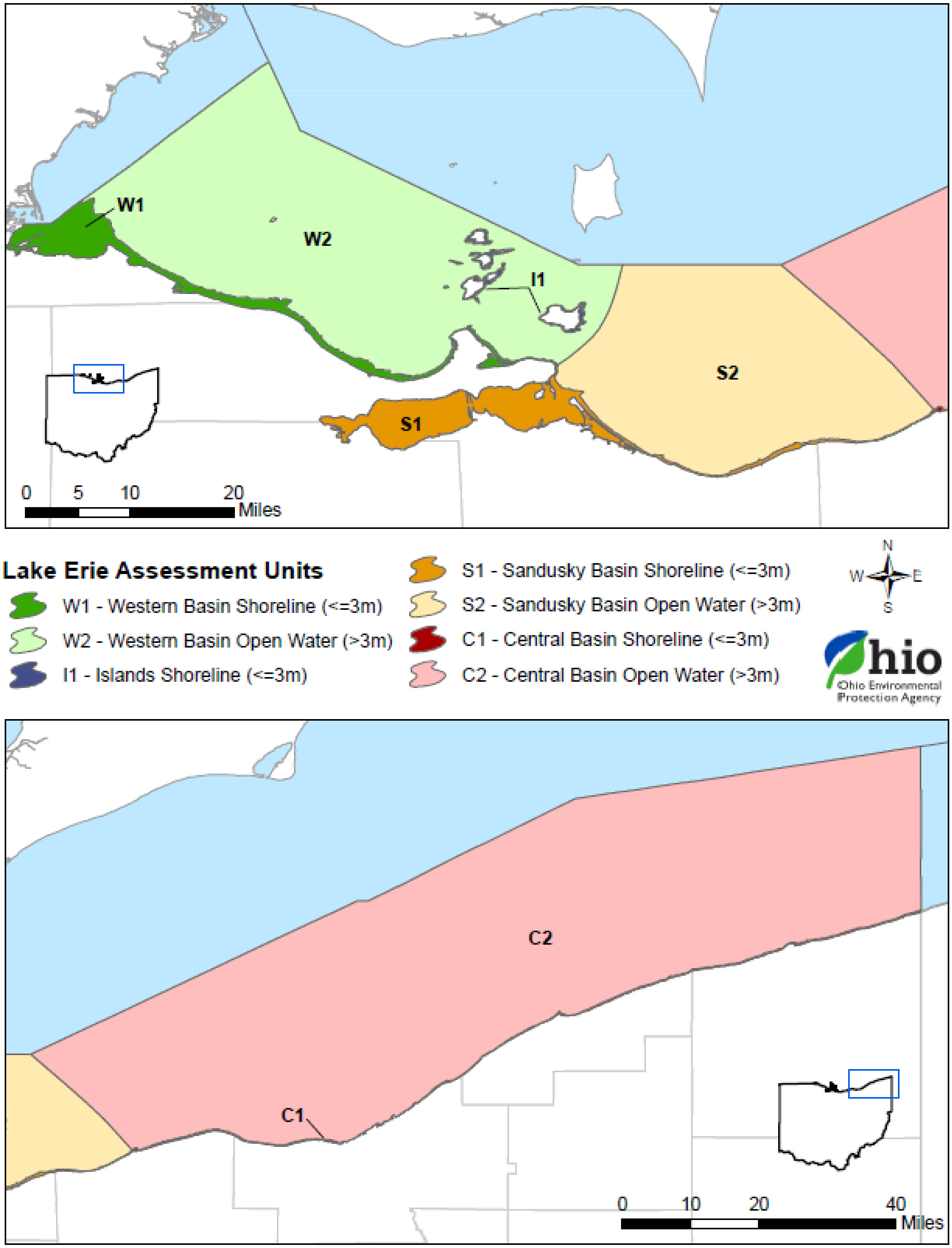


Figure F-7 — New Ohio Lake Erie AUs

Identifying Data Sources

As specified in the Ohio credible data law 2003 (ORC 6111.50 to 6111.56), Ohio EPA is limited to data accepted as Level 3 when making attainment determinations for Ohio waters. Data types may be applicable only for specific beneficial uses or AU types (for example, shoreline versus offshore AUs). Ohio EPA has determined that the Northeast Ohio Regional Sewer District (NEORSD) data through 2016 is Level 3 credible data, and the National Oceanic and Atmospheric Administration (NOAA) satellite information has been reviewed to ensure that it meets the Level 3 credible data requirements. Ohio EPA will continue evaluating protocols and data from U.S. EPA, NOAA, U.S. Geological Survey, the Ohio State University, Bowling Green State University and the University of Toledo to ensure more Level 3 data is available for future assessments.

Through the efforts of Great Lakes Water Quality Agreement (GLWQA) Annex 4 workgroups and Ohio EPA staff, a list of data collectors in the western basin was compiled, along with information related to the sample collection and analysis. Figure F-8 illustrates the locations of all the known routine data collection sites in the western basin. The charter boat captain sites are from the original study plan for illustrative purposes and may not include all the sites sampled over the last five years.

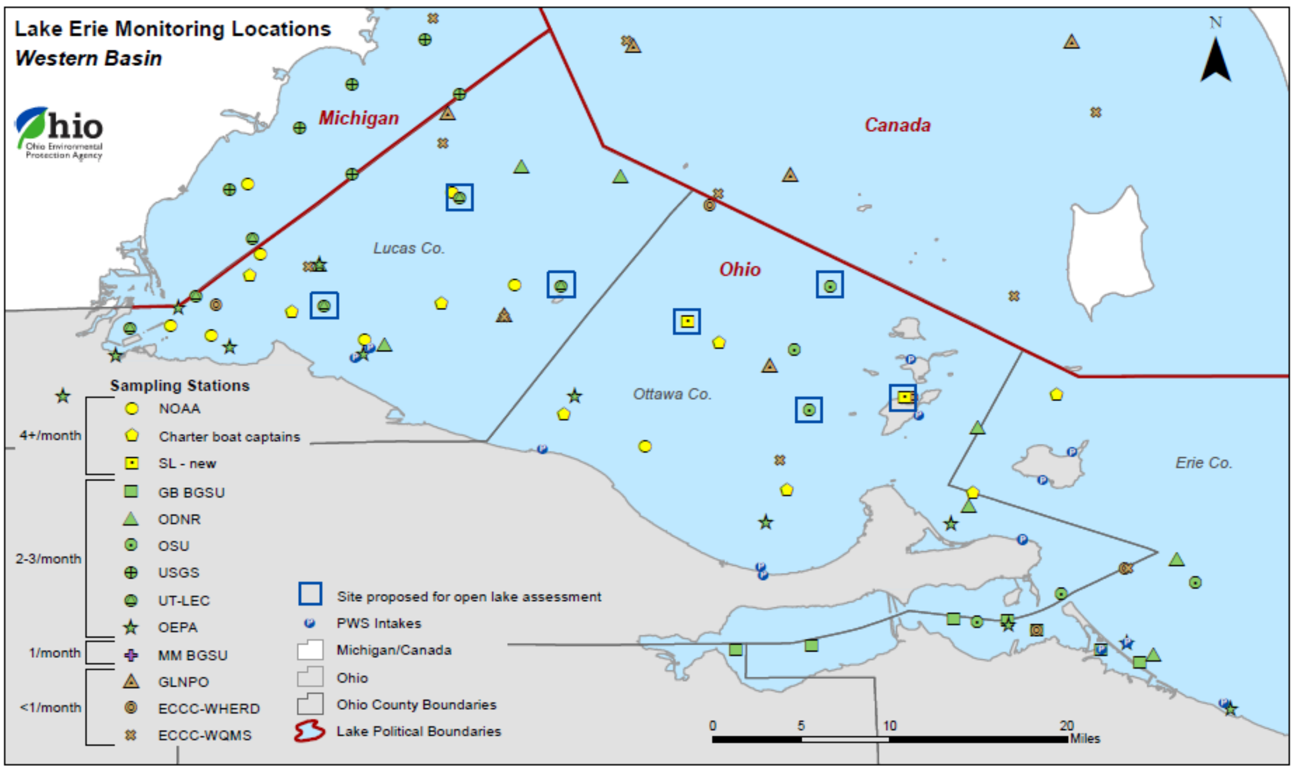


Figure F-8 — Monitoring locations in the western basin of Lake Erie in 2017.

Table F-19 presents a summary of the data available that is currently eligible for use by Ohio EPA to determine attainment, data that Ohio EPA could more easily accept as Level 3 credible data (some federal agencies are exempt from portions of the credible data requirements), as well as limitations to the use of the data in a reasonable assessment of a large water body such as Lake Erie where algal blooms shift and change significantly over a season.

Table F-19 — Data collected in Ohio waters of Lake Erie that is credible level 3 or could likely be approved as level 3 with review and coordination.

Agency/ Collector	Geographic Location	Start/ End Date	Sampling Frequency	Parameters analyzed	Basin	Limitations/Notes	Eligible for IR use?
U.S. EPA	Offshore/near shore — 9 sites in central basin; only 3-7 in OH waters	1983-present	Spring, Summer	Phytoplankton, zooplankton, nutrients, chlorophyll, water quality parameters	Central	2 samples/ year unless intense survey year	potential
U.S. EPA	Offshore/near shore — 3 sites in western basin OH waters	1983-present	Spring, Summer	Phytoplankton, zooplankton, nutrients, chlorophyll, water quality parameters	West	2 samples/ year unless intense survey year	potential
NOAA	All Lake Erie	2002-present	clear days	cyanobacterial chlorophyll	All		yes (2012 forward)
ODNR-Sandusky	South of Middle Sister	May - Sept	bi-weekly	Chl-A, Species, Phosphorus	West	only P data is confirmed level 3	yes for P, rest potential
ODNR-Sandusky	Toledo Water Intake	May - Sept	bi-weekly	Chl-A, Species, Phosphorus	West	only P data is confirmed level 3	yes for P, rest potential
ODNR-DOW Sandusky	Western basin Offshore	May-Sept	Bi-weekly	Phytoplankton, Zooplankton, Chlorophyll, DO/Temperature profile, Phosphorus	West	only P data is confirmed level 3	yes for P, rest potential
ODNR-DOW Sandusky	Western basin Nearshore	May-Sept	Bi-weekly	Phytoplankton, Zooplankton, Chlorophyll, DO/Temperature profile, Phosphorus	West	only P data is confirmed level 3	yes for P, rest potential
NOAA GLERL	Toledo Shipping Channel	2012-present	weekly June - October	biovolume, taxa, picoplankton, chla, PC, toxins, nutrients, phys-chem, DNA	West		potential
NOAA GLERL	Western basin Offshore	2012-present	weekly June - October	biovolume, taxa, picoplankton, chla, PC, toxins, nutrients, phys-chem, DNA	West		potential
NOAA GLERL	Maumee Bay	2012-present	weekly June - October	biovolume, taxa, picoplankton, chla, PC, toxins, nutrients, phys-chem, DNA	West	in bay	potential
NOAA GLERL	Mouth of Maumee River	2016-present	weekly June - October	biovolume, taxa, picoplankton, chla, PC, toxins, nutrients, phys-chem, DNA	West	in bay, just started 2016	potential
NOAA GLERL	Toledo Water Intake	2014-present	weekly June - October	biovolume, taxa, picoplankton, chla, PC, toxins, nutrients, phys-chem, DNA	West	started 2014	potential

Agency/ Collector	Geographic Location	Start/ End Date	Sampling Frequency	Parameters analyzed	Basin	Limitations/Notes	Eligible for IR use?
NOAA GLERL	West Sister Island	2014-present	weekly June - October	biovolume, taxa, picoplankton, chla, PC, toxins, nutrients, phys-chem, DNA	West	started 2014	potential
NOAA GLERL	Southeastern Western Basin	2015-present	weekly June - October	biovolume, taxa, picoplankton, chla, PC, toxins, nutrients, phys-chem, DNA	West	started 2015	potential
NEORSD	Lake Erie - Cleveland area 8 sites	2012-present	1/mo May-July 2/mo Aug-Oct	nutrients, chla, microcystin, alkalinity, TSS and field parameters	Central	mostly along shore, one site 7 miles out	yes through 2016
Ohio EPA	Maumee Bay near Woodtick Peninsula	2012-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	in bay	yes
Ohio EPA	Maumee Bay near State Park	2013-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	in bay	yes
Ohio EPA	Lake Erie near Toledo Lighthouse	2011-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	close to shore	yes
Ohio EPA	Lake Erie between Toledo/Oregon WTP Intakes	2015-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	close to shore	yes
Ohio EPA	Lake Erie near West Sister Island	2011-2015	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	data no longer being collected	yes
Ohio EPA	Lake Erie near Middle Sister Island	2013-2015	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	data no longer being collected	yes
Ohio EPA	Lake Erie near Middle Bass Island	2011-2015	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	data no longer being collected	yes
Ohio EPA	Lake Erie North of Port Clinton	2014-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	close to shore	yes
Ohio EPA	Lake Erie near Lake Side	2016-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	very close to shore, data started 2016	yes
Ohio EPA	Lake Erie Near Crane Reef	2016-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	West	data started 2016	yes
Ohio EPA	Sandusky Bay near Johnsons Island	2010-present	phytoplankton 3/yr, chemistry/field monthly	nutrients, for more see list in footnote (1)	SB	in bay	yes
Ohio EPA	Lake Erie near Cedar Point	2011-2015	phytoplankton 3/yr, chemistry/field monthly	nutrients, for more see list in footnote (1)	SB	close to shore, no longer being collected	yes

Agency/ Collector	Geographic Location	Start/ End Date	Sampling Frequency	Parameters analyzed	Basin	Limitations/Notes	Eligible for IR use?
Ohio EPA	Lake Erie near City of Sandusky WTP Intake	2016-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	SB	very close to shore, data started 2016	yes
Ohio EPA	Lake Erie near City of Huron WPT Intake	2016-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	SB	in shoreline area, data started 2016	yes
Ohio EPA	Lake Erie near Huron	2011-2015	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	SB	close to shore, no longer being collected	yes
Ohio EPA	Lake Erie near City of Vermilion WTP Intake	2016-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	SB	in shoreline area, data started 2016	yes
Ohio EPA	Lake Erie near Lorain	2011-present	phytoplankton 3/yr, chemistry/field 2x/month	nutrients, for more see list in footnote (1)	SB	close to shore	yes
Ohio EPA	Lake Erie near Rocky River	2010-present	phytoplankton 3/yr, chemistry/field monthly	nutrients, for more see list in footnote (1)	Central	close to shore	yes
Ohio EPA	Lake Erie near Wildwood	2010-present	phytoplankton 3/yr, chemistry/field monthly	nutrients, for more see list in footnote (1)	Central	close to shore	yes
Ohio EPA	Lake Erie near Fairport	2011-present	phytoplankton 3/yr, chemistry/field monthly	nutrients, for more see list in footnote (1)	Central	close to shore	yes
Ohio EPA	Lake Erie near Geneva	2011-present	phytoplankton 3/yr, chemistry/field monthly	nutrients, for more see list in footnote (1)	Central	close to shore	yes
Ohio EPA	Lake Erie near Conneaut	2010-present	phytoplankton 3/yr, chemistry/field monthly	nutrients, for more see list in footnote (1)	Central	close to shore	Yes

(1) Ohio EPA Parameters: Alkalinity, Bicarbonate, Carbonate, Chloride, Sulfate, Solids, TDS, TSS, Ammonia, Nitrite, Nitrate-Nitrite, Kjeldahl, Total, Phosphorus Total, Orthophosphate, Chlorophyll a, Microcystins, Field Parameters (water depth, secchi depth, pH, dissolved oxygen, temperature, fluorescence, conductivity and specific conductance), phytoplankton as noted.

NOTES: Ohio EPA Fish and Mayfly sites were not included since no chemistry or phytoplankton samples are typically collected there. That information can be found in the study plan at: ***epa.ohio.gov/Portals/35/lakeerie/2017_Erie_Study_Plan.pdf***.
Ohio EPA transects for dissolved oxygen and other field parameters are not included in the table. These are collected in the central basin at various depths and locations to assist in defining/tracking the hypoxic zone - but do not include nutrients, chlorophyll or cyanotoxins.

Establishing Expectations: Targets for Lake Erie Algal Blooms

A common means to estimate algal productivity and trophic status is to measure the photosynthetic pigment chlorophyll a in a filtered water sample. The importance of phosphorus as the limiting nutrient that feeds algal blooms is also recognized. Ohio does not have numeric criteria for these constituents in Lake Erie and no federal criteria have been established to date. Also, the GLQWA Annex 4 committees and workgroups recognized that measuring nutrient levels in the open waters of the lake may not be the best way to track success in reducing algal blooms. Ohio water quality standards (OAC 3745-1-04) do contain narrative requirements that all surface waters be:

> *"(D) Free from substances entering the waters as result of human activity in concentrations that are toxic or harmful to human, animal or aquatic life or are rapidly lethal in the mixing zone.*
> *(E) Free from nutrients entering the water as a result of human activity in concentrations that create nuisance growths of aquatic weeds and algae."*

Ohio EPA requested input from representatives from the Ohio State University Sea Grant College Program, University of Toledo, Bowling Green State University and NOAA to identify metrics that would provide a scientifically relevant determination of impairment. The request stated that the metrics needed to provide a reasonable, objective assessment method for the western basin open water using targets that will meet the goals established by the GLWQA Annex 4 committee and provide assurance that the WQS are met.

The foundation of the first phase of Ohio's assessment method for algae is an evaluation of the western basin algal bloom pattern over time, such as that conducted by NOAA in 2012 (Stumpf, 2012). Data sets from the MODIS (or Moderate Resolution Imaging Spectroradiometer) satellite (2012 to 2017) were used for this first assessment. The GLWQA Annex 4 committee set goals for phosphorus loadings to the lake at levels that are expected to produce a bloom no greater than those that occurred in 2004 or 2012. The extent of algal bloom coverage considered acceptable, or attaining the recreation use designation, should be no greater than that in 2004 or 2012. In addition, the algae (cyanobacteria) cell count level in the bloom should be no greater than 20,000 cells/mL. When cyanobacteria capable of producing cyanotoxins, especially *Microcystis*, exceed concentrations of 20,000 cells/ml, there is a higher likelihood that cyanotoxins will be present at detectable concentrations. The relationship between the presence of *Microcystis* blooms and elevated microcystins concentrations has been well documented in the Lake Erie western basin. This density (20,000 cells/mL) corresponds to the nominal floor used by NOAA to analyze satellite images with a comfortable degree of certainty (Wynne and Stumpf, 2015).

To account for the way that algal blooms shift in time and space in a large water body like the western basin, the method developed is as follows:

- In each 10-day frame, an exceedance means that a bloom with greater than 20,000 cells/mL covers (is present in) more than 30 percent of the western basin open water unit area
- If more than three 10-day frames have an exceedance in one year (July-Oct.), then that year exceeds the goal (is above the threshold target of the 2004 and 2012 blooms under Annex 4 of the GLWQA)
- Because of the year-to-year variation, if any two or more years in a rolling six-year window exceeds the goal (is above the threshold target of the 2004 and 2012 blooms under Annex 4 of the GLWQA) then the unit is impaired

Within each 10-day frame, an average percent coverage by a bloom at 20,000 cell/mL or greater was calculated for the western basin open water assessment unit (W2 in Figure F-7). In the western basin, blooms typically begin developing by July 22 and peak between August 10 and September 18 (Wynne and Stumpf, 2015). The 10-day time frames used in the assessment method are:

July 1 – July 10	Aug. 30 – Sept. 8
July 11 – July 20	Sept. 9 – Sept. 18
July 21 – July 30	Sept. 19 – Sept. 28
July 31 – Aug 9	Sept. 29 – Oct. 8
Aug. 10 – Aug. 19	Oct. 9 – Oct. 18
Aug. 20 – Aug. 29	Oct. 19 – Oct. 31

The threshold of 30 percent coverage is based on an examination of the bloom coverage in Lake Erie's western basin since 2002 and which blooms were considered to meet the Annex 4 target severity index (the Target Bloom in Figure F-9). Severity Index (SI) is the measure of the peak bloom biomass over a 30-day period (in each year, whichever 30-days captured/represents the most biomass in that year). As illustrated in Figure F-9, bloom severity meets the target in 2004 and very nearly in 2012. In those years the bloom was not considered to significantly impede the recreational use of the water and the extent of coverage did not exceed 30 percent of the western basin open water AU in more than three 10-day frames (fewer than three exceeded).

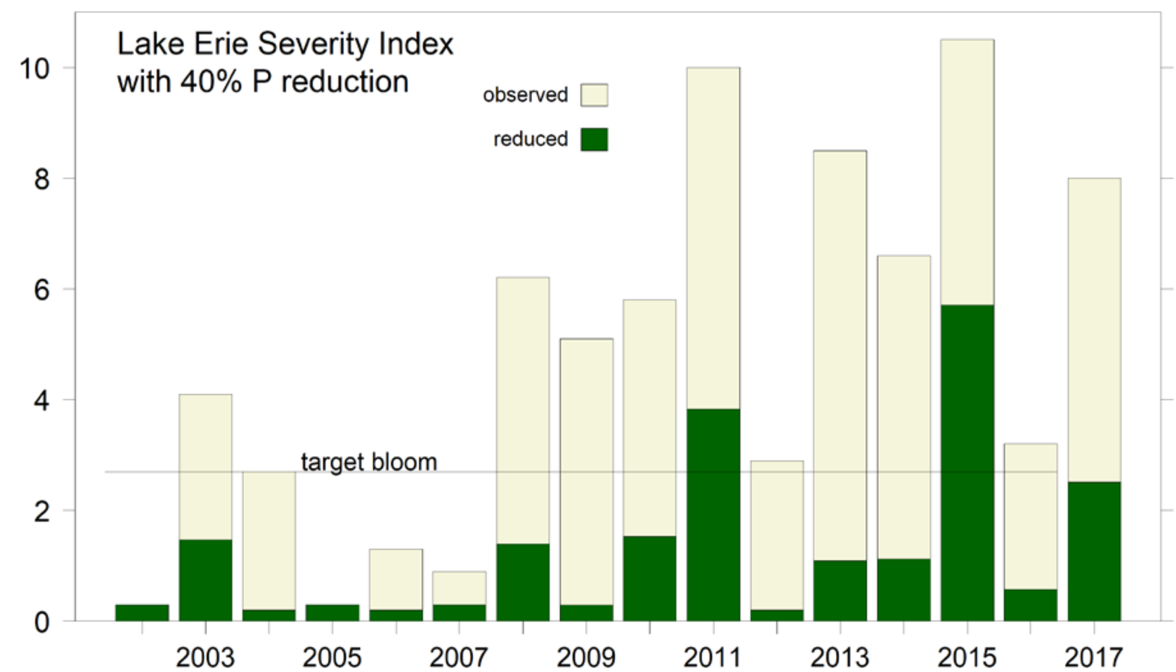


Figure F-9 — Bloom severity observed and projected (with 40 percent TP reduction) since 2002. Courtesy of Dr. Rick Stumpf, NOAA National Centers for Coastal Ocean Science.

F.4.3 Results

Table F-20 shows the end results of the analysis, using the MODIS satellite data 2012-2017 and including the full six-year window in the assessment. Some years do not include all 12 of the 10-day frames because of extended cloud cover or other interferences with the satellite images. The western basin open waters are considered impaired since the last five years all exceeded the thresholds outlined above (more than three 10-day frames exceeded within the year).

Table F-20 — The number of 10-day time frames exceeding the 30 percent coverage threshold (with 20,000 cells/mL or greater) in the western basin open water unit for each year beginning in 2012.

	≥30% coverage at ≥20,000 cell/mL	
Year	10-day frames exceeding	total frames
2012	2	12
2013	**10**	11
2014	**6**	12
2015	**9**	11
2016	**5**	10
2017	**7**	11

Since the island shoreline assessment units are contained within the western basin open water unit shape file that was used to conduct the analysis, the island shoreline unit is also considered impaired. As people are more likely to come into direct contact with the water and algae along the shoreline than in the open water, Ohio EPA is also including the western basin shoreline unit on the impaired waters list. This is based on proximity to the open waters that are clearly impaired, and the expectation that, reviewing the patterns of blooms over the past six years, the shoreline area would be just as impacted by the blooms as the open water.

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Evaluating Beneficial Use:
Aquatic Life

G1. Background and Rationale

G1.1 Background

Ohio EPA has been evaluating streams using standardized biological field collection methods for nearly 40 years. Stream assessments are based on the experience gained through the collection of more than 27,500 fish population samples, nearly 14,450 macroinvertebrate community samples and close to 223,000 water chemistry samples. Aquatic life use assessments for the 2018 Integrated Report (IR) are based on biological and chemical data collected from primarily 2007-2016 at more than 4,325 wadeable stream, large river and Lake Erie shoreline sampling locations; some earlier data collected between 2003-2006 were retained for specific watershed and large river assessments. Ohio's Credible Data Law states that all data greater than five years in age will be considered historical, but that it can be used if the director has identified compelling reasons as to why the data are credible. In the case of biological monitoring data, the use of data older than five years is necessary. The use of historical data is necessary because not enough biological samples are gathered from enough locations each year to conduct a thorough assessment of aquatic life use status across the state. Owing to limited staff and budget resources, it generally takes 10-15 years to visit enough assessment units and sufficiently monitor them to make aquatic life use assessments. A more complete picture of statewide aquatic life use health is presented when data are utilized based on the 10 to 15-year timeframe. Since water resource quality in many watersheds in Ohio today is most susceptible to changing land use patterns that are often subtle, slow to evolve, and difficult to monitor and assess, the use of older data is justified.

Ohio's water quality standards (WQS) have seven subcategories of aquatic life uses for streams and rivers (see Ohio Administrative Code 3745-1-07, ***epa.ohio.gov/portals/35/rules/01-07.pdf***). The WQS rule contains a narrative for each aquatic life use and the three most commonly assigned aquatic life uses have quantitative, numeric biological criteria that express the minimum acceptable level of biological performance based on three separate biological indices. These indices are the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb) for fish and the Invertebrate Community Index (ICI) for aquatic macroinvertebrates. A detailed description of Ohio EPA's biological assessment and biocriteria program, including specifics on each index and how each was derived, is available (see Biological Criteria for the Protection of Aquatic Life, ***epa.ohio.gov/dsw/bioassess/BioCriteriaProtAqLife.aspx***).

Procedures established in a specially designed 1983-1984 U.S. EPA study known as the *Stream Regionalization Project* (Whittier et al. 1987) were used to select reference, or least-impacted sites, in each of Ohio's five Level III ecoregions (Omernik 1987). Biological data from a subset of these sites in addition to supplemental data from other least-impacted Ohio reference sites were used to establish the ecoregion-specific biocriteria for each aquatic life use. Note that some criteria vary according to stream size and some indices do not apply in certain circumstances. Ohio's WQS rule stipulates that "biological criteria provide a direct measure of attainment of the warmwater habitat, exceptional warmwater habitat and modified warmwater habitat aquatic life uses" (OAC 3745-1-07(C)). The numeric biological criteria based on IBI, MIwb and ICI thresholds applicable to exceptional warmwater habitat (EWH), warmwater habitat (WWH), and modified warmwater habitat (MWH) waters are found in Table 7-1 of the WQS rule. Neither coldwater habitat (CWH) nor limited resource water (LRW) streams have numeric biological criteria at this time, so attainment status must be determined on a case-by-case basis. For sites and segments designated with these aquatic life uses, attainment status was determined by using biological data attributes (for example, presence and abundance of coldwater species in CWH streams) and/or interim assessment index targets (for example, those for LRW streams, Lake Erie lacustuaries, Lake Erie shoreline) to assess consistency with the narrative aquatic life use definitions in the WQS.

G1.2 General Determination of Attainment Status

A biological community at an EWH, WWH or MWH sampling site must achieve the relevant criteria for all three indices, or those available and/or applicable, to be in full attainment of the designated aquatic life use criteria. Partial attainment is determined if one criterion is not achieved while non-attainment results when all biological scores are less than the criteria or if poor or very poor index scores are measured in either fish or macroinvertebrate communities.

A carefully conceived ambient monitoring approach, using cost-effective indicators consisting of ecological, chemical and toxicological measures, can ensure that all relevant pollution sources are judged objectively based on environmental results. Ohio EPA relies on a tiered approach in attempting to link the results of administrative activities with true environmental measures. This integrated approach includes a hierarchical continuum from administrative to true environmental indicators. The six levels of indicators include: 1) actions taken by regulatory agencies (permitting, enforcement, grants); 2) responses by the regulated community (treatment works, pollution prevention); 3) changes in discharged quantities (pollutant loadings); 4) changes in ambient conditions (water quality, habitat); 5) changes in uptake and/or assimilation (tissue contamination, biomarkers, wasteload allocation); and, 6) changes in health, ecology or other effects (ecological condition, pathogens). In this process, the results of administrative activities (levels 1 and 2) can be linked to efforts to improve water quality (levels 3, 4 and 5), which should translate into the environmental results (level 6). Thus, the aggregate effect of billions of dollars spent on water pollution control since the early 1970s can now be determined with quantifiable measures of environmental condition.

Superimposed on this hierarchy is the concept of stressor, exposure and response indicators. Stressor indicators generally include activities that have the potential to degrade the aquatic environment, such as pollutant discharges (permitted and unpermitted), land use effects and habitat modifications. Exposure indicators are those that measure the effects of stressors and can include whole effluent toxicity tests, tissue residues and biomarkers, each of which provides evidence of biological exposure to a stressor or bioaccumulative agent. Response indicators are generally composite measures of the cumulative effects of stress and exposure and include the more direct measures of community and population response that are represented here by the biological indices that comprise Ohio's biological criteria. Other response indicators could include target assemblages (rare, threatened, endangered, special status, and declining species) or bacterial levels that serve as surrogates for the recreation uses. These indicators represent the essential technical elements for watershed-based management approaches. The key, however, is to use the different indicators within the roles that are most appropriate for each indicator.

Identifying the most probable causes of observed impairments revealed by the biological criteria and linking this with pollution sources involves an interpretation of multiple lines of evidence including water chemistry data, sediment data, habitat data, effluent data, biomonitoring results, land use data and biological response signatures within the biological data themselves. Thus, the assignment of principal causes and sources of impairment represents the association of impairments (defined by response indicators) with stressor and exposure indicators. The identified causes of impairment will serve as the target parameters for future total maximum daily load (TMDL) development or regulatory program actions.

Adequate sampling is necessary to represent the aquatic life use attainment status for large river assessment units (LRAUs, each average 32 miles in length) or watershed assessment units (WAUs, each an average 28 mi^2 in surface area); these assessment units are defined in Sections D1 and G2 of this report. Despite Ohio EPA's significant commitment to biological sampling efforts, about 34 percent of Ohio's 1,538

WAUs are precluded from this analysis because of no or insufficient data or data are considered not just historical for credible data purposes, but no longer representative (over 10 years old). Many large Ohio rivers with LRAU reaches have current data; however, seven major rivers (12 LRAUs) are being assessed with data collected outside the 10-year window (data from years 2003-2006). While some data may be available for some of the assessment units (AUs), many have no water quality monitoring data, or the scope of monitoring was judged to be too limited to adequately generate an assessment. Generally, at least two sample sites are minimally considered necessary for a WAU assessment, although under specific circumstances, a WAU may be evaluated with one site. Presently, Ohio EPA prefers that the principal investigators make informed decisions about the data relevance for a particular AU evaluation rather than institute specific guidance on minimum effort.

Recognizing the state's limited resources, one way to increase assessment unit coverage is to utilize all available relevant Level 3 credible data. While Ohio EPA uses data from a variety of sources, the data used to determine the aquatic life use status in this report were primarily collected by Ohio EPA. For this report and some past reports, additional biological data were provided by the Ohio Department of Natural Resources (ODNR), Northeast Ohio Regional Sewer District (NEORSD), U.S. Geological Survey (USGS), the University of Toledo, the Ohio State University, National Center for Water Quality Research (NCWQR) at Heidelberg College, Midwest Biodiversity Institute (MBI), Cleveland Metroparks and EnviroScience, Inc. Those interested in providing data to Ohio EPA for aquatic life use attainment status determinations must attend appropriate training provided by Ohio EPA or its designee through the Ohio Credible Data Program Level 3 Certification, and document and retain competency in Ohio EPA biological sampling protocols. All data used to make attainment determinations are carefully reviewed for consistency with all Ohio EPA methods and guidance.

G2. Evaluation Method

G2.1 Rivers and Streams: Large River Assessment Units (LRAUs)

Decades of monitoring work by Ohio EPA have resulted in an extensive data set that includes data for all 38 large river assessment units in Ohio with sampling spanning 2003-2016. The longitudinal sampling pattern (upstream to downstream and bracketing pollution sources and tributaries) used to measure fish community health, macroinvertebrate community condition and water chemistry allows WQS biocriteria attainment status to be fairly precisely estimated based on linear distances. The length of the large river deemed to be in full attainment, as described in the previous section, is divided by the total assessed length of the large river and multiplied by 100 to yield a value between 0 (no miles in attainment) and 100 (all miles in attainment). An LRAU is considered meeting its designated aquatic life use only if a score of 100 is reported. In other words, if all miles are not in full attainment of the designated aquatic life use, the entire LRAU is listed as impaired and placed in IR Category 4 or 5, depending on whether a TMDL is required.

G2.2 Rivers and Streams: Watershed Assessment Units (WAUs)

Beginning with the *2010 IR*, the aquatic life use assessment methodology defined the WAU as the U.S. Geological Survey 12-digit hydrologic unit code watershed, or HUC12 (1,538 HUCs averaging 28 mi^2 drainage areas), rather than the 11-digit HUC watershed (331 HUC11s averaging 130 mi^2 drainage areas) used in prior IRs. Reporting on the HUC12 scale provides information on a finer scale and allows for better reporting of watershed improvements.

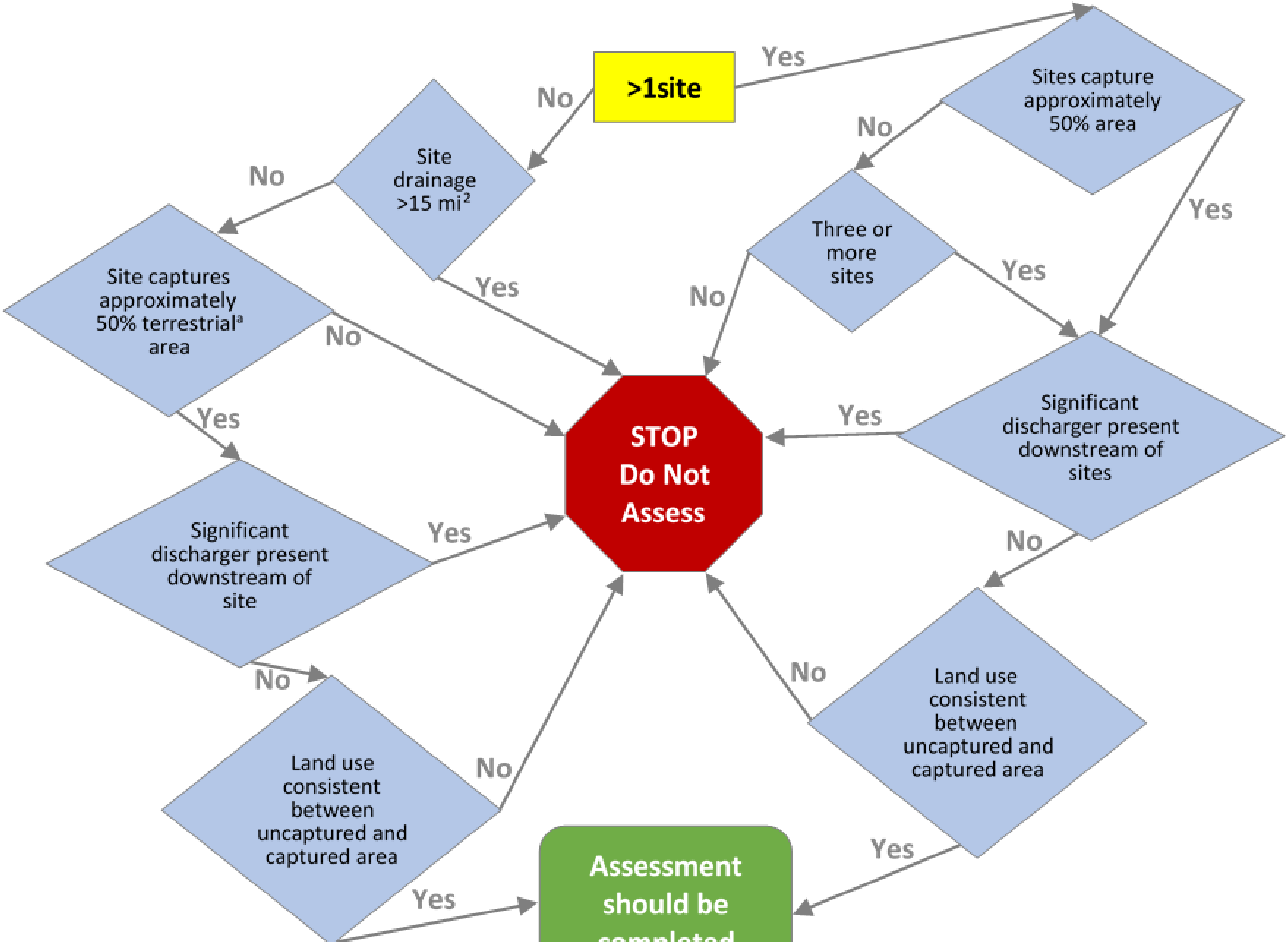
This dramatic reduction in assessment unit size requires consideration of what constitutes adequate sampling within each HUC12 WAU and appropriate evaluation of the sampling results. The relatively small drainage area of the HUC12 WAU requires that the sites evaluated adequately characterize the smaller watershed. For that reason, three scores will be determined for each WAU when sufficient data make this possible. A headwater assessment score that characterizes the aquatic community of the WAU by itself will occur by evaluating all sites with drainage area <20 mi^2 together. A wading stream score will be determined for all sites with drainage area between 20 mi^2 and 50 mi^2 that occur within the WAU. The wading stream score is necessary since a site between 20 mi^2 and 50 mi^2 characterizes the entire watershed upstream from the site, potentially two or more HUC12s, not just to the extent of the WAU boundary where the site resides. A principal stream score for sites >50 mi^2 will also be calculated, as these larger streams reflect a much greater land area than sites at a smaller drainage area. The final assessment unit score will be derived from these three scores. The table below represents this graphically.

WAU (HUC12)	Headwater Assessment — HA (<20 mi^2)			Wading Assessment — WA (≥ 20 mi^2 <50 mi^2)			Intermediate Score (IS)	Principal Assessment — PA (≥ 50 mi^2 <500 mi^2)			WAU Score
	Total Sites	# Sites Full	HA Score	Total Sites	# Sites Full	WA Score	$\frac{HA+WA}{2}$	Total Sites	# Sites Full	PA Score	$\frac{IS+PA}{2}$

While the smaller size of the HUC12 WAU greatly reduces the number of sites necessary to be assessed, this creates an emphasis on appropriate sampling locations within the assessment unit. To ensure that decisions regarding adequate coverage are uniformly carried out, a flow chart for the process was created (Figure G-1). The flow chart considers the drainage area associated with a minimal number of sites and incorporates questions as to spatial proximity of the sites within the watershed, land use consistency among sampling locations, and location of significant dischargers within the WAU.

Once it is determined that sampling coverage is adequate to conduct a WAU assessment, the number of headwater sites demonstrating full aquatic life use attainment are divided by the total number of headwater sites within the WAU. The quotient is then multiplied by 100 to provide the headwater score.

Determining the wading stream and principal stream scores involve a similar approach. The wading stream score is based on the number of wading stream sites (sites draining a watershed between 20 mi^2 and 50 mi^2) demonstrating full attainment of aquatic life use. The total number of wading stream sites in full attainment are divided by the total number of wading stream sites. The quotient is then multiplied by 100 to provide the wading stream score. The same methodology is used to produce the principal stream score, but the scoring is limited to those sites in the WAU draining >50 mi^2.



[a] If the HUC-12 contains a large amount of open water, such as a lake or reservoir, this area will be deducted from the total drainage area for this criterion.

Figure G-1 Flowchart for determining if WAU score can be derived based on available sampling locations.

An intermediate WAU score is calculated as the average of the headwater and wading stream scores. The overall WAU score is derived by averaging the intermediate score and the principal stream score. For HUC12s without principal streams, the intermediate stream score will represent the overall WAU score. This procedure provides some weighting to the assessment when principal stream miles are present (more influence on the final watershed score by principal streams). This weighting is important in that full use or impairment within the principal streams reflects the overall condition of the much larger primary watershed. A manual scoring adjustment is made in those few instances when a WAU score, with many principal stream sites, is unduly affected by the results from one headwater or one wading site. A WAU meets its aquatic life designated use only if a score of 100 is reported. In other words, if all sites are not in full attainment of the designated aquatic life use, the WAU is listed as impaired and placed in IR Category 4 or 5, depending on whether a TMDL is required.

Additional synthesis of data was used to provide aggregate statewide statistics for Ohio's universe of assessed wading and principal streams and rivers (> 20 mi^2 drainage areas) and large rivers (> 500 mi^2 drainage areas). Baseline IR statistics generated beginning with the 2010 IR were used along with the updated 2018 IR results to track trends of attainment levels across Ohio's watersheds and large rivers to quantify progress made in point and nonpoint source pollution controls and in meeting Ohio's goals of 80 percent full aquatic life use attainment by 2020 for assessed WAU wading and principal stream and river sites and 100 percent full aquatic life use attainment by 2020 for assessed LRAU miles.

G2.3 Lake Erie Shoreline and Islands: Lake Erie Assessment Units (LEAUs)

Aquatic life use determinations are predicated on a narrative description of the aquatic community associated with the relevant use tier. In the absence of numeric criteria, the narrative expectation provides the impairment determination. In 1997, Ohio EPA completed the *Development of Biological Indices Using Macroinvertebrates in Ohio Nearshore Waters, Harbors, and Lacustuaries of Lake Erie in Order to Evaluate Water Quality* (Ohio EPA, 1995). In 1999, *Biological Criteria for the Protection of Aquatic Life: Volume IV: Fish and Macroinvertebrate Indices for Ohio's Lake Erie Nearshore Waters, Harbors, and Lacustuaries* was produced (Ohio EPA, 1997 Draft). Also, in 1999, *Biological Monitoring and an Index of Biotic Integrity for Lake Erie's Nearshore Waters* (Thoma, 1999) was published as a book chapter in *Assessing the Sustainability and Biological Integrity of Water Resources Using Fish Communities* (Simon, editor, 1999). The data analyses in these documents, including refinement of field sampling protocols and development of assessment indices, provide a foundation to establish numeric biological targets/expectations using IBI and MIwb scores for aquatic life use in Lake Erie along the Ohio shoreline and in lacustuary areas. The term lacustuary was coined to specify the zone where Lake Erie water levels have intruded into tributary river channels. The aquatic life use status of a lacustuary is included as part of the assessment of the tributary WAU or LRAU.

Excluding lacustuaries, the status of the Lake Erie shoreline and islands is currently evaluated using fish community assessment targets for the Lake Erie IBI and MIwb based on night electrofishing at sites included in the four shoreline LEAUs: Lake Erie Western Basin Shoreline (including Maumee Bay); Lake Erie Sandusky Basin Shoreline; Lake Erie Central Basin Shoreline; and Lake Erie Islands Shoreline. All available fish data were collected within 100 meters of the mainland, bay or island shoreline. Status of LEAUs was determined by the percentage of sites in narrative full attainment of biological targets (scaled to prevailing shoreline habitat type) and where sufficient and current biosurvey data were available.

Ohio EPA was awarded a Great Lakes Restoration Initiative (GLRI) grant in 2010 to develop a comprehensive Lake Erie shoreline monitoring program. This 2011-2013 project included a strategy to design and implement a monitoring program for the Ohio Lake Erie shoreline zone (including bays, harbors and lacustuaries) that can be maintained on an annual basis.

The GLRI grant was a collaborative effort between state agencies (Ohio EPA and ODNR) and major universities with Lake Erie basin research interests and expertise (the Ohio State University, University of Toledo, John Carroll University and Heidelberg University). Physical, chemical and biological parameters monitored from 2011-2013 provided data to support long-term trend analysis, establish background conditions in selected areas and conduct sampling related to the impacts of projects implemented in tributaries of the Lake Erie watershed. Data will be used to monitor the progress of implementation projects in Areas of Concern (AOCs) to restore beneficial uses, track implementation of WAPs, develop TMDLs for pollutants impairing beneficial uses, support Balanced Growth Initiative actions on the shoreline, and provide updated information for IRs, Lake Erie quality index updates, and updates to the Lake Erie Lakewide Management Plan (LAMP). More information about the Great Lakes Restoration Initiative and projects which have been proposed can be found at the Ohio Lake Erie Commission website (see Great Lakes Restoration Initiative, ***lakeerie.ohio.gov/GLRI.aspx***).

For field year 2016, Ohio EPA utilized a FFY2014 CWA 106 Supplemental Monitoring grant to continue funding the base monitoring program conducted by Ohio EPA at shoreline and open water sites in Lake Erie. Details of the monitoring program are provided in the current year study plan available at ***epa.ohio.gov/dsw/lakeerie/index.aspx#125073721-nearshore-monitoring***.

Of note for future Lake Erie assessments will be the collection of shoreline data for the National Aquatic Resource Survey (NARS) of coastal waters of the United States (the National Coastal Condition Assessment - NCCA) which was conducted during the summer of 2015. Coordinated by U.S. EPA in collaboration with Great Lake states, these one-visit snapshots of lake water quality will be used to provide statistically valid national and regional assessments of Great Lakes resource condition. Additional information about the 2010 NCCA and the latest 2015 NCCA results, when available, can be found at the U.S. EPA NARS website (see National Aquatic Resource Surveys, ***epa.gov/national-aquatic-resource-surveys***).

G3. Results

For the 2018 IR, new aquatic life data collected in 2015 and 2016 were incorporated into the assessment database. During this period, biosurvey data from 862 sampling sites located in 229 HUC12 WAUs, 38 sampling sites located in 18 LRAUs and 19 samples collected from four of the seven LEAUs were available to completely or partially update previously assessed AUs or provide new assessments for AUs with unknown aquatic life status. All data were collected by Ohio EPA or Level 3 Qualified Data Collector external sources. Watersheds intensively monitored during 2015 and 2016 included the St. Mary's River basin, selected Lake Erie Central Basin tributaries, selected direct tributaries to the Maumee River, selected Southeast Ohio River tributaries, selected Southwest Ohio River tributaries, the Conotton Creek basin, the Raccoon Creek basin and the Symmes Creek basin. The only large rivers comprehensively reassessed were the Whitewater River, Cuyahoga River and Raccoon Creek but updates for specific segments of the Auglaize River, Maumee River, Great Miami River, Little Miami River, Muskingum River, Tuscarawas River, Walhonding River and Scioto River were also completed with a lesser number of sites. Detailed watershed survey reports for many of the basins mentioned above are or will be available from Ohio EPA's Division of Surface Water (see Biological and Water Quality Report Index, ***epa.ohio.gov/dsw/document_index/psdindx.aspx***).

A further examination of individual AUs was made to determine status changes caused by site data collected during 2005 and 2006 that are more than 10 years old and are less appropriate for determining attainment status since the *2016 IR*. From this examination, it was determined that data from 150 HUC12 WAUs were now insufficient to provide adequate spatial coverage either due to (1) all data being age restricted or (2) enough of the data are age restricted that the number of sites fell below the minimum needed to assess. These AUs are not being delisted if currently Category 5. Significant basins affected, along with last sampling year, include the Blanchard River (2005), Fourmile Creek/Indian Creek (2005), Nimishillen Creek (2005), Salt Creek (2005), Twin Creek (2005), Walnut Creek (2005), Yellow Creek (2005), upper Mahoning River (2006), Paint Creek (2006), Scioto Brush Creek (2006) and Whiteoak Creek (2006). Eleven large river assessment units (Blanchard River, Grand River, Hocking River [2], Mad River, Muskingum River [3], Paint Creek and Tuscarawas River [2]) were last comprehensively sampled between 2003 and 2006. However, as these seven large rivers were not expected to have changed significantly since the previous sampling, the data are being retained and used in the overall assessment of these large rivers.

Summarized *2018 IR* statistics for aquatic life assessments for large river, watershed and Lake Erie AUs as well as the comparable statistics from the *2002-2016 IRs* are tabulated in Table G-1. More detailed aquatic life use results and statistics for each 2018 AU (watershed, large river and Lake Erie units), along with similar data from previous IRs, are provided via interactive maps at ***epa.ohio.gov/gis.aspx***.

G3.1 LRAUs

LRAUs in Ohio (38 LRAUs spanning 23 rivers with watersheds greater than 500 square miles and totaling 1,248 river miles) remained essentially unchanged in percent of monitored miles in full attainment compared to the same statistic reported in the 2016 IR (Table G-1, Figure G-2). Based on monitoring through 2016, the full attainment statistic now stands at 87.5 percent (1,089 of 1,243 assessed LRAU miles), up 0.1 percent from the 2016 IR. Significant large rivers assessed for the 2018 IR included the Whitewater River (2013 external data), Cuyahoga River (2016 external data) and Raccoon Creek (2016). Attainment statistics for these three rivers (three LRAUs) are as follows.

- Whitewater River: 100 percent full EWH attainment over 8.3 miles
- Cuyahoga River: 61.3 percent full WWH attainment over 24.2 miles
- Raccoon Creek: 100 percent full WWH attainment over 37.6 miles

Progress toward the 100 percent by 2020 aquatic life use goal for Ohio's large rivers is depicted in Figure G-2. Between the 2002 and 2018 reporting cycles, the percentage of large river miles in full attainment has increased from 62.5 percent to 87.5 percent and, nearly 100 percent of total miles have been assessed. Continued success in approaching the 100 percent full attainment threshold for 100 percent of large river miles by 2020 will depend on sustained resources allocated to monitoring LRAUs with an emphasis on those which were last sampled prior to 2009 and whose data will exceed 10 years in age in 2018 (the last year of data to be included in the 2020 goal assessment). Eleven large rivers (15 AUs), representing nearly 490 large river miles, currently meet this constraint and none have been sampled or are scheduled for sampling.

Table G-1 Summary of aquatic life use assessment for Ohio's WAUs[1], LRAUs and LEAUs: 2002-2018 IR cycles.

IR Cycle	2002 (1991-2000)	2004 (1993-2002)	2006 (1995-2004)	2008 (1997-2006)	2010 (1999-2008)	2012 (2001-2010)	2014 (2003-2012)	2016 (2003-2014)	2018 (2003-2016)
HUC11 WAUs (331)									
No. AUs Assessed (% of total)	224 (68%)	225 (68%)	212 (64%)	218 (66%)	221 (67%)	-	-	-	-
No. Sites Assessed	3272	3620	3785	4030	4200	-	-	-	-
Average AU Scores									
Full Attainment	**46.6**	**48.3**	**52.5**	**54.7**	**58.5**	-	-	-	-
Partial Attainment	25.2	23.6	22.6	22.4	21.2	-	-	-	-
Non-Attainment	28.2	28.1	24.9	22.9	20.3	-	-	-	-
HUC12 WAUs (1538)									
No. AUs Assessed (% of total)[2]	-	-	-	-	999 (65%)	908 (59%)	933 (61%)	983 (64%)	1,007 (65.5%)
No. Sites Assessed	-	-	-	-	4200	3867	3876	3875	3911
Average AU Score[3]	-	-	-	-	**56.7**	**57.7**	**59.2**	**61.5**	**64.2**
% Sites Full Attainment	-	-	-	-	55.1	57.0	57.8	59.3	61.8
% Sites Partial Attainment	-	-	-	-	20.0	21.6	22.3	20.7	19.7
% Sites Non-Attainment	-	-	-	-	24.9	21.4	19.9	20.0	18.5
LRAUs (23 rivers/38 AUs totaling 1247.54 Miles)									
No. Rivers/AUs Assessed[4]	22	21	17	16	18/30	18/31	22/37	23/38	23/38
No. Sites Assessed	422	425	374	278	265	312	332	358	370
No. Miles Assessed (% of total)	905 (70%)	918 (71%)	873 (68%)	850 (66%)	852 (69%)	984 (80%)	1,147 (92%)	1,216 (98%)	1,243 (99.7%)
% Miles Full Attainment	**62.5**	**64.0**	**76.8**	**78.7**	**93.1**	**89.0**	**89.2**	**87.4**	**87.5**
% Miles Partial Attainment	23.0	21.4	15.1	13.9	5.5	7.5	6.3	8.7	8.8
% Miles Non-Attainment	14.5	14.6	8.1	7.4	1.4	3.5	4.5	3.9	3.7
LEAUs (4[5])									
No. AUs Assessed	3	3	3	3	3	3	3	3	4
No. Sites Assessed[6]	92	111	93	49	34	23	38	45	47
% Sites Full Attainment	**12.0**	**18.0**	**19.4**	**10.2**	**14.7**	**30.4**	**13.2**	**13.3**	**17.0**
% Sites Partial Attainment	13.0	14.4	16.1	22.4	17.7	30.4	34.2	31.1	25.5
% Sites Non-Attainment	75.0	67.6	64.5	67.4	67.6	39.2	52.6	55.6	57.5

1 WAUs for the IR 2002-2010 cycles were based on HUC11s; WAUs transitioned to HUC12s for cycles beginning with 2010.

2 2010 statistics based on direct assessment of HUC12 AUs with data collected between 2005 and 2008 (n=545) and HUC11 extrapolated assessment of HUC12 AUs with data collected between 1998 and 2004 (n=454). 2012, 2014, 2016, and 2018 IR assessments based on direct assessment of HUC12 AUs with data collected between 2001 and 2010 (n=908), 2003 and 2012 (n=933), 2005 and 2014 (n=983) and 2007 and 2016 (n=1007), respectively.

3 Statistic based on the average of available AU scores with up-to-date or acceptable data, derived as explained in Section G2.2.

4 LRAUs were generally sampled between 2007 and 2016; however, seven rivers (11 LRAUs) were assessed with data collected primarily between 2003 and 2006.

5 For the 2018 IR, LEAUs were refined to distinguish the Sandusky Bay shorelines and open water as a transition area between the western and central basins, resulting in four shoreline units that were assessed for aquatic life use.

5 Data for Lake Erie shoreline sites used in the 2002-2012 IR cycles were generally collected between 1993 and 2002; for the 2014-2018 IRs, data were collected 2011-2016.

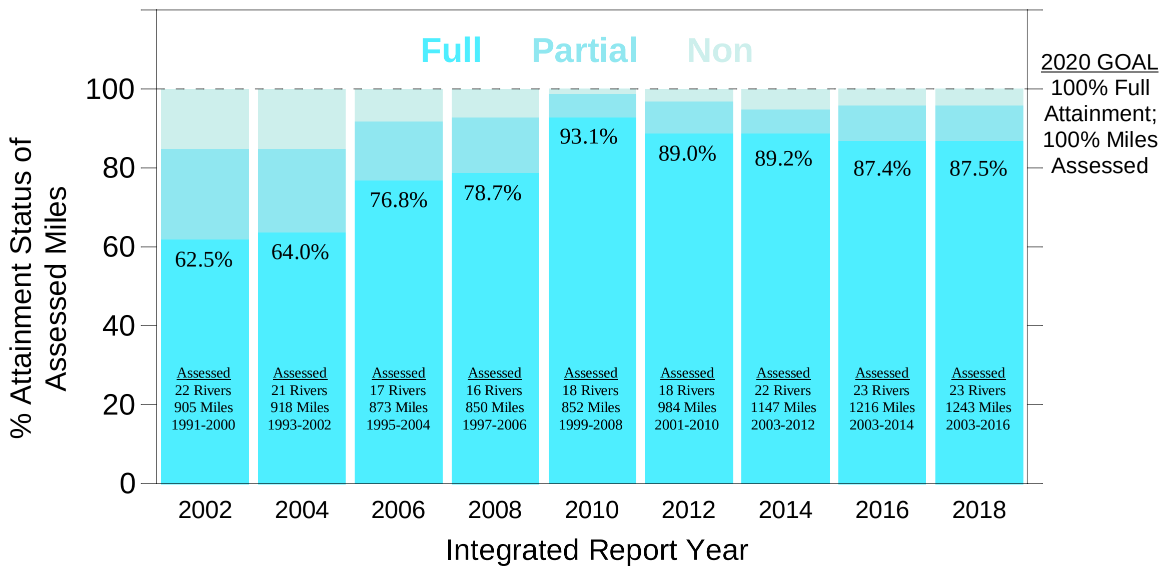


Figure G-2 — Percent attainment status and goal progress ("100% by 2020") for monitored miles of Ohio's large river assessment units (23 rivers/38 AUs/1247.54 miles total).

Note: Data compiled over the last nine IR cycles with the current 2018 cycle including data collected from 2003-2016.

G3.2 WAUs

For the 2018 IR, the average HUC12 WAU score reflected a positive increase from the corresponding score reported in the 2016 IR (Table G-1, Figure G-3). Based on monitoring through 2016, the average HUC12 WAU score stands at 64.2, a 2.7-point increase from the 2016 IR and a 5.0 point increase from the 2014 IR. The WAU score is roughly equivalent to the percentage of monitored sites with full aquatic life use attainment in WAUs assessed for this IR cycle. This trend and trajectory is typical of what has been observed over the last several cycles (a pattern of steady increases of 1-3 points). Included in Table G-1 and depicted in Figure G-3 is the corresponding average score based on the old HUC11 WAUs, which were tracked from 2002 through 2010 and were used to gauge the progress of the 80 percent by 2010 aquatic life use goal as reported in the 2010 IR.

Table G-2 depicts the breakdown of site full attainment based on the watershed size category used to determine an individual watershed's score based on available sites in the HUC12 WAU. As in previous reports, the results show that biological impairment is more likely at sites on small streams (more than four in 10 headwater sites are impaired) and that impairment lessens significantly as sites drain larger areas (nearly seven in 10 assessed principal stream and small river sites, 69.3 percent, are in full attainment). This phenomenon correlates well with the most widespread causes associated with aquatic life impairment in these watersheds.

Table G-3 and Figure G-4 depict the attainment status breakdown of the 3,911 WAU sites collected primarily from 2007-2016 by designated or recommended (existing) aquatic life use. As would be expected, most sites (74.2 percent) are assigned the base warmwater habitat (WWH) aquatic life use, for which attainment of biocriteria signifies meeting the fishable/swimmable goal of the Clean Water Act (CWA). For this cycle, about 55 percent of assigned WWH sites are meeting the WWH use. About 18.3

percent of the 3,911 sites are assigned more protective aquatic life uses (exceptional warmwater habitat-EWH, coldwater habitat-CWH or a dual use which includes both-EWH/CWH). The remainder of the sites (7.5 percent) are assigned less than goal CWA uses (modified warmwater habitat-MWH and limited resource water-LRW). Both more protective and less than goal uses are only assigned after a use attainability analysis has been conducted based on rigorous field data and this study determines that the assigned aquatic life use is the most appropriate to protect existing high-quality/unique biological communities or set reasonable restoration benchmarks for communities challenged by pervasive anthropogenic or natural influences. As might be expected, a high percentage of sites assigned to more protective uses are fully meeting that use (88.0 percent) while those with assigned less than goal uses have lower achievement of even the lessened expectations of these uses (61.2 percent meet).

Table G-4 lists the top five aquatic life use impairment causes for the period 2003 through 2016. For this time period, principal causes for HUC12 WAU impairments were those primarily related to landscape modification issues involving agricultural land use and urban development. These types of impairments would be most manifest in smaller streams, a fact backed up by the numbers presented in Table G-2. It is important to note that between 24 percent and 47 percent of impaired HUC12 WAUs had at least one monitored site impaired by one of these individual causes and many WAUs had several sites affected by three or more of the five causes listed as responsible for the aquatic life use impairment. This would not be an unusual situation given the frequently close association between these impairment causes (for example, nutrients, sedimentation/siltation, habitat modifications and hydromodifications in rural/agricultural landscapes relying on channelization and field tiles for drainage). Also of note is the prevalence of HUC12 WAUs and LRAUs which are impaired by the generic organic enrichment cause category; 35 percent of impaired WAUs show sewage-related impairments such as high biochemical oxygen demand, elevated ammonia concentrations, depressed dissolved oxygen concentrations, and/or in-stream sewage solids deposition. Eight of 20 impaired LRAUs also note sewage-related causes. While the LRAU percentage remained unchanged from the value reported in the 2016 IR, the WAU value ticked up by five percentage points and is now the second most prevalent cause of impairment behind siltation/sedimentation in WAUs, surpassing both habitat modifications and nutrient enrichment since the previous IR. This upswing suggested that adequate treatment and disposal of human and animal wastes via wastewater treatment plants, home sewage treatment systems and land applications of septage and animal manure continue to be critical water quality issues in many Ohio watersheds and perhaps is expanding at a faster rate than other common impairment causes.

Progress towards the 80 percent by 2020 aquatic life use goal for Ohio's wading and principal stream and river sites (those monitored sites draining watersheds between 20 and 500 square miles) is depicted in Figure G-5 for the 2018 IR cycle. Contrasted with the 2010 IR statistic, when the 2020 goal benchmark was established, the percentage of qualifying sites in full attainment has increased nearly eight percentage points with an increase from 61.4 percent to 69.3 percent. If this rate of change remains consistent over the next and last cycle of data (new data collected in 2017 and 2018), the statistic should exceed 70 percent but will likely not reach the 80 percent goal by the time the 2020 IR is produced. It is readily apparent that more proactive implementation of watershed recommendations in TMDL reports and watershed action plans (WAPs) will be needed to recover impaired aquatic communities and protect those currently meeting aquatic life expectations in order to meet the 80 percent goal. It will also be critical that resources be directed to follow-up monitoring in areas with implemented restoration and protection projects so that success of efforts can be documented and reflected in future goal statistics. This latter effort is now well underway in survey areas with TMDLs approved and implemented beginning in the late 1990s and is an ongoing activity in support of the Ohio EPA Nonpoint Source Program (see ***epa.ohio.gov/dsw/nps/index.aspx*** for more program information).

Table G-2 Breakdown by watershed size category of sites in full, partial and non-attainment in monitored WAUs (1,007 HUC12s) based on data collected primarily from 2007-2016.

Watershed Size Category (mi^2)	# of Sites (% of total)	Number of Sites in Full Attainment (%)	Number of Sites in Partial Attainment (%)	Number of Sites in Non-Attainment (%)
0-20 (headwater)	2,353 (60.2)	1,337 (56.8)	474 (20.2)	542 (23.0)
20-50 (wading)	628 (16.0)	394 (62.7)	145 (23.1)	89 (14.2)
50-500 (principal)	930 (23.8)	685 (73.7)	154 (16.5)	91 (9.8)
Total	3,911	2,416 (61.8)	773 (19.8)	722 (18.4)

Table G-3 Breakdown by designated or recommended aquatic life use of sites in full, partial and non-attainment in monitored watershed assessment units (1,007 HUC12s) based on data collected primarily from 2007-2016.

Aquatic Life Use[1]	# of Sites (% of total)	Number of Sites in Full Attainment (%)	Number of Sites in Partial Attainment (%)	Number of Sites in Non-Attainment (%)
EWH	413 (10.6)	355 (85.9)	54 (13.1)	4 (1.0)
EWH/CWH	89 (2.3)	83 (93.2)	3 (3.4)	3 (3.4)
CWH	213 (5.4)	191 (89.7)	13 (6.1)	9 (4.2)
WWH	2,902 (74.2)	1,607 (55.4)	670 (23.1)	625 (21.5)
MWH	246 (6.3)	161 (65.5)	33 (13.4)	52 (21.1)
LRW	48 (1.2)	19 (39.6)	-	29 (60.4)
Total	3,911	2,416 (61.8)	773 (19.8)	722 (18.4)

EWH: exceptional warmwater habitat, CWH: coldwater habitat, WWH: warmwater habitat
MWH: modified warmwater habitat, LRW: limited resource water

1 **Bold** text indicates use that meets the minimum fishable/swimmable goal of the Clean Water Act.
Bold/italics text indicates use that exceeds the minimum fishable/swimmable goal of the Clean Water Act.
Plain text indicates less than goal use that does not meet the minimum fishable/swimmable goal of the Clean Water Act.

Table G-4 Prevalence of the top five causes of aquatic life use impairment in WAUs and LRAUs based on biological and water quality survey data collected from 2003-2016.

		Number and Percentage of Monitored AUs with Impaired Aquatic Life Use Listed with a Top Five Cause of Impairment[1]				
Assessment Unit (AU)	Number	Siltation/ Sedimentation	Habitat Modification	Nutrient Enrichment	Organic Enrichment	Hydro-modification
Watershed	***1,538***					
Monitored 2007-2016	1,007					
Impaired aquatic life use	608	284 (47%)	198 (33%)	176 (29%)	213 (35%)	144 (24%)
No impairment	399					
Large River	***38***					
Monitored 2003-2016	38					
Impaired aquatic life use	20	7 (35%)	8 (40%)	8 (40%)	8 (40%)	8 (40%)
No impairment	18					

1 Listed as an aquatic life use impairment cause for at least one stream within the watershed AU or one reach within the large river AU.

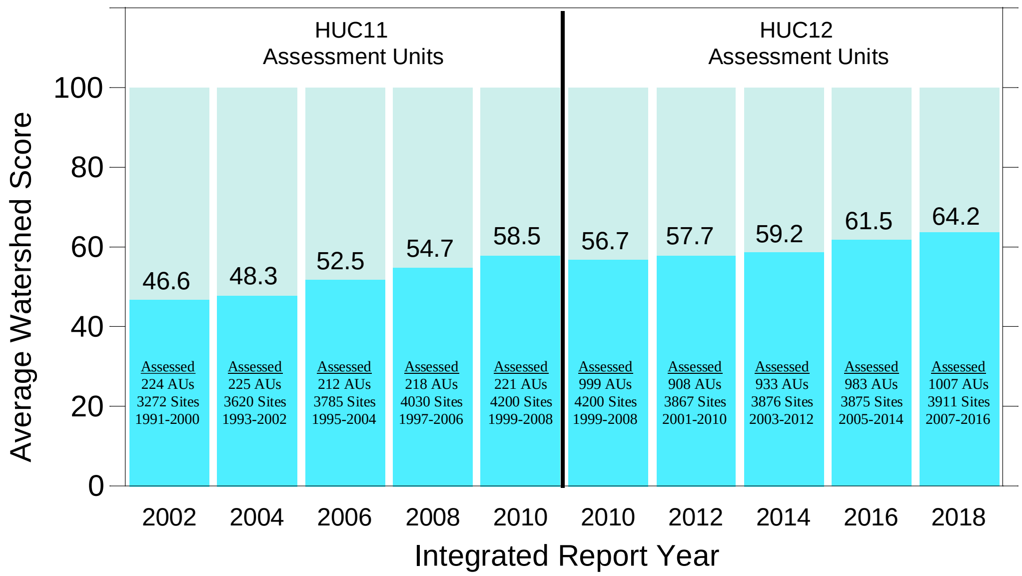


Figure G-3 — Average full attainment watershed score for monitored Ohio HUC11 watershed assessment units (IR cycles 2002-2010) and HUC12 watershed assessment units (IR cycles 2010-2018).

Note: Data compiled over the last nine IR cycles with the current 2018 cycle including data collected primarily from 2007-2016.

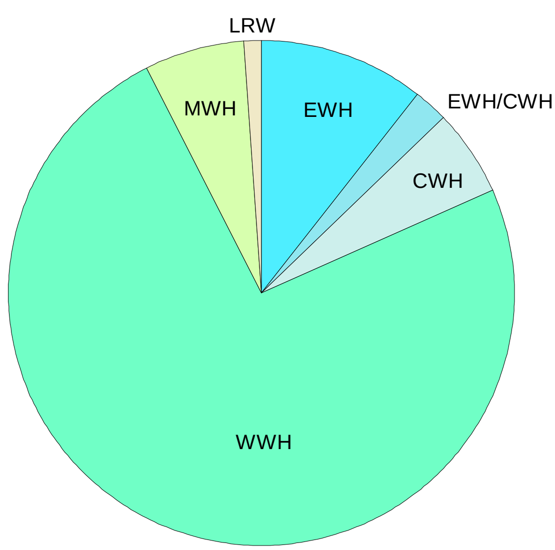


Figure G-4 — Breakdown by designated or recommended aquatic life use of sites in monitored watershed assessment units (1,007 HUC12s) based on data collected primarily from 2007-2016 (n= 3,911 sites).

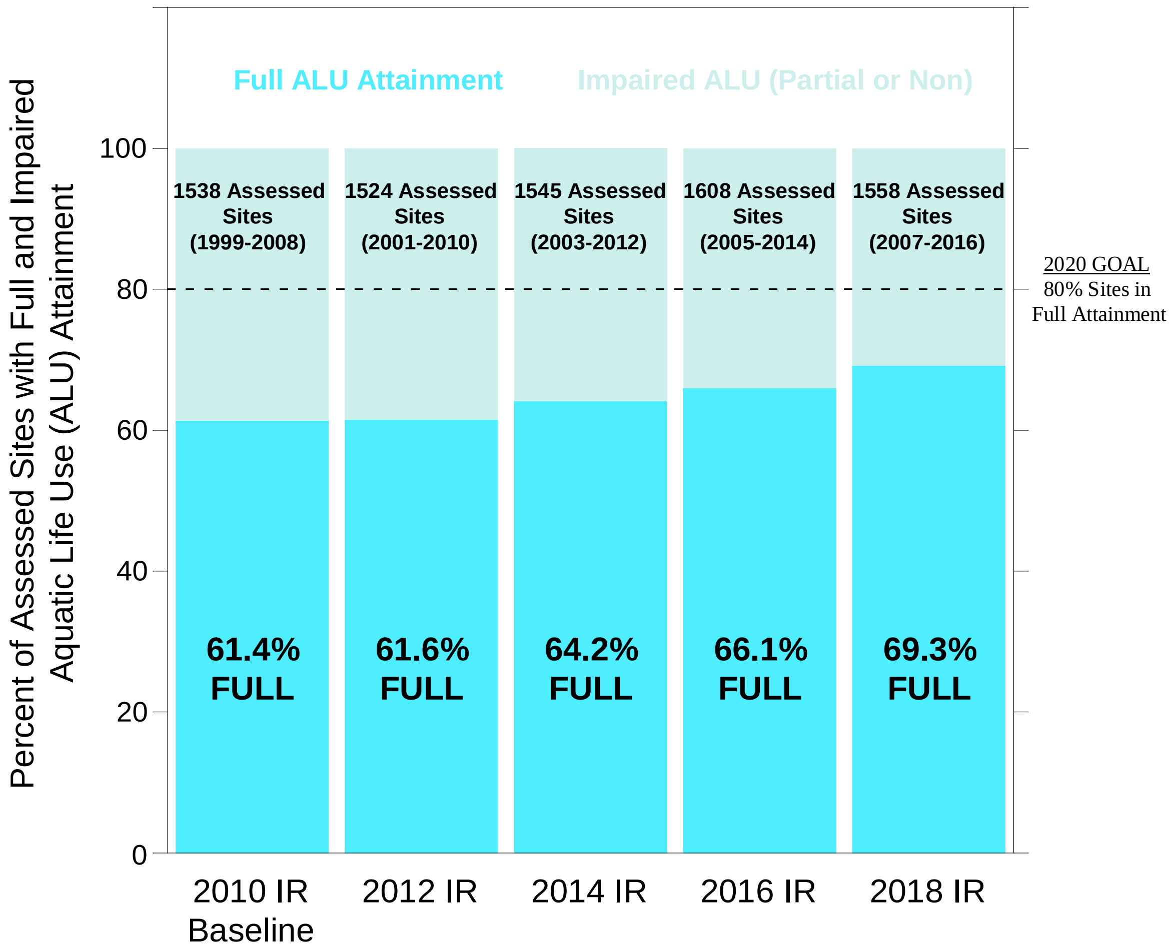


Figure G-5 — Status and trend of aquatic life use 80 percent by 2020 goal for wading and principal stream and river sites in Ohio based on the last five IR cycles.

G3.3 LEAUs

For previous IRs, assessments were based on past data collected in the mid-1990s through the early 2000s. Significant changes appear to be ongoing in Lake Erie, and, as a result, these older data are no longer being used to determine aquatic life use attainment status in the LEAUs. However, these data are used in the following discussion to highlight key trends in fish community condition over two time periods of sampling.

From 2011-2016, 131 fish community collections using night electrofishing methods (day electrofishing at two Sandusky Bay sites) were taken from 47 sites spread over the shoreline LEAUs; these data serve as the core data set for assessment of Lake Erie status. For this cycle, and despite the rather limited amount of data, the assessment methodology as used in past IRs was once again used to determine aquatic life use status in the LEAUs. This included the averaged IBI and MIwb scores for all sampling passes available at a given sampling location which were then compared to target expectations based on the prevailing bottom substrate type at that location (hard bottoms — bedrock, boulder, rubble or soft bottoms — sand, silt, muck). Results for the IBI and MIwb scores at 33 shoreline sites (excluding the shoreline located in Sandusky Bay and the Lake Erie Islands sites) compared to expectations are presented in Figure G-6 and Figure G-7.

All the shoreline LEAUs assessed remain Category 5 with significant impairment of sites due primarily to tributary loadings of nutrients and sediment, exacerbated by continued trophic disruptions caused by the proliferation of exotic species, algal blooms and shoreline habitat modifications. In the aggregate, only nine of 47 fish community collections were assessed as fully attaining the designated EWH aquatic life use; 11 were assessed as partially attaining and the remaining 27 were in non-attainment (Table G-1).

A breakdown of results reflects the following site attainment status for each of the LEAUs.

AUID	AU Name	# Sites	# Full	# Partial	# Non
041202000201	Lake Erie Western Basin Shoreline (including Maumee Bay)	9	3	0	6
041202000301	Lake Erie Western Basin Open Water	0	0	0	0
041202000101	Lake Erie Islands Shoreline	4	0	1	3
041202000202	Lake Erie Sandusky Basin shoreline	14	5	5	4
041202000302	Lake Erie Sandusky Basin open water	0	0	0	0
041202000203	Lake Erie Central Basin shoreline	20	1	5	14
041202000303	Lake Erie Central Basin open water	0	0	0	0

During 2015 and 2016, fish community sampling was conducted at 14 Lake Erie shoreline sites. Communities at 12 of these sites had been collected one or more times during previous years (2011-2014) and two were sites sampled for the first time. Compared to the results reported in the 2016 IR, nine of the 12 repeat sites reflected an upward trend in the averaged biological index score; two sites were unchanged and only one reflected a downward trend. Fish communities at nine sites (up from six in 2016) were fully meeting aquatic life use target expectations. Five of the fully attaining sites were in the Sandusky Basin. Three full attainment sites were located on the western basin shoreline and one full attainment site on the central basin shoreline was located within West Harbor just to the west of the Cuyahoga River in Cleveland. All partial attainment sites were due to MIwb scores meeting expectations which may have reflected better aggregated numerical abundance of fish, increased biomass and structural evenness, the latter being a product of species richness and the distribution of numbers and biomass among the various species. At several partial attainment sites, IBI scores, while not quite meeting targets, were approaching acceptable scores. These shoreline sites were in the Sandusky Basin and near the Grand River, Ashtabula River and Conneaut Creek along Ohio's central basin shoreline.

For this IR, an attempt was made to compare the recent data set collected 2011-2016 to similar electrofishing results collected from co-located sites sampled in the 1990s and early 2000s. For the most part, there seemed to be little change in medians and ranges of these two indices at the sites spanning the two timeframes. New data collected from 2015 and 2016 had little effect on the resulting statistics. As with past reporting, the biggest changes between the two sampling periods appeared linked to Lake Erie Islands shoreline sites but that may have been more an artifact of the small sample sizes. One Lake Erie IBI component metric which did seem to reflect a significant change across the two timespans was the proportion of exotic species by numerical abundance in each sampling pass. For Lake Erie, typical common exotic species which can be collected using the electrofishing sampling method include round and tube nose goby, white perch, ghost shiner, gizzard shad, common carp and goldfish.

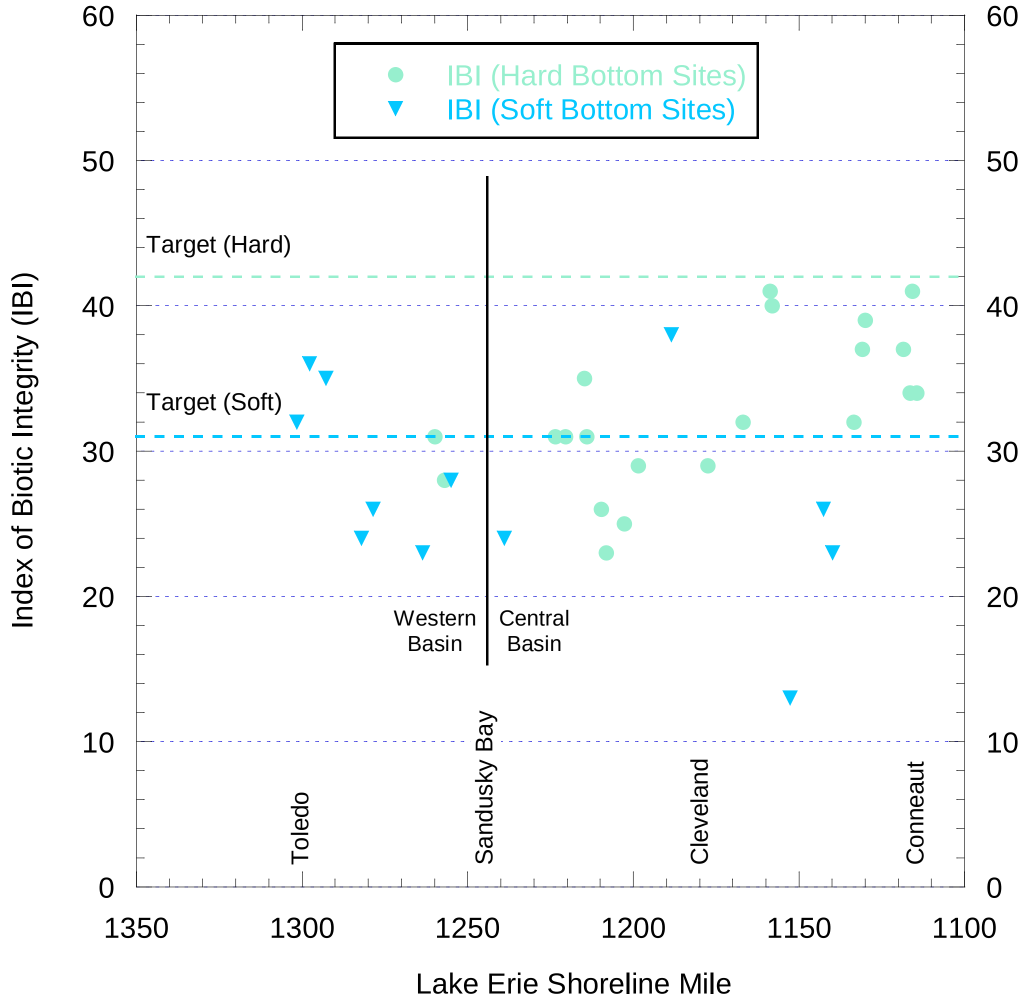


Figure G-6 — Average IBI scores compared to habitat-scaled targets based on sampling passes available for sites (n=33) along the Lake Erie shoreline from Toledo to Conneaut, 2011-2016.

Figure does not include average IBI scores for Sandusky Bay or Lake Erie Islands shoreline sites.

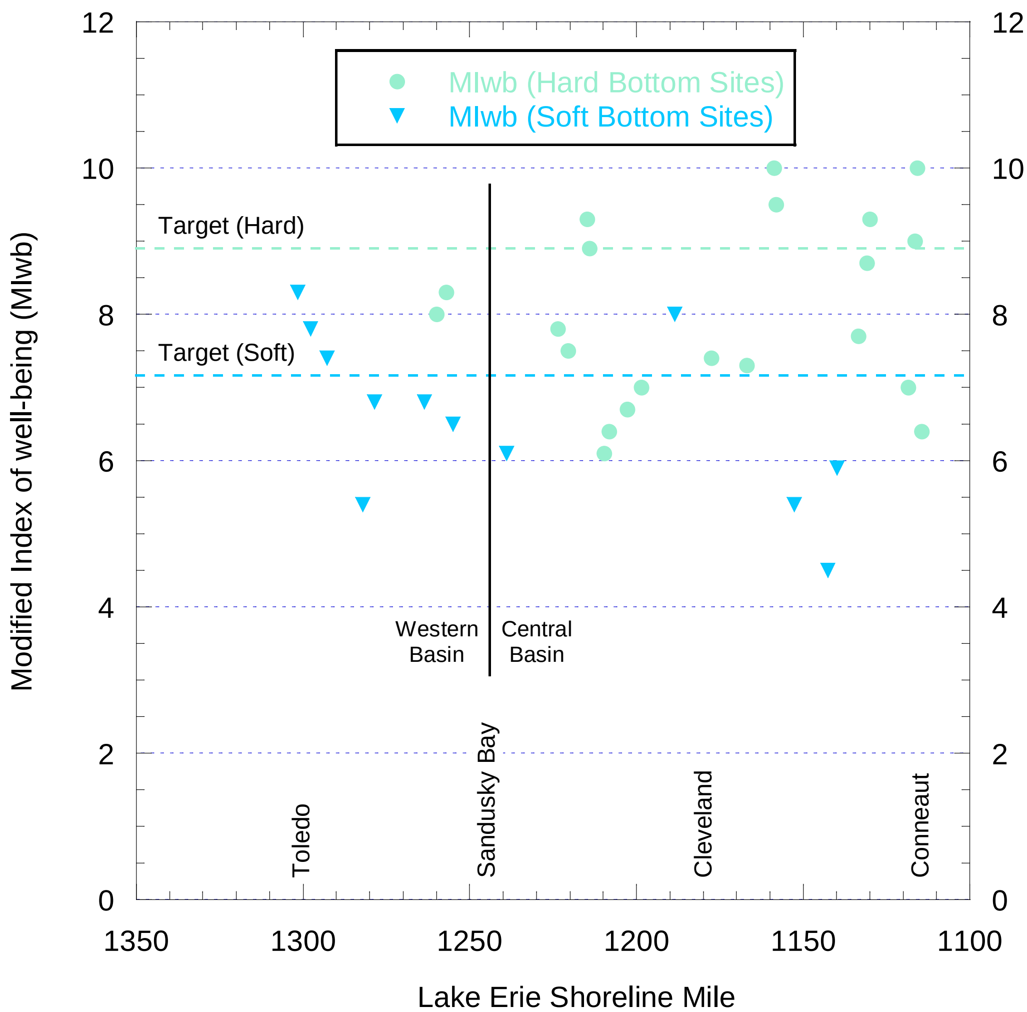


Figure G-7 — Average MIwb scores compared to habitat-scaled targets based on sampling passes available for sites (n=33) along the Lake Erie shoreline from Toledo to Conneaut, 2011-2016.

Figure does not include average MIwb scores for Sandusky Bay or Lake Erie Islands shoreline sites.

Section

H

Evaluating Beneficial Use: Public Drinking Water Supply

H1. Background

The 2018 Integrated Report (IR) is the sixth reporting cycle to include assessment of the public drinking water supply (PDWS) beneficial use. Ohio continues to look for connections between Clean Water Act and Safe Drinking Water Act (SDWA) activities and leverage the programs to clean up and protect drinking water sources. Acknowledgement of the public water supply use and identification of impaired waters provides an effective issue in which to engage the public and stakeholders in watershed-wide planning and implementation activities. Conversely, the public water systems can be effective partners in these efforts and stand to benefit through reduced treatment costs, reduced risk to human health and credits toward achieving compliance with new SDWA regulations via source water controls in the watershed.

Assessments for each public water system were completed for nitrate, pesticide and algae (cyanotoxin) indicators. Assessments included in this cycle are based on treated and raw water quality compliance data and, to a limited extent, other source water quality data available from Ohio EPA and external sources. Information used to complete assessment determinations include public water system treatment information, intake location, number and type of reservoirs and water quality data. Assessments were completed for stream sources, in-stream impounded reservoir sources and upground reservoirs with active drinking water intakes. Figure H-1 identifies Ohio watershed assessment units (WAUs), large river assessment units (LRAUs) and Lake Erie assessment units (LEAUs) that contain surface waters currently utilized as drinking water sources by a public water system. WAUs correspond to 12-digit hydrologic unit codes. Six public water systems had intakes go inactive since the last reporting period, including: Echoing Hills Village (Shalimar Lake Intake, Upper Pond Intake, and Lower Pond Intake); Twin City Water and Sewer (Stillwater Creek); Burr Oak Regional (East Branch Sunday Creek); Crooksville Village (Black Fork); ODNR Blue Rock (Manns Fork Salt Creek); and ODNR Hocking Hills State Park (Rose Lake Intake). The WAUs associated with these public water systems were not assessed.

H2. Evaluation Method

The methodology for assessing the PDWS beneficial use was first presented in the 2006 Integrated Water Quality Monitoring and Assessment Report. Updates to the methodology were included in subsequent IRs. The methodology used for this reporting cycle, including the use of an algae indicator, is described in this section. For more detail on how the method was first developed and rationale for indicator selection and exclusion, please refer to the initial methodology at ***epa.ohio.gov/portals/35/tmdl/2006IntReport/IR06_app_C_PDWSmethodology.pdf***.

H2.1 Beneficial Use Designation

The PDWS use designation is defined in paragraph (B)(3) of Ohio Administrative Code (OAC) rule 3745-1-07. It applies to public waters that, with conventional treatment, will be suitable for human intake and meet federal regulations for drinking water. Although not necessarily included in rules 3745-1-08 to 3745-1-30 of the OAC, the bodies of water with one or more of the following characteristics are designated public water supply by definition:

- All publicly owned lakes and reservoirs, except for Piedmont reservoir;
- All privately owned lakes and reservoirs used as a source of public drinking water;
- All surface waters within 500 yards of an existing public water supply surface water intake; and
- All surface waters used as emergency water supplies.

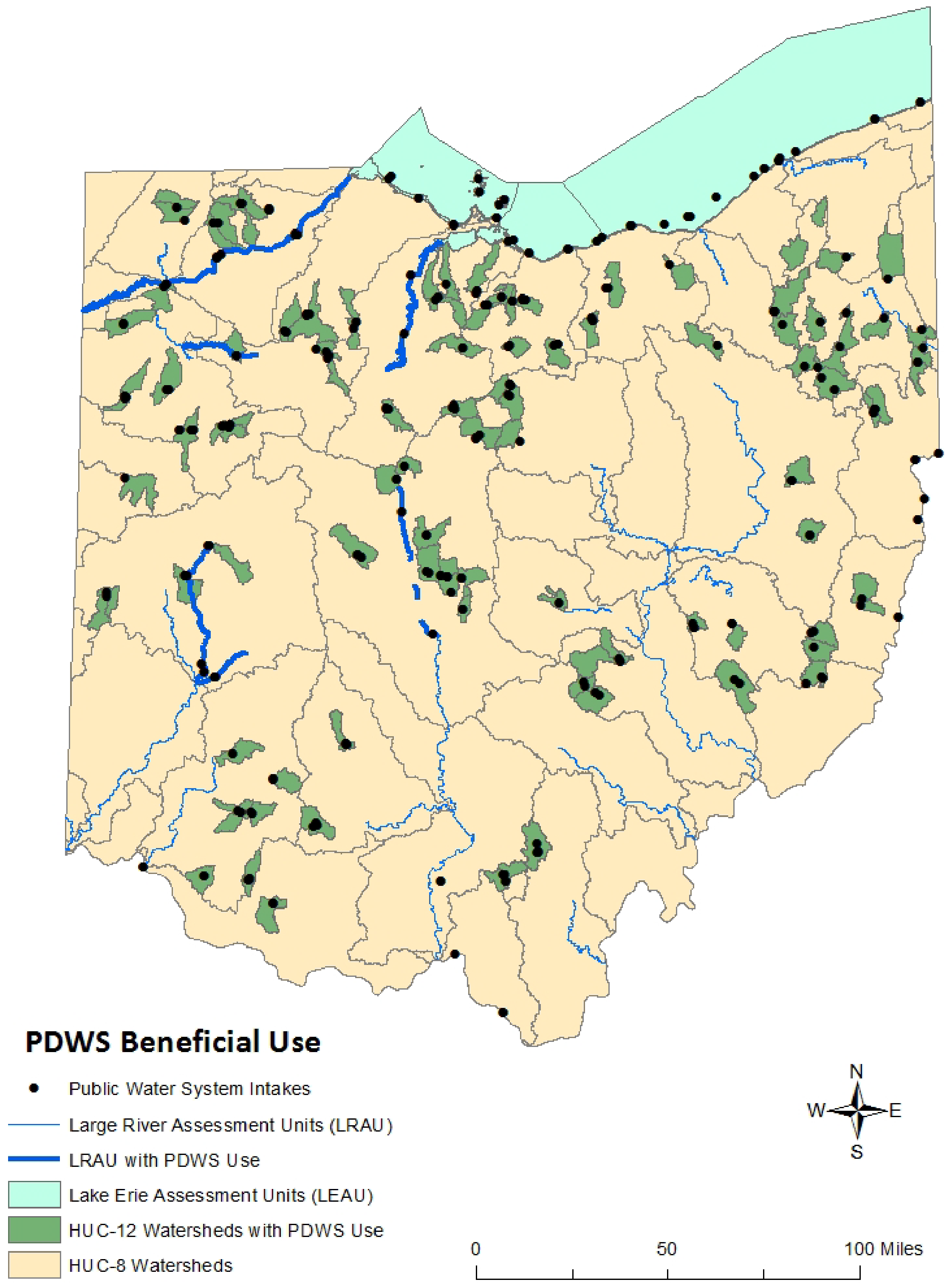


Figure H-1 — Ohio WAUs, LRAUs and LEAUs that contain at least one active surface water drinking water intake.

Ohio EPA is focusing assessment efforts and limited resources on water bodies currently serving as public drinking water sources. Water bodies with inactive drinking water intakes that are being maintained as an emergency source of drinking water will also be assessed. Assessments for waters designated with the PDWS use but not currently used as a drinking water source are considered a lower priority and will be assessed only when water quality data is available.

Attainment determinations will apply to hydrologic assessment units (AUs) as defined by Ohio EPA's Division of Surface Water (DSW). For inland rivers the assessment unit is defined as the 12-digit hydrologic unit code (HUC 12) or the large river assessment unit. LEAUs were revised this cycle to cover all of Ohio's waters and now include seven units based on geographic location and depth (shoreline: less than or equal to three meters and open water: greater than three meters). There are 30 active public water system intakes located within six of the seven LEAUs. Although this beneficial use designation applies to a 500-yard zone surrounding the intakes, the attainment determination will be associated with the corresponding hydrologic assessment unit and factor into the 303(d) priority listing determination for impaired waters.

H2.2 Water Quality Standards

Water quality standards are designed to protect source water quality to the extent that public water systems can meet the finished water SDWA standards utilizing only conventional treatment. Source water quality will be assessed though comparison of in-stream and applicable treated water quality data to numeric chemical water quality criteria for the core indicators: nitrate; pesticides and other contaminants; and *Cryptosporidium* (following criteria development). The numeric water quality criteria correspond to the maximum contaminant levels established by the SDWA or were adopted from U.S. EPA's 304(a) recommended water quality criteria. Criteria will apply as average concentrations except for nitrate. At elevated levels, nitrate can cause acute health effects and the SDWA finished water standard applies as a maximum concentration not to be exceeded. Consequently, the water quality criteria for nitrate will be applied as a maximum value. Annual time-weighted mean pesticide concentrations were calculated by taking the annual average of the quarterly averages and comparing to the water quality criteria.

An additional core indicator based on algae and associated cyanotoxins is based on the aesthetic narrative criteria for algae described in OAC rule 3745-1-07 and uses cyanotoxins as an indicator of algae impairment. The State of Ohio initially developed numeric cyanotoxin drinking water thresholds for microcystins, saxitoxins, anatoxin-a and cylindrospermopsin in 2011 and these thresholds are the basis for cyanotoxin indicators of impairment. The PDWS beneficial use assessments are based on comparison to the thresholds identified in the 2014 State of Ohio Public Water System Harmful Algal Bloom Response Strategy. In 2016, Ohio finalized new rules for harmful algal blooms and cyanotoxins at public water systems, including requirements for routine microcystins and cyanobacteria screening monitoring and reporting. For this report, Ohio EPA reevaluated the cyanotoxin indicators and, to maintain consistency, decided to not change the cyanotoxin indicators for the 2018 reporting cycle. Since cyanotoxin thresholds are based on acute or short-term exposures, the criteria are based on a maximum concentration not to be exceeded.

Public Drinking Water Supply Beneficial Use Cyanotoxin Indicators and Thresholds			
Microcystins (µg/L)	Anatoxin-a (µg/L)	Cylindrospermopsin (µg/L)	Saxitoxins (µg/L)
1.0	20	1.0	0.2

H2.3 Attainment Determination

Each assessment will result in identification of one of three attainment categories: Impaired; Full Attainment; and Not Assessed-Insufficient Data. For AUs with multiple PDWS zones, the attainment statuses of all zones are combined and the lowest attainment status applied to determine the PDWS assessment status for the entire assessment unit. That is, the overall AU status is considered Impaired if any of the PDWS zones have an impaired attainment status. Conversely, the overall assessment status for the AU could be listed as Full Support only if sufficient data for at least the nitrate indicator was available to determine the attainment status for all PDWS zones within the AU.

AUs are further evaluated for water quality conditions placing them on a watch list. Source waters are placed on the watch list when water quality was impacted, but not at a level that indicates impairment. Waters may remain on the watch list based on historical data, if current raw water data or applicable finished water quality data are not available. While these waters are still considered in full attainment of the PDWS use, they will be targeted for additional monitoring and more frequent assessment as resources allow. Table H- 1 identifies impaired and watch list water quality conditions.

Table H- 1 PDWS attainment determination.

Applies to ambient and treated water quality data from 2010 through October 2017.

Indicator	Impaired Conditions
Nitrate	☐ Two or more excursions[a] above 10.0 mg/L within the 5-year period
Pesticides	☐ Annual average exceeds WQ criteria (atrazine = 3.0 µg/L)
Other Contaminants	☐ Annual average exceeds WQ criteria
Algae: Cyanotoxins[b]	☐ Two or more excursions[a] above the state drinking water thresholds (microcystins = 1.0 µg/L) within the 5-year period
Cryptosporidium[c]	☐ Annual average exceeds WQ criterion (1.0 oocysts/L)
Indicator	**Full Attainment Conditions**
Nitrate	☐ No more than one excursion[a] above 10.0 mg/L within the 5-year period
Pesticides	☐ Annual average does not exceed the WQ criteria (atrazine = 3.0 µg/L)
Other Contaminants	☐ Annual average does not exceed the WQ criteria
Algae: Cyanotoxins	☐ No more than one excursion[a] above the state drinking water thresholds (microcystins = 1.0 µg/L, cylindrospermopsin = 1.0 µg/L, and saxitoxins = 0.2 µg/L) within the 5-year period
Cryptosporidium	☐ Annual average does not exceed the WQ criterion
Indicator	**"Watch List" Conditions** *Source waters targeted for additional monitoring and assessment*
Nitrate	☐ Maximum instantaneous value > 8 mg/L (80% of WQ criterion)
Pesticides	☐ Running quarterly average ≥ WQ criteria ☐ Maximum instantaneous value ≥ 4x WQ criteria
Other Contaminants	☐ Maximum instantaneous value ≥ WQ criteria
Algae: Cyanotoxins	☐ Maximum instantaneous value ≥ 50% of the state drinking water thresholds
Cryptosporidium	☐ Annual average ≥ 0.075 oocysts/L

[a] Excursions must be at least 30 days apart in order to capture separate or extended source water quality events.
[b] Impaired conditions based on source water detections at inland public water systems and detections at public water system intakes for Lake Erie source waters. Cyanotoxins include: microcystins, saxitoxins, anatoxin-a and cylindrospermopsin.
[c] Impaired conditions for *Cryptosporidium* are based on water quality criteria that Ohio EPA intends to develop.

H2.4 Data Sources and Requirements

To capture current water quality conditions, the beneficial use will be evaluated using the most recent five years of data. The 2018 PDWS use impairment list was developed using public water system compliance monitoring treated and raw water quality data and ambient (stream and lake) water quality data from January 2012 through October 2017. Water quality data were requested and obtained from the Syngenta Crop Protection, Inc. Atrazine Monitoring Program (AMP; 2012-2016). Treated water quality data were obtained from the Safe Drinking Water Information System (SDWIS) database, which contains all SDWA compliance data submitted to the Division of Drinking and Ground Waters (DDAGW) by Ohio public water systems and their certified laboratories. Raw water quality data from samples collected near intakes were obtained from DSW's ambient monitoring database and level 3 credible data collected and submitted by level 3 qualified data collectors. Additional raw water quality data were collected by DDAGW at intake locations and cyanotoxin data were retrieved from Ohio EPA's Harmful Algal Bloom database.

Treated water quality data could only be used for the assessments if the water system did not blend with ground water, selectively pump from the stream source to an upground reservoir to avoid contamination or use a nitrate or pesticide removal treatment process. A significant number of water systems use activated carbon during the water treatment process, which precludes use of the treated pesticide data for PDWS assessments and leads to a significant number of assessments completed with nitrate and algae data only.

The following sampling guidance was followed to ensure that surface water samples are representative of the source water.

- Preferred sampling location was within the 500-yard PDWS zone or directly at the intake. Samples collected at the treatment plant raw water line were also considered representative.
- Data collected upstream from the intake beyond the 500-yard zone were utilized if there were no significant hydrologic or water quality changes between the sample location and the intake. Dams, channel modification, tributaries with significant flow or contaminant sources were assumed to significantly alter in-stream water quality and limit applicability of farther upstream sampling data.
- For PDWS lakes and reservoirs with known stratification or seasonal turnover, the preferred data collection location was either the raw water intake line or in the lake at the same depth or zone as the raw water intake screen(s). Surface sampling data collected at the intake were utilized if no other raw water data were available.

PDWS attainment determinations based on small sample sets present several challenges. The small sample set may fail to identify an exceedance of a water quality standard, resulting in a determination of attainment when in fact an area is impaired. Statistical confidence in the determination decision is also reduced. To address these concerns, the assessment looks at multiple lines of evidence including several sources of water quality data and treatment plant information. The attainment decision target sample size is 20 samples collected within the past five years. This sample count will provide sufficient power to detect exceedances of greater than or equal to 15 percent above the criterion with a Type I error of 0.15. Ohio EPA has limited resources for source water sampling, therefore attainment determinations may be concluded with a minimum of 10 samples if these samples represent the critical period when the contaminant is typically detected. Attainment decisions may also be made with less than the required sample count when there is overwhelming evidence of impairment, such as a large single sample exceedance of nitrate or microcystins (verified with a repeat sample).

Many source water contaminants occur in surface waters seasonally with maximum concentration in early spring through summer. To ensure that sampling for nitrates and pesticides accurately characterizes these seasonal fluxes, at least 50 percent of the samples are collected from March to August with at least two years represented. The critical sampling time for cyanotoxins is late spring through fall (May to November). To minimize dataset seasonal bias, any impairment determination based on exceedance of a mean water quality criterion requires a minimum of 10 samples representing at least two seasons. If a large dataset is available with sample collection skewed toward high flow events (stratified sampling program), it may be necessary to calculate time-weighted seasonal or monthly average values.

Most of the nitrate assessments were completed with sufficient samples and well over the recommended minimum sample counts. Much lower sample counts for pesticides were available and several assessments were completed with fewer than 10 samples. Use of fewer than 10 samples were allowed if the samples were collected from at least two separate years, the samples were all within the spring runoff period (typically March through June) and all results were well below (all results less than 50 percent) the water quality criteria. Exception to the ten-sample minimum was also allowed if the PDWS zone was in an area with minimal atrazine application, all samples were also below the criteria and available samples were collected during the spring runoff period when occurrence is most likely.

To provide additional information within the Not Assessed reporting category 3, “i” was added to note when some water quality data were available but not enough to complete an assessment. A determination was also made to retain all impaired listings until sufficient valid data were obtained to justify delisting.

The impaired status will remain until there are five consecutive years without any excursions and sufficient raw water data are obtained. The same number of samples required to list an AU as impaired due to nitrate, pesticides or algae will be required to delist the AU.

For the 2018 assessment cycle, only the nitrate, pesticide and algae (cyanotoxin) indicators were evaluated in-depth. Other contaminants monitored by the public water systems for SDWA compliance and reported in the SDWIS database were also reviewed but no in-stream raw water data were evaluated for these contaminants. All available *Cryptosporidium* data from SDWA compliance monitoring were reviewed for this assessment cycle, but the water quality criteria have not yet been established and no impairment determinations could be made based on this parameter.

H2.5 Ohio River Assessments

The Ohio River Valley Water Sanitation Commission (ORSANCO) evaluates the PDWS use for Ohio River intakes and presents assessments in the Biennial Assessment of Ohio River Water Quality Conditions Report. ORSANCO is an interstate agency that was created in 1948 to control and abate pollution in the Ohio River Basin. ORSANCO operates programs to monitor, assess and improve water quality within the basin. Consequently, Ohio EPA will not assess the PDWS use for intakes located on the Ohio River. ORSANCO’s water quality standards are available at the commission’s website: ***orsanco.org***.

H3. Results

Using the PDWS assessment methodology and available water quality data, results for the PDWS beneficial use are presented here for all WAUs, LRAUs and LEAUs where the PDWS use applies. Applicable water quality data were evaluated to determine an impairment status for each key indicator in each AU. To be considered assessed, sufficient data were required for only the nitrate indicator. There are 110 public water systems using surface water (excluding Ohio River intakes) in 119 separate AUs. The 119 AUs with the PDWS beneficial use include the following: 104 WAUs; nine LRAUs; and six LEAUs. A summary of the nitrate, pesticide and algae (cyanotoxin) indicators for each public water system are presented in Section

H4. Table H-2 provides supporting information for each of the 39 AUs listed as impaired for the PDWS beneficial use.

Nitrate Indicator. Sufficient data were available to complete nitrate evaluations for 60 (50 percent) of the 119 AUs using data primarily from Ohio EPA's compliance database and Ohio EPA watershed surveys. Of all 119 AUs, seven (six percent) were identified as impaired and 53 (45 percent) were in full support. There were two new assessment units identified as impaired due to nitrates this reporting cycle. Impairments included five of the nine LRAUs. Three Maumee River and one Sandusky River LRAU remain impaired and there is a new impairment on one Scioto River LRAU. Most of the 31 waters placed on the nitrate watch list (single detection greater than 8 mg/L) are in northwestern Ohio (Figure H-2).

Ohio EPA is working with U.S. EPA to develop a total maximum daily load (TMDL) report that addresses nitrate impacts to all three of the PDWS impaired Maumee River LRAUs. The Maumee River is the source water for five public water supplies.

Pesticide Indicator. Sufficient data were available to complete atrazine evaluations for 32 (27 percent) of the 119 PDWS AUs using data from Ohio EPA's compliance database (treated water), Ohio EPA water quality surveys and Syngenta Crop Protection, Inc.'s AMP. Five of the WAUs were impaired while the remaining 27 were in full support. There were no new assessment units identified as impaired due to pesticides. For LRAUs, five remained on the watch list from the previous report cycle. A total of 21 waters were placed on the pesticide watch list because of elevated atrazine [single exceedance of four times the water quality criteria (WQC) or quarterly average greater than WQC]. These areas of elevated atrazine coincide with the predominantly agricultural land use in western and northwestern Ohio (Figure H-3).

Algae (cyanotoxin) Indicator. Starting June 1, 2016, Ohio public water systems are required to conduct routine monitoring for microcystins and cyanobacteria, greatly increasing the data available to assess the algae indicator. Sufficient data were available to list 37 AUs (31 percent) as impaired due to algae. The impairment listing includes all AUs in Lake Erie with drinking water intakes, including: Western Basin shoreline and open water; Sandusky Basin shoreline and open water; Central Basin open waters; and Island shoreline AUs. In addition, 28 WAUs and three LRAUs are assessed as impaired. While microcystins are the predominant cyanotoxin impacting attainment determinations, saxitoxins triggered impairment determinations in three WAUs and cylindrospermopsin led to impairment in one WAU. An additional 17 AUs were also placed on the algae watch list. WAUs that are impaired or on the watch list for cyanotoxins were found distributed across Ohio virtually in every geographic region (Figure H-4).

***Cryptosporidium* Indicator.** Since Ohio EPA has not yet formalized water criteria for *Cryptosporidium*, assessment of this indicator could not be included in this report nor used for Ohio's 2016 303(d) listings. Ohio EPA requested all available *Cryptosporidium* data from U.S. EPA and summarized the results to demonstrate how the data would be evaluated using the PDWS assessment methodology.

The highest average (in oocysts/L) in any 12 consecutive months is compared to SDWA Bin classifications 1 through 4. Any water systems with an average *Cryptosporidium* concentration between 0.075 and less than 1.0 oocysts/L would be placed in Bin 2. Most Ohio public water systems using surface water are already meeting the treatment levels required for this bin. Concentrations equal or greater than 1.0 oocysts/L place the system in Bin 3 or 4 and require additional treatment beyond conventional or source water controls in the watershed, resulting in significant expenditures for the community. Ohio EPA's proposed water quality criteria and watch list condition for *Cryptosporidium* correlate to these trigger concentrations for the Bins.

Cryptosporidium data are available for 110 public water systems. This dataset included samples collected to fulfill SDWA regulations that require the water systems to submit samples over a two-year period. Water systems collected between 24 to 47 samples in Round 1 of data collection which started in 2006 and was completed in 2012. Round 2 of sampling began in 2015 and was completed for large systems serving greater than 50,000 people in 2017. Sampling for smaller systems continues.

A review of available data indicates that no water systems have exceeded the 1.0 oocysts/L 12-month average. Nine water systems had average concentrations between 0.075 oocysts/L and 1.0 oocysts/L and met the threshold for the watch list. Watch list water systems are: Columbus; Fremont; Berea; Westerville; Newark; Greenville; Cambridge; Napoleon; and Sebring.

H4. Supplemental Information

Table H-3 provides a summary of PDWS assessment results for the nitrate, pesticide and algae indicators and is organized by assessment unit. A description of the PDWS use zone is also included.

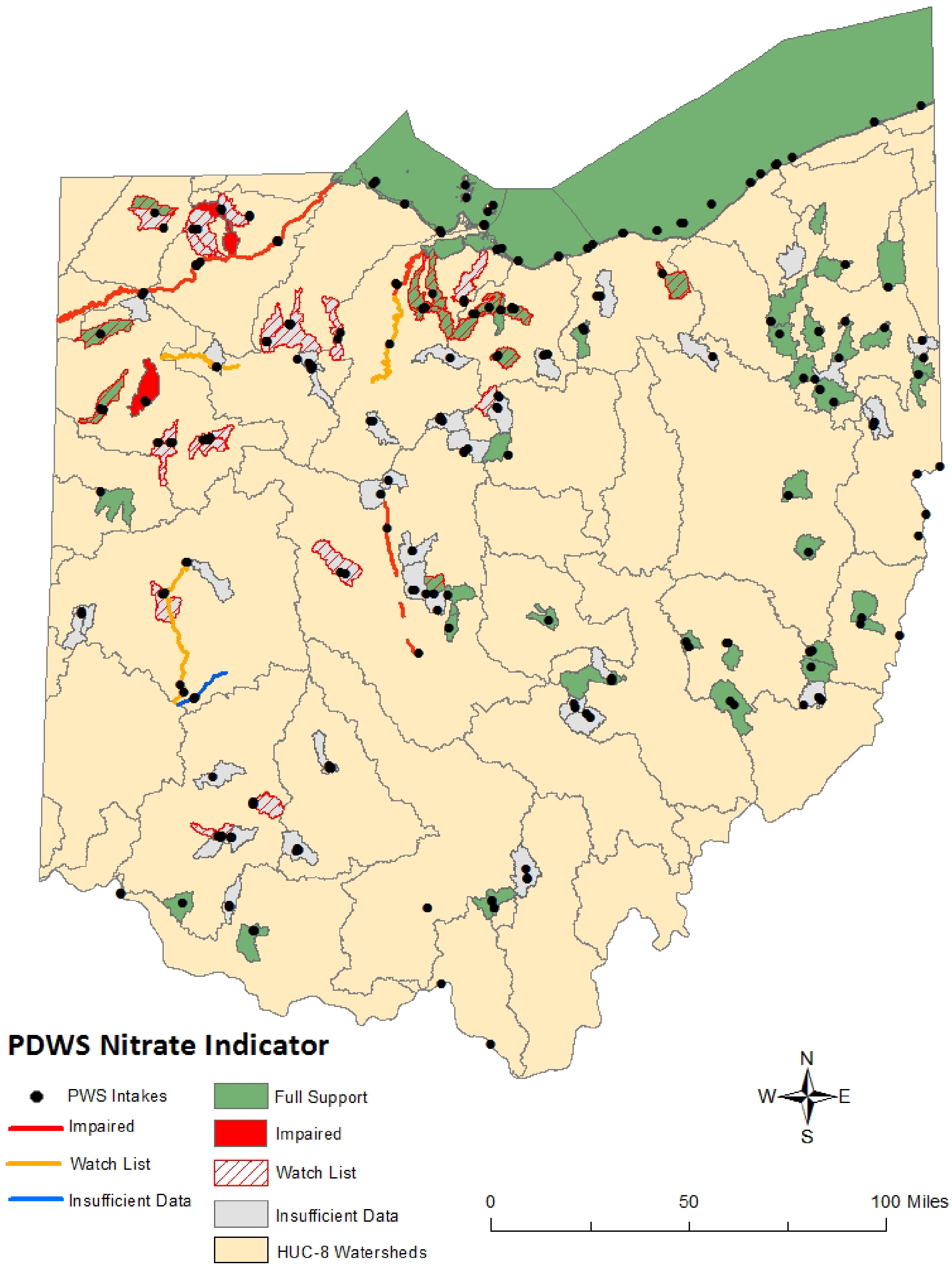


Figure H-2 — AUs with nitrate indicator results.

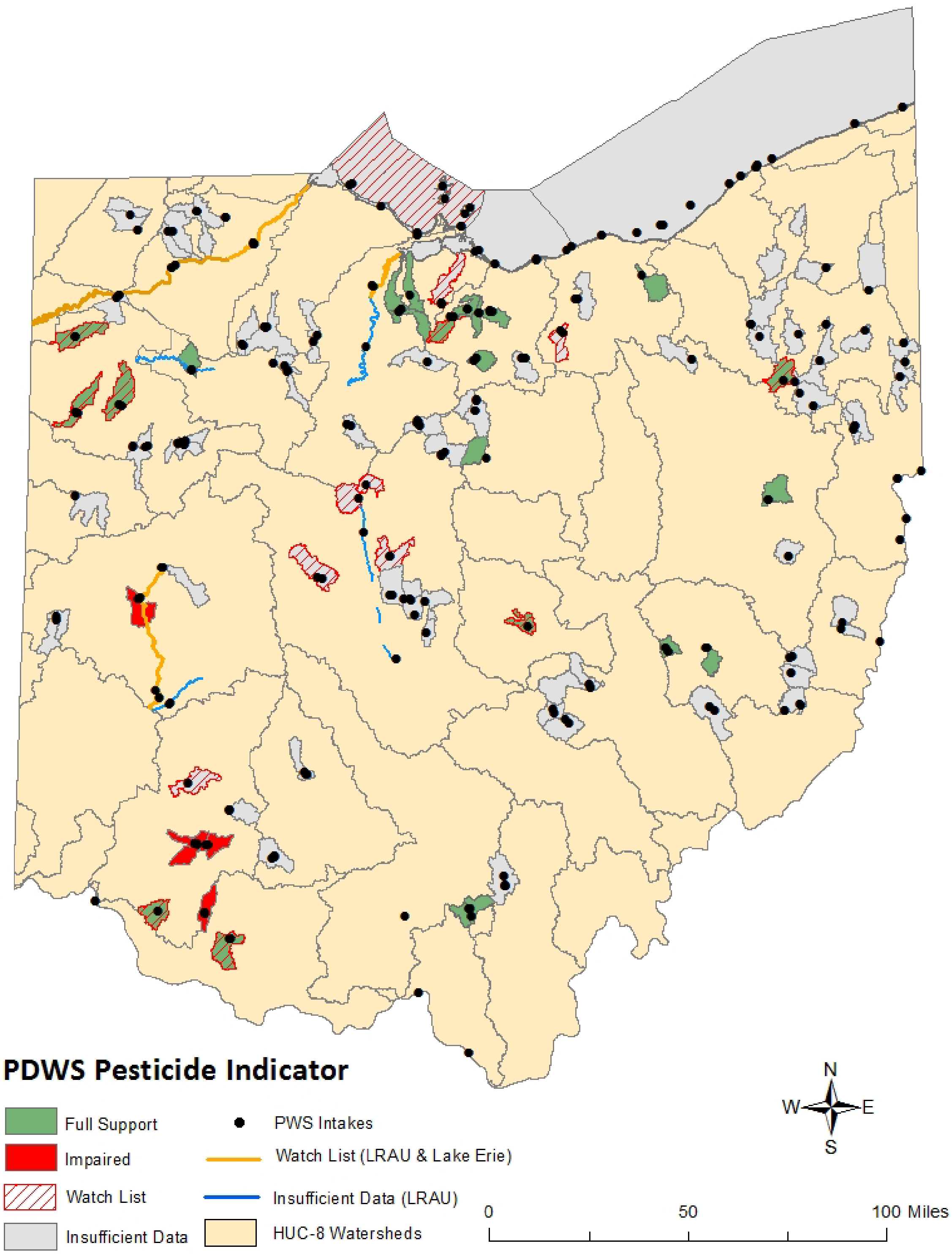


Figure H-3 — AUs with pesticide indicator results.

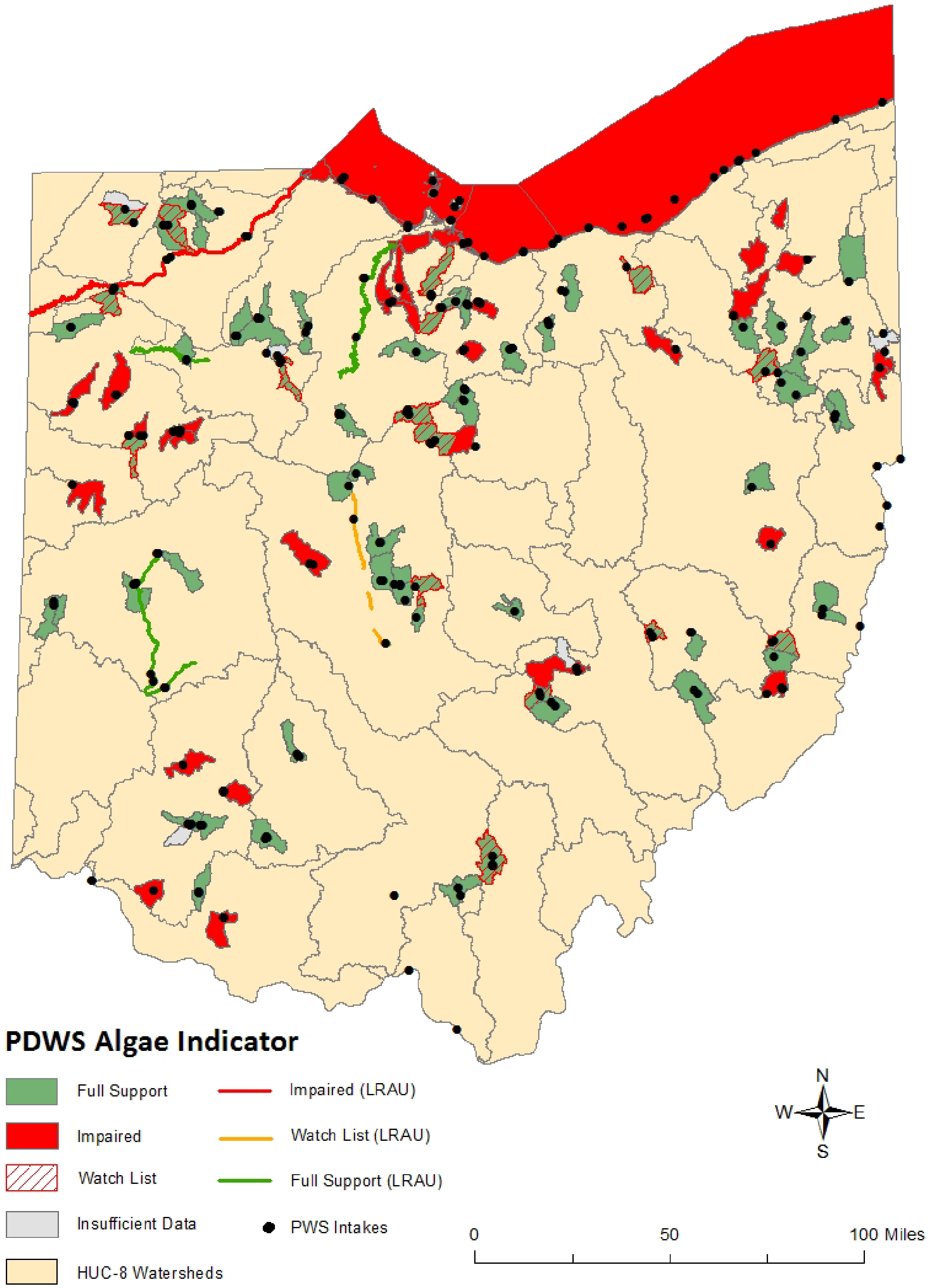


Figure H-4 — AUs with algal toxin indicator results.

Table H-2 — Waters designated as impaired for (not supporting) the PDWS beneficial use.

Assessment Unit	Cause of Impairment	Summary of Key Water Quality Data
04100005 90 01 Maumee River Mainstem (IN border to Tiffin River)	*Nitrate* One public water system had at least one excursion above the nitrate WQC and finished nitrate levels above the WQC. Original impairment listed in 2008. *Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	The City of Defiance exceeded the nitrate WQC in finished water during three events (12/24/02-1/28/03; 6/17/03-6/19/03; and 5/15/06-5/16/06). None of the excursions occurred during the reporting period, but the impairment will remain until raw water is collected that supports delisting the assessment unit. A watch list level exceedance occurred on 1/14/13 (8.73 mg/L) and there were seven samples collected by the public water system at their intake that exceeded the WQC (>10 mg/L), indicating more data is needed to delist. The source water for the City of Defiance exceeded the microcystins threshold in 2014 and 2016 (maximum concentration 19 µg/L).
04100007 02 03 Sims Run-Auglaize River 04100007 03 05 Lost Creek 04100007 03 06 Lima Reservoir- Ottawa River 04100007 04 03 Honey Run	*Algae (New Impairment for Williams and Bresler)* One public water system had microcystins concentrations above the threshold in 2010, 2012 and 2015.	The City of Lima's Metzger Reservoir exceeded the microcystins threshold two times in 2010 and once in 2012 (maximum concentration 5.3 µg/L). The City of Lima's Williams Reservoir and Bresler Reservoir had seven raw water microcystins sample results greater than the threshold in August, October and November of 2015 and Williams Reservoir had additional exceedances in 2012. Maximum microcystins concentrations were 1400 µg/L (Williams) and 39 µg/L (Bresler).
04100007 06 04 Dry Fork-Little Auglaize River	*Nitrate (New Impairment)* One public water system had two excursions above the Nitrate 10.0 mg/L WQC. *Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	Nitrate samples collected from the source water for City of Delphos public water system exceeded the WQC in 2015 and 2017. Included were 15.9 mg/L on 6/10/15 and 15.6 mg/L on 12/2/17. The City of Delphos' raw water had microcystins exceeding the threshold in 2016 and 2017 (maximum detection 1.7 µg/L).
04100009 03 02 Lower Bad Creek	*Nitrate* One public water system had two excursions above the Nitrate 10.0 mg/L WQC.	Nitrate samples collected from source water for Delta public water system exceeded WQC in 2015. Included were 17.6 mg/L on 6/11/15 and 13.4 mg/L on 7/14/15.
04100009 06 03 Haskins Ditch – Maumee River	*Algae* One public water system had numerous microcystins concentrations above the threshold.	During 2013-2014, the microcystins threshold was exceeded at the Bowling Green public water system reservoir raw water 19 times. For 2015, the average concentration for microcystins exceeded 7.0 µg/L.

Assessment Unit	Cause of Impairment	Summary of Key Water Quality Data
04100009 90 01 Maumee River Mainstem (Tiffin River to Beaver Creek)	*Nitrate* One public water system had several excursions above the nitrate WQC during the 5-year period. The public water system had finished nitrate levels above the WQC and received SDWA violations. *Algae (New Impairment)* One public water system had at least two raw water samples above the threshold for microcystins.	Finished water nitrate excursions occurred at Campbell's Soup in 2012 (11.3 - 12.5 mg/L), 2014 (10.6 mg/L), and 2016 (10.6 – 11.3 mg/L). Finished water sample results exceeded the 8.0 mg/L watch list threshold at Napoleon in 2012, 2013, 2014, 2015 and 2016. Campbell's Soup's Maumee River intake exceeded the microcystins threshold in 2015, 2016 and 2017 (maximum concentration 3.9 µg/L) and Napoleon exceeded the threshold in 2015 and 2016 (maximum concentration 4.0 µg/L).
04100009 90 02 Maumee River Mainstem (Beaver Creek to Maumee Bay)	*Nitrate* One public water system had at least one excursion above the nitrate WQC during the 5-year period. *Algae* One public water system had at least two raw water samples above the threshold for microcystins.	Numerous Maumee River samples from 2012 to 2015 exceeded the Nitrate WQC. In addition, raw water from Bowling Green exceeded the nitrate WQC during three events in 2011 and 2012. Bowling Green's Maumee River intake exceeded the microcystins threshold in 2014 and 2015.
04100011 02 04 Raccoon Creek 04100011 12 02 Beaver Creek 04100011 12 03 Green Creek	*Algae* One public water system had numerous microcystins concentrations above the threshold.	For the City of Clyde public water system, Beaver Creek Reservoir raw water sample results for microcystins routinely exceeded the threshold in 2014 and 2015. Included was a maximum of 300 µg/L in July 2015 on Beaver Reservoir.
04100011 90 02 Sandusky River Mainstem (Wolf Creek to Sandusky Bay)	*Nitrate* One public water system had an excursion above the nitrate WQC during the 5-year period in both raw and finished water. This public water system also received SDWA violations.	The City of Fremont exceeded the nitrate WQC in May 2010 (13 mg/L). In addition, Sandusky River samples exceeded the nitrate WQ criteria numerous times from 2010-2015.
04100012 04 03 Walnut Creek - West Branch Huron River	*Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	The City of Willard's raw water had microcystins exceeding the threshold on one occasion in 2015 and and on multiple occasions in October and November of 2017 (maximum detection >5 µg/L).

Assessment Unit	Cause of Impairment	Summary of Key Water Quality Data
04100012 06 03 Norwalk Creek	*Algae* One public water system had at least two raw water samples above the threshold for microcystins.	Norwalk public water system reservoir sampling had 22.7 µg/L microcystins on Memorial Reservoir in August 2014 and results greater than 5.0 µg/L in June and July 2015.
04110002 01 01 East Branch Reservoir-East Branch Cuyahoga River 04110002 01 04 Ladue Reservoir-Bridge Creek 04110002 02 03 Lake Rockwell-Cuyahoga River	*Algae* One public water system had at least two raw water samples in each assessment unit with microcystins concentrations above the threshold.	Source waters for the City of Akron had microcystins levels above the drinking water threshold in 2010, 2016, and 2017. In 2010, maximum raw water microcystins concentrations were 43.0 µg/L in LaDue reservoir, 3.6 µg/L in East Branch reservoir and 3.2 µg/L in Lake Rockwell. Maximum microcystins concentrations at Akron's Lake Rockwell intake were 1.3 µg/L in 2016 and 2.2 µg/L in 2017.
04110004 01 02 Headwaters Grand River	*Algae (New Impairment)* One public water system had at least two raw water samples exceeding the saxitoxins threshold.	Raw water samples from the Village of West Farmington exceeded the saxitoxins threshold in 2015 and 2016. The maximum raw water saxitoxins concentration was 0.49 µg/L on 8/29/16.
05030103 08 05 Headwater Yellow Creek	*Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	Aqua Ohio Struthers source water from Lake Evans had microcystins exceeding the threshold on one occasion in 2016 and from July to November 2017 (maximum >10 µg/L).
05030103 08 06 Burgess Run – Yellow Creek	*Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	The City of Campbell had source water microcystins threshold exceedances in 2016 and 2017 (maximum 3.4 µg/L).
05030201 01 01 Upper Sunfish Creek	*Algae* One public water system had at least two raw water samples above the threshold for microcystins.	Raw water sampling for the Village of Woodsfield source water from Ruble Lake and Witten Lake exceeded the microcystins threshold in 2010 and 2015. Maximum microcystins concentrations on Rubel Lake in 2010 were 360 µg/L. Maximum microcystins concentrations in 2015 were 1.4 µg/L on Rubel Lake and 2.1 µg/L on Witten Lake.
05040001 01 04 Wolf Creek	*Algae* One public water system had at least two raw water samples exceeding the saxitoxins threshold.	Raw water samples from the City of Barberton's Wolf Creek Reservoir exceeded the saxitoxins threshold multiple times from July through September 2015. The maximum raw water saxitoxins concentration was 0.81 µg/L on 8/22/15.

Assessment Unit	Cause of Impairment	Summary of Key Water Quality Data
05040001 15 03 Upper Little Stillwater Creek	*Algae* One public water system had at least two raw water samples above the threshold for microcystins.	The Village of Cadiz raw water sampling from Tappan Lake exceeded the microcystins threshold in 2014, 2015, 2016, and 2017. There were 114 results greater than the 1.0 µg/L threshold.
05040002 03 01 Headwaters Clear Fork Mohican River	*Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	The City of Mansfield's source water from Clear Fork reservoir had microcystins exceeding the threshold from August to November 2017 (maximum 5.6 µg/L). Saxitoxins were also detected, but only one raw water sample exceeded the saxitoxins threshold (maximum 0.25 µg/L).
05040004 04 07 Painter Creek-Jonathon Creek	*Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	The City of Maysville's source water had microcystins exceeding the threshold in November and December 2016 and January 2017 (maximum 1.9 µg/L).
05060001 06 02 Middle Mill Creek	*Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	The City of Marysville's source water had microcystins exceeding the threshold in September, October and December 2017 (maximum 3.1 µg/L).
05060001 90 01 Scioto River Mainstem (L. Scioto R. to Olentangy R.); excluding O'Shaughnessy and Griggs reservoirs	*Nitrate (New Impairment)* One public water system had an excursion above the nitrate WQC during the 5-year period in both raw and finished water. This public water system also received SDWA violations.	The City of Columbus exceeded the nitrate WQC in finished drinking water from 6/8/15 through 6/17/15 (maximum 12.5 mg/L) and again from 6/17/16 through 7/1/16 (maximum 10.7 mg/L).
05080001 07 05 Garbry Creek-Great Miami River	*Pesticides* One public water system had the pesticide atrazine in source water where the annual average exceeded the WQC.	The City of Piqua uses several surface water sources and participates in Syngenta Crop Protection's AMP[1]. Swift Run Lake (impounded section of Swift Run) is one of the three drinking water sources and the atrazine annual average[2] was 3.62 µg/L in 2008. In 2011, atrazine results remained at levels of concern with several lake samples exceeding 12.0 µg/L (4xWQ criteria). This included 38.5 µg/L in June 2011.
05090201 08 02 Headwaters Straight Creek	*Algae* One public water system had at least two source water samples exceeding the saxitoxins threshold.	During 2015 (June – December), raw water sampling on Sycamore Run Reservoir (Waynoka Regional public water system) indicated several exceedances of the threshold for saxitoxins. Included are: 0.29 µg/L (12/7/15), 0.88 µg/L (10/23/15 and 10/27/15), 0.49 µg/L (8/17/15) and 0.82 µg/L (6/26/15).

Assessment Unit	Cause of Impairment	Summary of Key Water Quality Data
05090201 10 01 Sterling Run	*Pesticides* One public water system had the pesticide atrazine in source water where the annual average exceeded the WQC.	The Village of Mt. Orab draws surface water from Sterling Run and participates in Syngenta Crop Protection's AMP[1]. The 2011 annual average[2] (6.2 µg/L) exceeded the WQC. In addition, single sample maximum atrazine detections were over four times the WQC in June 2011 (121 µg/L) and April 2012 (18.05 µg/L).
05090202 04 06 Lower Caesar Creek	*Algae (New Impairment)* One public water system had at least two source water samples above the threshold for microcystins.	The City of Wilmington's raw water sampling from Caesar Creek Lake intake had microcystins exceeding the threshold in May, June, and July of 2017 (maximum 12.8 µg/L).
05090202 06 04 Headwaters Cowan Creek	*Algae (New Impairment)* One public water system had at least two source water samples above the threshold for cylindrospermopsin.	The City of Wilmington's sampling from Burtonville Upground Reservoir (100 MG) intake had three occurrences with cylindrospermopsin exceeding the threshold in July and September 2017 (maximum 1.22 µg/L).
05090202 07 02 Second Creek 05090202 10 05 West Fork East Fork Little Miami River 05090202 13 01 Headwaters Stonelick Creek	*Pesticides* One public water system had the pesticide atrazine in source water where the annual average exceeded the WQC.	The Village of Blanchester draws surface water from Whitacre Run, Stonelick Creek and the West Fork of the East Fork Little Miami River and participates in Syngenta Crop Protection's AMP[1]. The raw and finished water sampling locations for this monitoring program do not differentiate between the three separate source waters. In 2005, the annual average of the AMP samples was 4.63 µg/L and exceeded the WQC for atrazine in finished water. Ohio EPA conducted two sampling runs in 2008 at the three separate sources and measured elevated atrazine levels ranging between 23 µg/L and 70 µg/L. Considering the 2008 atrazine levels, Ohio EPA conservatively applied the impairment listing to all three AUs. In 2012, atrazine concentrations were greater than four times the WQC in samples collected at Stonelick Creek (102.0 µg/L) and the West Fork of the East Fork Little Miami River (89.5 µg/L) and resulting annual averages for atrazine exceeded the WQC in the source water. Finished water result of 21.7 µg/L in May 2014. The impairment listings will remain until adequate source water sampling is conducted to confirm the water source is no longer impaired.
05090202 12 03 Lucy Run-East Fork Little Miami River	*Algae* One public water system had at least two source raw water samples with microcystins concentrations above the threshold.	Multiple raw water samples collected from Clermont County public water system source water locations on Harsha Lake (East Fork Lake State Park) from 2012 to 2017 exceeded the microcystins threshold. Maximum concentration observed was 190 µg/L in June 2014. Saxitoxins also detected in source water but below the threshold.

Assessment Unit	Cause of Impairment	Summary of Key Water Quality Data
05120101 02 04 Grand Lake-St Marys	*Algae* One public water system had at least two raw water samples with microcystins concentrations above the threshold.	The Grand Lake Saint Marys public water system intake for the City of Celina continues to be heavily impacted by microcystins. Threshold exceedances have occurred every year since the lake was first sampled in 2009, with exceedances occurring year-round in recent years. Microcystins concentrations routinely exceed 100 µg/L in the early and late summer months, with a maximum detection of 185 µg/L on 9/21/15.
041202000201 Lake Erie Western Basin Shoreline (≤3m)	*Algae* Two public water systems had at least two raw water samples with microcystins concentrations above the threshold.	Carroll Township and Ottawa County had raw water samples that exceeded the microcystins threshold in 2010, 2011 and 2013- 2017.
041202000301 Lake Erie Western Basin Open Water (>3m)	*Algae* Four public water systems had at least two raw water samples above the threshold for microcystins.	Oregon and Toledo had raw water samples that exceeded the microcystins threshold in 2010, 2011 and 2013-2017. Marblehead had raw water samples that exceed the microcystins threshold in 2010, 2015 and 2017. Kelleys Island had results above the threshold from 2013-2015 and in 2017.
041202000101 Lake Erie Islands Shoreline (≤3m)	*Algae* Three public water systems had at least two raw water samples above the threshold for microcystins.	Put-In-Bay had sample results above the threshold in 2010 and from 2013-2017. Camp Patmos had results above the threshold in 2010, 2013, 2014, 2015 and 2017. Lake Erie Utilities had results above the threshold in 2014, 2015 and 2017.
041202000202 Lake Erie Sandusky Basin Shoreline (≤3 m)	*Algae* One public water system had at least two raw water samples above the threshold for microcystins.	Sandusky had raw water samples that exceeded the microcystins threshold in 2014, 2015 and 2017. Vermillion had raw water microcystins above threshold for the first time in in 2016.
041202000302 Lake Erie Sandusky Basin Open Water (>3 m)	*Algae* Two public water systems had at least two raw water samples above the threshold for microcystins.	Huron had raw water microcystins above the threshold in 2013, 2015, 2016 and 2017. Sandusky had raw water samples that exceeded the microcystins threshold in 2014, 2015 and 2017. Vermillion had raw water microcystins above threshold for the first time in in 2016.
041202000303 Lake Eire Central Basin Open Water (>3m)	*Algae* Four public water systems had at least two raw water samples above the threshold for microcystins.	Lake County West, Mentor, Painesville and Fairport Harbor all had raw water microcystins threshold exceedances in 2015 and 2017. Mentor and Fairport Harbor had additional detections in 2016. Lake County East, Ashtabula and Conneaut had their first threshold exceedances in 2017.

[1] The January 2003 Atrazine Interim Reregistration Eligibility Decision and subsequent Memorandum of Agreement between U.S. EPA and the atrazine registrants, including Syngenta Crop Protection, Inc., initiated an atrazine monitoring program at select community water systems.
[2] Annual average calculated as average of the quarterly means for calendar year.

Table H-3 — Summary of PDWS assessment results for the nitrate, pesticide and algae indicators.

Assessment Unit ID	Assessment Unit Name	PDWS Zone [Public Water System(s)]	Use Support	Nitrate Indicator	Pesticide Indicator	Algae Indicator
04100005 90 01	Maumee River Mainstem (IN border to Tiffin River)	Maumee River @ RM 65.84 [Defiance]	No	Impaired	Full Support; Watch List	Impaired
04100006 03 01	Bates Creek-Tiffin River	Tiffin River @ RM 47.54 [Archbold]	Yes	Full Support; Watch List	Insufficient Data	Insufficient Data
04100006 03 03	Flat Run-Tiffin River	Archbold Upground Reservoirs [Archbold]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support; Watch List
04100007 02 03	Sims Run-Auglaize River	Auglaize River @ RM 64.58 (Agerter Rd), Williams and Bresler Reservoirs [Lima]	No	Insufficient Data; Watch List	Insufficient Data	Impaired
04100007 03 05	Lost Creek	Lima Metzger, Ferguson, and Lost Creek Reservoirs [Lima]	No	Insufficient Data; Watch List	Insufficient Data	Impaired
04100007 03 06	Lima Reservoir-Ottawa River	Ottawa River @ RMs 42.60 (Roush Rd) and 43.45 (upstream of low-head dam at Metzger Rd) [Lima]	No	Insufficient Data; Watch List	Insufficient Data	Impaired
04100007 04 03	Honey Run	Williams and Bresler Reservoirs [Lima]	No	Insufficient Data; Watch List	Insufficient Data	Impaired
04100007 06 04	Dry Fork-Little Auglaize River	Little Auglaize River @ RM 23.40 [Delphos]	No	Impaired	Full Support; Watch List	Impaired
04100007 08 04	Lower Town Creek	Town Creek @ RM 18.35 [Van Wert]	Yes	Full Support; Watch List	Full Support; Watch List	Full Support
04100007 12 06	Big Run-Flatrock Creek	Flat Rock Creek @ RM 14.13 [Paulding]	Yes	Full Support; Watch List	Full Support; Watch List	Full Support
04100007 12 09	Eagle Creek-Auglaize River	Defiance Upground Reservoir [Defiance]	Unknown	Insufficient Data	Insufficient Data	Full Support; Watch List
04100008 02 03	Findlay Upground Reservoirs-Blanchard River	Findlay Upground Reservoirs [Findlay]	Unknown	Insufficient Data	Insufficient Data	Full Support; Watch List
04100008 02 05	City of Findlay Riverside Park-Blanchard River	Blanchard River @ RMs 58.72, 62.43 and 65.20 [Findlay]	Unknown	Insufficient Data	Insufficient Data	Insufficient Data
04100008 06 02	Pike Run-Blanchard River	Ottawa Upground Reservoirs [Ottawa Village]	Unknown	Insufficient Data	Full Support	Full Support
04100008 90 01	Blanchard River Mainstem (Dukes Run to mouth)	Blanchard River @ RM 28.50 [Ottawa Village]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support
04100009 03 02	Lower Bad Creek	Bad Creek @ RM 17.0 [Delta]	No	Impaired	Insufficient Data	Full Support
04100009 04 01	Konzen Ditch	Unnamed trib segments immediately adjacent to Wauseon Reservoir, Big Ditch Intake [Wauseon]	Unknown	Insufficient Data; Watch List	Insufficient Data	Insufficient Data

Assessment Unit ID	Assessment Unit Name	PDWS Zone [Public Water System(s)]	Use Support	Nitrate Indicator	Pesticide Indicator	Algae Indicator
04100009 04 02	North Turkeyfoot Creek	Stucky Ditch Intake and Reservoir [Wauseon]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support; Watch List
04100009 06 03	Haskins Road Ditch – Maumee River	Bowling Green Upground Reservoir [Bowling Green]	No	Insufficient Data	Insufficient Data; Watch List	Impaired
04100009 07 02	Fewless Creek-Swan Creek	Swan Creek @ RM 30.84 [Swanton]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support
04100009 90 01	Maumee River Mainstem (Tiffin River to Beaver Creek)	Maumee River @ RMs 35.91 [McClure], 45.88 and 47.10 [Campbell Soup], 47.13 [Napoleon and Wauseon]	No	Impaired	Full Support; Watch List	Impaired
04100009 90 02	Maumee River Mainstem (Beaver Creek to Maumee Bay)	Maumee River @ RMs 23.16 [Bowling Green]	No	Impaired	Insufficient Data; Watch List	Impaired
04100010 01 01	Rader Creek	Rader Creek @ RM 13.57 and Upground Reservoirs [McComb]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support
04100010 01 03	Rocky Ford	Rocky Ford Creek @ RMs 10.66 and 11.10 and Upground Reservoirs [North Baltimore]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support
04100010 02 02	East Branch Portage River	East Branch Portage River @ RMs 13.84 and 16.15 and Upground Reservoirs [Fostoria]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support
04100010 02 03	South Branch Portage River	Veterans Memorial Reservoir [Fostoria]	Unknown	Insufficient Data	Insufficient Data	Full Support
04100011 01 03	Mills Creek	Snyders Ditch @ RMs 5.0 and 5.5 and Upground Reservoirs [Bellevue]	Unknown	Insufficient Data; Watch List	Insufficient Data; Watch List	Full Support; Watch List
04100011 02 04	Raccoon Creek	Raccoon Creek Upground Reservoir [Clyde]	No	Full Support; Watch List	Full Support	Impaired
04100011 04 03	Headwaters Middle Sandusky River	Sandusky River @ RM 115.4 and Upground Reservoirs [Bucyrus]	Unknown	Insufficient Data	Insufficient Data	Full Support; Watch List
04100011 07 02	Town of Upper Sandusky-Sandusky River	Sandusky River @ RMs 82.9 and 83.15 and Upground Reservoirs [Upper Sandusky]	Unknown	Insufficient Data	Insufficient Data	Full Support
04100011 08 05	Middle Honey Creek	Honey Creek @ RM 28.35 and Upground Reservoirs [Attica]	Unknown	Insufficient Data	Insufficient Data	Full Support
04100011 12 02	Beaver Creek	Beaver Creek @ RM 2.88 and Upground Reservoirs [Clyde]	No	Full Support; Watch List	Full Support	Impaired
04100011 12 03	Green Creek	Beaver Creek Upground Reservoir [Clyde]	No	Full Support; Watch List	Full Support	Impaired
04100011 90 01	Sandusky River Mainstem (Tymochtee Creek to Wolf Creek)	Sandusky River @ RM 41.08 [Tiffin-Ohio American Water]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support

Assessment Unit ID	Assessment Unit Name	PDWS Zone [Public Water System(s)]	Use Support	Nitrate Indicator	Pesticide Indicator	Algae Indicator
04100011 90 02	Sandusky River Mainstem (Wolf Creek to Sandusky Bay)	Sandusky River @ RM 18.02 [Fremont]	No	Impaired	Insufficient Data; Watch List	Full Support
04100012 01 04	New London Upground Reservoir-Vermilion River	Vermilion River @ RM 52.24 and Upground Reservoirs [New London]	Unknown	Insufficient Data	Insufficient Data	Full Support
04100012 02 04	Mouth Vermilion River	Vermilion River @ RM 0.2 [Vermilion]	Yes	Full Support	Insufficient Data	Full Support
04100012 04 03	Walnut Creek-West Branch Huron River	West Branch Huron River @ RM 33.8 and Upground Reservoirs [Willard]	No	Full Support; Watch List	Full Support	Impaired
04100012 05 03	Frink Run	Frink Run @ RM 4.83 and Upground Reservoir #5 [Bellevue]	Yes	Full Support; Watch List	Full Support; Watch List	Full Support; Watch List
04100012 05 06	Mouth West Branch Huron River	W. Branch Huron River @ RM 8.52 and Upground Reservoirs [Monroeville]	Yes	Full Support; Watch List	Full Support	Full Support
04100012 06 03	Norwalk Creek	Norwalk Creek @ RMs 0.11 and 4.02 [Norwalk]	No	Full Support	Full Support	Impaired
04100012 06 04	Mouth East Branch Huron River	East Branch Huron River @ RM 6.16 [Norwalk]	Yes	Full Support	Full Support	Full Support
04110001 02 02	Baldwin Creek-East Branch Rocky River	E. Branch Rocky River @ RM 5.06, Baldwin Creek @ RM 0.48, upstream boundaries of Rocky River reservation (RM 15.15) to West Branch [Berea]	Yes	Full Support; Watch List	Full Support	Full Support; Watch List
04110001 05 01	Charlemont Creek	Charlemont Creek @ RM 2.97 and Upground Reservoir [Wellington]	Yes	Full Support	Insufficient Data; Watch List	Full Support
04110001 05 06	Lower West Branch Black River	West Branch Black River @ RM 14.42 [Oberlin]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support
04110002 01 01	East Branch Reservoir – East Branch Cuyahoga River	East Branch Reservoir [Akron]	No	Full Support	Insufficient Data	Impaired
04110002 01 04	LaDue Reservoir- Bridge Creek	LaDue Reservoir [Akron]	No	Insufficient Data	Insufficient Data	Impaired
04110002 02 02	Feeder Canal-Breakneck Creek	Lake Hodgson (Breakneck Creek) [Ravenna]	Yes	Full Support	Insufficient Data	Full Support
04110002 02 03	Lake Rockwell-Cuyahoga River	Lake Rockwell (Cuyahoga River RM 62.0 to 57.97) [Akron]	No	Full Support	Insufficient Data	Impaired
04110004 01 02	Headwaters Grand River	Grand River @ RM 89.12 [West Farmington]	No	Full Support	Insufficient Data	Impaired
05030101 04 03	Stone Mill Run-Middle Fork Little Beaver Creek	Salem Reservoir [Salem]	Unknown	Insufficient Data	Insufficient Data	Full Support

Assessment Unit ID	Assessment Unit Name	PDWS Zone [Public Water System(s)]	Use Support	Nitrate Indicator	Pesticide Indicator	Algae Indicator
05030101 05 01	Cold Run	Cold Run @ RM 4.96, Salem Reservoir, Unnamed Tributary (Cold Run RM 4.97) @ RM 1.42 [Salem]	Unknown	Insufficient Data	Insufficient Data	Full Support
05030103 01 03	Fish Creek-Mahoning River	Mahoning River @ RMs 83.55 [Alliance] and 91.50 [Sebring]	Yes	Full Support	Insufficient Data	Full Support
05030103 02 01	Deer Creek	Deer Creek @ RM 0.54 (Walborn Reservoir) [Alliance]	Yes	Full Support	Full Support; Watch List	Full Support; Watch List
05030103 02 04	Island Creek-Mahoning River	Berlin Lake [Mahoning Valley S.D]	Unknown	Insufficient Data	Insufficient Data	Full Support
05030103 03 04	Kirwan Reservoir-West Branch Mahoning River	West Branch @ RM 13.25 (W. Branch/Michael J. Kirwan Res) [ODNR-West Branch S.P.]	Yes	Full Support	Insufficient Data	Full Support
05030103 03 06	Charley Run Creek-Mahoning River	Mahoning River @ RMs 56.47 [Newton Falls]	Yes	Full Support	Insufficient Data	Full Support
05030103 05 02	Middle Mosquito Creek	Mosquito Creek @ RM 12.49 (Reservoir) [Warren]	Yes	Full Support	Insufficient Data	Full Support
05030103 07 03	Lower Meander Creek	Meander Creek @ RM 2.96 (Meander Cr Reservoir) [Mahoning Valley S.D.]	Yes	Full Support	Insufficient Data	Full Support
05030103 08 05	Headwaters Yellow Creek	Yellow Creek @ RM 8.40 (Lake Evans) [Struthers- Aqua Ohio]	No	Full Support	Insufficient Data	Impaired
05030103 08 06	Burgess Run-Yellow Creek	Yellow Creek @ RM 2.0 (Lake Hamilton) [Campbell]	No	Full Support	Insufficient Data	Impaired
05030103 08 07	Dry Run-Mahoning River	Dry Run @ RM 2.86 (Lake McKelvey) [Campbell]	Unknown	Insufficient Data	Insufficient Data	Insufficient Data; Watch List
05030106 03 03	Cox Run-Wheeling Creek	Jug Run @ RM 3.18 (Provident Reservoir) [St. Clairesville]	Yes	Full Support	Insufficient Data	Full Support
05030106 07 03	Little McMahon Creek	Little McMahon Creek @ RM 6.6 (St. Clairesville Reservoir) [St. Clairesville]	Yes	Full Support	Insufficient Data	Full Support
05030106 09 01	North Fork Captina Creek	Unnamed trib (North Fork RM 10.0) @ RM 0.55 (Res #1 and #3) [Barnesville]	Yes	Full Support	Insufficient Data	Full Support; Watch List
05030106 09 02	South Fork Captina Creek	Slope Creek @ RM 1.85 Slope Creek Res) [Barnesville]	Yes	Full Support	Insufficient Data	Full Support
05030201 01 01	Upper Sunfish Creek	Sunfish Creek @ RM 25.50, Unnamed trib (Sunfish Creek RM 24.55) @ RM 0.15 and 0.80 [Woodsfield]	No	Insufficient Data	Insufficient Data	Impaired
05030201 09 01	Headwaters West Fork Duck Creek	Wolf Run @ RM 0.7 (Wolf Run Lake), Dog Run @ RM 1.35 (Caldwell Lake) [Caldwell]	Yes	Full Support	Insufficient Data	Full Support

Assessment Unit ID	Assessment Unit Name	PDWS Zone [Public Water System(s)]	Use Support	Nitrate Indicator	Pesticide Indicator	Algae Indicator
05030204 01 01	Center Branch	Center Branch Rush Creek @ RM 5.45, Unnamed Tributary (Somerset Creek RM 1.84) @ RM 0.89 [Somerset]	Unknown	Insufficient Data	Insufficient Data	Full Support; Watch List
05030204 01 02	Headwaters Rush Creek	Yeager Creek (Rush Creek RM 28.46) @ RM 1.0; New Lexington Reservoir [New Lexington]	Unknown	Insufficient Data	Insufficient Data	Full Support
05040001 01 04	Wolf Creek	Wolf Creek @ RM 5.12 (Reservoir) [Barberton]	No	Insufficient Data	Insufficient Data	Impaired
05040001 08 02	Pleasant Valley Run-Indian Fork	Indian Fork @ RM 3.0 and 3.7 (Atwood Lake) [Atwood Park and Resort]	Yes	Full Support	Full Support	Full Support
05040001 15 03	Upper Little Stillwater Creek	Tappan Lake [Cadiz]	No	Full Support	Insufficient Data	Impaired
05040002 01 01	Marsh Run	Marsh Run Creek @ RM 0.05 [Shelby]	Unknown	Insufficient Data; Watch List	Insufficient Data	Full Support
05040002 01 02	Headwaters Black Fork Mohican River	Black Fork River @ RMs 50.82, 53.88 [Shelby]	Unknown	Insufficient Data	Insufficient Data	Full Support
05040002 03 01	Headwaters Clear Fork Mohican River	Clear Fork River @ RM 30.6 (Clear Fork Reservoir) [Mansfield]	No	Full Support	Full Support	Impaired
05040004 04 05	Kent Run	Kent Run @ RM 1.3 [Maysville]	Unknown	Insufficient Data	Insufficient Data	Full Support
05040004 04 07	Painter Creek-Jonathon Creek	Frazier's Run (Fraziers Quarry) [Maysville]	No	Full Support	Insufficient Data	Impaired
05040005 02 07	Trail Run-Wills Creek	Wills Creek (Cambridge Reservoir) [Cambridge]	Yes	Full Support	Full Support	Full Support
05040005 05 01	North Crooked Creek	North Crooked Creek [New Concord]	Yes	Full Support	Full Support	Full Support; Watch List
05040006 02 05	Log Pond Run-North Fork Licking River	North Fork Licking River @ RM 3.0 [Newark]	Yes	Full Support	Full Support; Watch List	Full Support
05060001 03 03	City of Marion-Little Scioto River	Little Scioto River @ RM 7.1 [Marion-Ohio American Water]	Unknown	Insufficient Data	Insufficient Data; Watch List	Full Support
05060001 04 06	Glade Run-Scioto River	Scioto River @ RM 180.04 [Marion-Ohio American Water]	Unknown	Insufficient Data	Insufficient Data; Watch List	Full Support
05060001 06 02	Middle Mill Creek	Mill Creek @ RM 19.45 [Marysville]	No	Full Support; Watch List	Insufficient Data; Watch List	Impaired
05060001 08 01	Headwaters Olentangy River	Rocky Fork (Olentangy River RM 84.84) @ RM 0.6 [Galion]	Unknown	Insufficient Data	Insufficient Data	Full Support; Watch List
05060001 10 07	Delaware Run-Olentangy River	Olentangy River @ RMs 31.23 and 31.02 [Delaware]	Unknown	Insufficient Data	Insufficient Data; Watch List	Full Support
05060001 11 01	Deep Run-Olentangy River	Olentangy River @ RM 18.19 [Del-Co]	Unknown	Insufficient Data	Insufficient Data	Full Support

Assessment Unit ID	Assessment Unit Name	PDWS Zone [Public Water System(s)]	Use Support	Nitrate Indicator	Pesticide Indicator	Algae Indicator
05060001 13 08	Hoover Reservoir-Big Walnut Creek	Hoover Reservoir, Duncan Run @ RM 0.68 [Columbus]	Yes	Full Support	Full Support	Full Support; Watch List
05060001 14 03	Big Run-Alum Creek	Alum Creek Reservoir [Del-Co]	Yes	Full Support	Full Support	Full Support
05060001 14 04	Alum Creek Dam-Alum Creek	Alum Creek Reservoir and Alum Creek @ RM 26.74 [Del-Co]	Yes	Full Support Watch list	Full Support	Full Support
05060001 15 02	City of Gahanna-Big Walnut Creek	Big Walnut Creek @ RM 32.64 [Columbus]	Yes	Full Support	Insufficient Data	Full Support
05060001 16 01	Westerville Reservoir-Alum Creek	Alum Creek @ RM 21.20 (@ low-head dam) [Westerville]	Unknown	Insufficient Data	Insufficient Data	Full Support
05060001 90 01	Scioto River Mainstem (L. Scioto R. to Olentangy R.); excluding O'Shaughnessy and Griggs reservoirs	Scioto River at O'Shaughnessy dam (RM 148.8) to Dublin Road WTP dam [Columbus]	No	Impaired	Insufficient Data	Full Support; Watch List
05060002 08 02	Buckeye Creek	Buckeye Creek/Hammertown Lake [Jackson]	Yes	Full Support	Full Support	Full Support
05060002 08 03	Horse Creek-Little Salt Creek	Jisco Lake [Jackson]	Yes	Full Support	Full Support	Full Support
05060003 01 03	Town of Washington Court House-Paint Creek	Paint Creek @ RM 71.4 [Washington Court House]	Unknown	Insufficient Data	Insufficient Data	Full Support
05060003 05 02	Clear Creek	Clear Creek (Rocky Fork) @ RM 7.4 [Hillsboro]	Unknown	Insufficient Data	Insufficient Data	Full Support
05080001 07 02	Mosquito Creek	Tawawa Creek @ RM 0.14 [Sidney]	Unknown	Insufficient Data	Insufficient Data	Full Support
05080001 07 05	Garbry Creek-Great Miami River	Piqua Hydraulic System (Swift Run Lake) and Ernst Gravel Pit [Piqua]	No	Insufficient Data; Watch List	Impaired	Full Support
05080001 11 01	Mud Creek	Mud Creek @ RM 0.88 [Greenville]	Unknown	Insufficient Data	Insufficient Data	Full Support
05080001 11 02	Bridge Creek-Greenville Creek	Greenville Creek @ RM 22.3 [Greenville]	Unknown	Insufficient Data	Insufficient Data	Full Support
05080001 90 01	Great Miami River Mainstem (Tawawa Creek to Mad River)	Great Miami River @ RMs 86.6 and 90.3 [Dayton], 118.3 [Piqua] and 130.2 [Sidney]	Unknown	Insufficient Data; Watch List	Insufficient Data; Watch List	Full Support
05080001 90 02	Mad River Mainstem (Donnels Creek to mouth)	Mad River @ RMs 5.2 and 5.6 [Dayton]	Unknown	Insufficient Data	Insufficient Data	Full Support
05090101 04 01	Headwaters Little Raccoon Creek	Little Raccoon Creek @ RM 30, Lake Rupert, Alma Lake [Wellston]	Unknown	Insufficient Data	Insufficient Data	Full Support; Watch List
05090201 08 02	Headwaters Straight Creek	Sycamore Run @ RM 0.97 (Reservoir) and Straight Creek (Lake Waynoka) [Waynoka Regional]	No	Insufficient Data	Insufficient Data; Watch List	Impaired
05090201 10 01	Sterling Run	Sterling Run @ RM 6.47 [Mt. Orab]	No	Insufficient Data	Impaired	Full Support

Assessment Unit ID	Assessment Unit Name	PDWS Zone [Public Water System(s)]	Use Support	Nitrate Indicator	Pesticide Indicator	Algae Indicator
05090202 04 06	Lower Caesar Creek	Caesar Creek Lake [Wilmington]	No	Insufficient Data	Insufficient Data; Watch List	Impaired
05090202 06 04	Headwaters Cowan Creek	Cowan Creek @ RM 11.7 [Wilmington]	No	Insufficient Data; Watch List	Insufficient Data	Impaired
05090202 07 02	Second Creek	Whitacre Run @ RM 1.4 [Blanchester]	No	Insufficient Data	Impaired	Full Support
05090202 10 05	West Fork East Fork Little Miami River	West Branch of the East Fork LMR @ RM 4.6 and Westboro Reservoir [Blanchester]	No	Insufficient Data	Impaired	Full Support
05090202 12 03	Lucy Run-East Fork Little Miami River	Harsha Lake - Impounded E. Fork LMR [Clermont County]	No	Full Support	Full Support; Watch List	Impaired
05090202 13 01	Headwaters Stonelick Creek	Stonelick Creek @ RM 23.4 [Blanchester]	No	Insufficient Data	Impaired	Full Support
05120101 02 04	Grand Lake-St Marys	Grand Lake St. Marys [Celina]	No	Full Support	Insufficient Data	Impaired
041202000201	Lake Erie Western Basin Shoreline (≤3m)	[Ottawa County Regional, Carrol Water & Sewer]	No	Full Support	Insufficient Data	Impaired
041202000301	Lake Erie Western Basin Open Water (>3m)	[Toledo, Oregon, Kelleys Island, Marblehead]	No	Full Support	Insufficient Data; Watch List	Impaired
041202000101	Lake Erie Islands Shoreline (≤3m)	[Camp Patmos, Lake Erie Utility Co., Put-in-Bay]	No	Full Support	Insufficient Data	Impaired
041202000202	Lake Erie Sandusky Basin Shoreline (≤3m)	[Sandusky, Vermillion]	No	Full Support	Insufficient Data	Impaired
041202000302	Lake Erie Sandusky Basin Open Water (>3m)	[Sandusky, Huron, Vermillion, Elyria, Lorain]	No	Full Support	Insufficient Data	Impaired
041202000303	Lake Erie Central Basin Open Water (>3m)	[Conneaut, Ashtabula-Ohio American Water, Lake County East, Lake County West, Painesville, Fairport Harbor, Mentor-Aqua Ohio, Cleveland, Avon Lake]	No	Full Support	Insufficient Data	Impaired

Considerations for Future Lists

As new ideas are introduced and in the general course of progress, it is natural for evaluation and reporting of water quality conditions to evolve. Since the introduction of the Integrated Report (IR) format in 2002, methods for evaluating the recreation use, the human health use (via fish contaminants) and public drinking water supply use have been systematically added to the traditional aquatic life use reporting.

This section identifies future reporting possibilities and the status of each. The potential future changes include reporting on more types of waters (wetlands, inland lakes) or reporting on specific pollutants of interest (mercury).

I1. Wetlands

Ohio EPA's IR provides information on the overall condition of Ohio's water resources and identifies those waters that are not currently meeting water quality goals (Ohio EPA, 2016). It fulfills the requirements under the Clean Water Act (CWA) to report biennially on the current condition of Ohio's regulated waters [305(b) report] and to provide a list of impaired waters [303(d) list]. Given the sheer number of National Wetland Inventory [U.S. Fish and Wildlife Service, 2006-2007 (NWI)] mapped wetlands in Ohio (n = 134,736), it is not feasible to identify individual wetlands that are impaired as part of the 303(d) list, nor is it feasible to assess every individual wetland portrayed on the NWI mapping. Given the historic losses of wetlands in the state (Dahl, 1990) it would be problematic to attempt to list any of the remaining wetlands as impaired without giving consideration for the wetlands which have been eliminated from the landscape. The 2012 version of Ohio's IR (Ohio EPA, 2012) discussed a plan for incorporating wetland information into future reports, as general 305(b) information by using five primary items:

- identify historic wetland resources using Natural Resources Conservation Service (NRCS) digital soil survey data (USDA, 2012);
- identify existing wetland resources using NWI data (U.S. Fish and Wildlife Service, 2006-2007);
- perform a preliminary off-site wetland condition assessment using a Level 1 GIS tool;
- include information on past wetland field assessments within each 12-digit hydrologic unit code (HUC) [Seaber, Kapinos and Knapp, (1987)] watershed; and
- describe and summarize watershed specific field assessment work.

The 2014 report (Ohio EPA, 2014) was Ohio EPA's first attempt at implementing this plan. In 2013, Ohio EPA's Wetland Ecology Group (WEG) completed a study focusing on the inclusion of wetland information in the Total Maximum Daily Load (TMDL) process on the Middle Scioto watershed (Gara, Harcarik and Schumacher, 2013). This study provided the framework for incorporating wetland information into this reporting process. The focus of the study was twofold: 1) conduct a probabilistic survey of wetland condition for a current TMDL project in central Ohio using Level 2 [Ohio Rapid Assessment Method for Wetlands (ORAM)(Mack, 2001)] and Level 3 [Vegetation Index of Biotic Integrity (VIBI)(Mack, 2004; Mack and Gara, 2015)] assessment tools; and 2) develop a Geographic Information System (GIS)-based Level 1 assessment tool to estimate wetland condition within this survey area. The results of the Level 1 assessment were then compared to those obtained using the more detailed Level 2 and Level 3 field assessments. The Level 1 tool that was developed for the Middle Scioto TMDL study differed slightly from the proposed tool included in the 2012 IR (Ohio EPA, 2012). This updated assessment methodology is based on close statistical relationships between the individual metrics and detailed field assessments previously conducted by the WEG. For this reason, the updated Level 1 tool was used when characterizing wetland condition within each of Ohio's HUC12 watersheds. Additional information regarding the Middle Scioto TMDL and the Statewide Level 1 assessment data can be found in previous versions of the IR (Ohio EPA 2012; Ohio EPA, 2014; Ohio EPA, 2016).

I1.1 Documented High-Quality Wetlands

Ohio EPA's section 401 water quality certification and isolated wetland permitting section requires applicants that seek to discharge dredged or fill material into wetlands to coordinate with the Ohio Department of Natural Resources' (ODNR) natural heritage database (NHD) to determine whether documented high-quality wetlands, or known occurrences of rare, threatened or endangered species are present in and around proposed impact sites. Many wetlands are identified in the current version of the NHD; however, the information currently available has not been updated in more than 10 years and is primarily based on the best professional judgement of previous ODNR staff without specific criteria for inclusion.

Recognizing a need for more up-to-date information to ensure proper identification and protection of high-quality wetlands, Ohio EPA, in consultation with a workgroup of wetland experts, has developed the following criteria for identifying these kinds of wetlands:

- The area is mapped on the NWI as emergent, scrub-shrub or forested – no open water habitats were included;
- The mapped wetland must be five acres in size or larger;
- At least a portion of the wetland is within the Ducks Unlimited's conservation and recreation lands (CARL) layer (Ducks Unlimited, 2008) or otherwise known to be protected by the State or another conservation organization; and
- There is evidence of high quality functions based on existing data including, but not limited to, NHD records of threatened or endangered species (ODNR, 2016) and/or Ohio EPA has determined the wetland to be Category 3 based on an Agency-approved assessment methodology such as ORAM (Mack, 2001), VIBI (Mack and Gara, 2015), VIBI-FQ (Gara, 2013) and/or Amph-IBI (Miccachion, 2011) data.

A total of 220 wetlands that meet the above criteria were identified. NWI Polygons that abut one another were joined together as a single wetland polygon and, in a few instances, NWI polygons that are not abutting one another were combined where a high degree of hydrologic interaction is likely based on aerial imagery interpretation (OSIP 2006-2007), topography and NRCS soil survey. In these instances, it is assumed that the wetland polygons would be considered within the same hydrogeomorphic classification and would be scored within a single scoring boundary using ORAM. Of the high-quality wetlands identified, 162 (73.6 percent) have not been assessed by Ohio EPA, but are identified in the NHD to be high-quality based on the presence of at least one threatened or endangered species; 19 wetlands (8.6 percent) have been determined by Ohio EPA to be category 3 wetlands using one of the above-mentioned methods; and 39 (17.7 percent) wetlands are considered to be high-quality wetlands based on both Ohio EPA categorical assessment and because of the recorded presence of at least one threatened or endangered species. A list of high-quality wetlands is included in Table I-1.

I1.2 Significant Wetland Areas

Ohio EPA also attempted to identify significant wetlands and wetland complexes. Many of these areas are included in the high-quality wetlands list described in Section I1.1 above; however, size was the main criterion used to determine whether an area should be included on the significant wetland area list. Ohio EPA analyzed NWI polygons, aerial imagery and topographic maps to identify wetlands and wetland complexes that likely have a high degree of hydrologic interaction. Generally only areas which exceed 300 acres of mapped NWI wetlands are included in this list. The lone exception is Cedar Bog (approximately 296 acres) in Champaign County. A list of significant wetland areas is included in Table I-2.

I1.3 Next Steps

Ohio EPA proposes that periodic Level 2 and Level 3 field assessments be conducted on a random selection of wetlands within targeted HUC12 watersheds on a rotating basin schedule, like what is currently being done with Ohio EPA stream assessments. It is the recommendation of the WEG that the assessments focus on significant wetland areas and high-quality wetlands that lack prior assessment data. Focusing on these areas will potentially give an understanding of wetland condition within the HUC12. Issues such as property access and staff resources will dictate the number of watersheds that can be surveyed, but as the number of field assessed HUC12s increases, a better understanding of the relationship between the Level 1 and Level 2/Level 3 characterizations will be illustrated. This understanding will be critical to the continued improvements to our ability to assess the ecological condition of wetlands using remotely-sensed, landscape-level GIS data. Current staffing resource issues have prevented us from expanding the ecological monitoring program to include regular watershed-scale wetland surveys at this time and in the foreseeable future.

Table I-1 — List of high-quality wetland areas.

Site Name	Reason	Owner	Owner Type	Size (Acres)
Abshire And Graves Scenic River Area	NHD	ODNR	State	20
Akron Watershed Land	Cat 3/NHD	City of Akron	Local	5,013
Aquilla Lake WA	NHD	ODNR	State	673
Aquilla Lake	Cat 3	Private	Private	410
Arcola Creek	Cat 3/NHD	Lake County Metroparks	Local	30
Area K	Cat 3	ODNR	State	20
Arthur W Youngblood Watershed Area	NHD	City of Akron	Local	36
Ashcroft Preserve	NHD	Grand River Partners, Inc.	Private	516
ATV	Cat 3	Columbus and Franklin County Metro Parks	Local	9
Aurora Sanctuary NP	NHD	Audubon Society of Greater Cleveland	NGO	44
Aurora Wetlands II	NHD	Summit County Metro Parks	Local	30
Avoca Park	NHD	Great Parks of Hamilton County	Local	19
Baker Swamp	Cat 3/NHD	The Nature Conservancy	NGO	68
Bass Lake	NHD	Western Reserve Land Conservancy	Private	149
Bass Lake Preserve	NHD	Geauga County Park District	Private	22
Bath Nature Preserve	NHD	Bath Township	Local	6
Battaglia	NHD	Portage County Park District	Local	27
Battelle Darby Creek Metro	NHD	Columbus and Franklin County Metro Parks	Local	48
Bay Point	NHD	Natural Areas Land Conservancy	NGO	13
Beach City WA	NHD	ODNR	State	27
Beaumont Scout Reservation	NHD	Boy Scouts of America	NGO	266
Beaver Creek Preserve Easement	NHD	Beavercreek Wetlands Association	NGO	104
Beaver Creek SP	NHD	ODNR	State	24
Beaver Creek WA	NHD	ODNR	State	279
Beck Fen	NHD	The Nature Conservancy	NGO	147
Bedford Reservation	NHD	Cleveland Metroparks	Local	222
Berlin Lake WA	NHD	ODNR	State	328
Betsch Fen	NHD	The Nature Conservancy	NGO	26
Big Creek Reservation	NHD	Cleveland Metroparks	Local	20
Big Island WA	NHD	ODNR	State	1,160
Big Swamp Woods	Cat 3/NHD	Cleveland Museum of Natural History	Local	83
Bradley Woods Reservation	Cat 3/NHD	Cleveland Metroparks	Local	112
Browns Lake Bog	Cat 3/NHD	The Nature Conservancy	NGO	60
Buck Creek SP	NHD	ODNR	State	63

Site Name	Reason	Owner	Owner Type	Size (Acres)
Burton Wetlands	Cat 3/NHD	Geauga Park District	County	9
Cackley Swamp	NHD	Appalachia Ohio Alliance	NGO	307
Calamus	Cat 3	Columbus Audubon Society	NGO	9
Campbell SNP	NHD	ODNR	State	49
Canal Corridor	NHD	Stark County Parks	County	66
Cascade Valley Park	NHD	Summit County Metro Parks	County	6
Cedar Bog NP	Cat 3/NHD	Ohio Historical Society	State	244
Cedar Point National Wildlife Refuge	Cat 3/NHD	U.S. Fish & Wildlife Service	Federal	1,853
Charles Mill Lake	NHD	Muskingum Watershed Conservancy District	Local	619
Chesterfield Swamp (Gleeson Family Nature Reserve)	NHD	Morrow County Park District	County	44
City of Ravenna Park	NHD	City of Ravenna	Local	67
Clark Lake WA	NHD	ODNR	State	21
Collier SNP	Cat 3	ODNR	State	21
Conneaut Township Park	NHD	Conneaut Township	Local	64
Conneaut WA	NHD	ODNR	State	24
Cooper Hollow WA	NHD	ODNR	State	94
Cooperrider/Kent Bog SNP	Cat 3/NHD	ODNR	State	82
Cranberry Bog NP	NHD	ODNR	State	13
Crystal Lake	NHD	The Nature Conservancy	NGO	25
Culberson Woods SNP	Cat 3	ODNR	State	29
Daubel	NHD	Black Swamp Conservancy	Private	109
Davenport Pond and Wetlands	NHD	Appalachia Ohio Alliance	NGO	6
Delaware WA	NHD	ODNR	State	79
Dickason Run Swamp	NHD	Ohio Valley Conservation Coalition	NGO	47
E. Frohring	NHD	Western Reserve Land Conservancy (Easement)	Private	17
Eagle Creek NP	Cat 3	ODNR	State	358
East Harbor SP	NHD	ODNR	State	124
Edge of Appalachia	NHD	Cincinnati Museum of Natural History	Local	64
Eldon Russell Park	NHD	City of Akron	Local	40
Farley Property	NHD	Geauga County Park District	County	498
Firestone Metro Park	NHD	Summit County Metro Parks	County	109
Firestone/Yeagley WA	NHD	ODNR	State	81
Fish Creek WA	NHD	ODNR	State	53
Flatiron Lake Bog	NHD	The Nature Conservancy	NGO	37
Forrest Woods Nature Preserve	Cat 3/NHD	Black Swamp Conservancy	NGO	20
Fowler Woods NP	Cat 3	ODNR	State	48
Franklin Township Marsh	NHD	Ohio Valley Conservation Coalition	NGO	8
Furnace Run Park	NHD	Summit County Metro Parks	County	15
Gallagher/Springfield Fen SNP	NHD	ODNR	State	9
Garlo Heritage Nature Preserve	NHD	Seneca County Park District	County	40
Geneva SP	NHD	ODNR	State	25
Geneva Swamp	NHD	Cleveland Museum of Natural History	Local	285
Glade Wetland	NHD	The Nature Conservancy	NGO	7
Goll Woods SNP	NHD	ODNR	State	64
Goodyear	Cat 3	ODNR	State	77
Goodyear Heights Metro Park	NHD	Summit County Metro Parks	County	25
Gott Fen NP	Cat 3/NHD	ODNR	State	49
Grand River WA	NHD	ODNR	State	1,695

Site Name	Reason	Owner	Owner Type	Size (Acres)
Grand River Terraces	Cat 3	Cleveland Museum of Natural History	NGO	105
Gray Birch Bog	NHD	Western Reserve Land Conservancy	NGO	16
Greendale Buttonbush	Cat 3	U.S. Forest Service	Federal	9
Griggs Reservoir Park	Cat 3	City of Columbus Parks and Recreation	Local	9
Hambden Orchard WA	NHD	ODNR	State	358
Hampton Hills Metro Park	NHD	Summit County Metro Parks	County	28
Harper Valley Preserve, Inc.	NHD	Grand River Partners, Inc.	Private	19
Harris Nature Preserve 1999	NHD	Black Swamp Conservancy	Private	179
Headlands Beach SP	NHD	ODNR	State	10
Herrick Fen	Cat 3/NHD	The Nature Conservancy	NGO	48
Hertrick	NHD	Grand River Partners, Inc.	Private	6
Hess	NHD	Western Reserve Land Conservancy	NGO	122
Highland Heights Park	NHD	City of Highland Heights	Local	6
Highlandtown WA	NHD	ODNR	State	14
Hinckley Reservation	NHD	Cleveland Metroparks	Local	98
Holden Arboretum	NHD	Holden Arboretum	Private	33
Honey Point WA	NHD	ODNR	State	11
I-480 Preserve	NHD	Western Reserve Land Conservancy	NGO	18
Indian Creek WA	NHD	ODNR	State	52
Irwin Prairie SNP	Cat 3/NHD	ODNR	State	213
Jackson Bog NP	NHD	ODNR	State	18
Jackson Lake SP	NHD	ODNR	State	101
Kendrick Woods NP	NHD	ODNR	State	31
Killbuck Marsh WA	Cat 3/NHD	ODNR	State	4,169
Killdeer Plains WA	Cat 3/NHD	ODNR	State	670
Kinnikinnick Fen	NHD	Ross County Park District	County	19
Kiser Lake SP	NHD	ODNR	State	23
Kitty Todd	Cat 3/NHD	The Nature Conservancy	NGO	302
Kuehnle WA	NHD	ODNR	State	12
Lake Katherine SNP	NHD	ODNR	State	40
Lake La Su An WA	NHD	ODNR	State	145
Lake Park	NHD	Coshocton City & County Park District	Local	19
Lake Rockwell	NHD	City of Akron	Local	106
Lakeshore Reservation	NHD	Lake County Metroparks	Local	6
Lawrence Woods NP	Cat 3/NHD	ODNR	State	14
Liberty/Owens Fen NP	Cat 3/NHD	ODNR	State	58
Little Portage WA	NHD	ODNR	State	281
Little Rocky Hollow NP	NHD	ODNR	State	7
Little Darby Terrace	Cat 3	ODNR	State	8
Magee Marsh WA	Cat 3/NHD	ODNR	State	1,968
Mallard Club Marsh WA	NHD	ODNR	State	389
Mantua Bog NP	NHD	ODNR	State	44
Marsh Wetlands WA/NP	Cat 3/NHD	ODNR	State	132
Maumee Bay SP	NHD	ODNR	State	160
Maumee SF	NHD	ODNR	State	260
McCracken Fen SNP	NHD	ODNR	State	52
Mentor Marsh NP	NHD	ODNR	State	798
Mercer WA	NHD	ODNR	State	48
Metzger Marsh WA	NHD	ODNR	State	703
Miami Whitewater Forest	NHD	Hamilton County Park District	County	38
Milan WA	NHD	ODNR	State	55

Site Name	Reason	Owner	Owner Type	Size (Acres)
Mill Creek Park	NHD	Mill Creek Metroparks	County	356
Mill Hollow - Bacon Woods Park	NHD	Lorain County Metro Parks	County	370
Mill Stream Run Reservation - 1-71 Parcel	NHD	Cleveland Metroparks	Local	369
Mogadore Reservoir	NHD	City of Akron	Local	49
Mohawk Reservoir	NHD	Muskingum Watershed Conservancy District	Local	14
Morgan Swamp	Cat 3/NHD	The Nature Conservancy	NGO	589
Mosquito Creek WA	Cat 3/NHD	ODNR	State	1,431
Mud Lake Bog SNP	Cat 3/NHD	ODNR	State	26
Museum Lands	NHD	Cleveland Museum of Natural History	Local	75
Muzzy Lake (East)	NHD	City of Ravenna	Local	20
Myersville Fen NP	NHD	ODNR	State	12
North Fork Wetlands	NHD	Western Reserve Land Conservancy	Private	31
North Pond NP	Cat 3/NHD	ODNR	State	19
Northeast Ohio Wetlands, Inc.	NHD	Grand River Partners, Inc.	Private	34
O'Shaughnessy Reservoir Park	Cat 3	City of Columbus	Local	12
Oak Openings Preserve Metropark	Cat 3/NHD	Metroparks of the Toledo Area	Local	23
Observatory Park	NHD	Geauga County Park District	Local	822
Old Woman Creek NERR/NP	Cat 3/NHD	ODNR	State	87
Orwell WA	NHD	ODNR	State	152
Ottawa National Wildlife Refuge	NHD	U.S. Fish & Wildlife Service	Federal	500
Oxbow Lake WA	NHD	ODNR	State	17
Pallister SNP	Cat 3/NHD	ODNR	State	61
Parkersburg WA	NHD	ODNR	State	109
Pater WA	NHD	ODNR	State	7
Pennline Bog	NHD	Cleveland Museum of Natural History	Local	199
Pickerel Creek WA	NHD	ODNR	State	832
Pipe Creek WA	NHD	ODNR	State	66
Poland Village Park	NHD	Village of Poland	Local	135
Pond Brook Conservation Area	Cat 3/NHD	Summit County Metro Parks	County	483
Portage Lakes SP	NHD	ODNR	State	249
Portage Lakes Wetlands NP	NHD	ODNR	State	26
Prairie Oaks Metropark	NHD	Columbus and Franklin County Metro Parks	Local	8
Prairie Road Fen NP	Cat 3/NHD	ODNR	State	11
Price Road Swamp	NHD	City of Akron	Local	207
Punderson SP	NHD	ODNR	State	42
Putnam Marsh	NHD	Erie Metroparks	Local	281
Pymatuning Creek Wetlands NP	NHD	ODNR	State	610
Pymatuning SP	NHD	ODNR	State	121
Ravenna Arsenal	NHD	USA	Federal	636
Ray	NHD	Geauga County Park District	Local	83
Resthaven WA	Cat 3/NHD	ODNR	State	1,096
Rocky River Reservation	NHD	Cleveland Metroparks	County	162
Rome SNP	NHD	ODNR	State	279
Rutherford	Cat 3	U.S. Forest Service	Federal	19
Salt Fork SP	NHD	ODNR	State	1,225
Salt Fork WA	NHD	ODNR	State	122
School Lands	NHD	Ravenna City School District	NGO	132
Secor Metropark	NHD	Metroparks of the Toledo Area	County	50

Site Name	Reason	Owner	Owner Type	Size (Acres)
Seneca Lake	NHD	Muskingum Watershed Conservancy District	Local	38
Shawnee Lookout	NHD	Great Parks of Hamilton County	County	7
Shawnee SF	NHD	ODNR	State	137
Sheldon Marsh NP	Cat 3/NHD	ODNR	State	412
Shenango WA	Cat 3/NHD	ODNR	State	3,539
Showalter Bog	NHD	Portage County Park District	County	15
Silver Creek Fen	NHD	Western Reserve Land Conservancy	NGO	14
Singer Lake Bog	Cat 3/NHD	The Nature Conservancy	NGO	94
Slate Run Metropark	Cat 3	Columbus and Franklin County Metro Parks	Local	24
Spring Valley WA	NHD	ODNR	State	107
Springville Marsh NP	Cat 3/NHD	ODNR	State	233
Suawa	NHD	Grand River Partners, Inc.	Private	34
Sumner on Ridgewood	Cat 3	Concordia of Ohio (Easement)	Private	22
Swamp Cottonwood SNP	Cat 3	ODNR	State	5
Tinkers Creek NP	Cat 3/NHD	ODNR	State	473
Towner's Woods	NHD	Portage County Park District	County	16
Township Lands	NHD	Oberlin College	Local	16
Triangle Lake Bog NP	NHD	ODNR	State	68
Tummonds NP	NHD	ODNR	State	135
Twinsburg Bog	NHD	Western Reserve Land Conservancy	NGO	72
Tycoon Lake WA	NHD	ODNR	State	67
Urbana Raised Bog	NHD	Champaign County Fairgrounds	County	14
USFWS Ottawa National Wildlife Refuge	NHD	U.S. Forest Service	Federal	2,391
USFWS Ottawa National Wildlife Refuge Navarre Division	NHD	U.S. Forest Service	Federal	413
Veteran's Memorial Park	NHD	Lake County Metroparks	County	27
Walnut Beach Park	NHD	City of Ashtabula	Local	63
Waterloo WA	NHD	ODNR	State	153
Wayne National Forest	Cat 3/NHD	U.S. Forest Service	Federal	856
West Branch Copperbelly Site	NHD	Boy Scouts of America	NGO	60
West Woods	NHD	Geauga County Park District	County	155
Westwinds Woods	NHD	Metroparks of the Toledo Area	Local	37
Wildlife Habitat Restoration Program Chamberlain	NHD	ODNR	State	38
Willard Marsh WA	Cat 3/NHD	ODNR	State	775
Willow Point WA	NHD	ODNR	State	299
Wills Creek Reservoir	Cat 3	Muskingum Watershed Conservancy District	Local	9
Yellow Creek SF	NHD	ODNR	State	9
Yoctangee Park and Annex	NHD	City of Chillicothe	Private	14
Zaleski SF	Cat 3/NHD	ODNR	State	726

Table I-1 Key			
HQW	High Quality Wetland	SF	State Forest
NERR	National Estuarine Research Reserve	SNP	State Nature Preserve
NGO	Non-governmental organization	SP	State Park
NHD	Natural Heritage Database	SW	Significant Wetland
NP	Nature Preserve	USFWS	U.S. Fish and Wildlife Service
NWR	National Wildlife Refuge	WA	Wildlife Area
ODNR	Ohio Department of Natural Resources	WEG	Wetland Ecology Group

Table I-2 — List of significant wetland areas.

Site Name	Size (acres)
Akron Watershed Land	6,303
Andover Township Wetlands	405
Ashtabula Wetlands	495
Atwater Wetlands	1,039
Auburn Wildlife Area	519
Bates Creek Wetland	1,008
Beach City Reservoir Wetlands	1,114
Beach City Wildlife Area	1,741
Big Island Wildlife Area /Little Scioto	1,713
Black Fork Mohican River Wetlands	1,045
Boggs Fork Wetlands	869
Bolivar Reservoir	722
Bridge Creek Wetland	604
Bristol Township Wetland	662
Cackley Swamp	413
Cambridge Wetlands	3,234
Canal Fulton Wetlands	1,152
Cedar Bog	296
Cedar Point Wildlife Area/Maumee Bay State Park	2,434
Charles Mill Lake	832
Chippewa Lake	568
Crooked Creek Wetland	990
Deacon Creek Corner Wetland	1,034
Deerfield Wetlands	851
Denmark Township Wetland	702
Dillon Wildlife Area/Dillon State Park	1,608
Dorset Wildlife Area	1,702
Dover Reservoir Wetlands	998
Eagle Creek Wildlife Area	2,181
Flatrock Creek Riparian	1,759
Fox Lake Wetlands	418
Friday Creek Wetland	1,008
Funk Bottoms Wildlife Area	2,545
Geauga Park District Rookery Wetland	636
Geneva State Park	422
Grand River Wildlife Area	11,030
Griggs Mill Creek Wetland	330
Hambden Orchard Wildlife Area	1,866
Indian Lake Inlet Wetlands	785
Jerome Fork Wetlands	399
Killbuck Creek	2,218
Killbuck Marsh Wildlife Area	5,046
Kiwanis Lake Wetlands	437
Lake Luna Wetlands	1,041
Lennox Center Wetlands	1,131
Linton Road Wetland	1,213
Little Portage River Wetlands	1,086
Magee/Metzger/Ottawa National Wildlife Refuge (West)	5,412
Marrian Road Wetland	617
Mecca Township Wetland	609

Site Name	Size (acres)
Mentor Marsh State Nature Preserve	869
Mill Creek Wetland	1,527
Mogadore Reservoir Wetlands	1,070
Monroe Center Wetlands	438
Montville Township Wetland	1,506
Morgan Swamp State Nature Preserve	747
Mosquito Creek (Warren) Wetlands	863
Mosquito Creek Wildlife Area	4,276
Moxley/Smith/Sanford/Other Private Clubs	1,211
Muskingum River (Dresden) Wetlands	1,270
New Lyme Wildlife Area	981
North Bend Road Wetlands	626
Oak Openings - Irwin Prairie	1,086
Ohio Brush Creek Wetlands	476
Orwell Wetlands	1,063
Ottawa National Wildlife Refuge (Central)/Toussaint Shooting Club/Other	3,138
Ottawa National Wildlife Refuge (Navarre)	848
Phelps Road Wetland	3,143
Plymouth Township Wetland	1,224
Pond Brook	1,230
Potter Creek Wetlands	712
Pritchard Wetlands	409
Raccoon Creek (Wellston) Wetlands	1,123
Raccoon State Forest Wetlands	749
Racoon Creek/Zaleski State Forest/Lake Hope State Park	1,374
Ray State Line Road Wetlands	480
Resthaven Wildlife Area	1,309
Richmond Center Wetland	816
Rittman Wetland	826
Rome State Nature Preserve	1,256
Salt Fork Wetlands	1,102
Sandyville Wetlands	1,648
Shedd Road Wetland	808
Sheffield Center Wetland	1,687
Sheldon's Marsh	923
Shenango Wildlife Area	4,999
Sixteen Valley Wetlands	464
Skull Fork Wetlands	468
Spring Pond Wetland	530
St. Mary's River Riparian	2,617
Stillwater Creek Wetlands	714
Symmes Creek Wetlands	1,328
Trumbull Creek Wetlands	764
Twitchell Road Wetlands	405
Upstream East Branch Reservoir	1,220
West Branch Huron River Wetlands	2,220
West Branch Mahoning River Wetland	1,162
Willard Marsh Wildlife Area	1,240
Willow Creek Wetlands	378
Willow Point	316
Wills Creek Reservoir/Conesville Coal	2,564

Site Name	Size (acres)
Windham Wetlands	897
Winous Point Shooting Club/Ottawa Shooting Club/Pickerel Creek Wildlife Area	9,358
Wolf Creek Wetlands	753
Yankee Run Wetlands	876
Champion Township Wetlands	533
Wildare Wetlands	564
Lake Cardinal Area Wetlands	359

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I2. Mercury Reduction at Ohio EPA

Mercury is a persistent bioaccumulative toxic metal that is widely used in many products. Once mercury is released into the environment its toxicity, persistence and ability to travel up the food chain are important issues for human health and the environment. Ohio has a statewide health advisory for mercury from fish consumption for sensitive populations: women of childbearing age; and children 15 years old or younger (issued by the Ohio Department of Health).

U.S. EPA is allowing states to identify waters for a special 303(d) list category devoted to mercury issues (5M). While moving in this direction would be preferable as a way to focus on this important pollutant, Ohio EPA has decided that such a move is not possible for this report. At the same time, Ohio EPA is taking action to decrease mercury pollution and these efforts are summarized here.

I2.1 Ohio Law

House Bill 443 was made law on Jan. 4, 2007. The law has the mercury product regulations created initially in House Bill 583 and Senate Bill 323, establishing sales bans for certain mercury products. Public and private schools through high school were not to purchase mercury, mercury compounds or mercury-measuring devices for classroom use as of April 6, 2007. Mercury thermometers and mercury-containing novelty items were not to be sold in Ohio as of Oct. 6, 2007. The sale of novelty items that have mercury cell button batteries were banned as of 2011. Mercury thermostats were not to be sold or installed as of April 6, 2008. There are exemptions to the sales bans.

I2.2 Ohio Projects

Ohio EPA has worked in several areas seeking to reduce mercury emissions and increase awareness:

- identification of air sources of mercury, including identification of water bodies in the State impaired by mercury predominantly from atmospheric deposition, potential emissions sources contributing to deposition in the State and adoption of appropriate State-level programs to address in-state sources;
- identification of other potential multi-media sources of mercury, such as mercury in products and wastes and adoption of appropriate State-level programs (note that mercury-containing products may be a source of mercury to the air and other media during manufacturing, use or disposal);
- quantifying multi-media mercury reductions achieved by scrubber systems installed at Ohio power plants in response to a lawsuit filed by several northeastern states;
- adoption of statewide mercury reduction goals and targets, including percent reduction and dates of achievement, for air and other sources of mercury, as well as reduction targets for specific categories of mercury sources where possible;
- multi-media mercury monitoring, including water quality, air deposition and air emissions monitoring;

- publicly-owned treatment works with mercury variances implement Pollutant Minimization Programs to identify and reduce sources of mercury that discharge to their plants[1].
- investigating mercury in various types of wastewater, including:
    - primary materials industries, including primary metal production, oil refining and coal facilities;
    - facilities processing steel scrap (continuous casting and steel foundries);
    - publicly-owned treatment works, which looks at indirectly discharging industries through the pretreatment program and facility Pollutant Minimization Plan;
    - coal power plant wastewater from scrubbers, ash ponds and "Low Volume" wastewaters; and
    - other industries in interactive allocation segments to get an accurate accounting of mercury in the segments.
- working to control discharges from the state's one mercury cell sodium/chlorine plant[2].
- coordination across states, where possible, such as multi-State mercury reduction programs. Ohio EPA has had representatives in several organizations that work toward this goal.

I2.3 Ohio Resources

Many videos, fact sheets and presentations are available on Ohio EPA's website that relate to mercury. These include household mercury fact sheets; an introduction to mercury issues; a guide for dealing with mercury by school administrators; an informational sheet for building awareness of mercury in schools; information about mercury in industry; and suggestions for developing a community mercury reduction program. See ***epa.ohio.gov/ocapp/p2/mercury_pbt/mercury.aspx*** for more information.

I2.4 Federal Rules

In 2017, U.S. EPA finalized technology-based pretreatment standards under the Clean Water Act to reduce discharges of mercury and other metals from dental offices into municipal sewage treatment plants known as publicly owned treatment works (POTWs). Ohio EPA is responsible for ensuring the rule is implemented. The rule requires dental offices to comply with requirements based on the American Dental Association's recommended practices, including the use of amalgam separators. Once captured by the separator, dental amalgam can be recycled. Removing mercury when it is concentrated and easy to manage, such as through low-cost amalgam separators at dental offices (average annual cost per dental office in 2016 is about $800), is a common-sense solution to managing mercury that would otherwise be released to air, land and water. You can find this rule and supporting documents at U.S. EPA's website: ***epa.gov/eg/dental-effluent-guidelines***.

I3. Inland Lakes and Reservoirs

Ohio EPA initiated a renewed monitoring effort for inland lakes in 2008. This report assesses three of the four beneficial uses that apply to inland lakes: recreation; public drinking water supply; and human health (via fish tissue). Ohio EPA is in the process of updating the water quality standards rules for lakes. Once these rule updates are complete, Ohio EPA expects to include an assessment of the aquatic life use for lakes as a factor in listing watershed or large river assessment units (LRAUs) in future CWA Section 303(d) lists.

[1] The facilities track implementation of mercury reduction measures and monitor influent and effluent mercury levels. They facilities compile reduction information and submit annual progress reports to Ohio EPA.

[2] The current consent order includes reducing fugitive air emissions that have contributed to storm water discharges of mercury. The plant will be scrubbing cell emissions with water and sending those discharges to the plant's zero discharge process treatment system. The consent order also requires the company to track mercury mass balances through the facility and recycle where possible. This includes using collected storm water as process water make-up.

This section outlines the status of the monitoring effort for inland lakes; summarizes needed administrative rule changes; and previews a potential methodology for assessing the lake habitat aquatic life use in future 303(d) lists. The section was first introduced in 2010 and has not changed appreciably since then because the administrative rule changes have not yet occurred. Ohio EPA intends to continue monitoring inland lakes and reporting results in future cycles.

I3.1 Background of Ohio's Inland Lake Water Quality Monitoring Program

Ohio EPA's work to assess lakes began in 1989 with a CWA Section 314 Lake Water Quality Assessment grant that supported the evaluation of 52 lakes. Various additional grants enabled the evaluation of 89 more lakes through 1995. An analysis and determination of beneficial use status for 447 public lakes (greater than five acres in surface area) was presented in Volume 3 of the 1996 Ohio Water Resource Inventory [305(b) report]. As part of that report, Ohio EPA developed and applied the Lake Condition Index (LCI) to characterize overall lake health and to assess beneficial use status.

After dedicated U.S. EPA funding for lakes monitoring ended, Ohio EPA monitored only 53 lakes over the next 10 years. The Ohio LCI, developed by Ohio EPA between 1990 and 1996 to report on the status of lake condition, became obsolete with the passage of Ohio's Credible Data Law [House Bill 43 (amended), effective 10/21/2003]. This law requires that decisions on impairment for all surface waters (streams, lakes wetlands) be based solely on Level 3 credible data. Ohio's original LCI assessment process included a combination of Level 2 and Level 3 credible data to make impairment decisions.

Ohio EPA began researching ways to re-establish an inland lakes monitoring program in 2005. During the 2007 field season, Ohio EPA participated in the U.S. EPA-sponsored National Lakes Assessment (NLA). Ohio was assigned 19 lakes that were selected through a probability-based random selection process. The effort served as a precursor for a renewed lake sampling program in Ohio.

I3.2 Status of Inland Lakes Program

Ohio EPA currently monitors select inland lakes using the strategy described in Section 13.2.1 below. Priority is being placed on lakes used for public drinking water or used heavily for recreation and suspected of being impaired for either of those uses. Secondary priorities still on the horizon because of limited resources include developing a more robust sampling program, expanding to a wider variety of lakes, exploring the use of remote sensing in the screening of water quality in lakes and attempting to track water quality changes in lakes that might be subject to Section 319 funding and other watershed water quality improvement efforts. The objectives for monitoring inland lakes are to:

- Track status and trends of lake quality
- Determine attainment status of beneficial uses
- Identify causes and sources of impaired uses
- Recommend actions for improving water quality in impaired lakes

In this report, Ohio EPA discusses lake use impairment for recreation, public drinking water and human health (fish tissue) and previews a methodology for including inland lakes in the aquatic life use listing. The aquatic life use listing is dependent on the rule changes to Ohio's water quality standards, which include adoption of nutrient criteria. Once the criteria are adopted into Ohio's water quality standards rules, Ohio EPA expects to be able to definitively report on the status of the aquatic life use of lakes sampled through 2016.

I3.2.1 Lake Sampling – Lake Habitat Aquatic Life Use Assessment

Ohio EPA has implemented a sampling strategy that focuses on evaluating the water quality conditions present in the epilimnion of lakes. The sampling target consists of an even distribution of a total of 10 sampling events collected during the summer months. Key water quality parameters sampled for inland lake assessments include total phosphorus, total nitrogen, chlorophyll a, Secchi depth, ammonia, dissolved oxygen, pH, total dissolved solids and various metals such as lead, mercury and copper. Details of the sampling protocol are outlined in the Inland Lakes Sampling Procedure Manual, available on Ohio EPA's webpage at: ***epa.ohio.gov/dsw/inland_lakes/index.aspx***.

I3.2.2 Water Quality Standards for the Protection of Aquatic Life in Lakes

Presently, lakes in Ohio are designated as exceptional warmwater habitat (EWH) with respect to the aquatic life habitat use designation. Revisions to Ohio's WQS that would change the aquatic life use from EWH to lake habitat (LH) are in progress. A primary reason for this revision is that in Ohio, a set of biological criteria apply to rivers and streams, whereas no biocriteria apply to lakes. The numeric chemical criteria to protect the LH use will remain the same as the criteria to protect the EWH use (or WWH use where applicable) that currently applies to lakes, with a suite of nutrient criteria added.

The chemical criteria specific to the LH aquatic life use in the water quality standards rules under consideration are depicted in Table I-3.

Table I-3 — Proposed[1] lake habitat use criteria.
Note: All criteria are outside mixing zone averages unless specified differently.

Parameter Lake type	Form[2]	Units[3]	Statewide criteria	Ecoregional Criteria[4] ECBP	EOLP	HELP	IP	WAP
Ammonia								
All lake types	T	mg/L	Table 35-1	--	--	--	--	--
Chlorophyll a [5]								
Dugout lakes	T	µg/L	6.0	--	--	--	--	--
Impoundments	T	µg/L	--	14.0	14.0	14.0	14.0	6.2
Natural lakes	T	µg/L	14.0	--	--	--	--	--
Upground reservoirs	T	µg/L	6.0	--	--	--	--	--
Dissolved oxygen [6]								
Dugout lakes	T	mg/L	5.0 OMZM	--	--	--	--	--
Impoundments	T	mg/L	5.0 OMZM	--	--	--	--	--
Natural lakes	T	mg/L	5.0 OMZM	--	--	--	--	--
Upground reservoirs	T	mg/L	4.0 OMZM	--	--	--	--	--
Nitrogen [5]								
Dugout lakes	T	µg/L	450	--	--	--	--	--
Impoundments	T	µg/L	--	930	740	930	688	350
Natural lakes	T	µg/L	638	--	--	--	--	--
Upground reservoirs	T	µg/L	1,225	--	--	--	--	--
pH								
All lake types	--	s.u.	A	--	--	--	--	--
Phosphorus [5]								
Dugout lakes	T	µg/L	18	--	--	--	--	--
Impoundments	T	µg/L	--	34	34	34	34	14
Natural lakes	T	µg/L	34	--	--	--	--	--
Upground reservoirs	T	µg/L	18	--	--	--	--	--
Secchi disk transparency [7]								
Dugout lakes	--	m	2.60	--	--	--	--	--
Impoundments	--	m	--	1.19	1.19	1.19	1.19	2.16
Natural lakes	--	m	1.19	--	--	--	--	--
Upground reservoirs	--	m	2.60	--	--	--	--	--
Temperature								
All lake types	--	--	B	--	--	--	--	--

[1] Proposed in draft water quality standards rules, August 2008.
[2] T = total.
[3] m = meters; mg/L = milligrams per liter (parts per million); µg/L = micrograms per liter (parts per billion); s.u. = standard units.
[4] ECBP stands for Eastern Corn Belt Plains; EOLP stands for Erie/Ontario Lake Plain; HELP stands for Huron/Erie Lake Plains; IP stands for Interior Plateau; and WAP stands for Western Allegheny Plateau.
[5] These criteria apply as lake medians from May through October in the epilimnion of stratified lakes and throughout the water column in unstratified lakes.
[6] For dissolved oxygen, OMZM means outside mixing zone minimum with the 5.0 statewide criteria pertaining to EWH and 4.0 to WWH . The dissolved oxygen criteria apply in the epilimnion of stratified lakes and throughout the water column in unstratified lakes.
[7] These criteria apply as minimum values from May through October.
A pH is to be 6.5-9.0, with no change within that range attributable to human-induced conditions.
B At no time shall the water temperature exceed the average or maximum temperature that would occur if there were no temperature change attributable to human activities.

I3.3 Preview of Future Listings

An important distinction between assessment of aquatic life uses of rivers and streams in Ohio versus lakes is that the former relies on biological monitoring and a comparison of those results to the biological criteria as the assessment tool. Ohio does not have biological criteria that apply to lakes. As a result, the assessment methodology for the lake habitat aquatic life use will rely solely on the results of water quality sampling and a comparison of the results to the applicable numeric criteria. This is an obvious and important difference to the weight-of-evidence approach traditionally used by Ohio EPA for the assessment of rivers and streams.

I3.3.1 Methodology Preview: Lake Habitat Use Assessment

The following protocol is intended to be used to determine the attainment status of the LH aquatic life use in a future IR. This is dependent upon the completion of the WQS rulemaking currently in progress, which provide the foundational components necessary to complete the actual assessment process. The proposed protocol for assessing the LH aquatic life use designation for this preview is outlined as follows:

- Comparison of individual sample concentrations for any parameter sampled to the applicable aquatic life outside mixing zone average (OMZA) numeric criterion. If more than 10 percent of the samples within an assessment period (typically two years) exceed the OMZA numeric criterion, the LH use is impaired.
- Comparison of the ammonia concentrations of the lake samples collected to the LH OMZA numeric criterion. The LH use is impaired if more than 10 percent of the individual samples exceed the OMZA.
- Comparison of the average dissolved oxygen content of the epilimnetic samples of a thermally stratified lake (or samples throughout the water column of an unstratified lake) to the OMZA dissolved oxygen criteria for the LH use designation. If more than 10 percent of the average dissolved oxygen values do not meet the OMZA criterion, the LH use is considered to be impaired.
- Comparison of the median pH value of the epilimnetic samples of a thermally stratified lake (or samples from throughout the water column of an unstratified lake) to the OMZA pH criteria for the LH use designation. If more than 10 percent of the median pH values do not meet the OMZA criterion, the LH use is considered to be impaired.
- Comparison of the median chlorophyll a concentration of the samples collected over the sample period (typically two consecutive summers) to the applicable chlorophyll a criterion for the type of lake and ecoregion in which the lake is located. The LH use is impaired if the median chlorophyll a concentration exceeds the applicable chlorophyll a criterion.
- Total phosphorus, total nitrogen and Secchi depth parameters are used to flag potential impairment of the LH aquatic life use designation. Exceedance of these nutrient criteria is determined in a manner like that described for chlorophyll a. However, exceedances of the criteria for these parameters will trigger listing on the state's "watch list" rather than a determination of use impairment. Lakes listed on the watch list will be factored into the prioritization process for additional monitoring.

I3.3.2 Results

Table I-4 describes the assessment status of the LH aquatic life use designation for 17 lakes sampled by Ohio EPA in 2015-2016 based on the protocol outlined in the previous section.

Table I-4 — Summary of the lake habitat use assessment for lakes sampled in 2015-2016 using the draft assessment methodology described in this section.

Note: Values in red represent an exceedance of criteria resulting in a determination of non-support of the lake habitat aquatic life use designation. Values in yellow represent a watch list designation.

				Proposed Nutrient Criteria				Aquatic Life Criteria[1] (Units are percentages)												
Lake	Eco-region[3]	Lake Type[2]	Lake Habitat Use Status	chl. *A* (µg/L)	t-P (µg/L)	t-N (µg/L)	Secchi (m)	D.O (%)	pH (%)	NH_3 (%)	TDS	As	Hg	Se	Cd	Cr	Cu	Pb	Ni	Zn
				Seasonal Median Values				Percentage of Samples Exceeding the OMZA Criterion												
Delphos (NWDO)	HELP	UP	Watch List	5.85	6.4	2390	1.8	0	0	0	0	0	x	0	0	0	0	0	0	0
Van Wert #2 (NWDO)	HELP	UP	Non-Support	25.45	19.5	1000	1.56	10	0	0	0	0	x	0	0	0	0	0	0	0
Cambridge Reservoir (SEDO)	WAP	DPI	Non-Support	20.75	17	345	0.87	10	0	0	0	0	x	0	0	0	40	0	0	0
Forked Run Lake (SEDO)	WAP	DPI	Watch List	4.75	9.7	460	1.61	0	0	0	0	0	x	0	0	0	0	0	0	0
New Concord Reservoir (SEDO)	WAP	DPI	Non-Support	11	6.65	510	2.96	0	0	0	0	0	x	0	0	0	10	0	0	0
Salt Fork Reservoir (SEDO)	WAP	DPI	Non-Support	30.95	10.05	525	0.809	0	0	0	0	0	x	0	0	0	0	0	0	0
Seneca Lake (SEDO)	WAP	DPI	Non-Support	11.75	7.4	430	1.12	0	0	0	0	0	x	0	0	0	0	0	0	0
Veto Lake (SEDO)	WAP	DPI	Non-Support	58.9	19.0	1210	0.425	20	0	0	0	0	x	0	0	0	0	0	0	0
Wills Creek Lake* (SEDO)	WAP	DPI	Non-Support	19	13	800	0.24	80	0	0	0	0	x	0	0	0	0	0	0	0
Turkey Creek Lake (SWDO)	WAP	DPI	Full Support	5.4	12.0	250	2.3	0	0	0	0	0	x	0	0	0	0	10	0	0
Lake Waynoka (SWDO)	IP	DPI	Non-Support	13.3	19.5	470	1.25	30	0	0	0	0	x	0	0	0	0	0	0	0
Waynoka Upground Reservoir (SWDO)	IP	UP	Non-Support	10.8	53.0	620	1.31	60	0	0	0	0	x	0	0	0	100	0	0	0
Waynoka Water Supply Reservoir (SWDO)	IP	DPI	Non-Support	49.9	232.0	1,490	0.43	100	0	0	0	0	x	0	0	0	100	0	0	0

Lake	Eco-region[3]	Lake Type[2]	Lake Habitat Use Status	Proposed Nutrient Criteria chl. *A* (µg/L)	t-P (µg/L)	t-N (µg/L)	Secchi (m)	D.O (%)	pH (%)	NH_3 (%)	Aquatic Life Criteria[1] (Units are percentages) TDS	As	Hg	Se	Cd	Cr	Cu	Pb	Ni	Zn
Barberton Reservoir (NEDO)	EOLP	DPI	Non-Support	34.5	47.4	840	0.77	0	0	0	0	0	x	0	0	0	0	0	0	0
Coe Lake (NEDO)	EOLP	DO	Non-Support	6.65	5.2	1080	2.85	30	0	0	0	0	x	0	0	0	20	0	0	0
Crystal Lake (NEDO)	EOLP	NL	Watch List	13.05	5.0	640	2.25	0	0	0	0	0	x	0	0	0	0	0	0	0
Wallace Lake (NEDO)	EOLP	DPI	Non-Support	2.95	5.0	800	1.8	30	0	0	0	0	x	0	0	0	0	0	0	0

[1] Represent parameters typically included in a standard lake assessment; additional parameters sampled as necessary.
[2] DPI = impoundment; UP = upground reservoir
[3] ECBP = Eastern Corn Belt Plains; EOLP = Erie/Ontario Lake Plain; WAP = Western Allegheny Plateau; HELP = Huron/Erie Lake Plain

I4. Future Lake Erie Monitoring and Assessment

Ohio EPA recognizes the need to develop a sustainable, long-term plan to monitor Lake Erie, both to support Ohio's water resource and to support assessment of the lake ecosystem objectives identified in the Great Lakes Water Quality Agreement (GLWQA). Long-term monitoring will need to provide data to evaluate water quality trends, assess the effectiveness of remedial and nutrient reduction programs, measure compliance with jurisdictional regulatory programs, identify emerging problems and support implementation of the remedial action plans in Ohio's four Areas of Concern (more information about Areas of Concern is available in Section C1 of this report).

Ohio EPA is currently evaluating the results of the monitoring effort funded by the Great Lakes Restoration Initiative (GLRI) grant and will use the data to develop a cost-effective and sustainable long-term monitoring strategy. Tracking spring phosphorus and summer chlorophyll concentrations at ambient stations on an annual basis will be one component, as will measuring physical profiles at transect locations used to track hypoxia/anoxia in the hypolimnion of the Central Basin. A schedule for biological monitoring of the shoreline assessment units will need to be developed to measure trends in attainment status for future IRs. Decisions regarding the collection of mayfly, phytoplankton, zooplankton and periphyton samples will also need to be made.

For the assessment of algae impacts and attainment of designated uses related to algae, Ohio EPA will continue collaborating with universities and other agencies to determine appropriate monitoring locations, frequencies and parameters, as well as how that data collection can be sustained.

In 2017, Ohio EPA collaborated with researchers from the University of Toledo, Bowling Green State University and the Ohio State University/Stone Laboratory to develop a pilot sampling program for the Ohio portion of the Lake Erie open waters. The locations of the sampling are illustrated in the blue box outlined sites in Figure I-1. These locations were chosen to supplement data being collected at other sites on the map by other parties to provide a more complete representation of the open water status. The other sites on the map are those where data is collected at least two times per month and include the desired parameters (for example, chlorophyll and microcystins).

The researchers at the Ohio State University/Stone Laboratory, University of Toledo and Bowling Green State University have obtained funding to continue to collect the data at the sites shown in Figure I-1, as well as four sites in the Sandusky Bay, for the next two years. They are working with Ohio EPA to ensure the data is credible level 3, with the expectation that it will be used in conjunction with satellite image products from the National Oceanic and Atmospheric Administration (NOAA) to provide a comprehensive assessment method for algal blooms in the open waters for future 303(d) lists (for example, to include microcystin or other cyanotoxin metrics).

NOAA continues to collect data at seven sites in Ohio water and the Northeast Ohio Regional Sewer District collects data at eight sites in the central basin of the lake. To maximize resources and contribute to a monitoring network that can effectively inform management decisions and provide statistically relevant data, Ohio EPA will continue to collaborate with other state, federal and local partners as well as the universities.

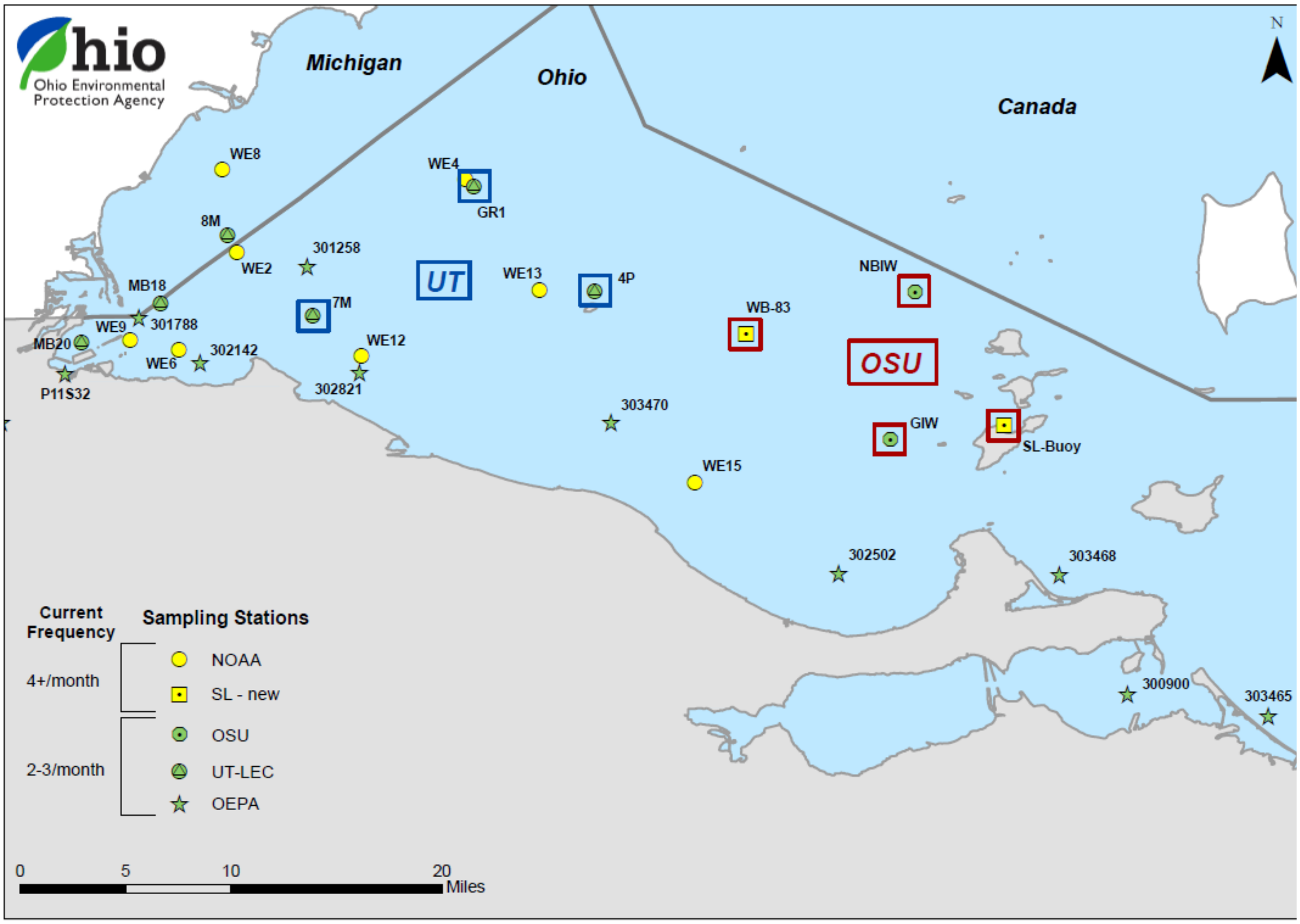


Figure I-1 — Supplemental weekly sampling locations for chlorophyll and microcystin; sampled by University of Toledo and the Ohio State University/Stone Laboratory (boxed sites) researchers in 2017.

Section

J

Addressing Waters Not Meeting Water Quality Goals

The federal Clean Water Act (CWA) requires that states identify waters not meeting water quality goals and then prioritize them for action to restore their beneficial uses[1]. The resulting list of prioritized impaired waters is known as the 303(d) list. Ohio's 2018 303(d) list is presented in Section L4 of this report.

Ohio made substantial changes to its listing process in 2010 (see Sections A and J in the *2010 Integrated Report* [Ohio EPA, 2010]); Ohio's *2012 Integrated Report* and 303(d) list (Ohio EPA, 2012) contained relatively few changes compared to the major adjustments made in 2010. A significant change to the 2014 report included the addition of a new indicator (algae) to the public drinking water supply (PDWS) use. The 2016 report contained changes in how the information was organized and what data sets were used (for instance, 2015 data was included for both recreation and PDWS uses) and was amended to include new open water assessment units for Lake Erie and a new recreation assessment methodology based upon algae. In 2018, the most significant changes are to the recreation use assessments and how Lake Erie Assessment Unit are defined (increased from six to seven units). The assessment based on bacteria has been updated to comply with the new *E. coli* WQS which include a 90-day geometric mean and statistical threshold value (see Sections F1-F3). In addition, an assessment method for recreation based on algae for the western basin of Lake Erie has been added in Section F4.

This section outlines the listing framework, lays out the prioritizing and delisting processes and results and reports on the status of Ohio total maximum daily load (TMDL) efforts including schedules for future TMDLs in Ohio.

J1. Ohio's 303(d) Listing Framework

The process of listing involves assigning a condition status (a category) for each of four beneficial uses for each assessment unit (AU). Data requirements, descriptions of available data, assessment methodologies and results were discussed and reported by individual beneficial use in Sections E, F, G and H.

In 2010, Ohio modified the five-category listing structure suggested by U.S. EPA to accommodate listing by beneficial use and introduced subcategories to give more information about the status of each water. In 2012, one additional subcategory - t - was added to aid reporting the status of AUs relative to approved TMDLs and data availability. In 2014, the "t" subcategory was altered slightly and a new category - d - was added to better reflect circumstances encountered as Ohio EPA revisits watersheds having approved TMDLs. In 2016, a new subcategory in Category 5 (5-alternative or 5-alt) was added to report on alternative restoration approaches for CWA 303(d) listed waters. Such waters will still require TMDLs until water quality standards are achieved. Ohio does not have any AUs listed under 5-alt in this report but anticipates using this subcategory in the future. In 2018, a new subcategory "p" is added under Category 5 to track which impairments are based on threatened status, primarily for nutrients. Table J-1 summarizes the categories and subcategories used in this report.

Also, in 2010, Ohio began listing by beneficial use within each AU and reporting on a smaller AU size. Watershed AUs shifted from an average size of 130 square miles to 27 square miles. Under the old system, an impairment of one beneficial use caused the AU to be Category 5 (impaired) regardless of the status of other uses.

[1] Beneficial uses include aquatic life, human health (fish contaminants), recreation and public [drinking] water supply.

Table J-1 — Category definitions for the 2018 Integrated Report and 303(d) list.

Category[2]		Subcategory	
0	No water currently utilized for water supply		
1	Use attaining	d	TMDL complete; new data show the AU is attaining WQS
		h	Historical data
		t	TMDL complete at HUC[3] 11 scale; AU attaining WQS at HUC 12 scale
		x	Retained from 2008 IR
2	Not applicable in Ohio system		
3	Use attainment unknown	h	Historical data
		i	Insufficient data
		t	TMDL complete at HUC 11 scale; there may be no or not enough data to assess this AU at the HUC 12 scale
		x	Retained from 2008 IR
4	Impaired; TMDL not needed	A	TMDL complete
		B	Other required control measures will result in attainment of use
		C	Not a pollutant
		h	Historical data
		n	Natural causes and sources
		x	Retained from 2008 IR
5	Impaired; TMDL needed	alt	Alternative restoration approaches[4]
		M	Mercury
		d	TMDL complete; new data show the AU is not attaining WQS
		h	Historical data
		p	Protection/preservation for threatened waters
		x	Retained from 2008 IR

Figure J-1 illustrates the significance of these changes in the listing procedures. A = aquatic life use; R = recreation use; H = human health use; and P = public water supply use. The numbers refer to the categories described in Table J-1 above. In the example, an AU listed in 2008 as impaired (category 5) appeared on the 2010 303(d) list as five units with four uses each; thus, reporting one piece of information changed to reporting 20 pieces of information. Whereas the 2008 list indicated only that the unit was impaired, the new listing indicates all the following information:

- Aquatic life use is impaired (5) in one unit, not impaired (1) in one and unknown (3) in one. A TMDL to address impairments has been completed in one unit (4A) and the impairment in the remaining unit is being addressed in some other way (4B, for example, a discharge permit).
- Recreation use is impaired (5) in three units, unknown (3) in one and a TMDL to address the impairment in one unit has been completed (4A).
- Human health results based on fish tissue analysis indicate that four of the five units are impaired (5) and one is unknown (3).
- Public drinking water supplies exist in only two of the five units and one of those is impaired (5). The status of the other is unknown (3).

[2] Shading indicates categories defined by U.S. EPA; other categories and subcategories are defined by Ohio EPA.
[3] HUC means hydrologic unit code.
[4] Ohio currently has no waters that are listed under this subcategory.

For the aquatic life use, Ohio EPA continues the transition that began in 2010 of translating data evaluated at the 11-digit hydrologic unit size to the smaller 12-digit size. We expect that the few remaining relic categories will be dealt with as those areas are monitored again.

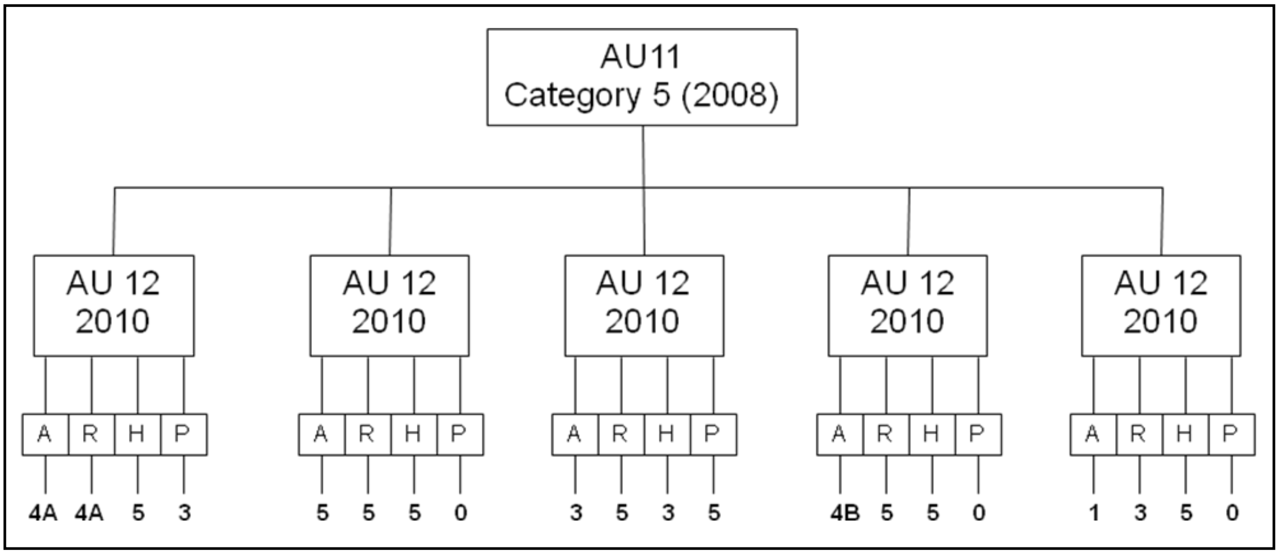


Figure J-1 — Listing by smaller AUs and individual beneficial uses.

Table J-2 shows the number of potential listings that could result from the combination of smaller AUs and listing by individual use.

Table J-2 — Potential listing opportunities in Ohio's listing framework.

	2008 and Before			2010 and After		
AU Types	Number of AUs	Status Reports per Unit	Total Number of Possible Listings	Number of AUs	Status Reports per Unit	Total Number of Possible Listings
Watershed	331	1	331	1538	4	6,152
Large river	23	1	23	38	4	152
Lake Erie shore	3	1	3	3	4	12
Totals	**357**	**1**	**357**	**1,579**	**4**	**6,316**

J2. Prioritizing the Impaired Waters: the 303(d) List

As previously stated, the impaired waters are identified and assigned a category by individual beneficial use in Sections E, F, G and H. After waters are identified as impaired and it is determined that a TMDL is required, the waters are prioritized to produce the 303(d) list (see Section L4). Because Ohio uses a highly integrated monitoring and TMDL linkage to ensure efficient use of resources, it makes sense to continue to set priorities by AU rather than by individual use.

Ohio River and Open Waters of Lake Erie

ORSANCO has lead responsibility for the multi-jurisdictional Ohio River water quality as outlined in Section D2. Binationally, the U.S. and Canada are working together under the GLWQA to address water quality issues in Lake Erie. Ohio EPA is actively participating in TMDLs for tributaries as well as many other actions for Lake Erie outlined in Section J3, so priority for Ohio EPA-initiated TMDLs is assigned a low priority for these waters. TMDLs in watersheds that drain to the Ohio River and Lake Erie will reduce the pollutant load delivered to each water.

Inland Waters and Lake Erie Shoreline

A point system is used to assign priority to impaired AUs. A total of 22 points could be assigned to an AU, distributed as shown in Figure J-2. The priority results for specific AUs are reported in Section L and in AU summary information available on the web page.

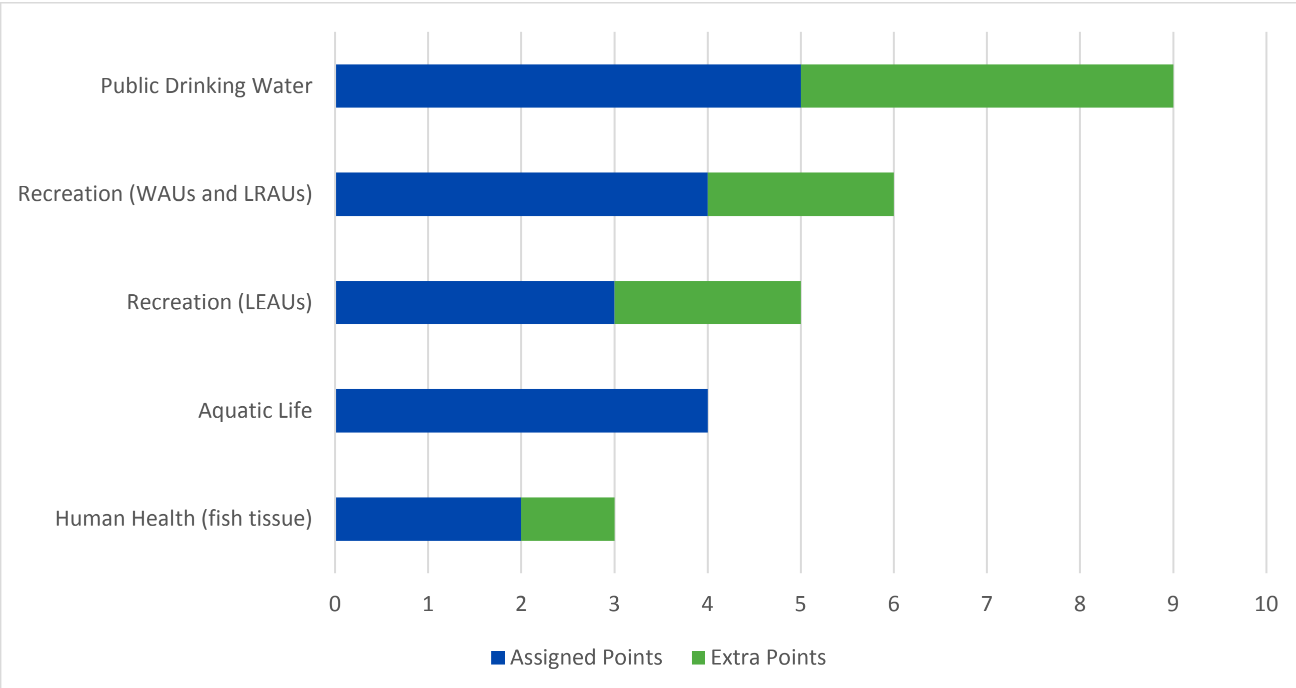


Figure J-2 — Priority points assigned based on use impairment or other factors (extra points).

The AUs are assigned priority points using the guidelines in Table J-3. The points assigned to the public drinking water and human health uses are straightforward. For the recreation and aquatic life uses, points are assigned based on a computed index score (see Sections F2 and G2). The lowest quartile (scores between 0 and 25) get the fewest points because a TMDL may not be the most effective way to address the impairments. Scores in this range indicate severe basin-wide problems, comprehensive degradation that may require significant time and resources and broad-scale fixes, including, possibly, fundamental changes in land use practices. Education about the effects various practices have on water quality and encouraging stewardship may be more effective in these areas than a traditional TMDL approach. Scores in the highest quartile (between 75.1 and 100) generally indicate a localized water quality issue. Addressing the impairment may not require a complete watershed effort; rather, a targeted fix for a particular problem may be most effective. Thus, these receive the next lowest number of priority points. The most points are awarded for scores in the middle quartiles (between 25.1 and 50 and between 50.1 and 75), indicating problems of such scale that purposeful action should produce a measurable response within a 10-year period. These waters are the best candidates for a traditional TMDL.

Two additional points may be awarded to AUs that are impaired for the recreation use and contain Class A waters. Class A waters are those most suitable for recreation, such as popular paddling streams and lakes with public access points developed, maintained and publicized by governmental entities. Priority points for Lake Erie recreation use are calculated based on the bathing water geometric mean for *E. coli* and the percentage of days that the AU exceeded that criteria. An impaired AU gets one point if the percentage of days in exceedance was in the range of 0 to 10 percent; two points if in the range of 10.1 percent to 20 percent; and three points if the percentage of days in exceedance was greater than 20.1 percent. Two additional points may also be awarded to AUs that are impaired for recreation use based on algae.

Table J-3 — Priority points for impaired AUs.

Point Values	Condition	Number of AUs WAUs	LRAUs	LEAUs
Human Health Use impairment (fish tissue contaminants) (maximum of 3 points)				
2	Listed as impaired for Fish Contaminants (Human Health Use)	436	32	4
1	Additional point in AUs that exceed 500 ppb for PCBs or Hg	3	0	0
Recreation Use impairment – WAUs and LRAUs (maximum of 6 points)				
1	Listed as impaired with AU score between 0 and 25	108	0	
2	Listed as impaired with AU score between 75.1 and 100	92	17	
3	Listed as impaired with AU score between 25.1 and 50	271	2	
4	Listed as impaired, with AU score between 50.1 and 75	279	7	
2 extra	Additional points if AU contains Class A waters	74	26	
Recreation Use impairment - LEAUs (maximum of 5 points)				
1	Listed as impaired with 0 to 10% of season exceeding *E. coli* criteria			1
2	Listed as impaired with 10.1% to 20% of season exceeding *E. coli* criteria			1
3	Listed as impaired with > 20.1% of season exceeding *E. coli* criteria			2
2 extra	Additional points if AU is impaired for algae			3
Aquatic Life Use impairment (maximum of 4 points)				
1	Listed as impaired, with AU score between 0 and 25	161	0	2
2	Listed as impaired, with AU score between 75.1 and 100	35	8	0
3	Listed as impaired, with AU score between 25.1 and 50	119	2	2
4	Listed as impaired, with AU score between 50.1 and 75	93	2	0
Public Drinking Water Use impairment (maximum of 9 points)				
5	Listed as impaired for Public Drinking Water Use for one indicator	33	5	6
2 extra	Additional points in AUs impaired for each additional indicator	1	3	0
1	Not listed as impaired, but on watch list; one point for each indicator	33	3	0

As outlined in Section C3, the priority schedule for TMDL projects in Table J-15 was developed considering the above information, as well as the following:

- Social Factors (highly used recreational waters, drinking water supply for significant populations, ongoing/sustained involvement of any local groups or government, etc.)
- Value Added (is a TMDL the most efficient way to achieve improved water quality?)
- Is there an approved watershed action plan – if so how many implemented projects?
- How much regulatory authority exists over sources?
- Is there an alternative way to improve water quality more quickly than a TMDL? (for example, immediate implementation of an existing plan or projects, or imposing more stringent permit limits to address a localized problem)
- Are there other factors in play? Examples include:
    - Pending enforcement for a discharger (possible 4B option)
    - U.S. Army Corps of Engineers modeling of reservoir discharge to improve downstream water quality
    - Local or statewide strategy or requirements in place to address an issue/pollutant (for example, new health department rules for home sewage treatment systems if they are sole/primary source of impairment)

Near-Term Priorities for Ohio EPA

Ohio is facing increasing problems with cyanobacteria blooms in inland lakes, including development of HABs in source waters. Many public water systems are experiencing increased treatment costs to manage the extra carbon load and cyanotoxins at their intake. The smaller conventional systems will have difficulty treating water for these problems and the expense will be very high to upgrade those plants.

In the *2014 Integrated Report*, Ohio listed waters impaired by algal toxins for the first time. In the 2016 report, more waters are listed, especially lakes and reservoirs. To emphasize protection of the public drinking water supply beneficial use from HABs, Ohio is making inland lakes used for public water supply a focus for the next several years for monitoring and improving water quality through TMDLs or other approaches.

Based on a review of the inland lakes or reservoirs that were listed as impaired or on the Watch List for algae indicators in the 2014 Integrated Report, as well as the more recent data collected for algae at PDWS with intakes in inland lakes or reservoirs that led to the 303(d) listing in this report, the following inland lakes were chosen as Ohio's priorities for the next few years:

- Tappan Lake in Harrison county (upper Little Stillwater Creek)
- W.H. Harsha Lake in Clermont County (Lucy Run - East Fork Little Miami River)
- Clyde/Beaver Creek Reservoir in Seneca County (Beaver Creek, Green Creek)

The impairments (or watch list parameters) cited include nitrate, pesticides and algae indicators. Where there is a TMDL developed, it is older and/or does not include the stream reaches that most impact the lake/reservoir. In most cases, there are active local parties interested and/or there is a sizable population served by these sources. Ohio EPA considers nutrients (primarily phosphorus as the TMDL parameter) to be the priority for the inland lake efforts. However, the cause of impairment in more than one area also includes pesticides and/or nitrates, so other pollutants may be added to the TMDL or alternative plan. These waters are listed on the 303(d) Priority list in Section L4 as follows:

AU Number	AU Name	Sq. Mi. in Ohio	Human Health	Recreation	Aquatic Life	PDW Supply	Priority Points
05040001 15 03	Upper Little Stillwater Creek	29.72	1	1	3	5	5
05090202 12 03	Lucy Run-East Fork Little Miami River	32.48	1	1	5	5	7
04100011 12 02	Beaver Creek	29.3	3i	4Ah	4A	5	5
04100011 12 03	Green Creek	30.78	1	5	4A	5	9

While they do not have the highest priority points, the AUs with higher priority points that include a PDWS impairment already have a TMDL under development or will be addressed through other means such as the Great Lakes Water Quality Agreement Annex 4 nutrient reduction efforts discussed in J3.

Tappan Lake

- Stillwater Creek basin – primarily forest with mining influences.
- 2,350 acres of water surface.
- Provides drinking water to the Village of Cadiz (pop. ~ 3,350).
- Lake is operated by the U.S. Army Corp of Engineers. It is a multipurpose project for flood reduction, recreation and fish and wildlife enhancement.
- Assessed by Ohio EPA in 2012-2013 and did not meet the draft lake habitat use criteria.
- *2014 Integrated Report* listed the lake as impaired for PDWS based on algae indicators (microcystin).

2018 IR Update

The Tappan Lake Nutrient Reduction Initiative (TLNRI) was formed at the end of 2017 by the Muskingum Watershed Conservancy District and the Village of Cadiz. TLNRI's goal is to eliminate the presence of harmful algal blooms and their resultant water-borne toxins in Tappan Lake within the next decade. The TLNRI has outlined the following steps toward achieving their goal:

- Phase 1: Comprehensive study of existing water quality data for the watershed and identification of gaps (year one)
- Phase 2: Collection of data to fill gaps, evaluation and selection of remedial actions for the watershed (years two through four)
- Phase 3: Implementation of action plan for the watershed (years five through 10)

Ohio EPA is an active partner in the initiative and will provide support through participation in the four subgroups. The Stillwater Creek watershed is a high priority project for either a TMDL or an alternative plan. The Agency will continue to participate in the TLNRI efforts and determine which approach is most appropriate as that work unfolds.

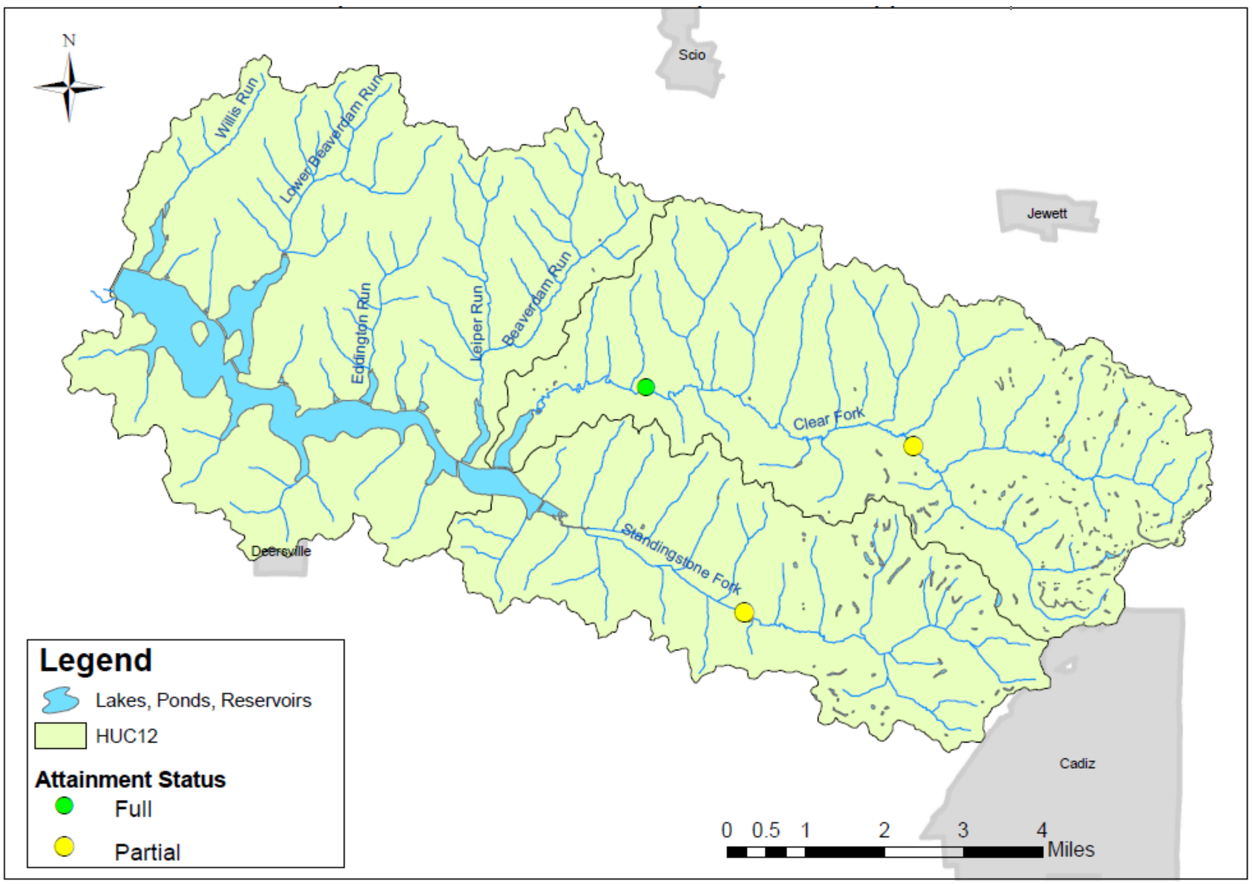


Figure J-3 — Watershed upstream from Tappan Lake and attainment status of sites from 2012 Stillwater River survey.

William H. Harsha Lake

- Located in the East Fork of the Little Miami River watershed – largely agriculture and forest with some urban influence.
- 2,160 acres of water surface.
- Lake is operated by the U.S. Army Corp of Engineers and is a multipurpose project for flood reduction, water supply, recreation and wildlife habitat.
- *2014 Integrated Report* listed the lake as impaired for PDWS based on algae indicators (microcystin) and placed it on the watch list for atrazine.

From the *Ohio EPA East Fork Little Miami River Technical Support Document, 2014*:

- Clermont County operates a community public water system that serves a population of approximately 117,097 people. The water supply sells water to the village of Batavia, village of Williamsburg and New Richmond Robin-Grays water system. Clermont County operates two ground water plants and one surface water plant. The BMW surface water plant draws water from an intake structure on Harsha (East Fork) Lake. The system's treatment capacity is approximately 27.5 million gallons per day, but current average production is 12.5 million gallons per day.
- There are several environmental organizations active in the East Fork Little Miami River watershed. The oldest of these is Little Miami Incorporated (LMI) which has been active for 45 years. Most of LMI's activities have involved the purchase of conservation easements or property purchases in the riparian zone of the river. Clermont County and SWCDs in Clermont, Brown, Highland and Clinton counties formed the East Fork Watershed Collaborative to take advantage of ODNR's Watershed Coordinator Program.
- Several research projects have been initiated in the East Fork watershed and Harsha Lake by U.S. EPA's National Exposure Research Laboratory in Cincinnati and the U. S. Army Corps of Engineers. Among other topics research and monitoring are examining HABs and nutrients, impacts on the Clermont County water intake, carbon sequestration, methane release, nutrient trading, environmental tipping points and fish population genetics. Currently, seven different projects are conducting monitoring in Harsha Lake.

2018 IR Update

The East Fork Watershed Cooperative, formed in 2001, continues to be active in addressing water quality issues in the East Fork Little Miami River watershed. The Cooperative is in the process of updating watershed action plans into Nine Element Nonpoint Source Implementation Strategy Plans. The first updated plan for the Fivemile Creek HUC 12, approved by Ohio EPA on July 31, 2017, is located upstream of Harsha Lake. The East Fork Little Miami River watershed is a high priority TMDL project for TMDL development. The Agency plans to initiate the next steps in the TMDL development process by the 2020 IR.

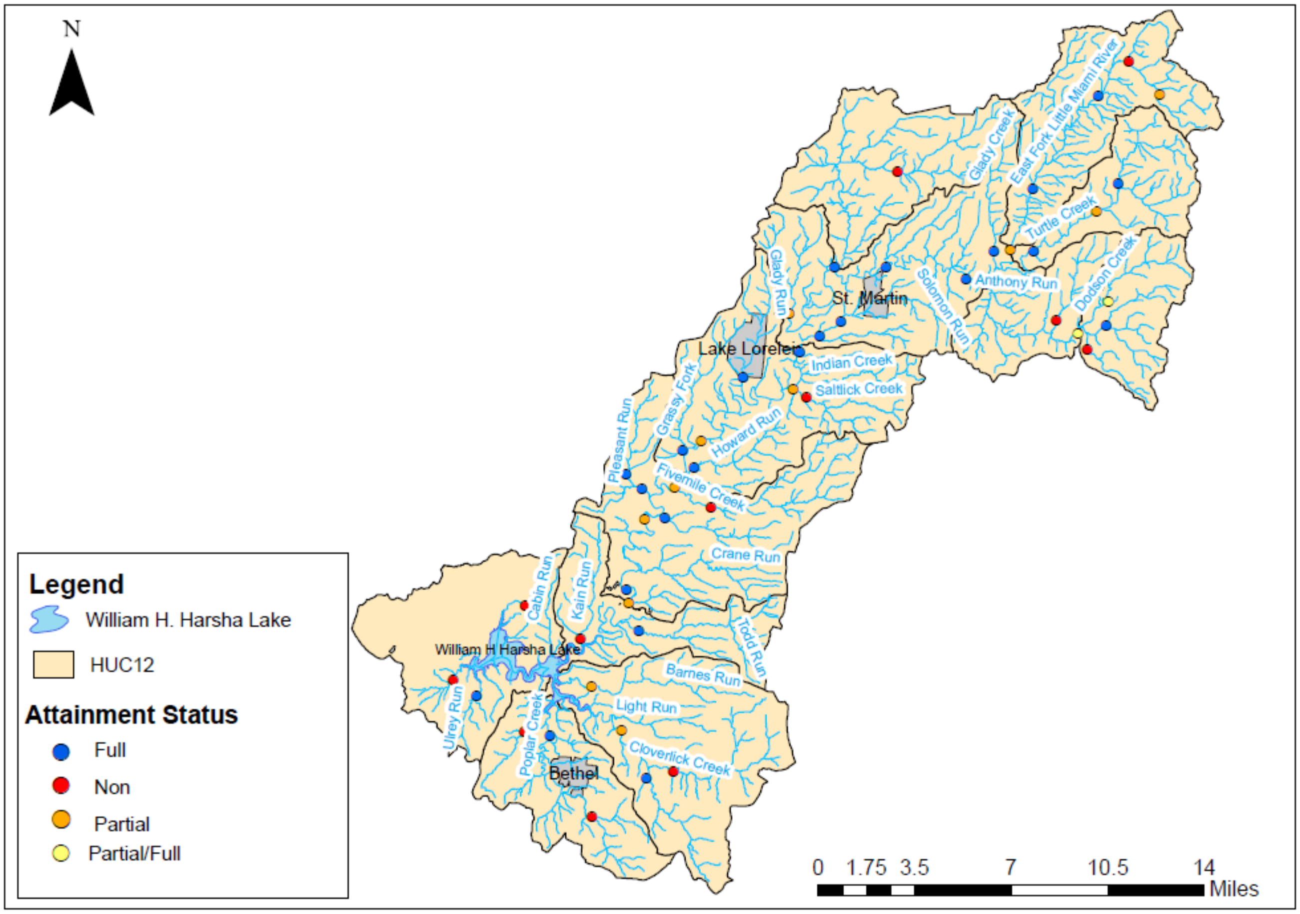


Figure J-4 — Watershed upstream from Harsha Lake and the attainment status of sites from the 2012 East Fork Little Miami River survey.

Clyde/Beaver Creek Reservoir (up-ground)

- Sandusky river watershed - primarily agricultural land use above reservoir.
- 110 acres of water surface.
- Provides drinking water to the City of Clyde (pop. ~6,320).
- Reservoir was assessed by Ohio EPA in 2009-2010 and did not meet the draft lake habitat use criteria.
- *2014 Integrated Report* placed the lake on the watch list for PDWS use based on algae indicators (microcystin) and nitrates. In the *2016 Integrated Report* it was listed as impaired for PDWS use based on algae indicators.
- The Raccoon Creek reservoir that also serves the City of Clyde is filled with water from Beaver Creek. The Raccoon creek reservoir was listed in the 2014 IR as impaired for PDWS based on algae indicators (microcystin).
- A TMDL for the lower Sandusky River was completed by Ohio EPA and approved by U.S. EPA but did not set specific loads for Beaver Creek since the stream was not listed as impaired.

2018 IR Update

Sampling of Raccoon Creek reservoir was completed in 2016 and 2017 as part of Ohio EPA's inland lakes sampling program. The results of this sampling will be included in the 2020 IR and will be used to direct the next steps in the restoration process for this watershed.

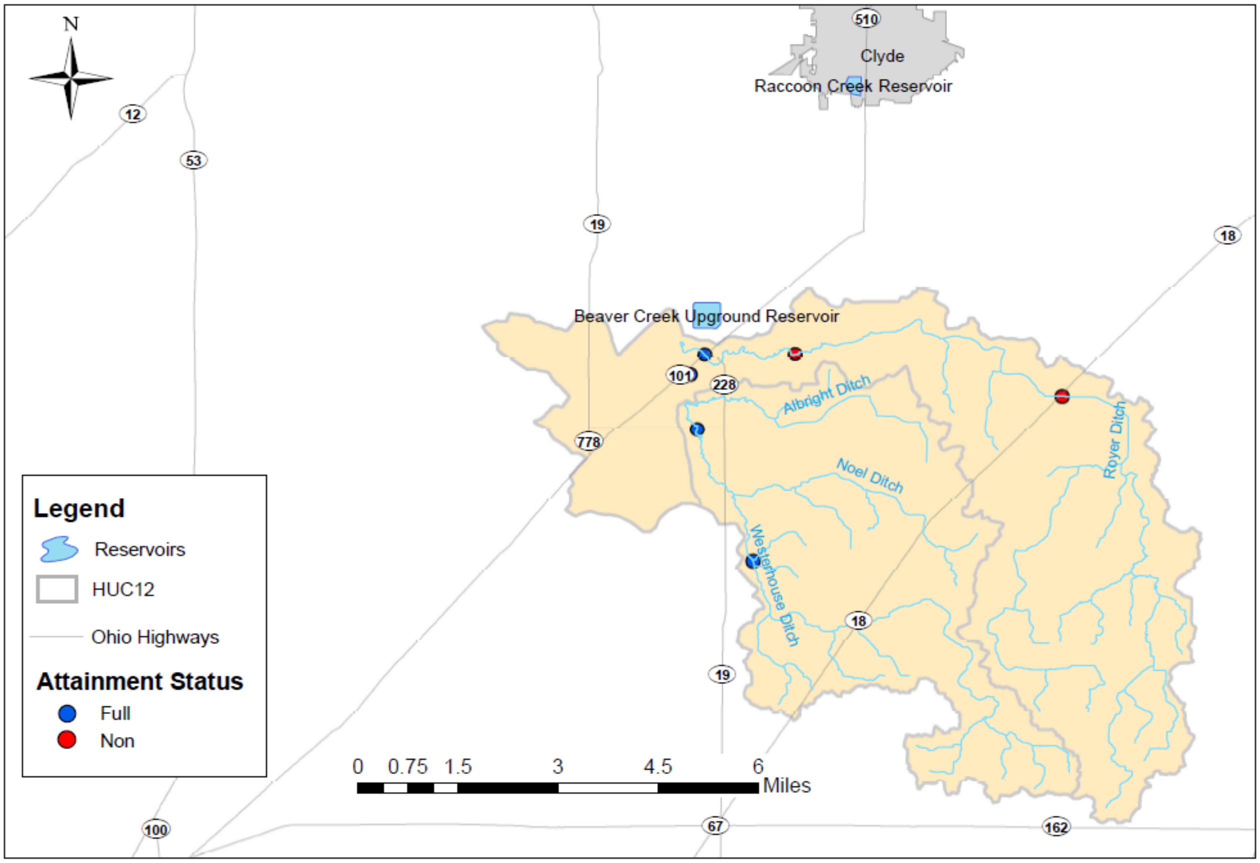


Figure J-5 — Watershed contributing to Beaver Creek Reservoir and the attainment status of sites sampled in 2009.

J3. Addressing Nutrients in Lake Erie

Ohio is working to address its contribution to the problems in Lake Erie through: nutrient TMDLs on tributaries; numerous state initiatives to reduce nutrient loads from Ohio in accordance with the Domestic Action Plan; and active participation on Annex 4 (Nutrients) and other Great Lakes Water Quality Agreement (GLWQA) efforts. Effective lake management and coordinated implementation are needed to address the Western Basin of Lake Erie algal blooms and the Central Basin hypoxia issues, requiring a multi-state and binational effort. Currently, there are many parallel planning and management efforts ongoing at the state, federal and binational level. For the open waters of Lake Erie, respecting and working through the binational governance framework is the appropriate process and Ohio intends to aggressively pursue state measures that complement the process and are neither duplicative nor contradictory.

Great Lakes Water Quality Agreement

Binationally, the U.S. and Canada are working together under the GLWQA to develop nutrient reduction strategies; and create and implement action plans to meet the targets. Annex 4 of the 2012 GLWQA specifically addresses nutrients in the Great Lakes and contains short-term requirements specific for Lake Erie. The U.S. and Canada formally adopted new phosphorus targets for the western and central basins of Lake Erie in February 2016. These targets have been incorporated into Ohio's Domestic Action Plan and are the goals for all the state's efforts to reduce phosphorus loading to the lake.

As water quality has improved through the decades, Ohio EPA has addressed most of the significant point source problems and are now left with primarily nonpoint source related impairments. The current Lake Erie algal blooms and Central Basin hypoxic zone are driven by nutrient loading to the Lake. Recent assessments by the Ohio Phosphorus Task Force (Phases I and II) and Annex 4's Objectives and Targets Task team, as well as a Nutrient Mass Balance Study completed by Ohio EPA in December 2016, indicate nonpoint sources are the primary source. A key challenge for nutrient management is to assess and manage both in-stream (near-field) and downstream (far-field) impacts in the receiving waterbody (Lake Erie). To compliment the 40 percent phosphorus reduction goals set forth by the Annex 4 committee, a separate analysis is being done to set seasonal/annual load reductions targets for the smaller tributaries (for example, within the Maumee basin). Ohio is directly involved in developing these goals and reduction targets needed for Lake Erie while moving forward on developing implementation strategies and acting to reduce nutrient contributions to the lake.

Annex 2 of the GLWQA provides the framework for long-term binational management of the Lake. A comprehensive LAMP has been developed for Lake Erie and is the binational platform where whole lake management plans are developed, implemented and tracked. Ohio is a key partner in the binational partnership. For example, Annex 2 calls for creation of a new nearshore framework and the binational partnership will be responsible for implementing the framework and reporting on progress. It is also expected that the nutrient targets from Annex 4 will be incorporated in the next version of the lake-wide management plans. Working through the binational partnership is critical for developing a coordinated approach with consistent reporting across the borders.

Lake Erie Collaborative Agreement

The Lake Erie Collaborative Agreement was another state/province led-initiative; it was signed in June 2015 by Ohio, Michigan and Ontario (***cglslgp.org/media/1590/western-basin-of-lake-erie-collaborative-agreement-6-13-15.pdf***). The three parties in the agreement are supportive of the binational Annex 4 effort but recognize that immediate actions can be implemented at the state and provincial levels. In order to get a head start on the Annex 4 process and hasten efforts to improve water quality in Lake Erie, Ohio released a draft *Collaborative Implementation Plan* in June 2016. One of the goals spelled out in the Collaborative Agreement was to reduce nutrient levels going into Lake Erie by 40 percent. The other was to develop a strategic plan to manage dredge material to ensure it complies with the state's recent commitment to stop open lake disposal of dredge material into Lake Erie by 2020. The GLWQA does not contain timeframes for implementation and restoration goals, but Ohio is working to meet the Collaborative Agreement phosphorus reduction goals of 20 percent by 2020 and 40 percent by 2025.

Ohio's Domestic Action Plan for Lake Erie

The State of Ohio's Domestic Action Plan expanded upon the *Collaborative Implementation Plan* and was submitted to U.S. EPA on Feb. 7, 2018. The commitment to meet the Collaborative Agreement phosphorus reduction goals of 20 percent by 2020 and 40 percent by 2025 was also incorporated into this plan. The plan is not intended to static but to be revised following the adaptive management philosophy. (***lakeerie.ohio.gov/Portals/0/Ohio DAP/DAP 1-0 Final for USEPA 2018-02-07.pdf***).

TMDLs for Lake Erie Watershed

TMDLs are conducted by the state or federal governments as required under the CWA for waters that have been formally identified as impaired. TMDLs use monitoring and modeling to identify where load reductions and restoration actions are needed. Ohio EPA plans to continue utilizing this tool to target implementation in Ohio's Lake Erie watersheds as it works to meet the Annex 4 phosphorus targets and allocations.

The TMDL document provides guidance on where to focus implementation and recommends BMPs. The TMDL process does not provide additional authority to either Ohio or U.S. EPA to regulate nonpoint sources of pollution; Ohio's regulatory tools are limited to permits and enforcement actions against point sources of pollution.

Ohio has completed TMDLs for 22 of 32 project areas (watersheds) feeding into Lake Erie and work on the remaining 10 watersheds is underway by either Ohio EPA or a contractor for U.S. EPA. All of these TMDLs employ the State's narrative water quality (WQ) criteria for nutrients and algae and have established phosphorus targets and methods to address near-field impacts on rivers and streams. Because Ohio lacks a WQS criterion for total phosphorus concentration in Lake Erie, TMDLs were not developed to address the excessive wet weather loads delivered to Lake Erie. However, Ohio is working with U.S. EPA, Tetratech (the contractor), Indiana and Michigan to develop a method for setting load reduction goals for the smaller tributaries to Lake Erie (for example, the tributaries to the Maumee river) and evaluate whether the tributary TMDLs will provide the load reductions needed to protect the lake. Where the local TMDL reductions are not sufficient to protect the lake, Ohio will be working with U.S. EPA and other partners to determine next steps.

The Annex 4 process of developing loading targets and Domestic Action Plans are very similar to the TMDL process but have the added advantage of being binationally managed according to the GLWQA. Key steps in each process are depicted in Figure J-6.

State TMDL vs Binational Annex 4

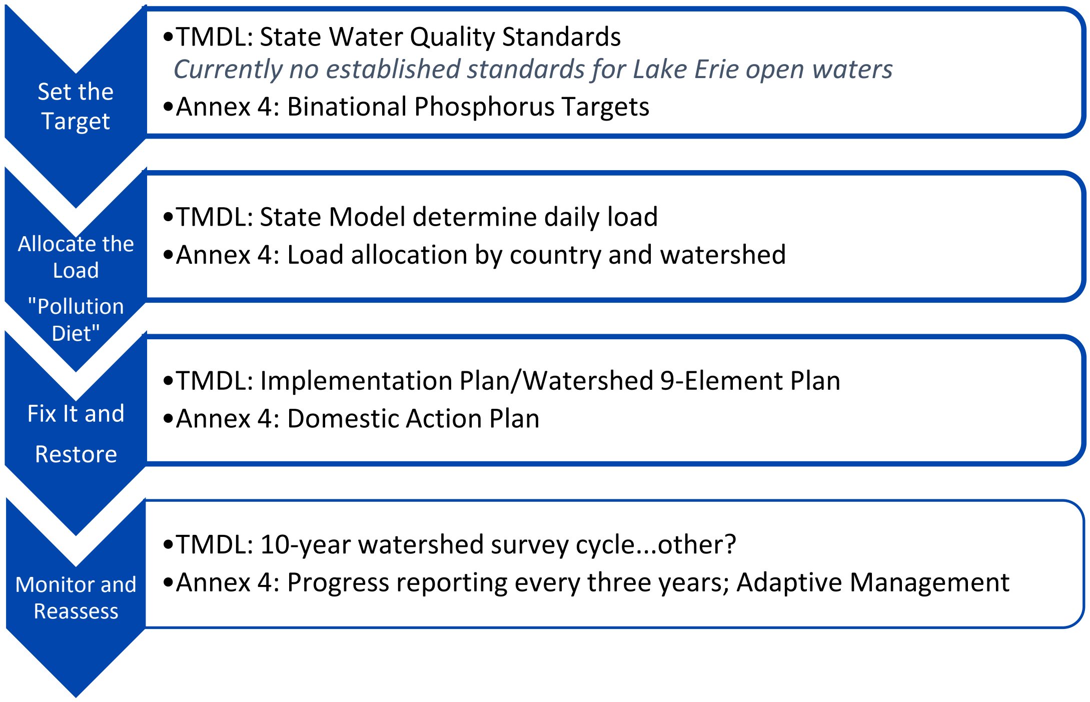


Figure J-6 — Key steps in the state TMDL and binational Annex 4 processes.

Ohio-based Nutrient Reduction Efforts

Ohio EPA's *NPS Management Plan* (Plan) is the Agency's guiding document that outlines recommended strategies, goals and objectives for controlling nonpoint sources of water quality impairment. The Plan was most recently updated in 2014 and identifies specific management activities to be implemented by Ohio EPA's NPS management program. The recent algal blooms on Lake Erie, the Ohio River and across the inland waters of Ohio were caused by excessive nutrients and exacerbated by changing weather patterns such as warmer temperatures and more intense storm events. The long-term solution is to reduce sources of nutrients while holistically restoring stream health and improving the waterway's ability to assimilate and utilize nutrients. This is also known as the stream's assimilative capacity. Restoring stream health will not only reduce the amounts of nutrients that reach the receiving water body, but restoration of in-stream and riparian habitat supports a healthy ecosystem, builds resilience to climate change impacts and improves recreational opportunities. The most current version of Ohio's *NPS Management Plan* is available at ***epa.ohio.gov/Portals/35/nps/NPS_Mgmt_Plan.pdf***.

Recognizing that Ohio's watersheds provide a significant amount of nutrients to Lake Erie and that its communities are bearing the brunt of algal bloom impacts, Ohio launched a series of initiatives at the state level in 2010 and has expanded the scope and scale of implementation, developed a statewide strategy, targeted funding and undertaken legislative action to address the problem. As part of the more than $3 billion Ohio has invested comprehensively in the Lake Erie watershed, more than $150 million was made available starting in 2014 to help to public water systems keep drinking water safe and wastewater facilities reduce the amount of phosphorus they discharge into the Lake Erie watershed. In addition, Ohio continues to target millions of dollars to support local health departments to find and fix faulty residential septic systems that are contributing nutrients to Ohio waters.

The following is a list of several state-led and statewide water quality improvement activities.

- Statewide Nutrient Reduction Strategy — Ohio's environmental, agricultural and natural resource agencies worked together to create a statewide strategy to reduce nutrient loading to streams and lakes, including Lake Erie. The strategy was submitted to U.S. EPA Region 5 in 2013. Ohio EPA is currently updating the strategy to address gaps identified through U.S. EPA's review. The strategy and more information about the effort are available at ***epa.ohio.gov/dsw/wqs/NutrientReduction.aspx***.
- GLRI Demonstration and Nutrient Reduction Projects — Nine grants totaling more than $13.9 million were awarded to Ohio. Highlights include: installation of the first two saturated buffers installed in Ohio; installation of approximately 70 controlled drainage structures; development of 52 whole farm conservation plans; planting of more than 9,000 acres of cover crops; installation and planting of 50 acres of reconstructed or restored wetlands; restoration of 3,500 linear feet of stream and 500 feet of streambank stabilization; installation of 4,400 feet of two-stage ditches; installation of rain gardens and vegetated infiltration basins in the Toledo area; and completion of 29 storm water, wetland and stream restoration projects in Cuyahoga County.
- Ohio Senate Bill 1 — This bill, effective July 3, 2015, requires major public-owned treatment works (POTWs) to conduct technical and financial capability studies to achieve 1.0 mg/L total phosphorus; establishes regulations for fertilizer or manure application for persons in the western basin[5]; designates the director of Ohio EPA as coordinator of harmful algae management and response and requires the director to implement actions that protect against cyanobacteria in the western basin and public water supplies; prohibits the director of Ohio EPA from issuing permits for sludge management that allow placement of sewage sludge on frozen ground; and prohibits the deposit of dredged material in Lake Erie on or after July 1, 2020, with some exceptions.
- Ohio Senate Bill 150 — This bill, effective Aug. 21, 2014, requires, among other things, that beginning Sept. 31, 2017, fertilizer applicators must be certified and educated on the handling and application of fertilizer; and authorizes a person who owns or operates agricultural land to develop a voluntary nutrient management plan or request that one be developed for him or her.
- Ohio HB 64 — This bill, effective June 30, 2015, required the development of a biennial report by spring 2016 on mass loading of nutrients delivered to Lake Erie and the Ohio River from Ohio's point and nonpoint sources. A summary of the bill is available at ***legislature.ohio.gov/legislation/legislation-summary?id=GA131-HB-64***.
- Ohio Clean Lakes Initiative — The Ohio General Assembly provided more than $3.5 million for projects to reduce nutrient runoff in the Western Lake Erie Basin.
- Healthy Lake Erie Initiative — The Ohio General Assembly provided $10 million to the Healthy Lake Erie Initiative to reduce the open lake placement of dredge material into Lake Erie. These sediments often contain high levels of nutrients or other contaminants so finding alternative use or disposal options is a priority.
- Directors' Agricultural Nutrients and Water Quality Working Group — This is a collaborative working group that consists of participants from Ohio EPA, ODA and ODNR. The group's report contains several recommendations to be implemented during the next several years. For example,

[5] "Western basin" is defined in this Senate Bill as consisting of the following 11 watersheds: Ottawa watershed, HUC 04100001; River Raisin watershed, HUC 04100002; St. Joseph watershed, HUC 04100003; St. Mary's watershed, HUC 04100004; Upper Maumee watershed, HUC 04100005; Tiffin watershed, HUC 04100006; Auglaize watershed, HUC 04100007; Blanchard watershed, HUC 04100008; Lower Maumee watershed, HUC 04100009; Cedar-Portage watershed, HUC 04100010; and Sandusky watershed, HUC 04100011.

the report recommends ways for farmers to better manage fertilizers and animal manure and provides the state with the means to assist farmers in the development of nutrient management plans and to exert more regulatory authority over the farmers who are not following the rules. The report is available at ***agri.ohio.gov/topnews/waterquality/docs/FINAL_REPORT_03-09-12.pdf***.

- Ohio Lake Erie Phosphorus Task Force Phase 2 — The Task Force, which includes participants from Ohio EPA, ODA and ODNR, originally met back in 2009 and was brought back together in 2012 to build on its previous work and make recommendations for improving water quality in the Lake Erie watershed. The taskforce finalized the latest report in 2014 and it is available at ***lakeerie.ohio.gov/Portals/0/Reports/Task_Force_Report_October_2013.pdf***.
- Ohio Point Source and Urban Runoff Workgroup — Businesses, municipalities and Ohio EPA came together to initiate the Point Source and Urban Runoff Workgroup in 2012 to identify actions that can be taken immediately to reduce phosphorus loadings from WWTPs, industrial discharges and urban storm water. The group's full report is available at ***epa.ohio.gov/portals/35/documents/point_source_workgroup_report.pdf***.

J4. Summary of Results

The consolidated results of the 2018 analysis are shown in Table J-4 and Figure J-7 — Summary of 2018 IR results for watershed AUs by beneficial use. through Figure J-9.

Table J-4 — Summary of results for each beneficial use[6]

	Human Health (fish tissue)	Recreation	Aquatic Life	Public Drinking Water Supply
Watershed assessment units				
Not being used for PDWS	0	0	0	1434
Attains	230	157	500	31
Unknown	872	186	109	39
Impaired, needs TMDL	436	750	411	33
Impaired, TMDL complete	0	445	408	1
Impaired, other remedy	0	0	0	0
Impaired, not pollutant	0	0	14	0
Impaired, natural condition	0	0	96	0
Total watersheds considered	**1538**	**1538**	**1538**	**1538**
Large river assessment units				
Not being used for PDWS	0	0	0	29
Attains	6	3	18	0
Unknown	0	3	0	4
Impaired, needs TMDL	32	26	12	5
Impaired, TMDL complete	0	6	5	0
Impaired, other remedy	0	0	0	0
Impaired, not pollutant	0	0	3	0
Impaired, natural condition	0	0	0	0
Total large rivers considered	**38**	**38**	**38**	**38**
Lake Erie assessment units				
Not being used for PDWS	0	0	0	1
Attains	0	0	0	0
Unknown	3	2	3	0
Impaired, needs TMDL	4	5	4	6
Impaired, TMDL complete	0	0	0	0
Impaired, other remedy	0	0	0	0
Impaired, not pollutant	0	0	0	0
Impaired, natural condition	0	0	0	0
Total Lake Erie considered	**7**	**7**	**7**	**7**

[6] Reported using federally-defined categories (see Table J-1), except for two defined by Ohio [category 0 (not being used for public water supply) and subcategory 4n (impaired due to natural condition)]. Other Ohio-defined subcategories are included in federal categories.

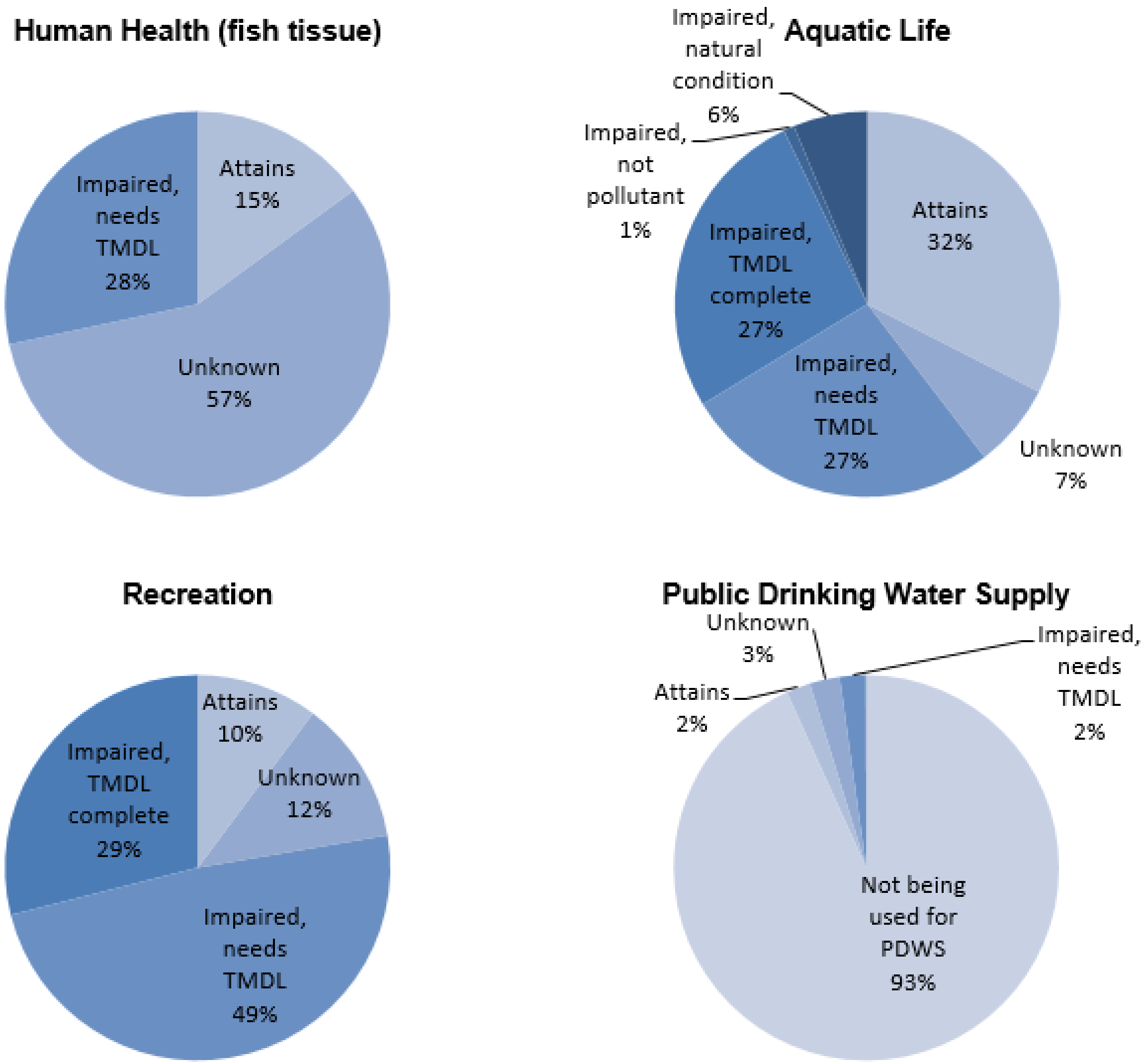


Figure J-7 — Summary of 2018 IR results for watershed AUs by beneficial use.

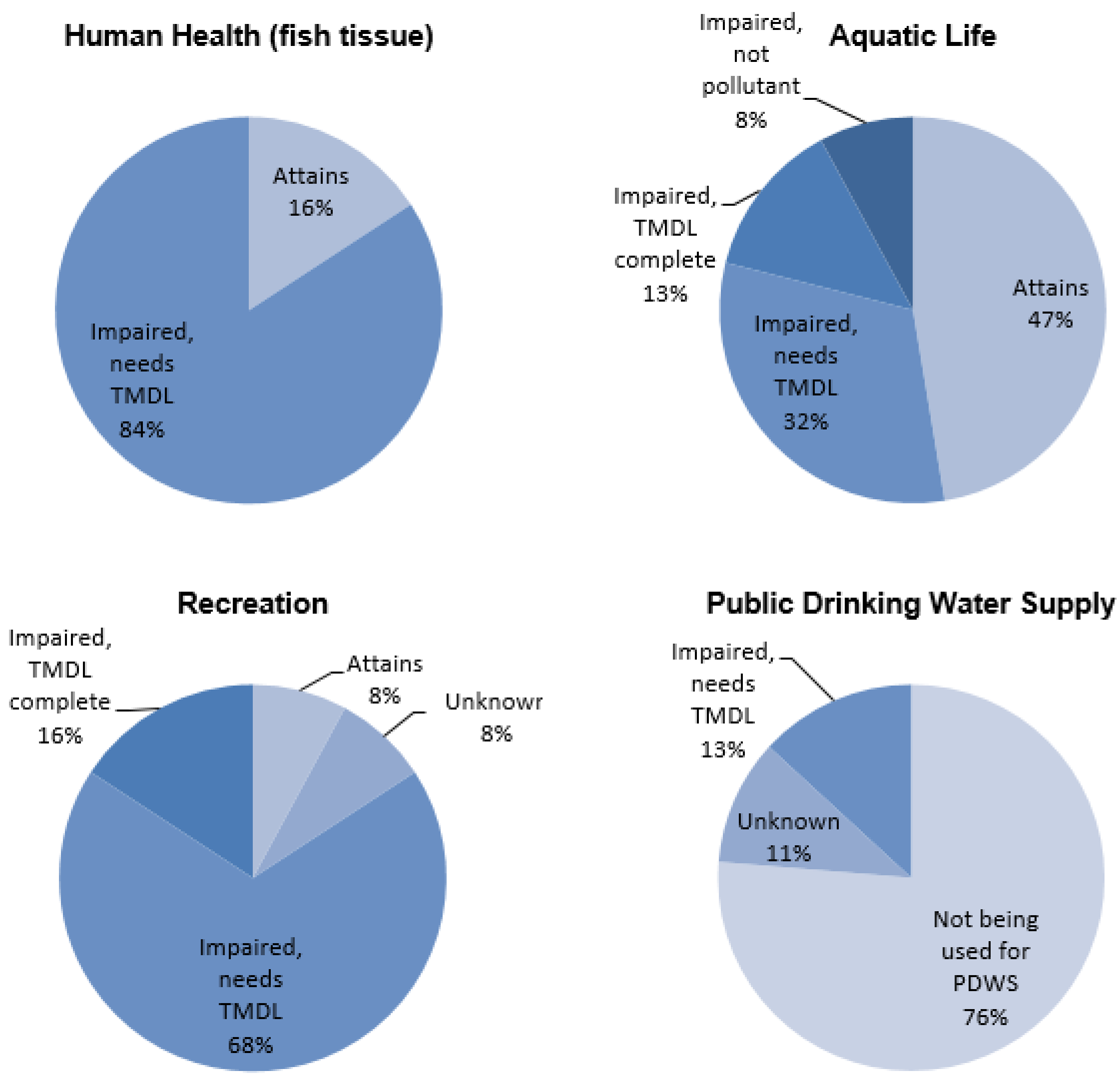


Figure J-8 — Summary of 2018 IR results for large river AUs by beneficial use.

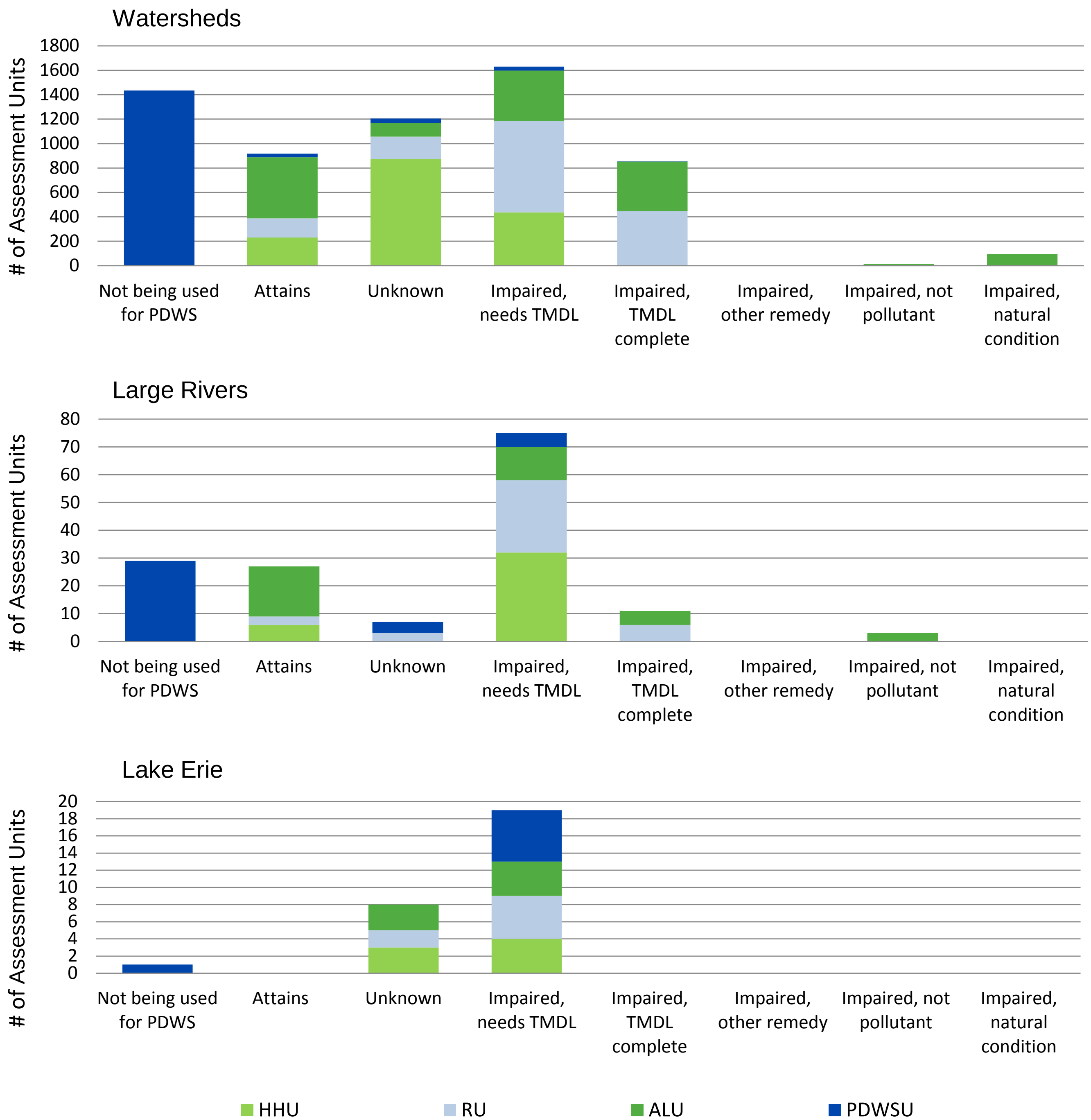


Figure J-9 — Summary of 2018 results by AU type.

J5. Changes for the 2018 303(d) List

Federal regulations require a demonstration of good cause for not including water bodies on the Section 303(d) list that were included on previous 303(d) lists (40 CFR 130.7(b)(6)(iv)). Over time, U.S. EPA has modified the wording of reasons for delisting in guidance (U.S. EPA 2005, 2006, 2009, 2011, 2013) to be used in preparing this report. Ohio is removing 69 AUs and adding 135 AUs based on one of these reasons:

- Flaw in original listing: reason noted for each change.
- New data: the assessment and interpretation of more recent data.

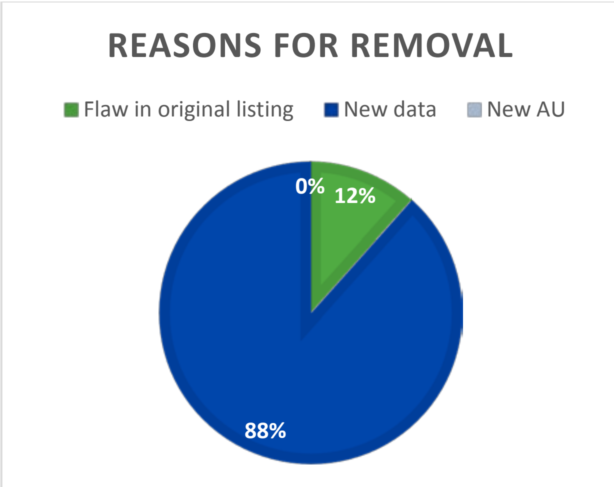
Table J-5 summarizes the number of watershed, large river and Lake Erie AUs being removed from or added to the 2018 303(d) list. Table J-6 and Figure J-6 summarize the number of AUs being changed for each of the reasons. Each AU removed or added for each reason is presented in Table J-7 through Table J-10.

Table J-5 — Number of AUs removed from or added to the 303(d) list.

	Number of AUs			
	Watershed	Large River	Lake Erie	Total
Delistings [Remove from 303(d) list]				
Human Health (fish tissue)	7	3	0	10
Recreation	3	0	0	3
Aquatic Life	56	0	0	56
Public Drinking Water Supply	0	1	1	2
Total	**66**	**4**	**1**	**71**
New Listings [Add to 303(d) list]				
Human Health (fish tissue)	16	0	0	16
Recreation	68	3	1	72
Aquatic Life	33	0	0	33
Public Drinking Water Supply	13	0	1	14
Total	**130**	**3**	**2**	**135**

Table J-6 — Summary of reasons for changes to the 2018 303(d) list.

	Number of AUs	
Reason for Change	Removals	Additions
Flaw in original listing	8	7
New data	61	128
Total	**69**	**135**



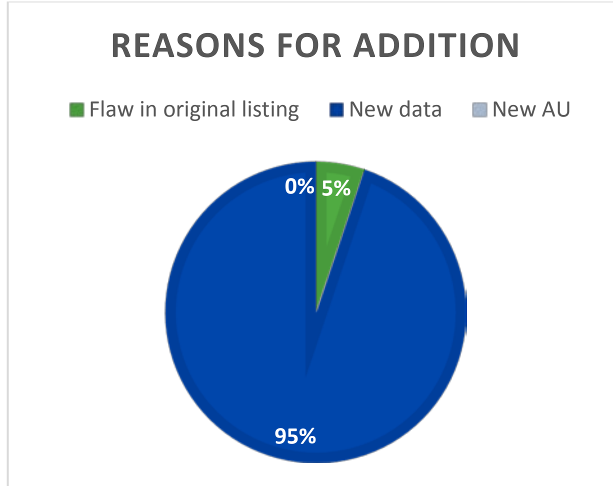


Figure J-10 — Summary of reasons for changes to the 2016 303(d) list.

Table J-7 — Removals from 303(d) list because of flaw in original listing.

Use	AU Number	AU Name	2016 Category	2018 Category
ALU	04100005 02 02	North Chaney Ditch-Maumee River	5hx	1
ALU	04100009 05 10	Lick Creek-Maumee River	5h	4n
ALU	04110001 03 02	Headwaters West Fork East Branch Black River	5h	1
ALU	05090101 06 02	Barren Creek-Raccoon Creek	5hx	1
HHU	05030103 02 01	Deer Creek	5	1
HHU	05040006 06 03	Dillon Lake-Licking River	5	1
HHU	05060002 02 05	Deer Creek Lake-Deer Creek	5	1
HHU	05090103 01 04	Storms Creek	5	1

Table J-8 — Removals from the 303(d) list because of new data.

Use	AU Number	AU Name	2016 Category	2018 Category
ALU	04100004 01 01	Muddy Creek	5hx	1
ALU	04100004 02 02	Eightmile Creek	5hx	4C
ALU	04100004 02 03	Blierdofer Ditch	5hx	1
ALU	04100005 02 03	Marie DeLarme Creek	5hx	1
ALU	04100005 02 05	Sixmile Cutoff-Maumee River	5hx	1
ALU	04100005 02 07	Sulphur Creek-Maumee River	5hx	1
ALU	04100009 01 01	West Creek	5hx	1
ALU	04100009 01 02	Upper South Turkeyfoot Creek	5hx	1
ALU	04100009 01 05	Little Turkeyfoot Creek	5hx	1
ALU	04100009 01 06	Lower South Turkeyfoot Creek	5hx	1
ALU	04100009 02 01	Preston Run-Maumee River	5hx	1
ALU	04100009 02 02	Benien Creek	5hx	1
ALU	04100009 02 03	Wade Creek-Maumee River	5hx	1
ALU	04100009 02 04	Garret Creek	5hx	1
ALU	04100009 02 05	Oberhaus Creek	5hx	1
ALU	04100009 02 06	Village of Napoleon-Maumee River	5hx	1
ALU	04100009 02 07	Creager Cemetery-Maumee River	5hx	1
ALU	04100009 03 01	Upper Bad Creek	5hx	1
ALU	04100009 03 02	Lower Bad Creek	5hx	1
ALU	04100009 04 01	Konzen Ditch	5hx	1

Use	AU Number	AU Name	2016 Category	2018 Category
ALU	04100009 04 03	Dry Creek-Maumee River	5hx	1
ALU	04100009 05 01	Big Creek	5hx	1
ALU	04100009 05 02	Hammer Creek	5hx	1
ALU	04100009 05 03	Upper Beaver Creek	5hx	1
ALU	04100009 05 04	Upper Yellow Creek	5hx	1
ALU	04100009 05 05	Brush Creek	5hx	1
ALU	04100009 05 06	Lower Yellow Creek	5hx	1
ALU	04100009 05 07	Cutoff Ditch	5hx	1
ALU	04100009 05 08	Middle Beaver Creek	5hx	1
ALU	04100009 05 09	Lower Beaver Creek	5hx	1
ALU	04110003 02 01	Indian Creek-Frontal Lake Erie	5hx	4n
ALU	05030201 06 03	Wolfpen Run-Little Muskingum River	5h	1
ALU	05030201 07 03	Wingett Run-Little Muskingum River	5h	1
ALU	05030201 07 05	Eightmile Creek-Little Muskingum River	5h	1
ALU	05030202 09 04	Crooked Creek-Ohio River	5hx	4n
ALU	05030204 04 02	Baldwin Run	5	1
ALU	05090101 05 01	Pierce Run	5	1d
ALU	05090101 06 01	Indian Creek	5hx	1
ALU	05090101 06 03	Mud Creek-Raccoon Creek	5hx	1
ALU	05090101 06 04	Bullskin Creek	5hx	1
ALU	05090201 02 03	Pond Run	5hx	1
ALU	05090201 02 04	Briery Branch-Ohio River	5hx	1
ALU	05090201 02 05	Upper Twin Creek	5hx	1
ALU	05090201 02 06	Lower Twin Creek	5hx	1
ALU	05090201 02 07	Rock Run-Ohio River	5hx	1
ALU	05090201 02 09	Stout Run	5hx	4n
ALU	05090201 02 10	Quicks Run-Ohio River	5hx	1
ALU	05090201 07 02	Headwaters East Fork Eagle Creek	5hx	1
ALU	05090201 07 03	Hills Fork-East Fork Eagle Creek	5hx	1
ALU	05090201 07 04	Rattlesnake Creek-West Fork Eagle Creek	5hx	1
ALU	05090201 08 03	Evans Run-Straight Creek	5hx	4n
ALU	05090201 08 04	Lee Creek-Ohio River	5hx	1
RU	04100009 01 02	Upper South Turkeyfoot Creek	5	1
RU	04100012 05 06	Mouth West Branch Huron River	5	1
RU	05090101 08 02	Black Fork	5	1
HHU	04100012 01 04	New London Upground Reservoir-Vermilion River	5h	1
HHU	05030103 07 03	Lower Meander Creek	5	1
HHU	05040001 03 08	Sippo Creek	5h	1
HHU	05030204 90 01	Hocking River Mainstem (Scott Creek to Margaret Creek)	5h	1
HHU	05030204 90 02	Hocking River (Margaret Creek to Ohio River)	5h	1
HHU	05040003 90 01	Walhonding River Mainstem (entire length)	5	1

Table J-9 — Addition to the 303(d) list because of flaw in original listing

Use	AU Number	AU Name	2016 Category	2018 Category
HHU	04110001 04 02	Salt Creek-East Branch Black River	1	5
HHU	05030103 08 09	Coffee Run-Mahoning River	3	5
HHU	05060001 18 05	Big Run-Walnut Creek	1	5
HHU	05060002 05 03	Lick Run-Scioto River	3i	5
HHU	05080002 01 03	Dry Run-Wolf Creek	1	5
PDWSU	04100007 03 05	Lost Creek	3i	5
PDWSU	04100007 03 06	Lima Reservoir-Ottawa River	3	5

Table J-10 — Additions to the 303(d) list because of new data

Use	AU Number	AU Name	2016 Category	2018 Category
ALU	04100004 03 01	Little Black Creek	3x	5
ALU	04100004 03 02	Black Creek	3x	5
ALU	04100004 03 03	Yankee Run-St Marys River	3x	5
ALU	04100004 03 04	Duck Creek	3x	5
ALU	04100012 05 05	Unnamed Creek "C"	1ht	5d
ALU	04100012 06 01	Headwaters East Branch Huron River	4Ah	5d
ALU	04110001 07 01	Headwaters Beaver Creek	3x	5
ALU	04110001 07 02	Mouth Beaver Creek	4C	5
ALU	04110001 07 03	Quarry Creek-Frontal Lake Erie	3x	5
ALU	04110003 05 01	Marsh Creek-Frontal Lake Erie	3	5
ALU	04120101 07 02	Turkey Creek-Frontal Lake Erie	1	5
ALU	04120101 07 03	Town of North Kingsville-Frontal Lake Erie	3	5
ALU	05030202 02 01	Headwaters West Branch Shade River	3x	5
ALU	05030202 02 02	Kingsbury Creek	3x	5
ALU	05030202 02 03	Headwaters Middle Branch Shade River	3x	5
ALU	05030202 02 04	Elk Run-Middle Branch Shade River	3x	5
ALU	05030202 02 05	Walker Run-West Branch Shade River	3x	5
ALU	05030202 08 05	Broad Run-Ohio River	3x	5
ALU	05040001 01 05	Portage Lakes-Tuscarawas River	4Ah	5d
ALU	05040001 07 01	Headwaters Upper Conotton Creek	3x	5
ALU	05040001 08 01	Cold Spring Run-Indian Fork	3x	5
ALU	05040001 08 02	Pleasant Valley Run-Indian Fork	3x	5
ALU	05040001 08 05	Dog Run-Conotton Creek	3x	5
ALU	05060003 05 04	Rocky Fork Lake-Rocky Fork	3	5
ALU	05080003 08 08	Howard Creek-Dry Fork Whitewater River	4n	5
ALU	05080003 08 09	Lee Creek-Dry Fork Whitewater River	1hx	5
ALU	05090101 01 01	Chickamauga Creek	3x	5
ALU	05090101 07 08	Wolf Creek-Indian Guyan Creek	3x	5
ALU	05090101 07 09	Paddy Creek-Ohio River	3x	5
ALU	05090101 08 02	Black Fork	3x	5
ALU	05090101 09 01	Sand Fork	3x	5
ALU	05090201 06 04	Big Threemile Creek	3x	5
ALU	05090201 10 03	Big Run-Whiteoak Creek	4A	5d
RU	04100010 06 02	Packer Creek	3	5
RU	04100010 06 03	Lower Toussaint Creek	3	5
RU	04100012 04 04	Holliday Lake	1t	5
RU	04100012 05 01	Mud Run	3	5
RU	04100012 05 02	Slate Run	3	5
RU	04100012 05 03	Frink Run	3	5

Use	AU Number	AU Name	2016 Category	2018 Category
RU	04100012 05 04	Seymour Creek	3	5
RU	04100012 05 05	Unnamed Creek "C"	3	5
RU	04110002 01 01	East Branch Reservoir-East Branch Cuyahoga River	1h	5
RU	04110002 01 03	Tare Creek-Cuyahoga River	1	5
RU	04110002 01 06	Sawyer Brook-Cuyahoga River	3	5
RU	05040001 07 02	Irish Creek	3	5
RU	05040001 07 03	Dining Fork	3	5
RU	05040001 07 05	North Fork McGuire Creek	3	5
RU	05040001 07 07	Headwaters Lower Conotton Creek	3	5
RU	05040001 08 01	Cold Spring Run-Indian Fork	1	5
RU	05040001 08 03	Thompson Run-Conotton Creek	3	5
RU	05040001 08 04	Huff Run	1	5
RU	05040001 08 05	Dog Run-Conotton Creek	1	5
RU	05080003 07 01	Headwaters Middle Fork East Fork Whitewater River	3	5
RU	05080003 08 07	Headwaters Dry Fork Whitewater River	3	5
RU	05080003 08 08	Howard Creek-Dry Fork Whitewater River	3	5
RU	05080003 08 09	Lee Creek-Dry Fork Whitewater River	3	5
RU	05090101 01 01	Chickamauga Creek	3	5
RU	05090101 02 01	East Branch Raccoon Creek	3	5
RU	05090101 02 02	West Branch Raccoon Creek	3	5
RU	05090101 02 03	Brushy Fork	3	5
RU	05090101 02 04	Twomile Run-Raccoon Creek	3	5
RU	05090101 02 05	Town of Zaleski-Raccoon Creek	3	5
RU	05090101 03 01	Hewett Fork	3	5
RU	05090101 03 02	Headwaters Elk Fork	3	5
RU	05090101 03 03	Flat Run-Elk Fork	3	5
RU	05090101 04 02	Dickason Run	3	5
RU	05090101 04 03	Meadow Run-Little Raccoon Creek	1	5
RU	05090101 04 04	Deer Creek-Little Raccoon Creek	3	5
RU	05090101 05 01	Pierce Run	3	5
RU	05090101 05 02	Strongs Run	3	5
RU	05090101 05 03	Flatlick Run-Raccoon Creek	3	5
RU	05090101 05 04	Robinson Run-Raccoon Creek	3	5
RU	05090101 06 01	Indian Creek	3	5
RU	05090101 06 02	Barren Creek-Raccoon Creek	3	5
RU	05090101 06 04	Bullskin Creek	3	5
RU	05090101 07 03	Swan Creek	3	5
RU	05090101 07 06	Little Indian Guyan Creek	3	5
RU	05090101 07 07	Johns Creek-Indian Guyan Creek	3	5
RU	05090101 07 08	Wolf Creek-Indian Guyan Creek	3	5
RU	05090101 08 03	Headwaters Symmes Creek	3	5
RU	05090101 09 01	Sand Fork	1h	5
RU	05090101 09 02	Buffalo Creek	3	5
RU	05090101 09 03	Camp Creek-Symmes Creek	3	5
RU	05090101 10 01	Johns Creek	3	5
RU	05090101 10 02	Long Creek	3	5
RU	05090101 10 03	Pigeon Creek-Symmes Creek	3	5
RU	05090101 10 04	Aaron Creek-Symmes Creek	3	5
RU	05090101 10 05	McKinney Creek-Symmes Creek	3	5
RU	05090101 10 07	Buffalo Creek-Ohio River	3	5
RU	05090201 02 01	Headwaters Turkey Creek	3	5

Use	AU Number	AU Name	2016 Category	2018 Category
RU	05090201 02 04	Briery Branch-Ohio River	3	5
RU	05090201 02 07	Rock Run-Ohio River	3	5
RU	05090201 02 09	Stout Run	3	5
RU	05090201 02 10	Quicks Run-Ohio River	3	5
RU	05090201 06 01	Crooked Creek-Ohio River	3	5
RU	05090201 06 05	Lawrence Creek-Ohio River	3	5
RU	05090201 07 02	Headwaters East Fork Eagle Creek	3	5
RU	05090201 07 04	Rattlesnake Creek-West Fork Eagle Creek	3	5
RU	05090201 07 05	Eagle Creek	3	5
RU	05090201 08 02	Headwaters Straight Creek	1	5
RU	05090201 08 03	Evans Run-Straight Creek	3	5
RU	05040001 90 02	Tuscarawas River Mainstem (Sandy Creek to Stillwater Creek)	3	5
RU	05080003 90 01	Whitewater River Mainstem (entire length)	3	5
RU	05090101 90 01	Raccoon Creek Mainstem (Little Raccoon Creek to mouth)	3i	5
RU	041202000101	Lake Erie Islands Shoreline (<=3m)	1	5
HHU	04100004 01 06	Fourmile Creek-St Marys River	1	5
HHU	04100004 03 03	Yankee Run-St Marys River	1	5
HHU	04100008 02 05	City of Findlay Riverside Park-Blanchard River	1	5
HHU	04100009 05 07	Cutoff Ditch	3	5
HHU	04100009 05 09	Lower Beaver Creek	3	5
HHU	04100012 05 06	Mouth West Branch Huron River	3	5
HHU	04100012 06 04	Mouth East Branch Huron River	3	5
HHU	04110004 05 02	Bronson Creek-Grand River	1h	5
HHU	05040002 08 02	Town of Perrysville-Black Fork Mohican River	3i	5
HHU	05040002 08 03	Big Run-Black Fork Mohican River	3i	5
HHU	05040003 03 04	Delano Run-Kokosing River	3i	5
PDWSU	04100007 02 03	Sims Run-Auglaize River	3i	5
PDWSU	04100007 06 04	Dry Fork-Little Auglaize River	1	5
PDWSU	04100012 04 03	Walnut Creek-West Branch Huron River	3	5
PDWSU	04110004 01 02	Headwaters Grand River	1	5
PDWSU	05030103 08 05	Headwaters Yellow Creek	1	5
PDWSU	05030103 08 06	Burgess Run-Yellow Creek	1	5
PDWSU	05040002 03 01	Headwaters Clear Fork Mohican River	1	5
PDWSU	05040004 04 07	Painter Creek-Jonathon Creek	1	5
PDWSU	05060001 06 02	Middle Mill Creek	1	5
PDWSU	05090202 04 06	Lower Caesar Creek	3i	5
PDWSU	05090202 06 04	Headwaters Cowan Creek	3i	5
PDWSU	05060001 90 01	Scioto River Mainstem (L. Scioto R. to Olentangy R.); excluding O'Shaughnessy and Griggs reservoirs	1	5

J6. Schedule for TMDL Work

Once waters are assessed and the impaired waters are prioritized, the next step is to determine a schedule to address the monitoring needs of all waters and restoration needs (including TMDLs) of the impaired ones. Various factors must be considered, including: Ohio's ongoing TMDL work; the process identified to do TMDLs; the monitoring strategy; and the resources available for the work.

Over the past few years, TMDL projects transitioned from the old HUC 11-scale watersheds to the new, smaller HUC 12-scale watersheds. Through 2009, TMDLs were completed using the HUC 11-scale AUs. Projects submitted for approval after April 1, 2010, reflect the new HUC 12-size units. Tables in Section J4 and the TMDL status map in Section K reflect current information based on the HUC 12 units.

J6.1. Ohio TMDL Status

Ohio EPA is currently working on TMDLs or re-assessments in about 45 project areas and has approved TMDLs in about 50 project areas. As of 2017, Ohio has assessed all our significant watershed areas using our current survey approach. Table J-13 summarizes Ohio TMDLs approved by U.S. EPA at the 11-digit HUC level. Table J-14 summarizes Ohio TMDLs approved by U.S. EPA at the 12-digit HUC level. It must be noted that the 2015 Ohio Supreme Court decision resulted in a delay of TMDLs submitted for approval by Ohio EPA, as discussed in Section C on pages C-16 and C-17 of this report.

J6.2. Long-Term Schedules for Monitoring and TMDLs

Ohio's rotating basin approach (see Section D) provides a foundation for scheduling monitoring and TMDL projects. The assessment methodology allows that, generally, aquatic life use monitoring data up to 10 years old may be considered in judging AUs, so it follows that each AU must be monitored at least once every 10 years to maintain coverage. However, resources to maintain this pace are no longer available — cycling through the entire basin rotation would take about 15 to 20 years at current resource levels. The delays caused by the 2015 Ohio Supreme Court Decision[7] and the workload resulting from the legislative changes to the process have also resulted in a larger backlog of TMDL reports. Fewer new assessments are planned for the next year or so to allow the report backlog to be reduced.

To maintain the monitoring and TMDL schedule, Ohio EPA is committed to researching and pursuing additional resources, both in terms of funding and partnering opportunities. Ohio's credible data law (ORC 6111.52) requires level three credible data to establish a TMDL and to identify, list and delist waters of the state for purposes of §303(d).

J6.3 Short-Term Schedule for TMDL Development

Ohio EPA evaluated the pending TMDL projects and plans to focus on the highest priority projects during the next two years, which are indicated in Table J-15. Because Ohio's TMDL process begins with a watershed assessment, all TMDLs to be completed in the next two years are already well in progress. In addition, the agency is committed to restoring water quality and will be exploring other alternatives to this end in both the short- and long-term, as outlined in the 303(d) Vision discussion in Section C7 of this report.

[7] March 2015 in Fairfield Cty. Bd. of Commrs. v. Nally, 143 Ohio St. 3d 93, 2015-Ohio-991, the Ohio Supreme Court determined that "A TMDL established by Ohio EPA pursuant to the Clean Water Act is a rule that is subject to the requirements of R.C. Chapter 119, the Ohio Administrative Procedure Act."

Table J-11 — Ohio TMDLs[8] approved by U.S. EPA at the 11-digit hydrologic unit scale.

AU Code	AU Name	U.S. EPA Approval Date	Pollutants Allocated, per U.S. EPA[9]
04110002 020	Cuyahoga River (below Black Brook to below Breakneck Creek)	10/11/2000	dissolved oxygen
04110002 030	Cuyahoga River (below Breakneck Creek to below Little Cuyahoga River)		
04110001 070	Rocky River (below West Br. to Lake Erie [including East Br.] and Lake Erie tribs [above Porter Cr to above Cuyahoga R]): Plum Creek	12/04/2001	phosphorus, nitrogen
05090202 010	Little Miami River (headwaters to above Massies Creek)	07/02/2002 05/13/2003	phosphorus, sediment
05090202 020	Little Miami River (above Massies Creek to below Beaver Creek)		
05090202 030	Little Miami River (below Beaver Creek of above Caesar Creek)		
05090202 040	Anderson Fork Caesar Creek		
05090202 050	Caesar Creek (except Anderson Fork)		
05060001 060	Bokes Creek (Scioto River above Bokes Creek to above Mill Creek)	09/27/2002 07/31/2003	phosphorus, sediment
05040001 100	Sugar Creek (headwaters to above Middle Fork Sugar Creek)	11/20/2002 07/08/2003	phosphorus, nitrogen, sediment
05040001 110	South Fork Sugar Creek		
05040001 120	Sugar Creek (upstream Middle Fork to mouth)		
05090101 020	Raccoon Creek (headwaters to above Hewett Fork)	3/20/2003	pH (acid), metals
05090101 030	Raccoon Creek (above Hewett Fork to below Elk Fork)		
05060001 070	Mill Creek (Scioto River basin)	9/02/2003	CBOD, ammonia, phosphorus, sediment, aldrin, d- BHC, dieldrin, endosulfan, endrin, heptachlor
05030201 110	East Fork Duck Creek	9/23/2003	TSS, aluminum, iron, manganese, BOD, ammonia
05030201 120	Duck Creek (except East Fork)		
04110002 040	Cuyahoga River (below Little Cuyahoga River to below Brandywine Creek)	9/26/2003	fecal coliform, phosphorus
04110002 050	Cuyahoga River (below Brandywine Creek to below Tinkers Creek)		
04110002 060	Cuyahoga River (below Tinkers Creek to Lake Erie)		
04110002	Cuyahoga River (mainstem)		
05080001 090	Stillwater River (headwaters to above Swamp Creek)	06/15/2004	nitrates, phosphorus
05080001 100	Stillwater River (above Swamp Creek to above Greenville Creek)		
05080001 110	Greenville Creek (headwaters to below West Branch)		
05080001 120	Greenville Creek (below West Branch to Stillwater River)		
05080001 130	Stillwater River (below Greenville Creek to above Ludlow Creek)		

[8] One or more AUs may be included in a TMDL report; the determination is made on a project-by-project basis, at the discretion of Ohio EPA. The TMDL goal is restoration of the designated use through the attainment of applicable criteria. Pollutants listed here were specifically recognized in U.S. EPA decision documents. TMDL reports typically include such parameters for targeting, pollutant load characterization and measuring interim progress and may explore other indicators of watershed condition.

[9] The TMDL goal is restoration of the designated use through the attainment of applicable criteria. Pollutants listed here were specifically recognized in U.S. EPA decision documents. TMDL reports typically include such parameters for targeting, pollutant load characterization and measuring interim progress and may explore other indicators of watershed condition.

AU Code	AU Name	U.S. EPA Approval Date	Pollutants Allocated, per U.S. EPA[9]
05080001 140	Stillwater River (above Ludlow Creek to Great Miami River)		
05080001	Stillwater River (mainstem)		
04100007 010	Auglaize River (headwaters to below Pusheta Creek)	09/23/2004	ammonia, phosphorus, pathogens, sediment
04100007 020	Auglaize River (below Pusheta Creek to above Jennings Creek)		
04100007 060	Auglaize River (above Jennings Creek to above Little Auglaize River)		
04110002 010	Cuyahoga River (headwaters to below Black Brook)	09/27/2004	phosphorus, sediment
04100011 020	Sandusky River (headwaters to above Broken Sword Creek)	09/30/2004	phosphorus, pathogens, sediment
04100011 030	Broken Sword Creek		
04100011 040	Sandusky River (below Broken Sword Creek to above Tymochtee Creek)		
04100011 050	Tymochtee Creek (headwaters to below Warpole Creek)		
04100011 060	Tymochtee Creek (downstream Warpole Creek to Sandusky River)		
04100011 070	Sandusky River (below Tymochtee Creek to above Honey Creek)		
04100011 080	Honey Creek		
05090203 010	Mill Creek	04/26/2005	phosphorus, nitrogen
04100012 040	Lake Erie Tributaries (below Huron River to above Vermilion River) [Old Woman and Chappel Creeks]	08/31/2005	nutrients, siltation, habitat alteration
05030204 060	Monday Creek	09/22/2005	pH, metals, sediment
05060001 130	Big Walnut Creek (headwaters to Hoover Dam)	09/26/2005	nutrients (phosphorus), pathogens, siltation, organic enrichment, flow, habitat alteration
05060001 140	Big Walnut Creek (below Hoover Dam to above Alum Creek)		
05060001 150	Alum Creek (headwaters to Alum Creek Dam)		
05060001 160	Big Walnut Creek (above Alum Creek [except above Alum Creek Dam] to Scioto River)		
04110003 010 (partial)	Lake Erie Tributaries (East of Cuyahoga River to West of Grand River; excluding Chagrin River) [Euclid Creek]	09/27/2005	nutrients (phosphorus), organic enrichment, habitat alteration
04100012 010	West Branch Huron River (headwaters to above Slate Run)	09/28/2005	nutrients (phosphorus), siltation, organic enrichment, flow, habitat alteration
04100012 020	West Branch Huron River (above Slate Run to above East Branch Huron River)		
04100012 030	Huron River (above East Branch to Lake Erie) and Lake Erie Tributaries (below Sawmill Creek to below Huron River)		
05030101 070	Middle Fork Little Beaver Creek	09/28/2005	nutrients (phosphorus), pathogens, siltation, organic enrichment, flow, habitat alteration, unionized ammonia
05030101 080	West Fork Little Beaver Creek		
05030101 090	Little Beaver Creek (downstream Middle and West Forks to mouth)		
05030204 070	Sunday Creek	03/31/2006	sediment, bacteria, acidity
05060001 190	Big Darby Creek (headwaters to below Sugar Run)	03/31/2006 10/27/2009	phosphorus, bacteria, sediment
05060001 200	Big Darby Creek (below Sugar Run to above Little Darby Creek)		
05060001 210	Little Darby Creek		
05060001 220	Big Darby Creek (below Little Darby Creek to Scioto River)		

AU Code	AU Name	U.S. EPA Approval Date	Pollutants Allocated, per U.S. EPA[9]
04100010 020	Toussaint Creek	09/22/2006	phosphorus
05040004 020	Wakatomika Creek (headwaters to downstream Brushy Fork)	09/28/2006	bacteria, manganese, iron, aluminum, total dissolved solids, alkalinity
05040004 030	Wakatomika Creek (downstream Brushy Fork to mouth)		
05040001 100	Sugar Creek (headwaters to above Middle Fork Sugar Creek)	05/08/2007	bacteria
05040001 110	South Fork Sugar Creek		
05040001 120	Sugar Creek (upstream Middle Fork to mouth)		
04110003 020	Chagrin River (headwaters to downstream Aurora Branch)	07/10/2007	nutrients (phosphorus and nitrate), bacteria, total suspended solids
04110003 030	Chagrin River (downstream Aurora Branch to mouth)		
05060001 090	Olentangy River (headwaters to downstream Flat Run)	09/19/2007	nutrients (phosphorus), bacteria, total suspended solids
05060001 100	Whetstone Creek		
05060001 110	Olentangy River (downstream Flat Run to downstream Delaware Run); excluding Whetstone Creek		
05060001 120	Olentangy River (downstream Delaware Run to mouth)		
05120101 020	Beaver Creek (Grand Lake St. Marys and tributaries)	09/28/2007	nutrients (phosphorus and nitrate), bacteria
05120101 030	Beaver Creek (downstream Grand Lake St. Marys Dam to mouth)		
05030202 090	Leading Creek	1/9/2008	total dissolved solids, total suspended solids, chlorides
04110001 020	West Branch Black River (headwaters to Black River)	8/20/2008	phosphorus, nitrate, bacteria, total suspended solids
04110001 030	East Branch Black River (headwaters to below Coon Creek)		
04110001 040	East Branch Black River (below Coon Creek to Black River)		
04110001 050	Black River (below East Branch to Lake Erie) and Lake Erie tribs (below Black R. to above Porter Cr)		
05040001 050	Nimishillen Creek	9/25/2008 12/16/2009	sediment, bacteria, phosphorus
04100007 110	Powell Creek	6/18/2009	phosphorus, nitrate-nitrogen, total suspended solids, biological oxygen
04100008 010	Blanchard River (headwaters to downstream Potato Run)	7/2/2009	phosphorus, bacteria, sediment
04100008 020	Blanchard River (downstream Potato Run to upstream Eagle Creek)		
04100008 030	Blanchard River (upstream Eagle Creek to upstream Ottawa Creek)		
04100008 040	Blanchard River (upstream Ottawa Creek to upstream Riley Creek); excluding Blanchard R.		
04100008 050	Riley Creek		
04100008 060	Blanchard River (downstream Riley Creek to mouth); excluding Blanchard R. mainstem		
04100008	Blanchard River (mainstem)		
05060002 070	Salt Creek (headwaters to upstream Queer Creek)	8/12/2009	sediment (bedload), habitat
05060002 080	Middle Fork Salt Creek		
05060002 090	Salt Lick Creek (excluding Middle Fork)		
05060002 100	Salt Creek (upstream Queer Creek to mouth); excluding Little Salt Creek and Middle Fork Salt Creek		

AU Code	AU Name	U.S. EPA Approval Date	Pollutants Allocated, per U.S. EPA[9]
05040001 010	Tuscarawas River (headwaters to downstream Wolf Creek)	9/15/2009	fecal coliform, sediment, phosphorus
05040001 020	Chippewa Creek		
05040001 030	Tuscarawas River (downstream Wolf Creek to downstream Sippo Creek); excluding Chippewa Creek		
05040001 090	Tuscarawas River (downstream Sippo Creek to upstream Sugar Creek); excluding Tuscarawas R. mainstem		
05040001 130	Tuscarawas River (downstream Sugar Cr. to upstream Stillwater Cr.); excluding Tuscarawas R. mainstem		
05040001 180	Tuscarawas River (downstream Stillwater Cr. to upstream Evans Cr.); excluding Tuscarawas R. mainstem		
05040001 190	Tuscarawas River (upstream Evans Creek to mouth); excluding Tuscarawas R. mainstem		
05040001	Tuscarawas River (mainstem)		
05030204 010	Hocking River (headwaters to Enterprise); excluding Rush Creek and Clear Creek	9/25/2009	fecal coliform, total phosphorus, sediment (bedload)
05030204 020	Rush Creek (headwaters to upstream Little Rush Creek)		
05030204 030	Rush Creek (upstream Little Rush Creek to mouth)		
05030204 040	Clear Creek		
05030204 050	Hocking River (Enterprise to upstream Monday Creek); excluding Hocking R. mainstem dst. Duck Creek		
05030204 080	Hocking River (downstream Monday Creek to Athens/RM 33.1); excluding Hocking R. mainstem		
05030204 090	Federal Creek		
05030204 100	Hocking River (downstream Athens/RM 33.1 to mouth); excluding Federal Creek and Hocking R. mainstem		
05030204	Hocking River (mainstem)		
04100009 070	Swan Creek (headwaters to above Blue Creek)	1/6/2010 10/25/2010	*E. coli*, total phosphorus, nitrate- nitrogen, total suspended solids, total aluminum, total copper, ammonia, total dissolved solids, dieldrin, strontium, benzo(a)pyrene
04100009 080	Swan Creek (above Blue Creek to Maumee River)		
05080001 150	Mad River (headwaters to below Kings Creek)	1/26/2010	fecal coliform, sediment (bedload), nitrate
05080001 160	Mad River (below Kings Creek to below Chapman Creek)		
05080001 170	Buck Creek		
05080001 180	Mad River (below Chapman Cr. to above Mud Cr. [except Buck Cr.])		
05080001 190	Mad River (above Mud Cr. to Great Miami River)		
05080002 030	Twin Creek (headwaters to above Bantas Fork)	3/4/2010	fecal coliform, sediment
05080002 040	Twin Creek (above Bantas Fork to Great Miami River)		
05030101 100	Ohio River (downstream Little Beaver Cr to upstream Yellow Creek) (Little Yellow Cr)	3/18/2010	fecal coliform, total phosphorus
05030101 180	Yellow Creek (headwaters to upstream Town Fork)		
05030101 190	Yellow creek (upstream Town Fork to mouth)		
05060001 170	Walnut Creek (headwaters to below Sycamore Creek)	5/4/2010	fecal coliform, sediment
05060001 180	Walnut Creek (below Sycamore Creek to Scioto River)		

Table J-12 —Ohio TMDLs[10] approved by U.S. EPA at the 12-digit hydrologic unit scale.

AU Code	AU Name	U.S. EPA Approval Date	Pollutants Allocated, per U.S. EPA[11]
05080001 09 01 – 06	Headwaters Stillwater River	9/8/2009[12]	phosphorus
05080001 10 01 – 04	Headwaters Greenville Creek		
05080001 11 01 – 03	Mud Creek-Greenville Creek		
05080001 12 01 – 05	Swamp Creek-Stillwater River		
05080001 13 01 – 03	Painter Creek-Stillwater River		
05080001 14 01 – 06	Ludlow Creek-Stillwater River		
05080001 90 02	Stillwater River Mainstem (Greenville Creek to mouth)		
05090201 09 01 – 04	Headwaters White Oak Creek	2/25/2010	fecal coliform, ammonia, total phosphorus, habitat/ total suspended solids, dissolved oxygen, nitrate + nitrite, atrazine
05090201 10 01 – 03	Sterling Run-White Oak Creek		
05090202 06 01 – 06	Headwaters Todd Fork	3/28/2011	*E. coli*, total phosphorus, chemical oxygen demand, sediment, total suspended solids, carbonaceous biochemical oxygen demand
05090202 07 01 – 04	East Fork Todd Fork-Todd Fork		
05090202 08 01 – 04	Turtle Creek-Little Miami River		
05090202 09 01 – 03	O'Bannon Creek-Little Miami River		
05090202 14 01 – 06	Sycamore Creek-Little Miami River		
05090202 90 01	Little Miami River Mainstem (Caesar Creek to O'Bannon Creek)		
05090202 90 02	Little Miami River Mainstem (O'Bannon Creek to Ohio River)		
05040004 06 01 – 06	Salt Creek (Muskingum River watershed)	6/6/2011	*E. coli*
05030103 01 01 – 03	Headwaters Mahoning River	9/28/2011 10/19/2011	*E. coli*, sediment, phosphorus
05030101 02 01 – 04	Deer Creek-Mahoning River		
05030101 03 01 – 06	West Branch Mahoning River-Mahoning River		
05030101 04 01 – 06	Eagle Creek-Mahoning River		
04100010 01 01 – 04	Rocky Ford-Middle Branch Portage River	9/30/2011	*E. coli*, total phosphorus, carbonaceous biochemical oxygen demand, sediment
04100010 02 01 – 05	South Branch Portage River-Middle Branch Portage River		
04100010 03 01 – 02	Upper Portage River		
04100010 04 01 – 02	Middle Portage River		
04100010 05 01 – 02	Lower Portage River-Frontal Lake Erie		
05060002 14 01 – 06	South Fork Scioto Brush Creek	9/30/2011	*E. coli*, phosphorus
05060002 15 01 – 07	Scioto Brush Creek		
05080001 01 01 – 03	Headwaters Great Miami River	3/26/2012	*E. coli*, sediment, nutrients, total dissolved solids
05080001 02 01 – 04	Muchinippi Creek		
05080001 03 01 – 06	Bokengehalas Creek-Great Miami River		
05080001 04 01 – 06	Stoney Creek-Great Miami River		
05080001 05 01 – 03	Headwaters Loramie Creek		
05080001 06 01 – 04	Turtle Creek-Loramie Creek		
04110004 04 01 – 03	Griggs Creek-Mill Creek	4/12/2012	

[10] One or more AUs may be included in a TMDL report. The determination is made on a project-by-project basis, at the discretion of Ohio EPA.

[11] The TMDL goal is restoration of the designated use through the attainment of applicable criteria; pollutants listed here were specifically recognized in U.S. EPA decision documents. TMDL reports typically include such parameters for targeting, pollutant load characterization and measuring interim progress and may explore other indicators of watershed condition.

[12] The TMDL was revised for one pollutant.

AU Code	AU Name	U.S. EPA Approval Date	Pollutants Allocated, per U.S. EPA[11]
04110004 06 01 – 07	Big Creek-Grand River		*E. coli*, phosphorus, flow regime
05060003 01 01 – 03	Headwaters Paint Creek	9/18/2012	*E. coli*, sediment
05060003 02 01 – 02	Sugar Creek		
05060003 03 01 – 05	Headwaters Rattlesnake Creek		
05060003 04 01 – 07	Lees Creek-Rattlesnake Creek		
05060003 05 01 – 05	Rocky Fork		
05060003 06 01 – 03	Indian Creek-Paint Creek		
05060003 07 01 – 04	Buckskin Creek-Paint Creek		
05060003 08 01 – 05	Headwaters North Fork Paint Creek		
05060003 09 01 – 04	Little Creek-North Fork Paint Creek		
05060003 10 01 – 03	Ralston Run-Paint Creek		
05060003 90 01	Paint Creek Mainstem (Paint Creek Lake dam to mouth)		
04100010 07 01 – 06	Cedar Creek-Frontal Lake Erie	9/25/2012	total phosphorus, nitrate + nitrite, ammonia, total suspended solids, *E. coli*
04100009 09 01 – 04	Grassy Creek-Maumee River		
04110004 01 01 – 06	Headwaters Grand River	4/10/2013	*E. coli,* total phosphorus, total kjeldahl nitrogen, ammonia, total dissolved solids,
04110004 02 01 – 03	Rock Creek		
04110004 03 01 – 05	Phelps Creek-Grand River		
04110004 05 01 – 02	Three Brothers Creek-Grand River		
05040004 04 01 – 07	Jonathan Creek	7/10/2013	*E. coli*, acidity
05040004 05 01 – 04	Moxahala Creek		
04100007 03 01 – 06	Upper Ottawa River Mid	4/15/2014	*E. coli,* total phosphorus, sediment
04100007 04 01 – 06	Middle Ottawa River		
04100007 05 01 – 03	Lower Ottawa River		
04100011 01 01 – 03	Lower Sandusky	8/11/2014	*E. coli,* total phosphorus, total suspended solids, nitrate+nitrite
04100011 01 02 – 05	Pickeral Creek-Frontal Sandusky Bay		
04100011 10 01 – 04	Wolf Creek		
04100011 11 01 – 05	Rock Creek - Sandusky River		
04100011 90 01 – 02	Sandusky Mainsteam (Tymochtee Creek to Sandusky Bay)		
04100011 12 01 – 03	Green Creek		
04100011 13 01 – 03	Muskellunge Creek-Sandusky River		
04100011 14 01 – 05	Muddy Creek-Frontal Sandusky Bay		

Table J-13 — Short-term schedule for TMDL development.

AU Code	AU Name
TMDLs approved by U.S. EPA after public review of 2014 303(d) list began	
None at this time	
TMDLs pending approval by U.S. EPA	
None at this time	
TMDLs expected to be submitted to U.S. EPA in FFY 2019	
05060001 01 01 – 04	Headwaters Scioto River
05060001 02 01 – 03	Rush Creek
05060001 03 01 – 04	Little Scioto River
05060001 04 01 – 06	Panther Creek-Scioto River
05060001 05 01 – 05	Fulton Creek-Scioto River
05060001 06 01 – 04	Mill Creek
05060001 90 01	Scioto River Mainstem (L. Scioto R. to Olentangy R.); excluding O'Shaughnessy and Griggs reservoirs
05040002 01 01 – 05	Headwaters Black Fork Mohican River
05040002 02 01 – 04	Rocky Fork-Black Fork Mohican River
05040002 03 01 – 03	Headwaters Clear Fork Mohican River
05040002 04 01 – 05	Possum Run-Clear Fork Mohican River
05040002 05 01 – 03	Muddy Fork Mohican River
05040002 06 01 – 06	Jerome Fork-Mohican River
05040002 07 01 – 03	Lake Fork Mohican River
05040002 08 01 – 06	Mohican River
05040002 90 01	Mohican River Mainstem (entire length)
TMDL projects that are being developed with assistance from U.S. EPA; completion expected in FFY 2019	
04100005 90 01	Maumee River Mainstem (IN border to Tiffin River)
04100009 90 01	Maumee River Mainstem (Tiffin River to Beaver Creek)
04100009 90 02	Maumee River Mainstem (Beaver Creek to Maumee Bay)
04100003 01 04, 06	East Branch St Joseph River
04100003 02 04	West Branch St Joseph River
04100003 03 01-06	Nettle Creek-St Joseph River
04100003 04 02, 05, 06	Fish Creek
04100003 05 01-03,05,06	Sol Shank Ditch-St Joseph River
04110001 03 01 - 03	Headwaters East Branch Black River
04110001 04 01 - 04	East Branch Black River
04110001 05 01 - 06	West Branch Black River
04110001 06 01 - 03	Black River
04100006 02 01-05	Mill Creek-Bean Creek
04100006 03 01-03	Upper Tiffin River
04100006 04 01-04	Lick Creek
04100006 05 01-04	Middle Tiffin River
04100006 06 01-04	Lower Tiffin River
TMDLs expected to be submitted to U.S. EPA in FFY 2020	
05040001 13 01-04	Upper Stillwater Creek
05040001 14 01-03	Middle Stillwater Creek
05040001 15 01-05	Little Stillwater Creek
05040001 16 01-04	Lower Stillwater Creek
04100005 02 01-08	Gordon Creek-Maumee River
04100009 01 01-05	South Turkeyfoot Creek
04100009 02 01-07	Garret Creek-Maumee River
04100009 03 01-02	Bad Creek
04100009 04 01-03	North Turkeyfoot Creek
04100009 05 01-10	Beaver Creek -Maumee River

AU Code	AU Name
04100009 06 01-03	Tontogany Creek – Maumee River
05040003 01 01 – 03	North Branch Kokosing River
05040003 02 01 – 03	Headwaters Kokosing River
05040003 03 01 – 07	Schenck Creek-Kokosing River
05040003 04 01 – 03	Jelloway Creek-Kokosing River
05080001 07 01 – 05	Tawawa Creek-Great Miami River
05080001 08 01 – 05	Lost Creek-Great Miami River
05080001 20 01 – 05	Honey Creek-Great Miami River
05080001 90 01	Great Miami River mainstem (Tawawa Creek to Mad River)
05090202 10 01 - 06	Headwaters East Fork Little Miami River
05090202 11 01 - 03	Fivemile Creek-East Fork Little Miami River
05090202 12 01 - 04	Cloverlick Creek-East Fork Little Miami River (*includes W.H. Harsha Lake*)
05090202 13 01 - 05	Stonelick Creek-East Fork Little Miami River
04100001 03 01 - 09	Ottawa River-Frontal Lake Erie
04100002 03 01, 03, 04	Little River Raisin-River Raisin
05080002 01 01 – 07	Wolf Creek-Great Miami River
05080002 04 01 – 04	Bear Creek-Great Miami River
05080002 07 01 – 06	Dicks Creek-Great Miami River
05080002 09 01 – 07	Taylor Creek-Great Miami River
05080002 90 01	Great Miami River Mainstem (Mad River to Four Mile Creek)
05080002 90 02	Great Miami River Mainstem (Four Mile Creek to Ohio River)

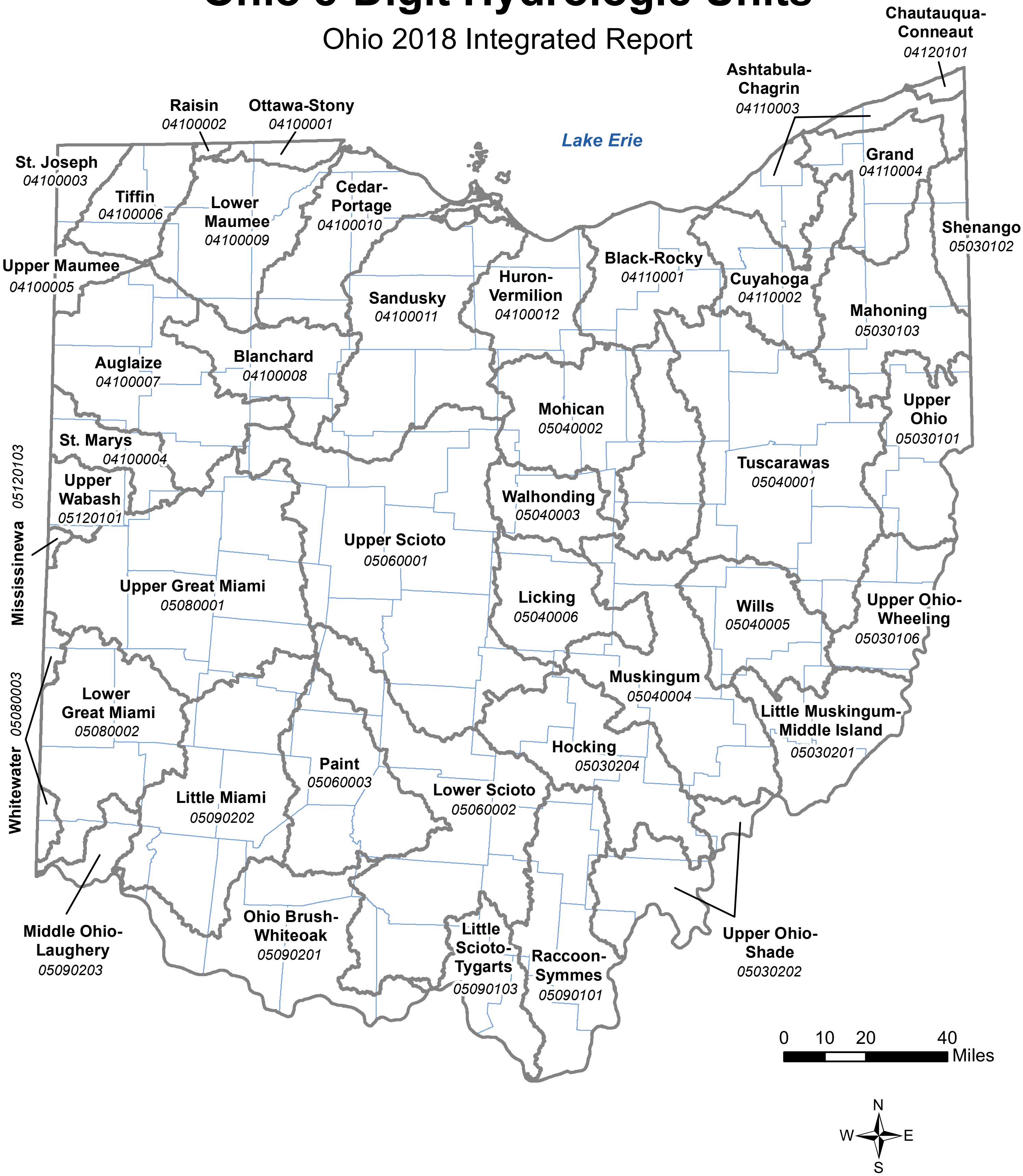
Section

K

Maps

Ohio 8-Digit Hydrologic Units

Ohio 2018 Integrated Report



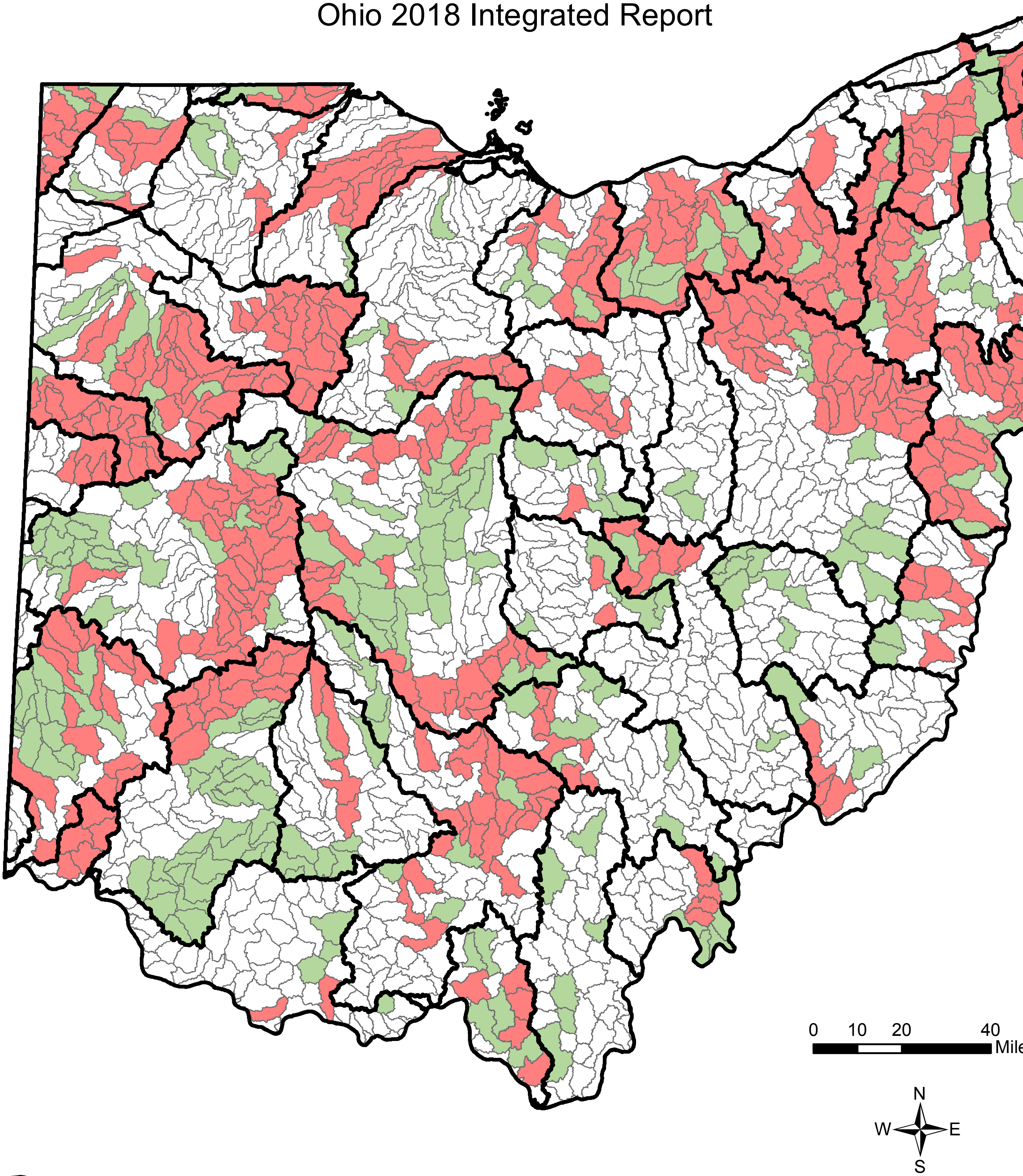
Updated 3/8/2018

This map is provided to help in interpreting the other maps. It includes county boundaries and the names, numbers, and boundaries of the major (8-digit hydrologic unit) watersheds.

Ohio Environmental Protection Agency

Section 303(d) Human Health (Fish Tissue) Use Categories
Watershed Assessment Units

Ohio 2018 Integrated Report



8-digit hydrologic units

1/1h - Use is fully supported

3/3i - No data or insufficient data

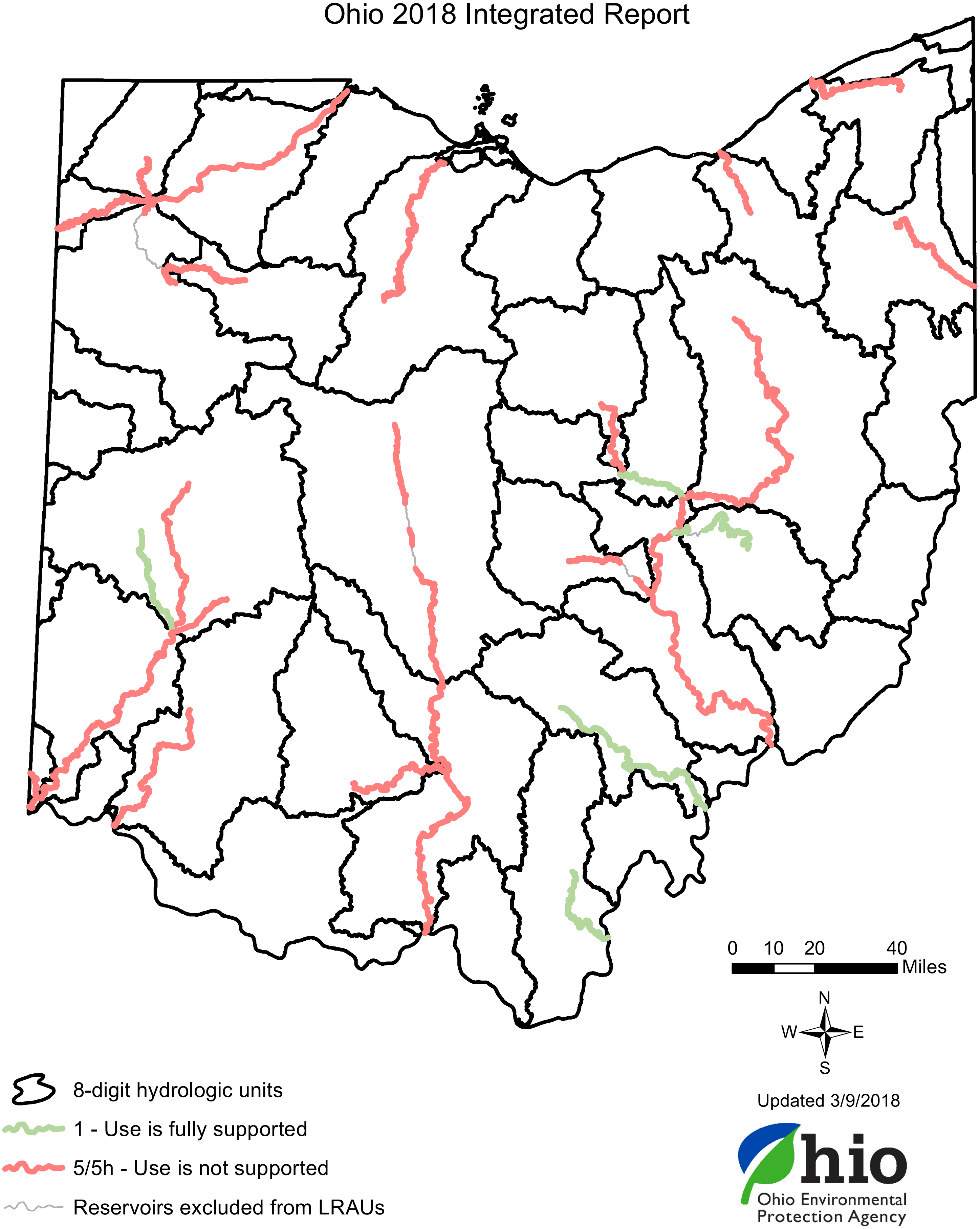
5/5h - Use is not supported

Updated 3/9/2018

Ohio Environmental Protection Agency

Section 303(d) Human Health (Fish Tissue) Use Categories
Large River Assessment Units

Ohio 2018 Integrated Report

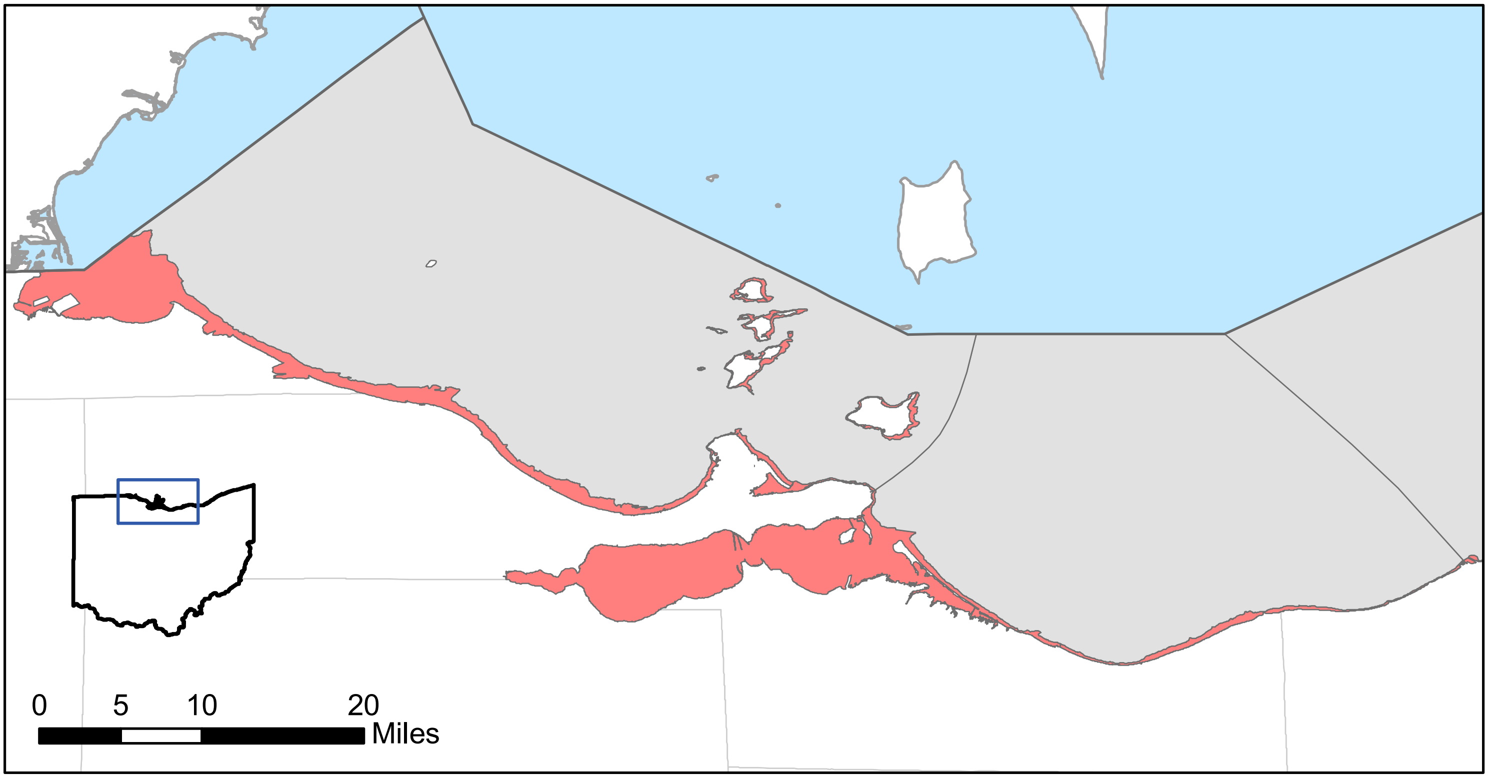


Updated 3/9/2018

Ohio Environmental Protection Agency

Section 303(d) Human Health (Fish Tissue) Use Categories
Lake Erie Assessment Units

Ohio 2018 Integrated Report



3i - Insufficient data

5 - Use is not supported

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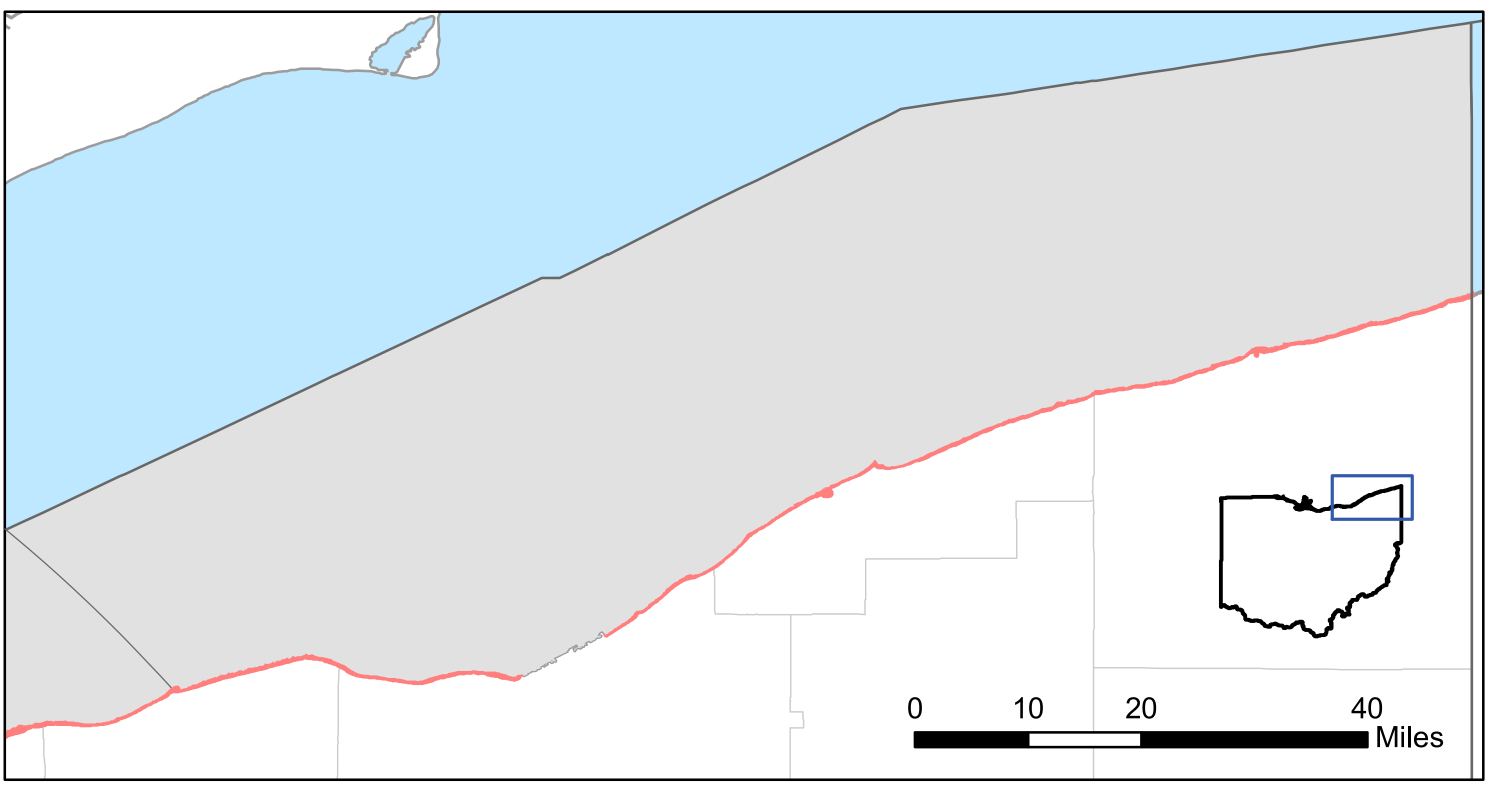
S

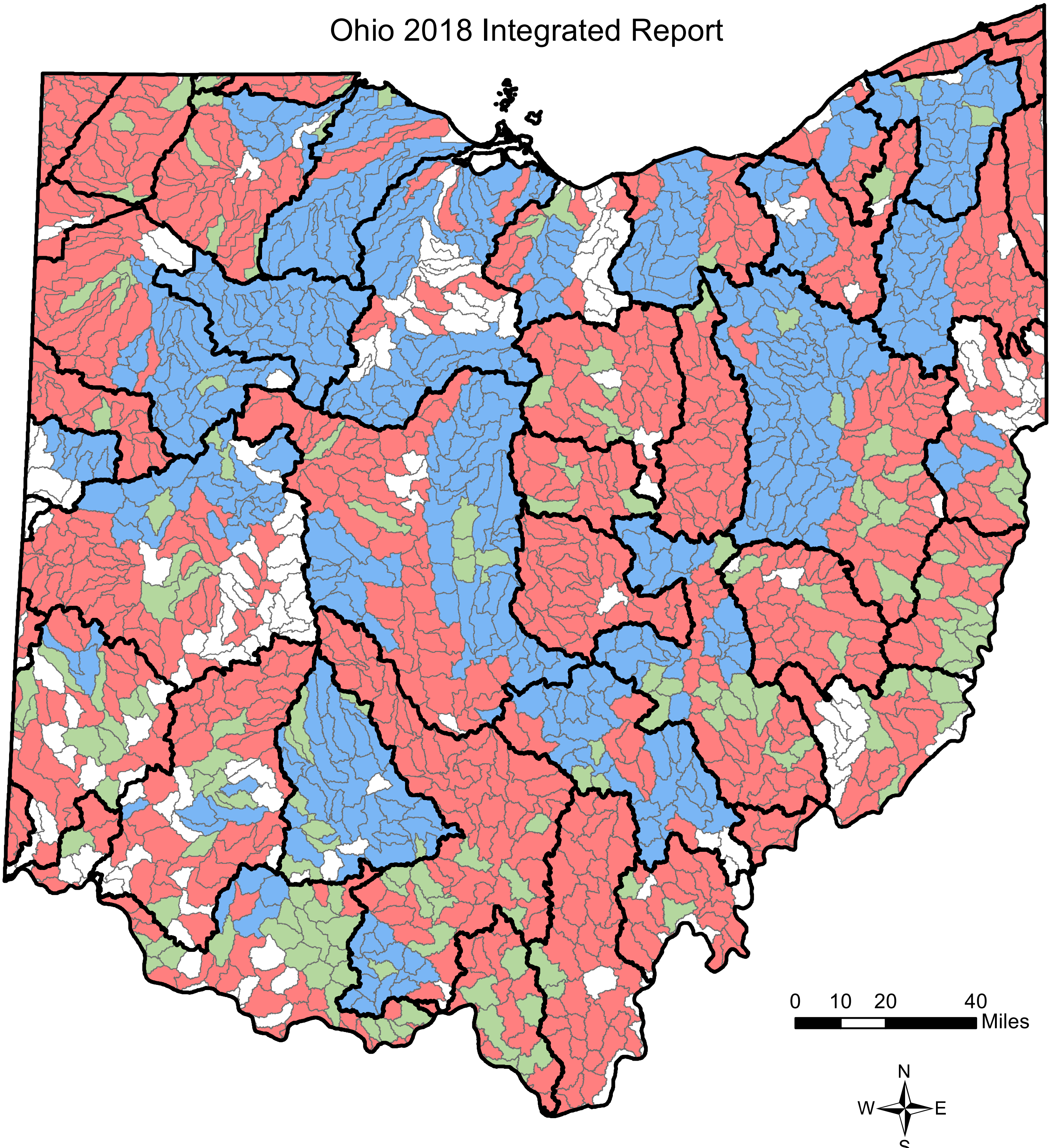
Updated 3/12/2018

Ohio Environmental Protection Agency



Section 303(d) Recreation Use Categories
Watershed Assessment Units

Ohio 2018 Integrated Report

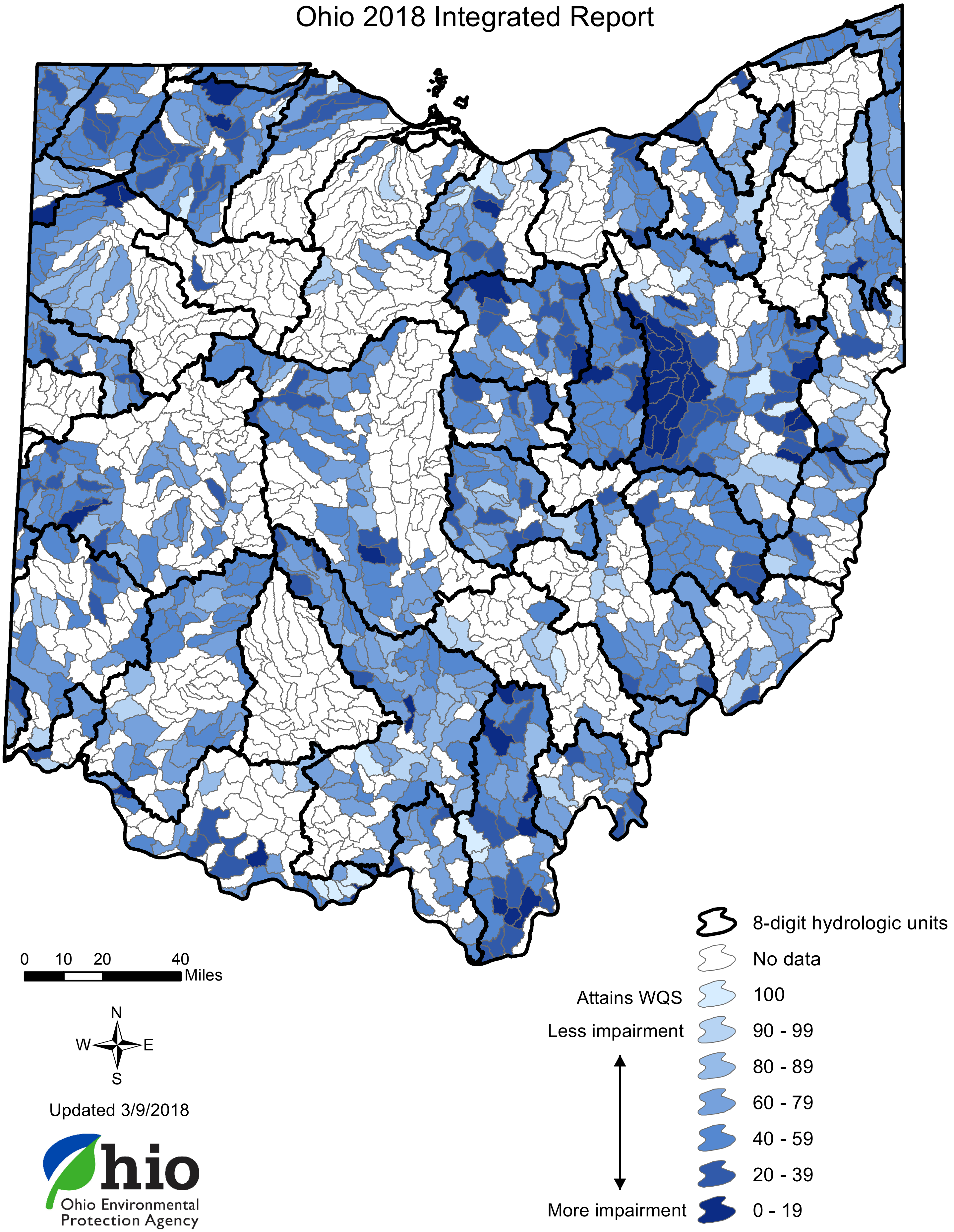


Updated 3/8/2018

Ohio Environmental Protection Agency

Recreation Use Index Scores
Watershed Assessment Units

Ohio 2018 Integrated Report

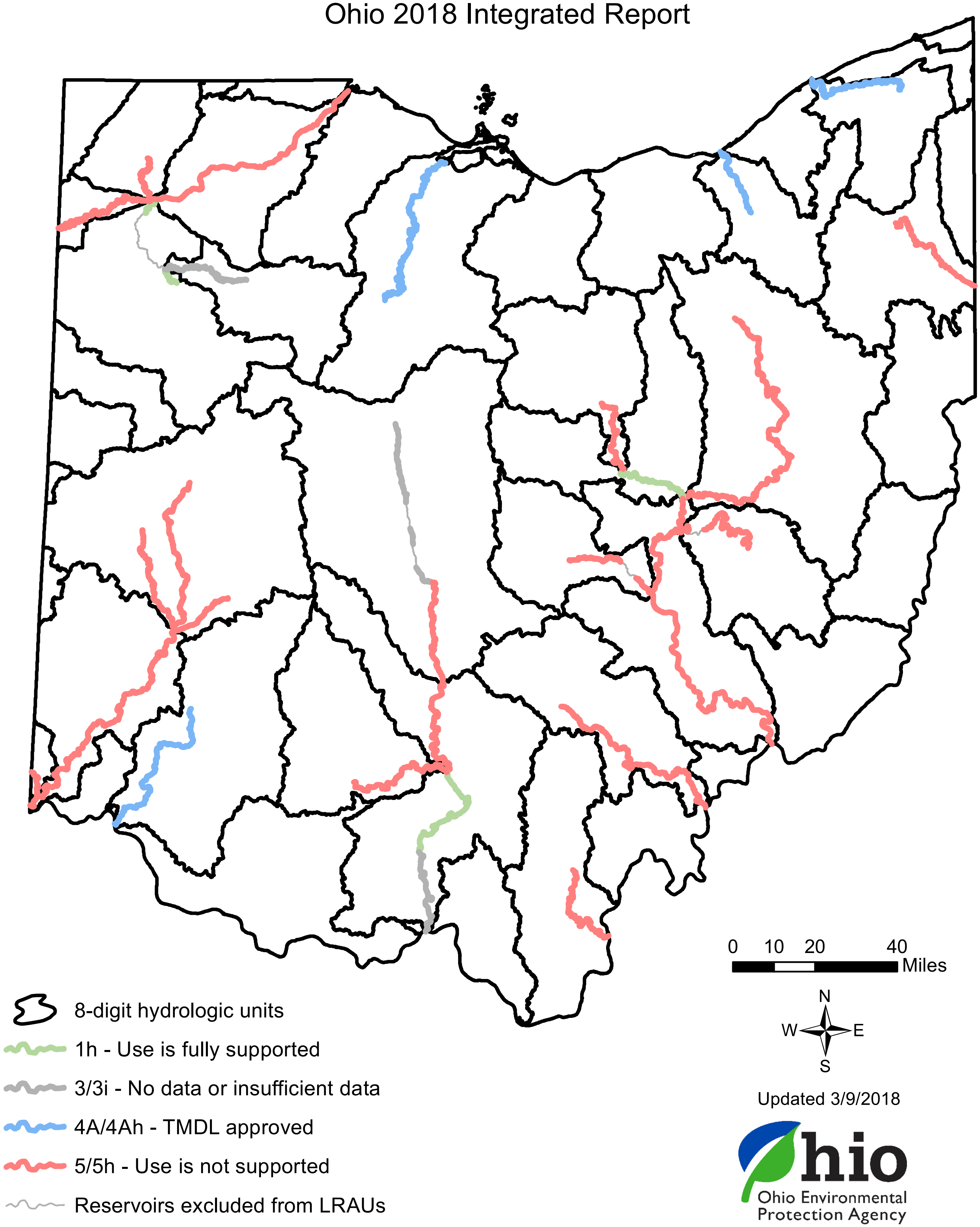


Updated 3/9/2018

Ohio Environmental Protection Agency

Section 303(d) Recreation Use Categories
Large River Assessment Units

Ohio 2018 Integrated Report

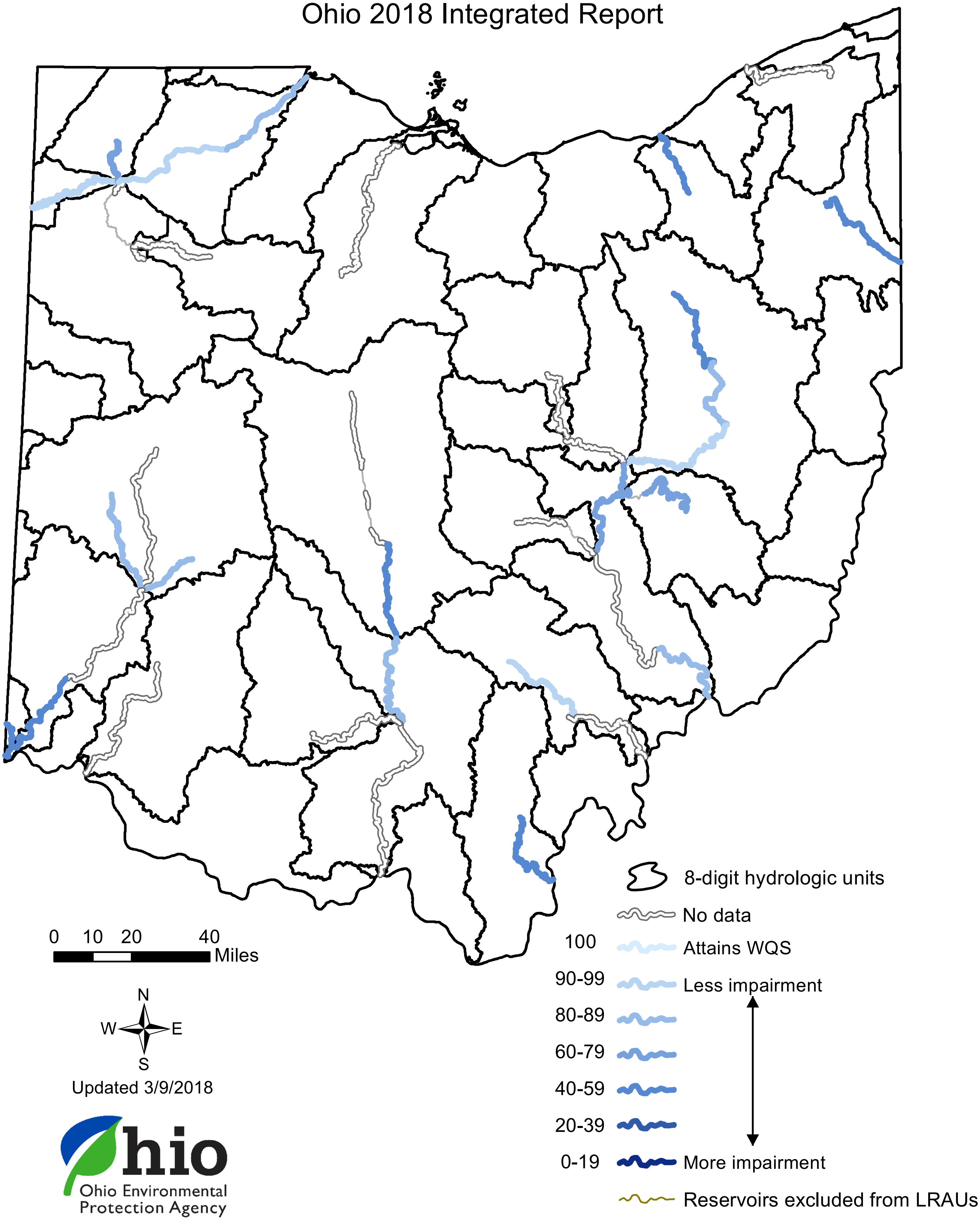


Updated 3/9/2018

Ohio Environmental Protection Agency

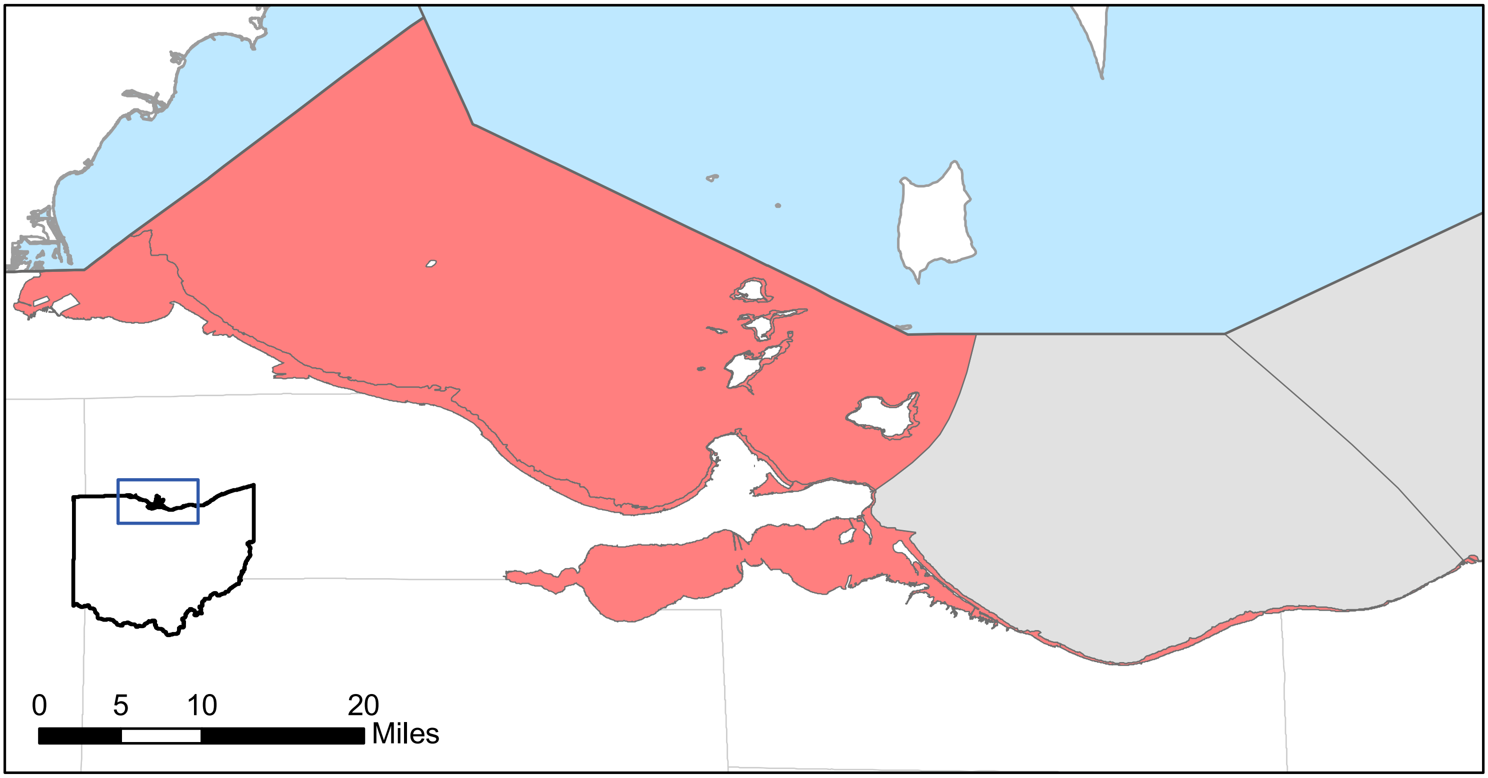
Recreation Use Index Scores
Large River Assessment Units

Ohio 2018 Integrated Report



Section 303(d) Recreation Use Categories
Lake Erie Assessment Units

Ohio 2018 Integrated Report



3 - No data   5 - Use is not supported

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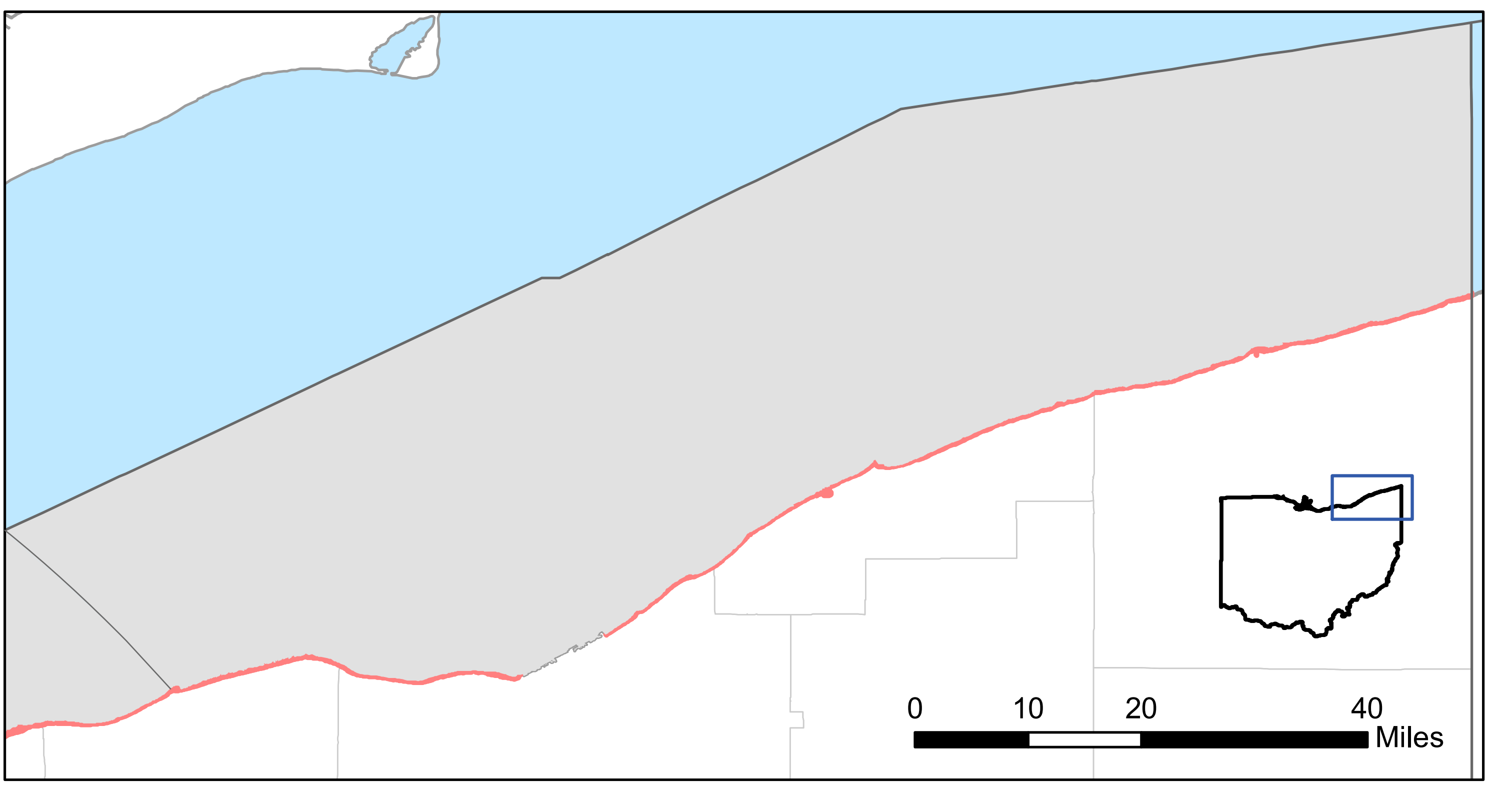
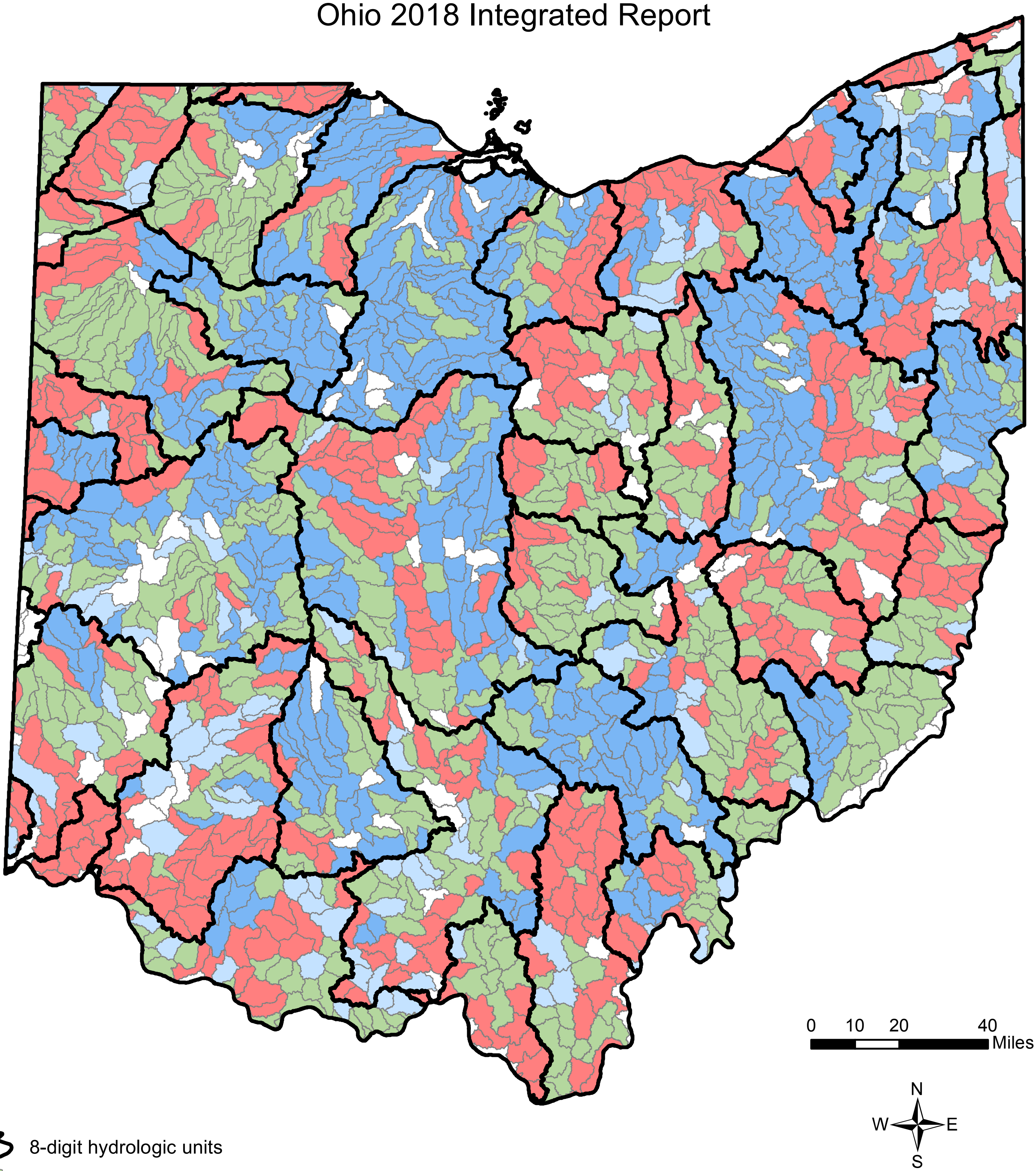
Updated 3/9/2018

Ohio Environmental Protection Agency



Section 303(d) Aquatic Life Use Categories
Watershed Assessment Units

Ohio 2018 Integrated Report



8-digit hydrologic units

1/1h/1hx/1d/1t/1ht - Use is fully supported; TMDL approved (d/t)

3/3i/3ih/3x/3t/3it/3iht - No data or insufficient data; TMDL approved (t)

4A/4Ah - TMDL approved

4/4Ch/4n/4nh - Impairment not from a pollutant; natural causes (n)

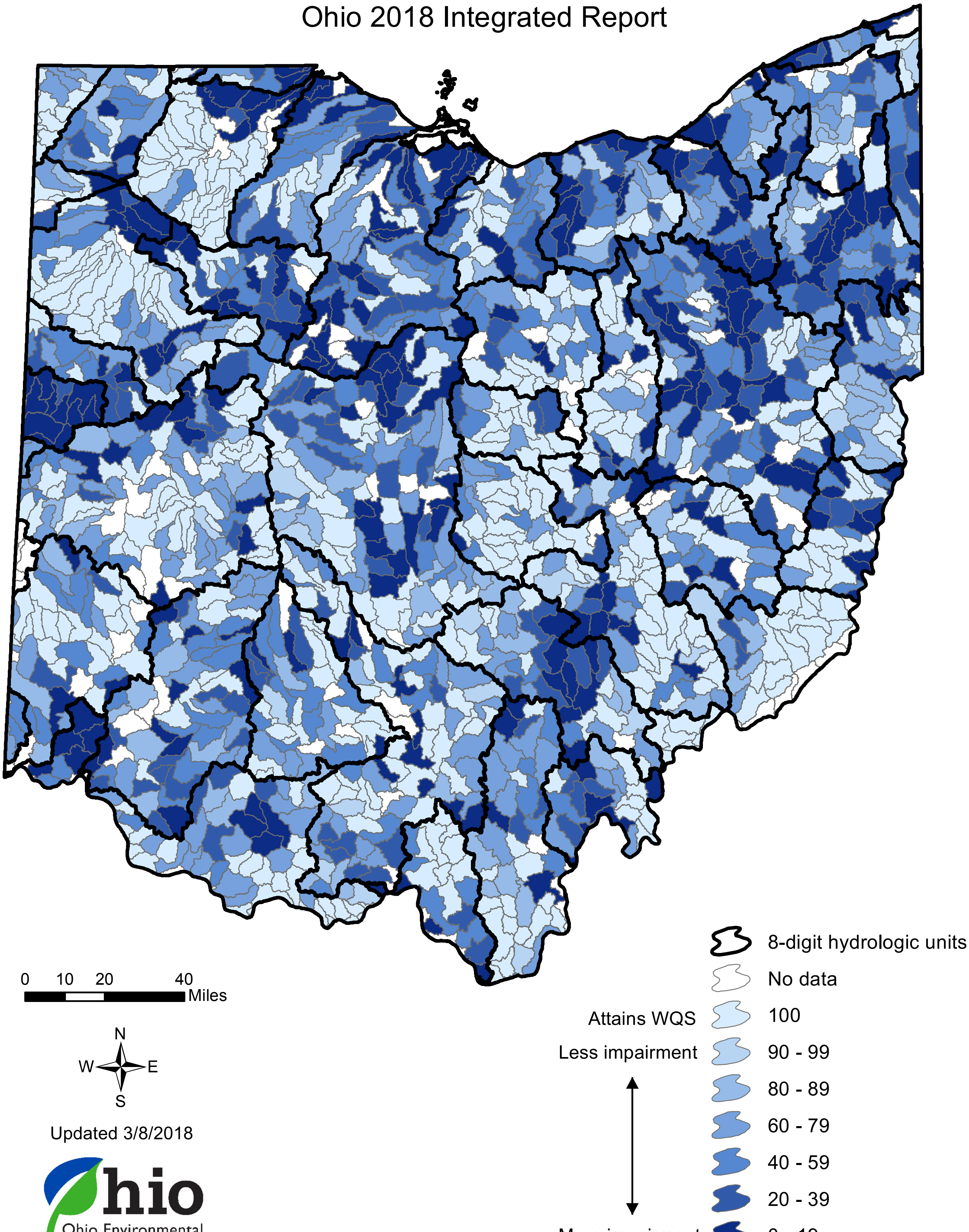
5/5d/5h/5hx/5p - Use is not supported; TMDL approved (d)

Updated 3/8/2018

Ohio Environmental Protection Agency

Aquatic Life Use Index Scores
Watershed Assessment Units

Ohio 2018 Integrated Report

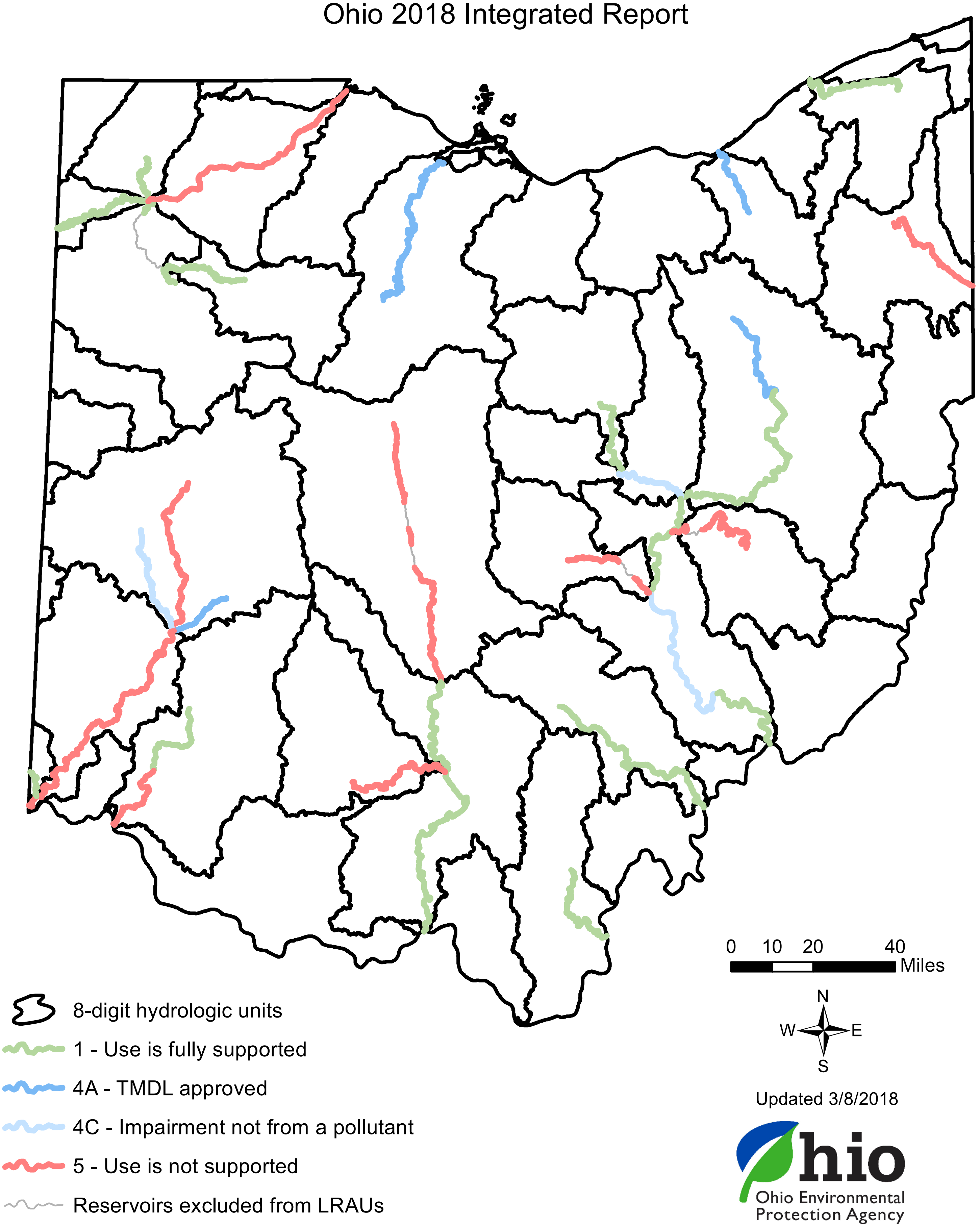


Updated 3/8/2018

Ohio Environmental Protection Agency

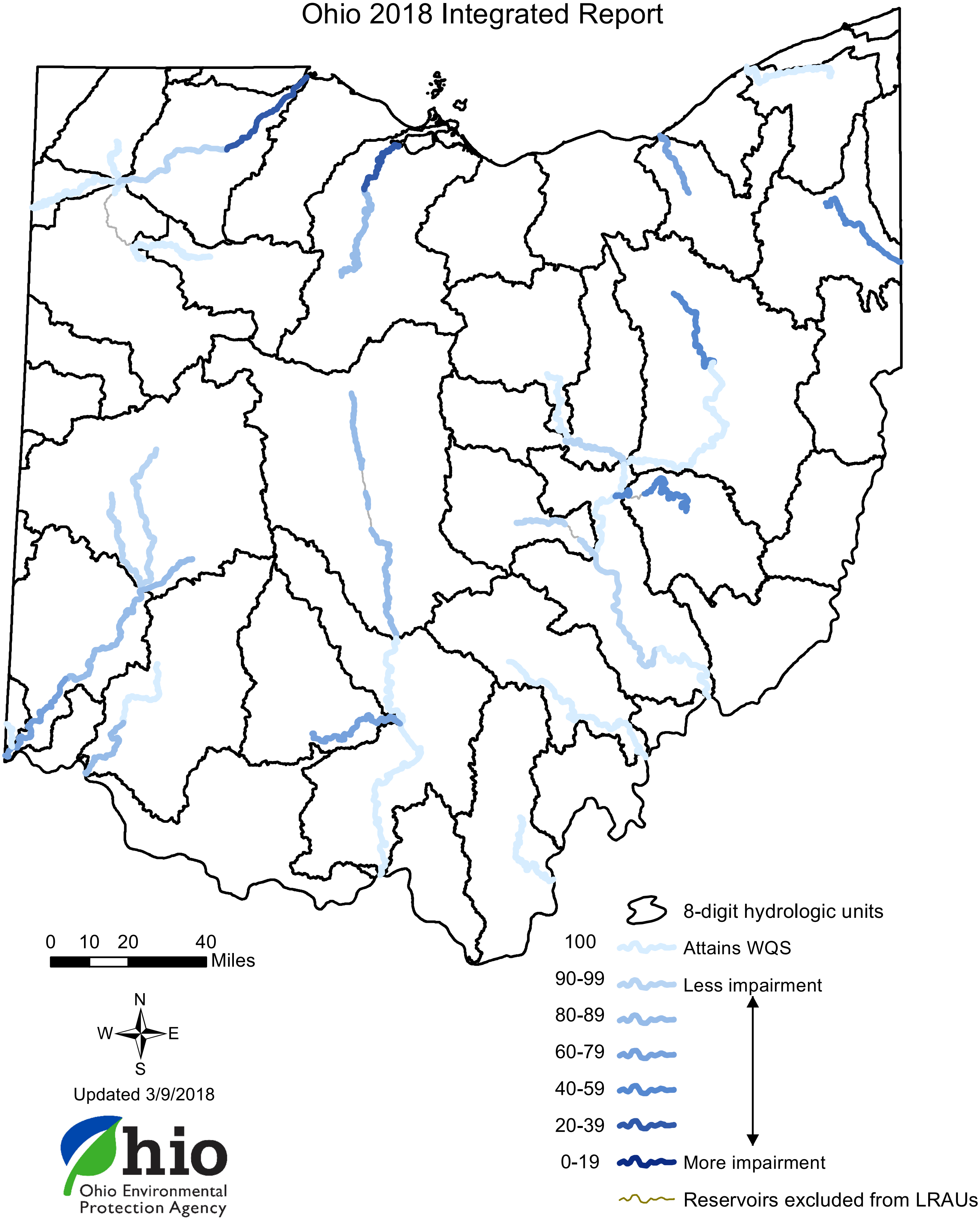
Section 303(d) Aquatic Life Use Categories
Large River Assessment Units

Ohio 2018 Integrated Report



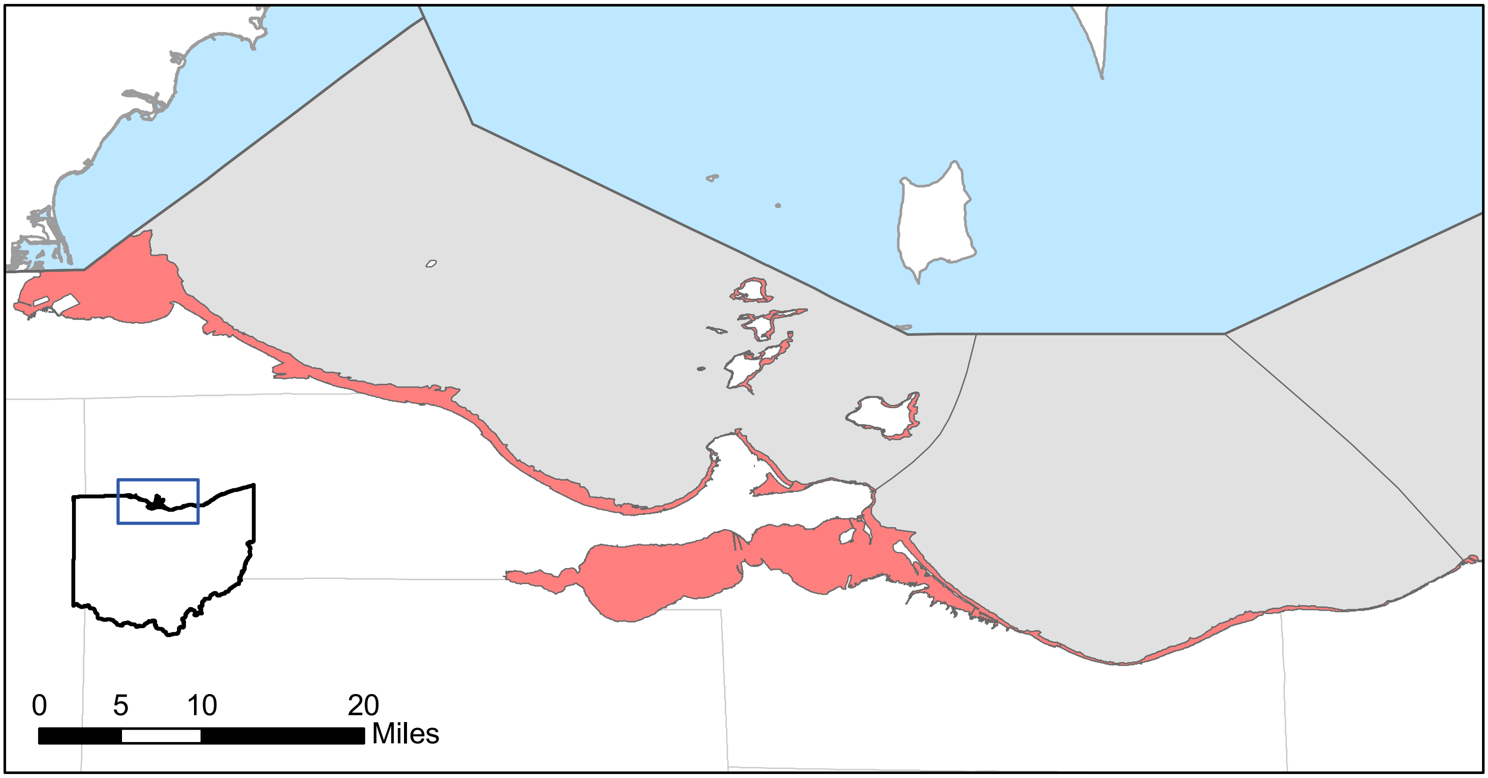
Aquatic Life Use Index Scores
Large River Assessment Units

Ohio 2018 Integrated Report



Section 303(d) Aquatic Life Use Categories
Lake Erie Assessment Units

Ohio 2018 Integrated Report



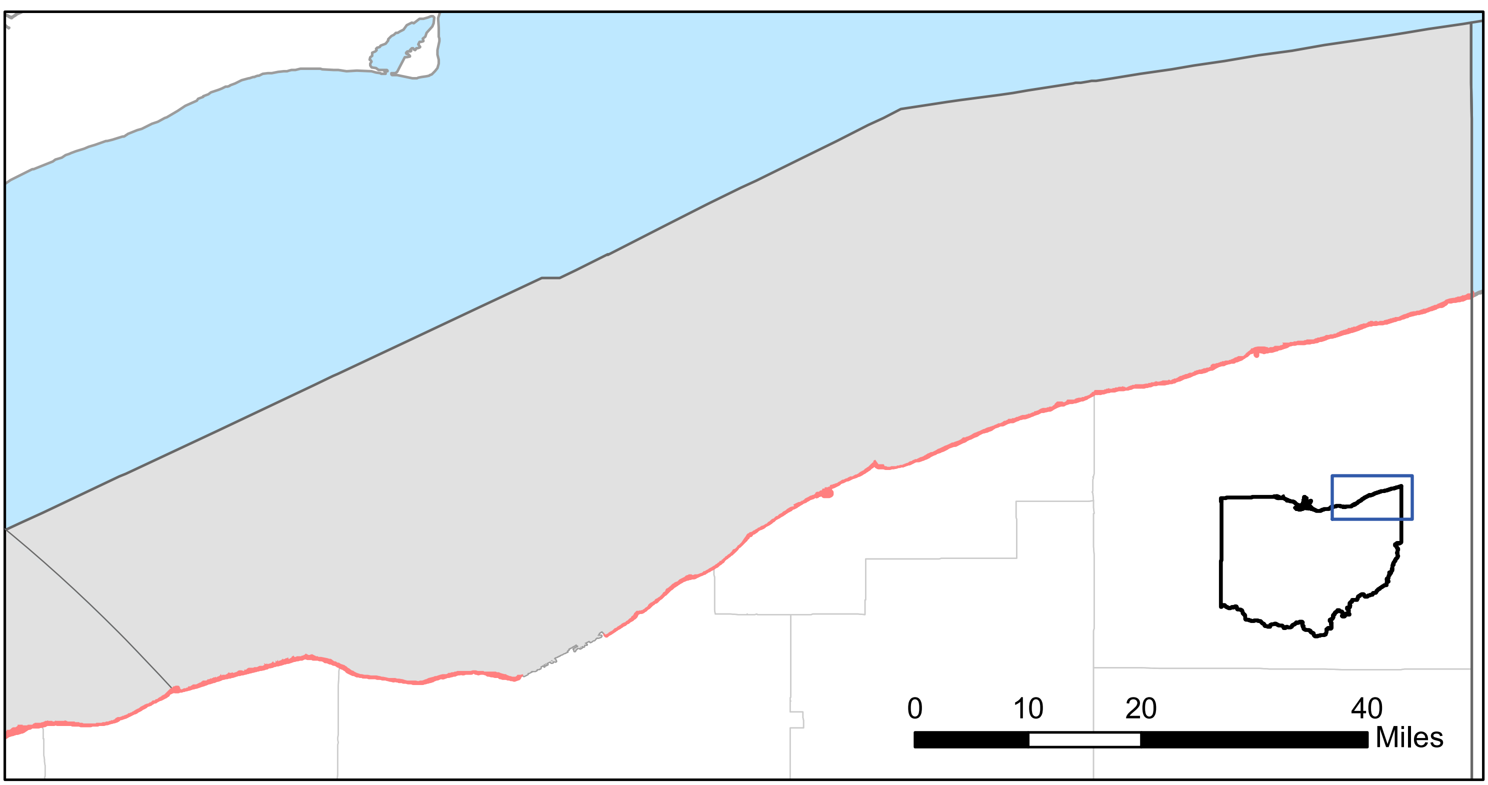
3 - No data

5 - Use is not supported

N
W
E
S

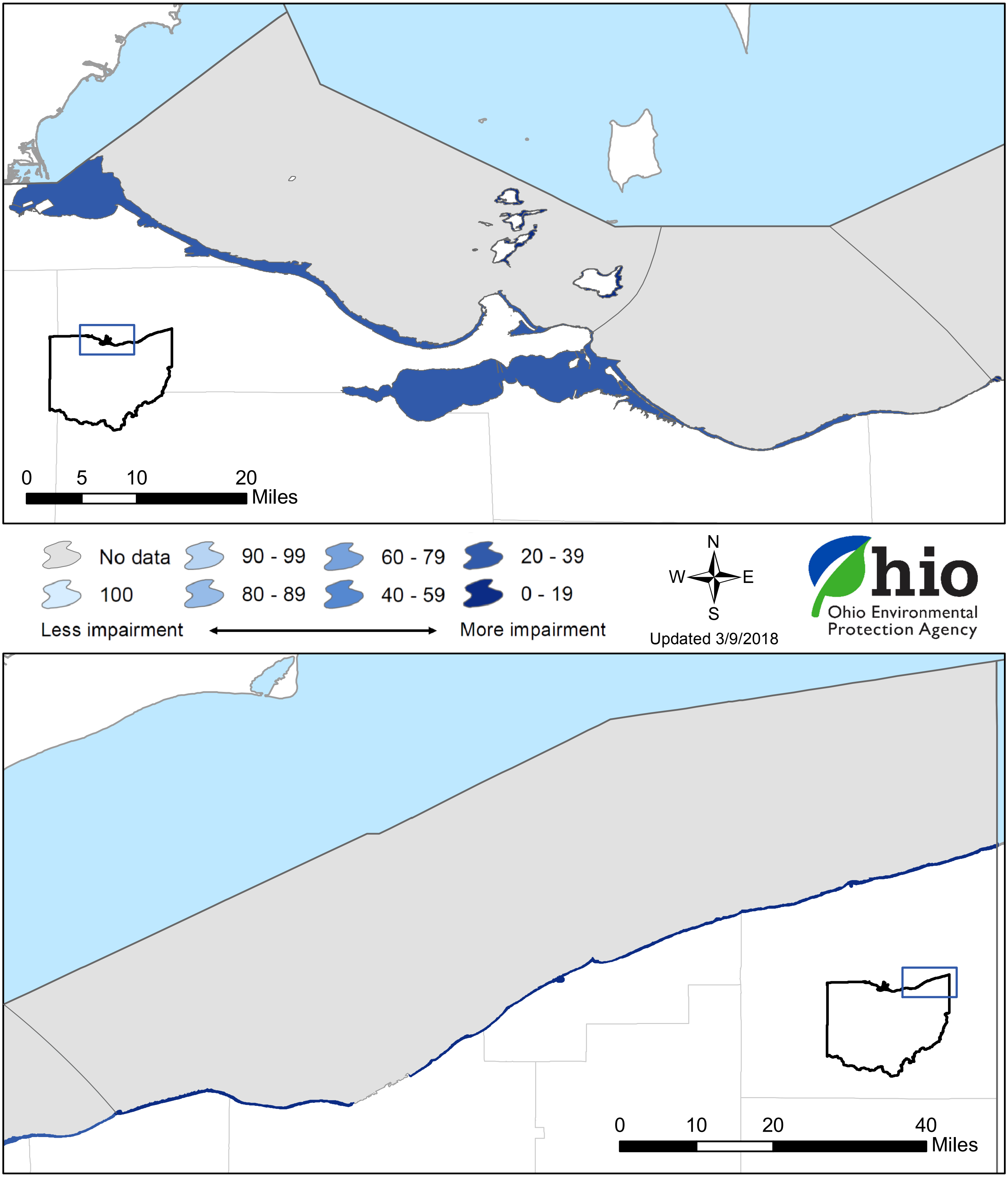
Updated 3/9/2018

Ohio Environmental Protection Agency



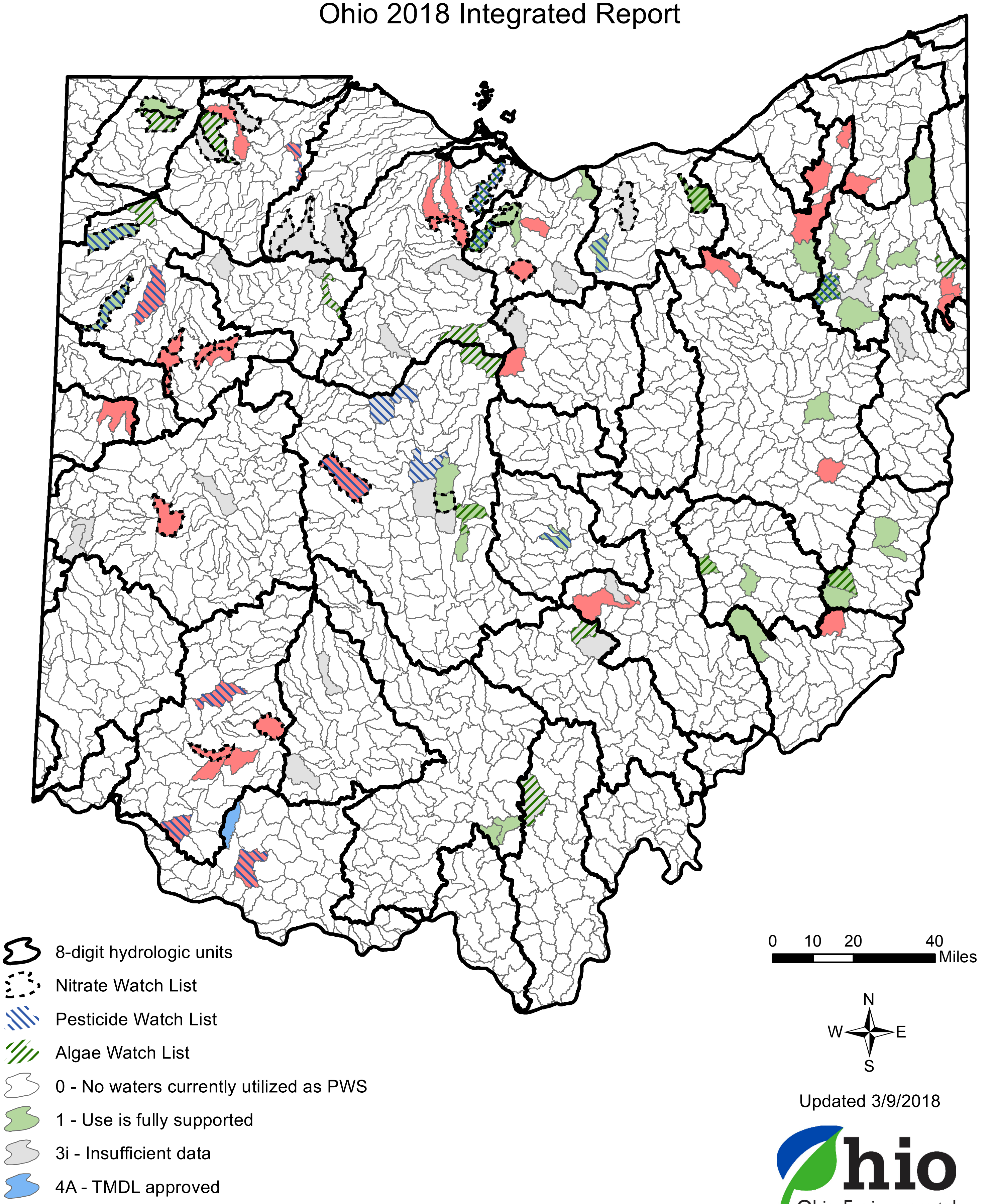
Aquatic Life Use Index Scores
Lake Erie Assessment Units

Ohio 2018 Integrated Report



Section 303(d) Public Drinking Water Supply Use Categories
Watershed Assessment Units

Ohio 2018 Integrated Report

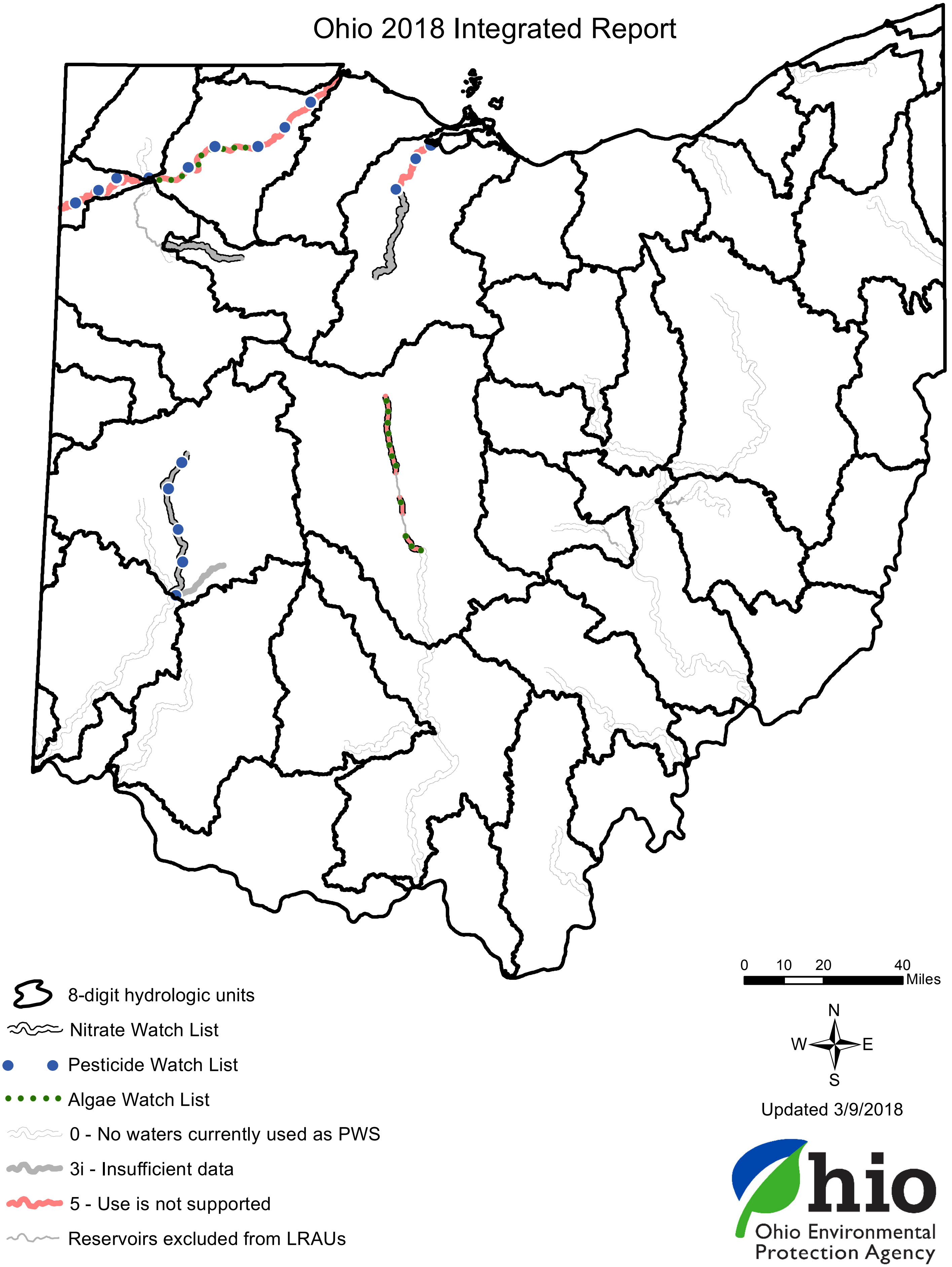


Updated 3/9/2018

Ohio Environmental Protection Agency

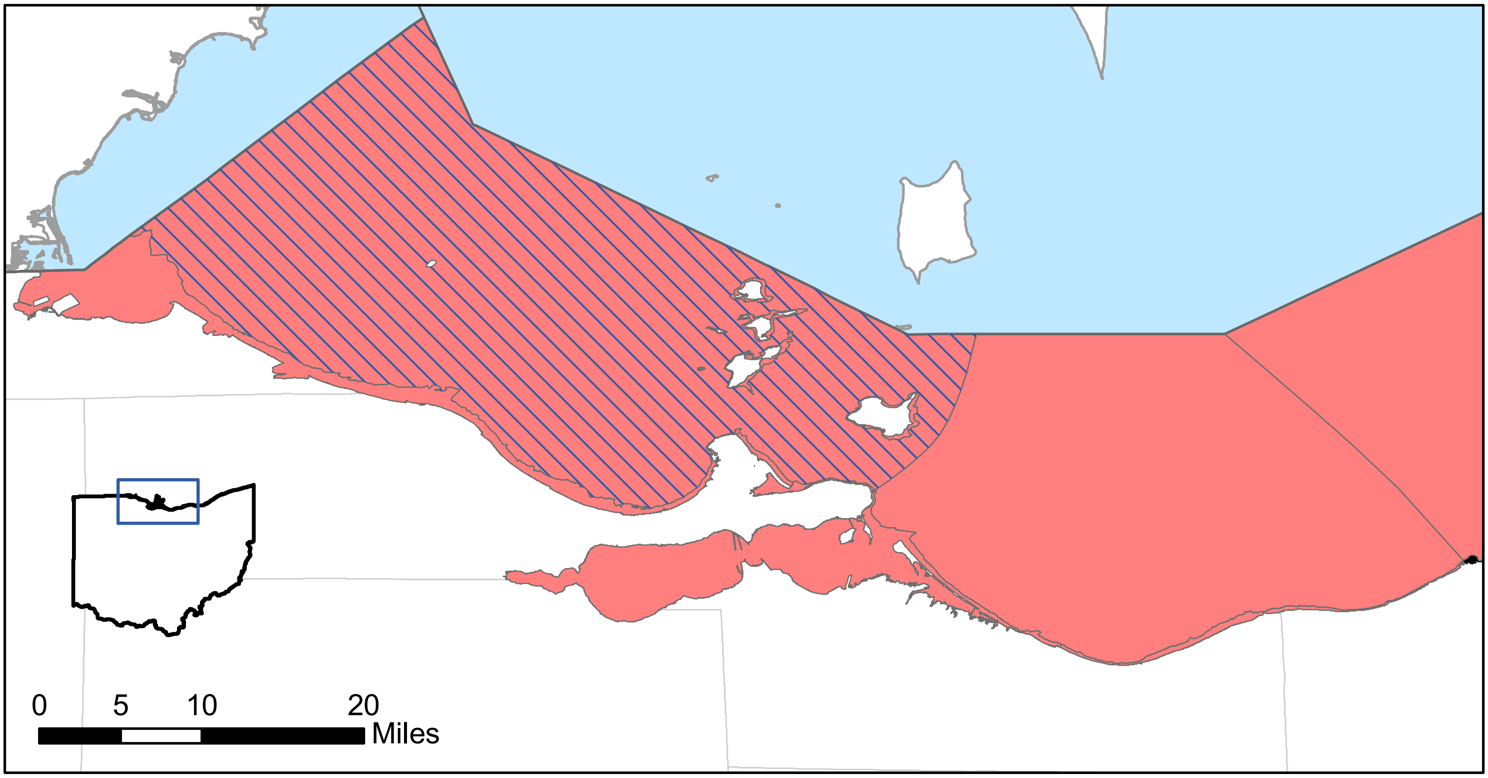
Section 303(d) Public Drinking Water Supply Use Categories
Large River Assessment Units

Ohio 2018 Integrated Report



Section 303(d) Public Drinking Water Supply Use Categories
Lake Erie Assessment Units

Ohio 2018 Integrated Report



Pesticide Watch List

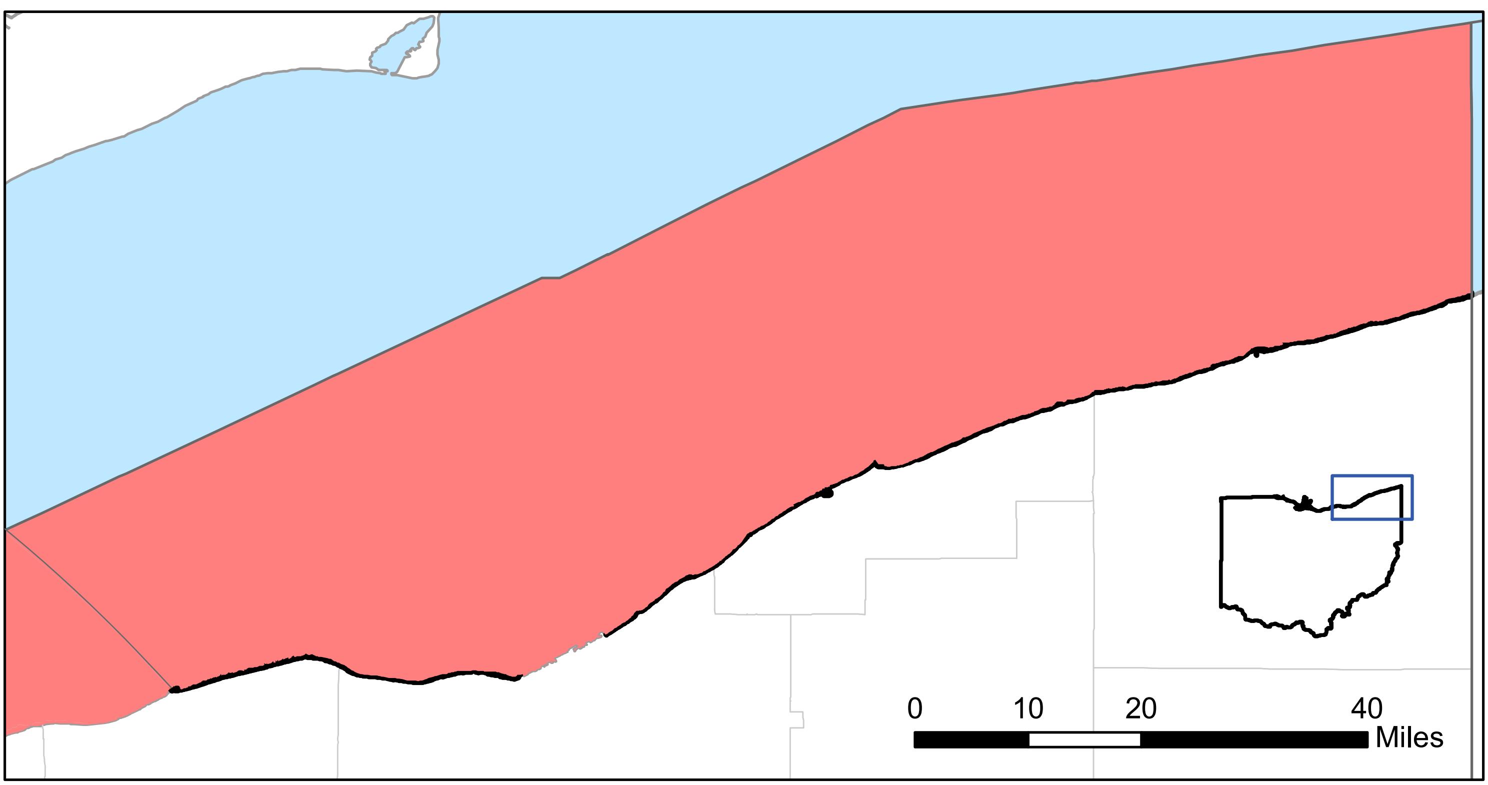
0 - No waters currently used as PWS

5 - Use is not supported

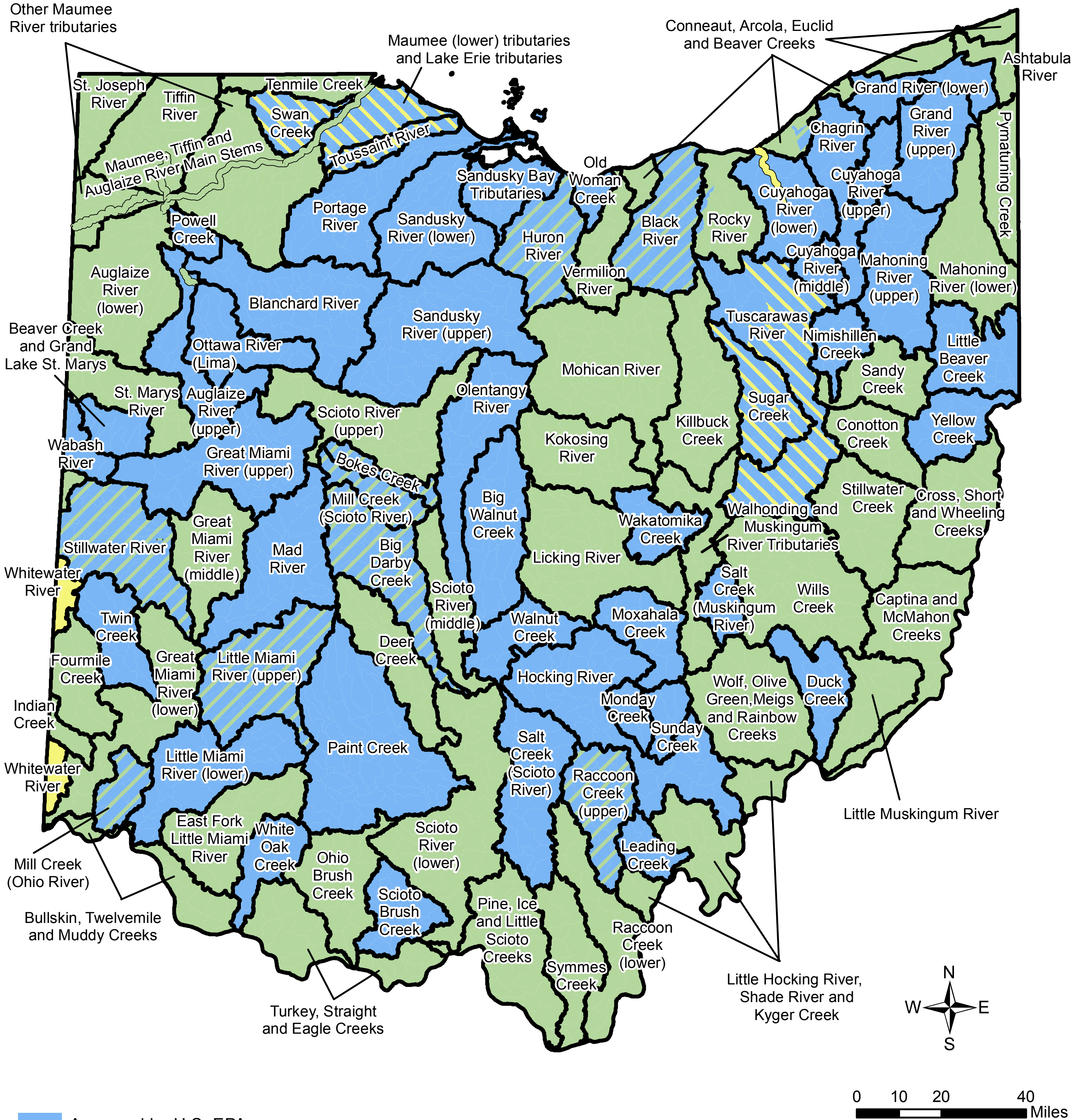
N
W E
S

Updated 3/9/2018

Ohio Environmental Protection Agency



Ohio Total Maximum Daily Load Program Progress



Approved by U.S. EPA

First cycle TMDL approved by U.S. EPA; second cycle TMDL under development

First cycle TMDL approved by U.S. EPA; second cycle watershed assessment in progress

TMDL under development

Watershed assessment in progress

Updated 3/9/2018

Ohio Environmental Protection Agency

Summary Tables of Waterbody Condition; Lists of Prioritized Impaired Waters; and Monitoring and TMDL Schedules

Section L contains tables showing the 303(d) listing details for each of the assessment unit types and is divided into five sections as follows:

- Section L1: Status of Watershed Assessment Units
- Section L2: Status of Large River Assessment Units
- Section L3: Status of Lake Erie Assessment Units
- Section L4: Section 303(d) List of Prioritized Impaired Waters
- Section L5: Category 4B demonstrations contained in approved Ohio TMDLs to date

In Sections L1 through L4, there are four columns labeled, in order, Human Health, Recreation, Aquatic Life and PDW Supply. These four columns represent each beneficial use included in the 303(d) list of impaired waters and the numbers in the columns represent the category for that assessment unit for that beneficial use. Table L-1 defines the categories and subcategories assigned to each use.

Table L-1 — Category definitions for the 2018 Integrated Report and 303(d) list.

Category[1]		Subcategory	
0	No water currently utilized for water supply		
1	Use attaining	d	TMDL complete; new data show the AU is attaining WQS
		h	Historical data
		t	TMDL complete at HUC[2] 11 scale; AU attaining WQS at HUC 12 scale
		x	Retained from 2008 IR
2	Not applicable in Ohio system		
3	Use attainment unknown	h	Historical data
		i	Insufficient data
		t	TMDL complete at HUC 11 scale; there may be no or not enough data to assess this AU at the HUC 12 scale
		x	Retained from 2008 IR
4	Impaired; TMDL not needed	A	TMDL complete
		B	Other required control measures will result in attainment of use
		C	Not a pollutant
		h	Historical data
		n	Natural causes and sources
		x	Retained from 2008 IR
5	Impaired; TMDL needed	alt	Alternative restoration approaches[3]
		M	Mercury
		d	TMDL complete; new data show the AU is not attaining WQS
		h	Historical data
		p	Protection/preservation for threatened waters
		x	Retained from 2008 IR

[1] Shading indicates categories defined by U.S. EPA; other categories and subcategories are defined by Ohio EPA.
[2] HUC means hydrologic unit code.
[3] Ohio currently has no waters that are listed under this subcategory.

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100001 03 01	Shantee Creek	14.60	5h	5h	5	0	6
04100001 03 02	Halfway Creek	2.53	5h	5h	5	0	7
04100001 03 03	Prairie Ditch	18.63	5h	5h	1	0	6
04100001 03 04	Headwaters Tenmile Creek	39.94	1h	5h	5	0	7
04100001 03 05	North Tenmile Creek	1.05	5h	5h	5	0	7
04100001 03 06	Tenmile Creek	11.24	5h	5h	5	0	7
04100001 03 07	Heldman Ditch-Ottawa River	28.15	5	5h	5	0	9
04100001 03 08	Sibley Creek-Ottawa River	21.58	5	5h	5	0	6
04100001 03 09	Detwiler Ditch-Frontal Lake Erie	8.13	3	1h	5	0	1
04100002 03 01	Headwaters Bear Creek	17.72	3	1h	1	0	0
04100002 03 03	Nile Ditch	2.33	3	3	3	0	0
04100002 03 04	Little Bear Creek-Bear Creek	6.47	3	5h	5	0	4
04100003 01 04	Bird Creek-East Branch St Joseph River	0.40	3	3	3	0	0
04100003 01 06	Clear Fork-East Branch St Joseph River	24.82	1	5h	4n	0	3
04100003 02 04	West Branch St Joseph River	14.76	5	5h	5	0	10
04100003 03 01	Nettle Creek	21.96	1	5h	5	0	8
04100003 03 02	Cogswell Cemetery-St Joseph River	9.76	5	5h	1	0	5
04100003 03 03	Eagle Creek	35.00	5h	5h	5	0	9
04100003 03 04	Village of Montpelier-St Joseph River	20.83	5h	5h	1	0	4
04100003 03 05	Bear Creek	22.37	5h	5h	1	0	6
04100003 03 06	West Buffalo Cemetery-St Joseph River	13.72	5h	5h	1	0	5
04100003 04 02	Headwaters Fish Creek	7.82	3	5h	1	0	3
04100003 04 05	Town of Alvarado-Fish Creek	2.64	3	3	3	0	0
04100003 04 06	Cornell Ditch-Fish Creek	6.19	3i	5h	1	0	3
04100003 05 01	Bluff Run-St Joseph River	23.74	5h	5h	1	0	5
04100003 05 02	Big Run	3.01	5h	5h	1	0	5
04100003 05 03	Russell Run-St Joseph River	17.98	5h	5h	1	0	5
04100003 05 05	Willow Run-St Joseph River	12.35	5	5h	1	0	8
04100003 05 06	Sol Shank Ditch-St Joseph River	1.23	5h	3	3	0	2
04100004 01 01	Muddy Creek	16.46	5h	5h	1	0	5
04100004 01 02	Center Branch St Marys River	29.00	5h	5h	5	0	9
04100004 01 03	East Branch St Marys River	21.26	5h	5h	5	0	4
04100004 01 04	Kopp Creek	33.82	5h	5h	5	0	7
04100004 01 05	Sixmile Creek	17.61	5h	5h	5	0	6
04100004 01 06	Fourmile Creek-St Marys River	16.50	5	5h	5	0	7
04100004 02 01	Hussey Creek	12.37	5h	5h	5	0	6
04100004 02 02	Eightmile Creek	22.45	5h	1h	4C	0	2
04100004 02 03	Blierdofer Ditch	14.57	5h	5h	1	0	3
04100004 02 04	Twelvemile Creek	23.58	5h	5h	5	0	9

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100004 02 05	Prairie Creek-St Marys River	42.22	5	5h	5	0	10
04100004 03 01	Little Black Creek	24.95	5h	5h	5	0	7
04100004 03 02	Black Creek	29.52	5h	5h	5	0	6
04100004 03 03	Yankee Run-St Marys River	59.44	5	5h	5	0	10
04100004 03 04	Duck Creek	11.68	5h	5h	5	0	8
04100004 03 05	Town of Willshire-St Marys River	11.21	1	5h	1	0	4
04100004 04 01	Twentyseven Mile Creek	24.88	3	5h	1	0	3
04100004 04 04	Little Blue Creek	1.12	3	3	3	0	0
04100005 02 01	Zuber Cutoff	29.84	3	5h	5	0	2
04100005 02 02	North Chaney Ditch-Maumee River	14.42	3	3	3	0	0
04100005 02 03	Marie DeLarme Creek	23.09	3	5h	1	0	4
04100005 02 04	Gordon Creek	42.85	3	5h	5	0	6
04100005 02 05	Sixmile Cutoff-Maumee River	15.70	3	3	1	0	0
04100005 02 06	Platter Creek	21.68	3	5h	5	0	6
04100005 02 07	Sulphur Creek-Maumee River	18.22	3	5h	1	0	4
04100005 02 08	Snooks Run-Maumee River	24.95	3	5h	5	0	5
04100006 02 01	Silver Creek-Bean Creek	3.09	3	3	3	0	0
04100006 02 02	Deer Creek-Bean Creek	22.49	3	5h	5	0	6
04100006 02 03	Old Bean Creek	33.33	3	1h	1	0	0
04100006 02 04	Mill Creek	31.97	3	5h	5	0	7
04100006 02 05	Stag Run-Bean Creek	14.45	3	5h	1	0	3
04100006 03 01	Bates Creek-Tiffin River	29.29	1	5h	5	1	7
04100006 03 02	Leatherwood Creek	17.34	5h	1h	5	0	3
04100006 03 03	Flat Run-Tiffin River	33.17	5	5h	5	3i	11
04100006 04 01	Upper Lick Creek	28.00	3	5h	5	0	7
04100006 04 02	Middle Lick Creek	30.86	3	5h	5	0	4
04100006 04 03	Prairie Creek	29.78	3	5h	5	0	6
04100006 04 04	Lower Lick Creek	17.39	3i	5h	1	0	3
04100006 05 01	Beaver Creek	45.14	5h	5h	5	0	7
04100006 05 02	Brush Creek	66.01	5h	5h	5	0	10
04100006 05 03	Village of Stryker-Tiffin River	25.25	5	5h	1	0	7
04100006 05 04	Coon Creek-Tiffin River	30.21	3	5h	4n	0	3
04100006 06 01	Lost Creek	32.33	3	5h	5	0	6
04100006 06 02	Mud Creek	26.60	1h	5h	5	0	7
04100006 06 03	Webb Run	20.39	3	5h	4n	0	4
04100006 06 04	Buckskin Creek-Tiffin River	20.96	5h	1h	4n	0	2
04100007 01 01	Headwaters Auglaize River	42.40	5h	4Ahx	1ht	0	2
04100007 01 02	Blackhoof Creek	16.30	5h	4Ahx	4Ah	0	2
04100007 01 03	Wrestle Creek-Auglaize River	29.88	5h	4Ahx	4Ah	0	2

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100007 01 04	Pusheta Creek	34.65	5h	4Ahx	1ht	0	2
04100007 01 05	Dry Run-Auglaize River	24.23	3i	4Ah	4Ah	0	0
04100007 02 01	Two Mile Creek	31.72	5h	4Ahx	4Ah	0	2
04100007 02 02	Village of Buckland-Auglaize River	9.98	1	4Ahx	1ht	0	0
04100007 02 03	Sims Run-Auglaize River	28.80	1	4Ahx	4Ah	5	5
04100007 02 04	Sixmile Creek-Auglaize River	29.90	5	5h	4Ah	0	4
04100007 03 01	Upper Hog Creek	21.68	5h	3	1	0	2
04100007 03 02	Middle Hog Creek	30.44	5h	4Ah	1	0	2
04100007 03 03	Little Hog Creek	22.23	5h	4Ah	4A	0	2
04100007 03 04	Lower Hog Creek	16.11	5h	4Ah	4A	0	2
04100007 03 05	Lost Creek	17.41	1	1d	4A	5	5
04100007 03 06	Lima Reservoir-Ottawa River	27.36	5	4Ah	5	5	8
04100007 04 01	Little Ottawa River	16.42	5h	4Ah	4A	0	2
04100007 04 02	Dug Run-Ottawa River	28.04	5h	4Ah	5	0	6
04100007 04 03	Honey Run	13.27	5h	4Ah	4A	5	7
04100007 04 04	Pike Run	13.24	5h	4Ah	1	0	2
04100007 04 05	Leatherwood Ditch	13.46	5h	4Ah	1	0	2
04100007 04 06	Beaver Run-Ottawa River	20.84	5h	4Ah	1	0	2
04100007 05 01	Sugar Creek	64.14	5h	4Ah	1	0	2
04100007 05 02	Plum Creek	39.84	5h	4Ah	5	0	6
04100007 05 03	Village of Kalida-Ottawa River	20.58	5h	4Ah	1	0	2
04100007 06 01	Kyle Prairie Creek	19.05	3	5h	1	0	4
04100007 06 02	Long Prairie Creek-Little Auglaize River	26.19	3	5h	1	0	4
04100007 06 03	Wolf Ditch-Little Auglaize River	21.20	1	5h	1	0	2
04100007 06 04	Dry Fork-Little Auglaize River	57.07	1	5h	1	5	11
04100007 07 01	Hagerman Creek	16.15	3	5h	1	0	4
04100007 07 02	West Branch Prairie Creek	50.54	1	5h	1	0	2
04100007 07 03	Prairie Creek	39.22	1	1h	1	0	0
04100007 08 01	Dog Creek	57.69	5	5h	1	0	4
04100007 08 02	Upper Town Creek	14.40	3	5h	5	0	6
04100007 08 03	Maddox Creek	33.76	3	5h	1	0	4
04100007 08 04	Lower Town Creek	38.72	5	5h	1	1	6
04100007 08 05	Middle Creek	16.40	3i	1h	1	0	0
04100007 08 06	Burt Lake-Little Auglaize River	13.93	1	1h	1	0	0
04100007 09 01	Upper Jennings Creek	26.99	5h	4Ahx	1ht	0	2
04100007 09 02	West Jennings Creek	13.95	5h	4Ahx	1ht	0	2
04100007 09 03	Lower Jennings Creek	28.13	5h	4Ah	4Ah	0	2
04100007 09 04	Big Run-Auglaize River	21.03	1	4Ah	1ht	0	0
04100007 09 05	Lapp Ditch-Auglaize River	21.23	3	4Ahx	1ht	0	0

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100007 09 06	Prairie Creek	13.80	5h	4Ahx	4Ah	0	2
04100007 09 07	Town of Oakwood-Auglaize River	16.50	3	4Ahx	3t	0	0
04100007 10 01	Upper Prairie Creek	15.29	3	5h	5	0	6
04100007 10 02	Upper Blue Creek	24.79	3	5h	1	0	3
04100007 10 03	Middle Blue Creek	19.45	3	5h	1	0	4
04100007 10 04	Lower Blue Creek	48.13	3i	5h	5	0	7
04100007 10 05	Town of Charloe-Auglaize River	21.95	3	5h	5	0	5
04100007 11 01	North Powell Creek	46.81	3	3	4A	0	0
04100007 11 02	Upper Powell Creek	38.83	3i	3	4A	0	0
04100007 11 03	Lower Powell Creek	12.87	3i	5h	4A	0	1
04100007 12 01	Headwaters Flatrock Creek	9.89	3	5h	1	0	3
04100007 12 04	Brown Ditch-Flatrock Creek	0.49	3	3	3	0	0
04100007 12 05	Wildcat Creek-Flatrock Creek	38.99	3	5h	5	0	7
04100007 12 06	Big Run-Flatrock Creek	48.28	5	5h	5	1	12
04100007 12 07	Little Flatrock Creek	17.83	3	5h	5	0	6
04100007 12 08	Sixmile Creek	28.31	3	5h	1	0	3
04100007 12 09	Eagle Creek-Auglaize River	34.27	3	5h	5	3i	3
04100008 01 01	Cessna Creek	23.21	5h	4Ah	4Ah	0	2
04100008 01 02	Headwaters Blanchard River	19.66	5h	4Ah	4Ah	0	2
04100008 01 03	The Outlet-Blanchard River	34.10	5h	4Ah	4Ah	0	2
04100008 01 04	Potato Run	27.85	5h	4Ah	4Ah	0	2
04100008 01 05	Ripley Run-Blanchard River	36.94	5h	4Ah	4Ah	0	2
04100008 02 01	Brights Ditch	28.45	5h	4Ah	3i	0	2
04100008 02 02	The Outlet	38.36	5h	4Ah	1h	0	2
04100008 02 03	Findlay Upground Reservoirs-Blanchard River	22.50	5h	4Ah	4Ah	3i	3
04100008 02 04	Lye Creek	27.56	5h	4Ah	4A	0	2
04100008 02 05	City of Findlay Riverside Park-Blanchard River	16.22	5	4Ah	4Ah	3i	2
04100008 03 01	Upper Eagle Creek	26.37	5h	4Ah	4Ah	0	2
04100008 03 02	Lower Eagle Creek	34.01	5h	4Ah	4Ah	0	2
04100008 03 03	Aurand Run	18.03	5h	4Ah	1h	0	2
04100008 03 04	Howard Run-Blanchard River	36.28	5h	4Ah	4Ah	0	2
04100008 04 01	Binkley Ditch-Little Riley Creek	14.36	3	4Ah	4Ah	0	0
04100008 04 02	Upper Riley Creek	14.35	3	4Ah	4Ah	0	0
04100008 04 03	Marsh Run-Little Riley Creek	16.25	3	4Ah	4Ah	0	0
04100008 04 04	Middle Riley Creek	15.62	3	4Ah	4Ah	0	0
04100008 04 05	Lower Riley Creek	25.14	3	4A	4Ah	0	0
04100008 05 01	Tiderishi Creek	19.17	5h	4Ah	4Ah	0	2
04100008 05 02	Ottawa Creek	44.92	5h	4Ah	4Ah	0	2
04100008 05 03	Moffitt Ditch	13.54	5h	4Ah	4Ah	0	2

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100008 05 04	Dukes Run	15.02	5h	4Ah	4Ah	0	2
04100008 05 05	Dutch Run	14.76	5h	4Ah	1h	0	2
04100008 05 06	Village of Gilboa-Blanchard River	41.20	3	4Ah	1h	0	0
04100008 06 01	Cranberry Creek	45.26	3	4Ah	1h	0	0
04100008 06 02	Pike Run-Blanchard River	28.64	3	4Ah	4Ah	3i	0
04100008 06 03	Miller City Cutoff	22.64	3	4Ah	4Ah	0	0
04100008 06 04	Bear Creek	12.67	3	4Ah	1h	0	0
04100008 06 05	Deer Creek-Blanchard River	39.36	3	4Ah	4Ah	0	0
04100009 01 01	West Creek	15.95	3	5h	1	0	3
04100009 01 02	Upper South Turkeyfoot Creek	21.03	3	1	1	0	0
04100009 01 03	School Creek	38.87	3	5h	5	0	6
04100009 01 04	Middle South Turkeyfoot Creek	36.24	3i	5h	5	0	6
04100009 01 05	Little Turkeyfoot Creek	23.12	3	5h	1	0	1
04100009 01 06	Lower South Turkeyfoot Creek	13.79	3i	5h	1	0	3
04100009 02 01	Preston Run-Maumee River	17.09	3	5h	1	0	3
04100009 02 02	Benien Creek	24.03	3	5h	1	0	3
04100009 02 03	Wade Creek-Maumee River	37.31	3	5h	1	0	1
04100009 02 04	Garret Creek	28.59	3	5h	1	0	1
04100009 02 05	Oberhaus Creek	24.00	3	5h	1	0	1
04100009 02 06	Village of Napoleon-Maumee River	21.33	3	5h	1	0	1
04100009 02 07	Creager Cemetery-Maumee River	17.91	3	5h	1	0	1
04100009 03 01	Upper Bad Creek	22.81	3	1h	1	0	0
04100009 03 02	Lower Bad Creek	41.46	1	5h	1	5	8
04100009 04 01	Konzen Ditch	25.21	3	1h	1	3i	1
04100009 04 02	North Turkeyfoot Creek	50.01	1	5h	5p	3i	6
04100009 04 03	Dry Creek-Maumee River	27.36	3	5h	1	0	4
04100009 05 01	Big Creek	21.52	3	5h	1	0	3
04100009 05 02	Hammer Creek	25.09	3	5h	1	0	3
04100009 05 03	Upper Beaver Creek	16.71	3	5h	1	0	1
04100009 05 04	Upper Yellow Creek	34.63	3	5h	1	0	2
04100009 05 05	Brush Creek	25.11	3	5h	1	0	4
04100009 05 06	Lower Yellow Creek	22.67	3i	1h	1	0	0
04100009 05 07	Cutoff Ditch	22.06	5	5h	1	0	5
04100009 05 08	Middle Beaver Creek	23.46	3i	5h	1	0	1
04100009 05 09	Lower Beaver Creek	16.78	5	5h	1	0	6
04100009 05 10	Lick Creek-Maumee River	23.39	3	3	3	0	0
04100009 06 01	Tontogany Creek	45.30	3	5h	1	0	4
04100009 06 02	Sugar Creek-Maumee River	21.72	3	5h	1	0	1
04100009 06 03	Haskins Road Ditch-Maumee River	15.73	3	5h	1	5	9

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100009 07 01	Ai Creek	50.83	3	4A	4A	0	0
04100009 07 02	Fewless Creek-Swan Creek	28.34	3	4A	4A	3i	1
04100009 07 03	Gale Run-Swan Creek	16.91	3	4A	4A	0	0
04100009 08 01	Upper Blue Creek	20.28	3	4A	3i	0	0
04100009 08 02	Lower Blue Creek	24.49	3	4A	4A	0	0
04100009 08 03	Wolf Creek	27.16	3	4A	4A	0	0
04100009 08 04	Heilman Ditch-Swan Creek	36.88	5	4A	4A	0	2
04100009 09 01	Grassy Creek Diversion	24.78	3	4A	3i	0	0
04100009 09 02	Grassy Creek	13.68	3	1d	4A	0	0
04100009 09 03	Crooked Creek-Maumee River	18.89	3	3	3	0	0
04100009 09 04	Delaware Creek-Maumee River	19.25	3i	4A	4A	0	0
04100010 01 01	Rader Creek	32.71	3	4Ah	4A	3i	1
04100010 01 02	Needles Creek	31.42	3	4Ah	4A	0	0
04100010 01 03	Rocky Ford	73.53	3	4Ah	4A	3i	1
04100010 01 04	Town of Rudolph-Middle Branch Portage River	31.14	3	4Ah	1	0	0
04100010 02 01	Bull Creek	30.47	3	4Ah	1d	0	0
04100010 02 02	East Branch Portage River	36.15	1	4Ah	5	3i	5
04100010 02 03	Town of Bloomdale-South Branch Portage River	53.57	3i	4Ah	5	3i	4
04100010 02 04	Rhodes Ditch-South Branch Portage River	20.66	5	4Ah	1	0	2
04100010 02 05	Cessna Ditch-Middle Branch Portage River	25.44	3	4Ah	1	0	0
04100010 03 01	North Branch Portage River	64.41	5	4Ah	5	0	6
04100010 03 02	Town of Pemberville-Portage River	18.06	5h	4Ah	1	0	2
04100010 04 01	Sugar Creek	59.39	5h	4Ah	4A	0	2
04100010 04 02	Larcarpe Creek Outlet #4-Portage River	27.89	5h	4Ah	4A	0	2
04100010 05 01	Little Portage River	32.63	5h	4Ah	4A	0	2
04100010 05 02	Portage River	48.86	5	4Ah	5	0	3
04100010 05 03	Lacarpe Creek-Frontal Lake Erie	40.30	3	3	3	0	0
04100010 06 01	Upper Toussaint Creek	74.00	5h	5	4Ah	0	5
04100010 06 02	Packer Creek	34.49	5h	5	4Ah	0	6
04100010 06 03	Lower Toussaint Creek	30.67	5	5	4Ah	0	5
04100010 07 01	Turtle Creek-Frontal Lake Erie	40.66	3	4A	4A	0	0
04100010 07 02	Crane Creek-Frontal Lake Erie	56.48	3	4A	4A	0	0
04100010 07 03	Cedar Creek-Frontal Lake Erie	58.05	3	4A	4A	0	0
04100010 07 04	Wolf Creek-Frontal Lake Erie	15.16	3	1d	3i	0	0
04100010 07 05	Berger Ditch	16.06	3	4A	4A	0	0
04100010 07 06	Otter Creek-Frontal Lake Erie	18.13	3	4A	4A	0	0
04100011 01 01	Sawmill Creek	14.28	3	4Ah	1	0	0
04100011 01 02	Pipe Creek-Frontal Sandusky Bay	48.54	3	4Ah	4A	0	0
04100011 01 03	Mills Creek	42.17	3i	5h	4A	3i	6

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100011 02 01	Frontal South Side of Sandusky Bay	43.42	3	4Ah	4A	0	0
04100011 02 02	Strong Creek	15.87	3	4Ah	3	0	0
04100011 02 03	Pickerel Creek	48.48	3i	4Ah	4A	0	0
04100011 02 04	Raccoon Creek	34.41	3i	4Ah	5	5	6
04100011 02 05	South Creek	22.00	3	4Ah	4A	0	0
04100011 03 01	Brandywine Creek-Broken Sword Creek	55.30	3	4Ahx	4A	0	0
04100011 03 02	Indian Run-Broken Sword Creek	39.04	3	4Ahx	4Ah	0	0
04100011 04 01	Headwaters Paramour Creek-Sandusky River	27.95	5h	4Ah	4Ah	0	2
04100011 04 02	Loss Creek-Sandusky River	24.26	5h	4Ahx	4A	0	2
04100011 04 03	Headwaters Middle Sandusky River	37.44	5h	4Ah	4Ah	3i	3
04100011 04 04	Grass Run	24.52	5h	4Ahx	4Ah	0	2
04100011 04 05	Headwaters Lower Sandusky River	24.07	5h	4Ahx	4Ah	0	2
04100011 05 01	Prairie Run	15.35	3	4Ahx	1ht	0	0
04100011 05 02	Headwaters Tymochtee Creek	19.12	3	4Ahx	4Ah	0	0
04100011 05 03	Carroll Ditch	17.81	3	4Ahx	3iht	0	0
04100011 05 04	Paw Paw Run	16.80	3	4Ahx	4Ah	0	0
04100011 05 05	Reevhorn Run	14.27	3	4Ahx	3iht	0	0
04100011 05 06	Upper Little Tymochtee Creek	20.69	3	4Ahx	4Ah	0	0
04100011 05 07	Lower Little Tymochtee Creek	14.56	3	4Ahx	4Ah	0	0
04100011 05 08	Warpole Creek	20.68	3	4Ahx	3iht	0	0
04100011 05 09	Enoch Creek-Tymochtee Creek	35.17	3	4Ahx	4Ah	0	0
04100011 06 01	Oak Run	15.30	3	3	3t	0	0
04100011 06 02	Baughman Run-Tymochtee Creek	27.34	3	3	4Ah	0	0
04100011 06 03	Hart Ditch-Little Tymochtee Creek	31.52	3	3	4Ah	0	0
04100011 06 04	Spring Run	29.94	3	5h	4Ah	0	2
04100011 06 05	Mouth Tymochtee Creek	26.11	1h	5h	4Ah	0	2
04100011 07 01	Little Sandusky River	36.04	1h	4Ahx	4Ah	0	0
04100011 07 02	Town of Upper Sandusky-Sandusky River	29.07	5h	4Ah	4Ah	3i	2
04100011 07 03	Negro Run	13.66	5h	4Ahx	1ht	0	2
04100011 07 04	Cranberry Run-Sandusky River	21.38	5h	4Ahx	4Ah	0	2
04100011 07 05	Sugar Run-Sandusky River	18.69	5h	4Ahx	4Ah	0	2
04100011 08 01	Brokenknife Creek	18.90	3	3	4Ah	0	0
04100011 08 02	Upper Honey Creek	40.96	3	3	4Ah	0	0
04100011 08 03	Aicholz Ditch	18.04	3	3	4Ah	0	0
04100011 08 04	Silver Creek	24.62	3	3	4Ah	0	0
04100011 08 05	Middle Honey Creek	41.31	3	5h	4Ah	3i	3
04100011 08 06	Lower Honey Creek	35.56	3	5h	1ht	0	4
04100011 09 01	Taylor Run	19.29	3	3	4Ah	0	0
04100011 09 02	Headwaters Sycamore Creek	40.55	3	3	1ht	0	0

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100011 09 03	Greasy Run-Sycamore Creek	23.99	3	5h	4Ah	0	4
04100011 09 04	Thorn Run-Sandusky River	21.36	3	3	4Ah	0	0
04100011 09 05	Mile Run-Sandusky River	16.69	3	3	4Ah	0	0
04100011 10 01	East Branch East Branch Wolf Creek	21.90	3	4Ah	4A	0	0
04100011 10 02	Town of New Riegel-East Branch Wolf Creek	33.40	3	4Ah	4A	0	0
04100011 10 03	Snuff Creek-East Branch Wolf Creek	29.22	3	4Ah	1	0	0
04100011 10 04	Wolf Creek	73.45	3	4Ah	4A	0	0
04100011 11 01	Rock Creek	34.78	3	3	4Ah	0	0
04100011 11 02	Morrison Creek	20.34	3	3	4Ah	0	0
04100011 11 03	Willow Creek-Sandusky River	16.62	3	3	4Ah	0	0
04100011 11 04	Sugar Creek	13.52	3	3i	1	0	0
04100011 11 05	Spicer Creek-Sandusky River	30.86	3	3	4A	0	0
04100011 12 01	Westerhouse Ditch	20.68	3	4Ah	1	0	0
04100011 12 02	Beaver Creek	29.30	3i	4Ah	4A	5	5
04100011 12 03	Green Creek	30.78	1	5h	4A	5	9
04100011 13 01	Muskellunge Creek	46.31	3i	4Ah	4A	0	0
04100011 13 02	Indian Creek-Sandusky River	37.59	3	4Ah	3i	0	0
04100011 13 03	Mouth Sandusky River	24.85	3	3	4A	0	0
04100011 14 01	Gries Ditch	13.93	3	4Ah	1	0	0
04100011 14 02	Town of Helena-Muddy Creek	45.21	3	4Ah	1	0	0
04100011 14 03	Little Muddy Creek	28.58	3	5h	4A	0	3
04100011 14 04	Town of Lindsey-Muddy Creek	24.12	5	4Ah	4A	0	2
04100011 14 05	North Side Sandusky Bay Frontal	26.53	3	3	3	0	0
04100012 01 01	Clear Creek-Vermilion River	22.22	5h	3	5h	0	3
04100012 01 02	Buck Creek	20.88	5h	3	5h	0	3
04100012 01 03	Southwest Branch Vermilion River	31.16	5h	5h	5h	0	6
04100012 01 04	New London Upground Reservoir-Vermilion River	31.05	1	3	5h	3i	3
04100012 01 05	Indian Creek-Vermilion River	34.51	5h	3	5h	0	5
04100012 02 01	East Branch Vermilion River	37.52	5h	3	5h	0	3
04100012 02 02	East Fork Vermilion River	35.05	5h	3	5	0	6
04100012 02 03	Town of Wakeman-Vermilion River	28.91	5h	3	5h	0	6
04100012 02 04	Mouth Vermilion River	28.13	5	5h	5h	1	10
04100012 03 01	Sugar Creek-Frontal Lake Erie	19.50	3	3	4Ah	0	0
04100012 03 02	Chappel Creek	23.99	3	3	4Ah	0	0
04100012 03 03	Cranberry Creek-Frontal Lake Erie	12.64	3	3	3t	0	0
04100012 03 04	Old Woman Creek	26.49	3	5h	4Ah	0	2
04100012 04 01	Marsh Run	31.49	3	4Ax	1d	0	0
04100012 04 02	Town of Plymouth-West Branch Huron River	31.00	3	4A	4A	0	0
04100012 04 03	Walnut Creek-West Branch Huron River	23.69	1	4Ax	1d	5	5

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100012 04 04	Holliday Lake	13.73	3	5	4A	0	4
04100012 04 05	Peru Township-West Branch Huron River	32.30	1	4Ax	1d	0	0
04100012 05 01	Mud Run	15.54	3	5	4A	0	4
04100012 05 02	Slate Run	31.01	3	5	4A	0	4
04100012 05 03	Frink Run	29.77	3	5	4A	1	7
04100012 05 04	Seymour Creek	16.20	3	5	4A	0	4
04100012 05 05	Unnamed Creek "C"	15.97	3	5	5d	0	7
04100012 05 06	Mouth West Branch Huron River	21.51	5	1	1d	1	3
04100012 06 01	Headwaters East Branch Huron River	28.94	3	4Ax	5d	0	1
04100012 06 02	Cole Creek	23.05	3	4Ax	1d	0	0
04100012 06 03	Norwalk Creek	20.54	1h	4Ax	1d	5	5
04100012 06 04	Mouth East Branch Huron River	15.29	5	4Ax	1d	1	2
04100012 06 05	Unnamed Creek "B"	18.16	3	4A	4A	0	0
04100012 06 06	Huron River-Frontal Lake Erie	44.81	5	1t	1d	0	2
04110001 01 01	Plum Creek	12.87	5h	5h	5	0	8
04110001 01 02	North Branch West Branch Rocky River	25.07	5h	5h	5	0	7
04110001 01 03	Headwaters West Branch Rocky River	22.98	5h	5h	5	0	6
04110001 01 04	Mallet Creek	18.04	5h	1h	1	0	2
04110001 01 05	City of Medina-West Branch Rocky River	26.37	1	5h	1	0	4
04110001 01 06	Cossett Creek-West Branch Rocky River	41.44	1	5h	4n	0	4
04110001 01 07	Plum Creek	17.54	5h	5h	5	0	6
04110001 01 08	Baker Creek-West Branch Rocky River	26.08	5	5h	5	0	9
04110001 02 01	Headwaters East Branch Rocky River	40.56	1	5h	1	0	4
04110001 02 02	Baldwin Creek-East Branch Rocky River	36.58	1	5	5	1	9
04110001 02 03	Rocky River	25.34	5	5h	5	0	9
04110001 02 04	Cahoon Creek-Frontal Lake Erie	38.43	3	5h	5	0	2
04110001 03 01	East Fork of East Branch Black River	14.17	5h	4Ah	5d	0	3
04110001 03 02	Headwaters West Fork East Branch Black River	43.41	5h	4Ah	4n	0	2
04110001 03 03	Coon Creek-East Branch Black River	38.31	1h	4Ah	4C	0	0
04110001 04 01	Town of Litchfield-East Branch Black River	36.06	1	4Ah	1d	0	0
04110001 04 02	Salt Creek-East Branch Black River	33.93	5	4Ah	4n	0	3
04110001 04 03	Willow Creek	22.58	5h	4Ah	4A	0	2
04110001 04 04	Jackson Ditch-East Branch Black River	33.63	5	4Ah	4C	0	2
04110001 05 01	Charlemont Creek	26.08	1h	4Ah	5d	1	2
04110001 05 02	Upper West Branch Black River	40.13	5h	4Ah	4A	0	2
04110001 05 03	Wellington Creek	29.61	1	4Ah	4A	0	0
04110001 05 04	Middle West Branch Black River	25.68	5h	4Ah	4A	0	2
04110001 05 05	Plum Creek	13.81	5h	4Ah	5d	0	3
04110001 05 06	Lower West Branch Black River	39.18	5	4Ah	4A	3i	3

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04110001 06 01	French Creek	38.44	5h	4Ah	5	0	5
04110001 06 02	Black River	35.38	5	4Ah	5	0	4
04110001 06 03	Heider Ditch-Frontal Lake Erie	26.30	3	4Ah	5d	0	1
04110001 07 01	Headwaters Beaver Creek	19.38	3	5h	5	0	4
04110001 07 02	Mouth Beaver Creek	25.44	3	5h	5	0	6
04110001 07 03	Quarry Creek-Frontal Lake Erie	25.59	3	5h	5	0	2
04110002 01 01	East Branch Reservoir-East Branch Cuyahoga River	18.58	1	5	4Ah	5	6
04110002 01 02	West Branch Cuyahoga River	35.98	5h	5h	4Ah	0	6
04110002 01 03	Tare Creek-Cuyahoga River	22.92	5h	5	4Ah	0	8
04110002 01 04	Ladue Reservoir-Bridge Creek	38.79	5	1h	4Ah	5	7
04110002 01 05	Black Brook	12.72	5h	3	1ht	0	2
04110002 01 06	Sawyer Brook-Cuyahoga River	20.44	1h	5	4Ah	0	6
04110002 02 01	Potter Creek-Breakneck Creek	34.18	5h	5h	4Ah	0	5
04110002 02 02	Feeder Canal-Breakneck Creek	45.04	5h	5h	4Ah	1	6
04110002 02 03	Lake Rockwell-Cuyahoga River	61.33	5	5	4Ah	5	11
04110002 03 01	Plum Creek	12.97	5h	3i	1ht	0	2
04110002 03 02	Mogadore Reservoir-Little Cuyahoga River	12.91	1	3	4Ah	0	0
04110002 03 03	Wingfoot Lake outlet-Little Cuyahoga River	30.79	5	5h	5	0	7
04110002 03 04	City of Akron-Little Cuyahoga River	19.66	5h	5h	4A	0	3
04110002 03 05	Fish Creek-Cuyahoga River	35.41	5h	5	4A	0	8
04110002 04 01	Mud Brook	29.77	1h	4Ahx	4Ah	0	0
04110002 04 02	Yellow Creek	31.21	5h	4Ah	4A	0	2
04110002 04 03	Furnace Run	20.30	5h	4Ah	4A	0	2
04110002 04 04	Brandywine Creek	27.06	5h	4Ahx	4Ah	0	2
04110002 04 05	Boston Run-Cuyahoga River	46.44	5	4Ax	4A	0	2
04110002 05 01	Pond Brook	16.62	5h	5h	5	0	8
04110002 05 02	Headwaters Tinkers Creek	25.25	5h	5h	5	0	7
04110002 05 03	Headwaters Chippewa Creek	17.82	5h	3	4Ah	0	2
04110002 05 04	Town of Twinsburg-Tinkers Creek	55.53	5h	5h	5	0	9
04110002 05 05	Willow Lake-Cuyahoga River	24.23	3	3	4A	0	0
04110002 06 01	Mill Creek	19.26	3	4Ahx	4A	0	0
04110002 06 02	Village of Independence-Cuyahoga River	16.97	3	4Ahx	4A	0	0
04110002 06 03	Big Creek	37.37	3	4Ahx	4A	0	0
04110002 06 04	Cuyahoga Heights-Cuyahoga River	19.08	3	4Ax	4A	0	0
04110002 06 05	City of Cleveland-Cuyahoga River	23.58	3	4Ahx	3t	0	0
04110003 01 01	East Branch Ashtabula River	35.32	5h	5h	4n	0	5
04110003 01 02	West Branch Ashtabula River	27.70	5h	5h	1	0	6
04110003 01 03	Upper Ashtabula River	15.50	5h	5h	1	0	6
04110003 01 04	Middle Ashtabula River	30.35	1h	5h	1	0	4

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04110003 01 05	Lower Ashtabula River	18.27	5	5h	5	0	10
04110003 02 01	Indian Creek-Frontal Lake Erie	29.21	3	5h	4n	0	4
04110003 02 02	Wheeler Creek-Frontal Lake Erie	32.83	3	5h	5	0	5
04110003 02 03	Arcola Creek	23.53	3	5h	5	0	7
04110003 02 04	McKinley Creek-Frontal Lake Erie	29.67	3	5h	5	0	4
04110003 03 01	Silver Creek	13.83	3	5h	1t	0	4
04110003 03 02	Headwaters Aurora Branch	37.50	3	5h	5d	0	6
04110003 03 03	McFarland Creek-Aurora Branch	20.42	3	5h	4A	0	4
04110003 03 04	Beaver Creek-Chagrin River	47.48	3	5h	4A	0	4
04110003 04 01	East Branch Chagrin River	51.33	3	4Ahx	4A	0	0
04110003 04 02	Griswold Creek-Chagrin River	76.54	5h	4Ah	5	0	5
04110003 04 03	Town of Willoughby-Chagrin River	17.97	3	4Ahx	4A	0	0
04110003 05 01	Marsh Creek-Frontal Lake Erie	28.33	3	5h	5	0	2
04110003 05 02	City of Euclid-Frontal Lake Erie	20.57	3	3	3	0	0
04110003 05 03	Euclid Creek	23.31	3	5h	5	0	5
04110003 05 04	Doan Brook-Frontal Lake Erie	45.29	3	5h	5	0	2
04110004 01 01	Dead Branch	24.17	5h	4Ah	3i	0	2
04110004 01 02	Headwaters Grand River	33.21	5h	4Ah	4A	5	7
04110004 01 03	Baughman Creek	18.44	5h	4Ah	4n	0	2
04110004 01 04	Center Creek-Grand River	31.43	3	4Ah	4A	0	0
04110004 01 05	Coffee Creek-Grand River	19.03	3	4Ah	1	0	0
04110004 01 06	Swine Creek	31.00	5h	4Ah	1	0	2
04110004 02 01	Upper Rock Creek	26.02	5h	4Ah	3i	0	2
04110004 02 02	Middle Rock Creek	21.37	1h	4Ah	4A	0	0
04110004 02 03	Lower Rock Creek	23.56	5h	1d	4A	0	2
04110004 03 01	Phelps Creek	29.36	5h	4Ah	4n	0	2
04110004 03 02	Hoskins Creek	26.87	5h	4Ah	4A	0	2
04110004 03 03	Mill Creek-Grand River	35.81	5h	4Ah	4A	0	2
04110004 03 04	Mud Creek	21.07	5h	4Ah	4A	0	2
04110004 03 05	Plumb Creek-Grand River	19.24	5	4Ah	1	0	3
04110004 04 01	Griggs Creek	20.68	1h	4Ah	4nh	0	0
04110004 04 02	Peters Creek-Mill Creek	54.81	1h	4Ah	4Ah	0	0
04110004 04 03	Town of Jefferson-Mill Creek	28.17	5	4Ah	5	0	5
04110004 05 01	Three Brothers Creek-Grand River	21.71	5h	4Ah	4n	0	2
04110004 05 02	Bronson Creek-Grand River	36.11	5	4Ah	4n	0	2
04110004 06 01	Coffee Creek-Grand River	22.01	3	4Ah	3ih	0	0
04110004 06 02	Mill Creek	20.99	3	4Ah	1h	0	0
04110004 06 03	Village of Mechanicsville-Grand River	16.62	3	3	3	0	0
04110004 06 04	Paine Creek	28.83	3	4Ah	4nh	0	0

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04110004 06 05	Talcott Creek-Grand River	19.32	3	1h	3ih	0	0
04110004 06 06	Big Creek	50.42	3	4Ah	4Ah	0	0
04110004 06 07	Red Creek-Grand River	26.30	3i	4Ah	4Ah	0	0
04120101 06 03	West Branch Conneaut Creek	1.18	3	3	1	0	0
04120101 06 05	Marsh Run-Conneaut Creek	36.71	3	5h	3	0	6
04120101 07 02	Turkey Creek-Frontal Lake Erie	1.32	3	3	5	0	2
04120101 07 03	Town of North Kingsville-Frontal Lake Erie	23.57	3	5h	5	0	5
05030101 04 01	East Branch Middle Fork Little Beaver Creek	31.02	5h	5h	4Ah	0	6
05030101 04 02	Headwaters Middle Fork Little Beaver Creek	41.42	5h	3	4Ah	0	2
05030101 04 03	Stone Mill Run-Middle Fork Little Beaver Creek	31.65	5h	3	4Ah	3i	2
05030101 04 04	Lisbon Creek-Middle Fork Little Beaver Creek	19.72	5h	5h	4Ah	0	5
05030101 04 05	Elk Run-Middle Fork Little Beaver Creek	24.72	5h	3	4Ah	0	2
05030101 05 01	Cold Run	14.48	3	3	1ht	3i	0
05030101 05 02	Headwaters West Fork Little Beaver Creek	17.82	3	5h	4Ah	0	3
05030101 05 03	Brush Creek	27.20	3	3	4Ah	0	0
05030101 05 04	Patterson Creek-West Fork Little Beaver Creek	52.42	3	5h	4Ah	0	1
05030101 06 01	Longs Run	14.81	5h	3	4Ah	0	2
05030101 06 02	Honey Creek	9.82	5h	5h	4Ah	0	5
05030101 06 03	Headwaters North Fork Little Beaver Creek	20.07	5h	3	1ht	0	2
05030101 06 04	Little Bull Creek	17.45	5h	3	1ht	0	2
05030101 06 05	Headwaters Bull Creek	18.29	5h	5h	4Ah	0	3
05030101 06 06	Leslie Run-Bull Creek	19.36	5h	5h	4Ah	0	4
05030101 06 07	Dilworth Run-North Fork Little Beaver Creek	3.02	5h	3	1ht	0	2
05030101 06 08	Brush Run-North Fork Little Beaver Creek	12.11	5h	3	1ht	0	2
05030101 06 09	Rough Run-Little Beaver Creek	18.11	5h	3	1ht	0	2
05030101 06 10	Bieler Run-Little Beaver Creek	7.36	5h	5h	1ht	0	8
05030101 07 01	Headwaters Yellow Creek	31.99	5h	4Ah	4Ah	0	2
05030101 07 02	Elkhorn Creek	33.56	5h	4Ah	1h	0	2
05030101 07 03	Upper North Fork	19.17	5h	5h	1h	0	4
05030101 07 04	Long Run-Yellow Creek	34.23	5	4Ah	4nh	0	2
05030101 08 01	Town Fork	25.99	1	5h	4Ah	0	2
05030101 08 02	Headwaters North Fork Yellow Creek	26.53	5h	5h	4Ah	0	6
05030101 08 03	Salt Run-North Fork Yellow Creek	28.73	5h	4Ah	4Ah	0	2
05030101 08 04	Hollow Rock Run-Yellow Creek	39.29	5	5h	4A	0	5
05030101 10 01	Upper Cross Creek	23.29	5h	5h	5	0	8
05030101 10 02	Salem Creek	15.30	5h	5h	5	0	9
05030101 10 03	Middle Cross Creek	14.49	5h	5h	1	0	3
05030101 10 04	McIntyre Creek	27.37	1h	5h	5	0	6
05030101 10 05	Lower Cross Creek	47.30	5	5h	5	0	6

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030101 11 02	Little Yellow Creek	22.75	1h	3	4A	0	0
05030101 11 03	Carpenter Run-Ohio River	22.48	1h	3	4A	0	0
05030101 11 06	Hardin Run-Ohio River	18.53	1h	1h	1	0	0
05030101 11 07	Island Creek	26.35	3	1h	1	0	0
05030101 11 09	Wills Creek-Ohio River	26.32	3	1h	1	0	0
05030102 01 04	Frontal Pymatuning Reservoir	35.74	5h	5h	5	0	7
05030102 01 05	Pymatuning Reservoir	5.07	1	3	3	0	0
05030102 03 01	Headwaters Pymatuning Creek	60.96	3	5h	4n	0	4
05030102 03 02	Sugar Creek-Pymatuning Creek	35.18	3	5h	5	0	5
05030102 03 03	Stratton Creek-Pymatuning Creek	19.23	3	5h	4n	0	4
05030102 03 04	Booth Run-Pymatuning Creek	33.96	1	5h	4C	0	6
05030102 04 01	Sugar Run-Shenango River	0.28	3	3	3	0	0
05030102 06 01	Yankee Run	44.81	3	5h	5	0	5
05030102 06 02	Little Yankee Run	41.72	3	5h	5	0	6
05030102 06 03	McCullough Run-Shenango River	7.84	3	3	3	0	0
05030102 06 06	Deer Creek-Shenango River	0.69	3	3	3	0	0
05030103 01 01	Beaver Run-Mahoning River	41.14	3	4Ah	4Ah	0	0
05030103 01 02	Beech Creek	31.64	3	4Ah	5h	0	3
05030103 01 03	Fish Creek-Mahoning River	56.70	5	4Ah	5h	1	3
05030103 02 01	Deer Creek	37.56	1	4Ah	4Ah	1	2
05030103 02 02	Willow Creek	20.02	5h	4Ah	4Ah	0	2
05030103 02 03	Mill Creek	32.42	5h	4Ah	5h	0	3
05030103 02 04	Island Creek-Mahoning River	29.05	5h	4Ah	5h	3i	3
05030103 03 01	Kale Creek	25.52	5h	4Ah	5h	0	3
05030103 03 02	Headwaters West Branch Mahoning River	31.11	5h	4Ah	5h	0	4
05030103 03 03	Barrel Run	12.43	5h	4Ah	4Ah	0	2
05030103 03 04	Kirwin Reservoir-West Branch Mahoning River	37.29	5	4Ah	5h	1	4
05030103 03 05	Town of Newton Falls-West Branch Mahoning River	27.53	1	4Ah	4Ah	0	0
05030103 03 06	Charley Run Creek-Mahoning River	33.16	5	4Ah	4Ah	1	2
05030103 04 01	Headwaters Eagle Creek	20.79	5h	4Ah	4nh	0	2
05030103 04 02	South Fork Eagle Creek	26.18	5h	4Ah	1h	0	2
05030103 04 03	Camp Creek-Eagle Creek	26.30	5h	4Ah	4Ah	0	2
05030103 04 04	Tinkers Creek	16.48	5h	4Ah	4Ah	0	2
05030103 04 05	Mouth Eagle Creek	20.70	1	4Ah	1h	0	0
05030103 04 06	Chocolate Run-Mahoning River	16.57	3	4Ah	5h	0	1
05030103 05 01	Upper Mosquito Creek	25.85	3	5h	4n	0	4
05030103 05 02	Middle Mosquito Creek	71.50	1	5h	1	1	2
05030103 05 03	Lower Mosquito Creek	40.92	5	5h	5	0	5
05030103 06 01	Duck Creek	33.24	3	5h	5	0	4

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030103 06 02	Mud Creek	14.19	3	5h	5	0	4
05030103 06 03	City of Warren-Mahoning River	40.38	3	5h	5	0	2
05030103 07 01	Upper Meander Creek	23.09	3	5h	4n	0	3
05030103 07 02	Middle Meander Creek	32.34	3	5h	4n	0	4
05030103 07 03	Lower Meander Creek	30.68	1	5h	5	1	5
05030103 07 04	Squaw Creek	18.63	3	3	5	0	1
05030103 07 05	Little Squaw Creek-Mahoning River	26.14	3	5h	4C	0	4
05030103 08 01	Headwaters Mill Creek	37.05	3	5h	5	0	4
05030103 08 02	Indian Run	14.28	3	5h	5	0	4
05030103 08 03	Andersons Run-Mill Creek	27.11	1	5h	5	0	4
05030103 08 04	Crab Creek	21.07	3	5h	1	0	3
05030103 08 05	Headwaters Yellow Creek	19.36	3	5h	5	5	10
05030103 08 06	Burgess Run-Yellow Creek	20.19	5h	5h	5	5	15
05030103 08 07	Dry Run-Mahoning River	25.38	3	5h	4n	3i	4
05030103 08 08	Hickory Run	5.87	3	3	3	0	0
05030103 08 09	Coffee Run-Mahoning River	15.60	5	5h	5h	0	6
05030106 02 01	South Fork Short Creek	14.48	3	1h	5	0	1
05030106 02 02	Middle Fork Short Creek	24.16	3	5h	5	0	7
05030106 02 03	North Fork Short Creek	22.16	3	5h	5	0	4
05030106 02 04	Piney Fork	22.58	3	5h	1	0	1
05030106 02 05	Perrin Run-Short Creek	26.22	3	5h	1	0	4
05030106 02 06	Little Short Creek	17.63	3	1h	5	0	1
05030106 02 07	Dry Fork-Short Creek	20.49	5	5h	1	0	6
05030106 03 01	Crabapple Creek	19.66	5h	5h	5	0	9
05030106 03 02	Headwaters Wheeling Creek	25.52	5h	1h	5	0	3
05030106 03 03	Cox Run-Wheeling Creek	39.30	5	5h	5	1	9
05030106 03 04	Flat Run-Wheeling Creek	23.29	5h	5h	5	0	6
05030106 07 01	Williams Creek	12.38	3	1h	1	0	0
05030106 07 02	Upper McMahon Creek	38.11	1	5h	1	0	4
05030106 07 03	Little McMahon Creek	14.92	3	1h	5	1	3
05030106 07 04	Lower McMahon Creek	25.77	5	1h	1	0	2
05030106 09 01	North Fork Captina Creek	32.72	1h	5h	1	1	5
05030106 09 02	South Fork Captina Creek	35.99	1	5h	4n	1	2
05030106 09 03	Bend Fork	27.02	3	5h	1	0	3
05030106 09 04	Piney Creek-Captina Creek	29.07	3i	5h	1	0	5
05030106 09 05	Pea Vine Creek-Captina Creek	38.02	5	1h	1	0	2
05030106 09 06	Cat Run-Captina Creek	17.45	3i	1h	4n	0	0
05030106 12 01	Rush Run	12.48	3	5h	5	0	6
05030106 12 02	Salt Run-Ohio River	20.82	3	5h	5	0	5

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030106 12 04	Glenns Run-Ohio River	22.15	3	5h	5	0	4
05030106 12 05	Boggs Run-Ohio River	6.41	3	3	3	0	0
05030106 12 06	Wegee Creek-Ohio River	17.48	3	1h	4n	0	0
05030106 12 07	Pipe Creek-Ohio River	24.14	3	1h	5	0	1
05030106 12 08	Big Run-Ohio River	7.78	3	3	5h	0	1
05030201 01 01	Upper Sunfish Creek	35.10	3	1h	1	5	5
05030201 01 02	Piney Fork	15.61	3	1h	1	0	0
05030201 01 03	Middle Sunfish Creek	19.88	3	5h	1	0	5
05030201 01 04	Lower Sunfish Creek	43.12	3i	1h	1	0	0
05030201 06 01	Rich Fork	22.41	3	5h	1	0	4
05030201 06 02	Cranenest Fork	26.31	3	5h	1	0	4
05030201 06 03	Wolfpen Run-Little Muskingum River	21.25	3	5h	1	0	4
05030201 06 04	Witten Fork	42.36	3	5h	1	0	4
05030201 06 05	Straight Fork-Little Muskingum River	36.70	3	5h	1	0	4
05030201 07 01	Clear Fork Little Muskingum River	48.82	3	1h	1	0	0
05030201 07 02	Archers Fork	18.55	3	5h	1	0	4
05030201 07 03	Wingett Run-Little Muskingum River	36.34	1	5h	1	0	2
05030201 07 04	Fifteen Mile Creek	20.52	3	5h	1	0	3
05030201 07 05	Eightmile Creek-Little Muskingum River	41.68	5	5h	1	0	4
05030201 08 01	Upper East Fork Duck Creek	31.64	3	3	4Ah	0	0
05030201 08 02	Middle Fork Duck Creek	26.50	3	3	4Ah	0	0
05030201 08 03	Middle East Fork Duck Creek	40.33	3	3	4Ah	0	0
05030201 08 04	Paw Paw Creek	23.42	3	3	4Ah	0	0
05030201 08 05	Lower East Fork Duck Creek	14.33	3	3	4Ah	0	0
05030201 09 01	Headwaters West Fork Duck Creek	74.68	1h	5h	4Ah	1	4
05030201 09 02	Buffalo Run-West Fork Duck Creek	31.80	5h	3	4Ah	0	2
05030201 09 03	New Years Creek-Duck Creek	25.47	5h	3	4Ah	0	2
05030201 09 04	Sugar Creek-Duck Creek	17.72	5	3	4Ah	0	2
05030201 10 01	Stillhouse Run-Ohio River	10.08	3	3	3t	0	0
05030201 10 02	Opossum Creek	25.31	3	1h	1	0	0
05030201 10 04	Haynes Run-Ohio River	14.09	3	3	3	0	0
05030201 10 05	Patton Run-Ohio River	22.63	3	3	3i	0	0
05030201 10 06	Mill Creek-Ohio River	26.37	3	5h	3i	0	4
05030201 10 07	Leith Run-Ohio River	20.59	3	1h	3i	0	0
05030201 10 09	Cow Creek-Ohio River	24.50	3	5h	3i	0	1
05030201 10 10	Bull Creek-Ohio River	3.35	3	3	3	0	0
05030202 01 02	Mile Run-Ohio River	21.08	3	5h	1	0	3
05030202 01 03	Headwaters Little Hocking River	35.55	3	5h	1	0	4
05030202 01 04	West Branch Little Hocking River	39.45	3	5h	1	0	4

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030202 01 05	Little West Branch Little Hocking River-Little Hocking River	27.31	3	5h	1	0	4
05030202 01 06	Sandy Creek-Ohio River	18.20	3	5h	1	0	3
05030202 02 01	Headwaters West Branch Shade River	22.19	3	5h	5	0	2
05030202 02 02	Kingsbury Creek	21.45	3	5h	5	0	7
05030202 02 03	Headwaters Middle Branch Shade River	40.09	3	5h	5	0	6
05030202 02 04	Elk Run-Middle Branch Shade River	17.57	3	5h	5	0	7
05030202 02 05	Walker Run-West Branch Shade River	27.69	3	5h	5	0	8
05030202 03 01	Horse Cave Creek	18.40	5h	5h	1	0	5
05030202 03 02	Headwaters East Branch Shade River	37.53	5h	5h	1	0	5
05030202 03 03	Big Run-East Branch Shade River	17.49	5h	5h	1	0	6
05030202 03 04	Spruce Creek-Shade River	18.80	5h	5h	1	0	4
05030202 04 04	Forked Run-Ohio River	27.95	1h	3	4n	0	0
05030202 07 01	Headwaters Leading Creek	13.37	3	5h	4A	0	3
05030202 07 02	Mud Fork	13.25	3	3	4A	0	0
05030202 07 03	Ogden Run-Leading Creek	23.89	3	1h	1t	0	0
05030202 07 04	Little Leading Creek	25.51	3	5h	4A	0	4
05030202 07 05	Thomas Fork	31.13	3	1h	4A	0	0
05030202 07 06	Parker Run-Leading Creek	42.91	3	5h	4A	0	2
05030202 08 02	Groundhog Creek-Ohio River	21.77	1h	5h	1	0	1
05030202 08 03	Oldtown Creek-Ohio River	17.78	1h	5h	1	0	3
05030202 08 04	West Creek-Ohio River	19.71	1h	5h	4n	0	1
05030202 08 05	Broad Run-Ohio River	22.66	1h	3	5	0	1
05030202 09 01	Kyger Creek	30.49	3	5h	5	0	7
05030202 09 02	Campaign Creek	46.61	3	5h	5	0	8
05030202 09 04	Crooked Creek-Ohio River	11.72	3	3	4n	0	0
05030204 01 01	Center Branch	24.83	1h	4Ah	4Ah	3i	1
05030204 01 02	Headwaters Rush Creek	45.54	3	5	4Ah	3i	4
05030204 01 03	Clark Run-Rush Creek	28.49	3	4Ah	4Ah	0	0
05030204 02 01	Headwaters Little Rush Creek	28.42	1	4Ah	1ht	0	0
05030204 02 02	Indian Creek-Little Rush Creek	32.93	3	4Ah	4Ah	0	0
05030204 02 03	Raccoon Run	27.35	3	4Ah	4Ah	0	0
05030204 02 04	Turkey Run-Rush Creek	47.34	1	4Ah	4Ah	0	0
05030204 03 01	Headwaters Clear Creek	47.79	3	5h	1h	0	2
05030204 03 02	Mouth Clear Creek	43.69	3i	5h	1h	0	2
05030204 04 01	Headwaters Hocking River	47.66	1h	4Ah	4Ah	0	0
05030204 04 02	Baldwin Run	12.61	5h	4Ah	1	0	2
05030204 04 03	Pleasant Run	17.71	5h	4Ah	1ht	0	2
05030204 04 04	Tarhe Run-Hocking River	20.64	5h	4Ah	4Ah	0	2
05030204 04 05	Buck Run-Hocking River	32.05	5h	4Ah	4Ah	0	2

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030204 05 01	Little Monday Creek	25.15	3	5h	4Ah	0	2
05030204 05 02	Lost Run-Monday Creek	36.54	3	5h	4A	0	2
05030204 05 03	Snow Fork	27.28	3	5h	4Ah	0	2
05030204 05 04	Kitchen Run-Monday Creek	27.02	3	5h	4A	0	2
05030204 06 01	Clear Fork	16.03	1	4Ah	4Ah	0	0
05030204 06 02	Scott Creek	23.68	5h	1h	4Ah	0	2
05030204 06 03	Oldtown Creek	13.81	5h	1h	1ht	0	2
05030204 06 04	Fivemile Creek	14.22	5h	1h	4Ah	0	2
05030204 06 05	Harper Run-Hocking River	26.94	3	4Ah	4Ah	0	0
05030204 06 06	Dorr Run-Hocking River	32.79	3	4Ah	4Ah	0	0
05030204 07 01	East Branch Sunday Creek	33.13	1h	4Ah	4Ah	0	0
05030204 07 02	Dotson Creek-Sunday Creek	24.18	3	4Ah	4A	0	0
05030204 07 03	West Branch Sunday Creek	42.49	3	4Ah	4A	0	0
05030204 07 04	Greens Run-Sunday Creek	39.06	3	4Ah	4A	0	0
05030204 08 01	Hamley Run-Hocking River	22.21	3	4Ah	4Ah	0	0
05030204 08 02	Headwaters Margaret Creek	33.07	3	4Ah	4Ah	0	0
05030204 08 03	Factory Creek-Margaret Creek	26.93	3	4Ah	4Ah	0	0
05030204 08 04	Coates Run-Hocking River	19.61	3	4Ah	1ht	0	0
05030204 09 01	Miners and Hyde Forks	16.55	3	4Ah	1ht	0	0
05030204 09 02	McDougall Branch	37.56	3	4Ah	1ht	0	0
05030204 09 03	Kasler Creek-Federal Creek	15.51	3	4Ah	4nh	0	0
05030204 09 04	Sharps Fork	35.71	3	4Ah	4Ah	0	0
05030204 09 05	Big Run-Federal Creek	39.36	3	4Ah	4A	0	0
05030204 10 01	Willow Creek-Hocking River	31.64	1h	5h	4Ah	0	4
05030204 10 02	Piper Run-Hocking River	20.57	3	3	3t	0	0
05030204 10 03	Fourmile Creek	16.19	1h	3	1ht	0	0
05030204 10 04	Frost Run-Hocking River	41.84	3	3	4Ah	0	0
05040001 01 01	Headwaters Tuscarawas River	35.82	5h	4A	4A	0	2
05040001 01 02	Pigeon Creek	24.70	5h	4A	4Ah	0	2
05040001 01 03	Hudson Run	13.76	5h	4A	4Ah	0	2
05040001 01 04	Wolf Creek	39.16	5h	4A	4Ah	5	7
05040001 01 05	Portage Lakes-Tuscarawas River	36.87	5	4A	5d	0	3
05040001 02 01	Headwaters Chippewa Creek	22.35	5h	4Ah	4A	0	2
05040001 02 02	Hubbard Creek-Chippewa Creek	21.80	5h	4Ah	4Ah	0	2
05040001 02 03	Little Chippewa Creek	32.16	5h	5h	4Ah	0	4
05040001 02 04	River Styx	29.55	5h	4Ah	4Ah	0	2
05040001 02 05	Tommy Run-Chippewa Creek	36.68	5h	4Ah	4Ah	0	2
05040001 02 06	Red Run	15.16	5h	4Ah	4Ah	0	2
05040001 02 07	Silver Creek-Chippewa Creek	30.24	5h	4Ah	4Ah	0	2

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040001 03 01	Pancake Creek-Tuscarawas River	22.61	5h	1d	4Ah	0	2
05040001 03 02	Nimisila Reservoir-Nimisila Creek	17.41	1	4A	4Ah	0	0
05040001 03 03	Lake Lucern-Nimisila Creek	14.15	5h	4A	1ht	0	2
05040001 03 04	Fox Run	14.19	5h	4A	4Ah	0	2
05040001 03 05	Town of Canal Fulton-Tuscarawas River	14.49	3	4Ah	3t	0	0
05040001 03 06	Headwaters Newman Creek	24.88	5h	4A	4Ah	0	2
05040001 03 07	Town of North Lawrence-Newman Creek	14.59	5h	4A	1ht	0	2
05040001 03 08	Sippo Creek	18.09	1	4A	4Ah	0	0
05040001 03 09	West Sippo Creek-Tuscarawas River	29.63	3	4A	4Ah	0	0
05040001 04 01	Conser Run	15.51	5h	5h	4n	0	3
05040001 04 02	Middle Branch Sandy Creek	15.57	5h	5h	1	0	3
05040001 04 03	Pipes Fork-Still Fork	34.81	5h	5h	1	0	3
05040001 04 04	Muddy Fork	17.14	5h	5h	5	0	9
05040001 04 05	Reeds Run-Still Fork	19.47	5h	5h	5	0	9
05040001 04 06	Headwaters Sandy Creek	32.13	5	5h	5	0	9
05040001 05 01	Swartz Ditch-Middle Branch Nimishillen Creek	25.27	5h	4Ah	4Ah	0	2
05040001 05 02	East Branch Nimishillen Creek	46.62	5h	4Ah	5	0	3
05040001 05 03	West Branch Nimishillen Creek	46.69	5h	4Ah	5	0	3
05040001 05 04	City of Canton-Middle Branch Nimishillen Creek	26.02	5	4Ah	5h	0	3
05040001 05 05	Sherrick Run-Nimishillen Creek	22.75	5	4Ah	5h	0	3
05040001 05 06	Town of East Sparta-Nimishillen Creek	20.58	5	4Ah	4Ah	0	2
05040001 06 01	Hugle Run	21.40	5h	5h	1	0	5
05040001 06 02	Pipe Run	27.71	5h	5h	4n	0	5
05040001 06 03	Black Run	16.39	5h	5h	1	0	5
05040001 06 04	Little Sandy Creek	21.15	5h	5h	1	0	5
05040001 06 05	Armstrong Run-Sandy Creek	32.20	5	5h	1	0	8
05040001 06 06	Indian Run-Sandy Creek	39.78	5h	5	5	0	9
05040001 06 07	Beal Run-Sandy Creek	22.85	5	1h	5	0	5
05040001 07 01	Headwaters Upper Conotton Creek	13.95	3	3i	5	0	1
05040001 07 02	Irish Creek	18.85	3	5	1	0	1
05040001 07 03	Dining Fork	14.79	3	5	1	0	1
05040001 07 04	Headwaters Middle Conotton Creek	15.21	3	5	1	0	1
05040001 07 05	North Fork McGuire Creek	26.67	3	5	1	0	1
05040001 07 06	McGuire Creek	22.97	3	1	4C	0	0
05040001 07 07	Headwaters Lower Conotton Creek	29.50	3	5	1	0	3
05040001 08 01	Cold Spring Run-Indian Fork	32.86	3	5	5	0	4
05040001 08 02	Pleasant Valley Run-Indian Fork	37.49	1	1	5	1	1
05040001 08 03	Thompson Run-Conotton Creek	24.96	3	5	1	0	5
05040001 08 04	Huff Run	13.94	3	5	5	0	2

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040001 08 05	Dog Run-Conotton Creek	35.23	3i	5	5	0	8
05040001 09 01	Little Sugar Creek	18.19	3	4A	4Ah	0	0
05040001 09 02	Town of Smithville-Sugar Creek	28.17	3	4A	4Ah	0	0
05040001 09 03	North Fork Sugar Creek	18.01	3	4A	4Ah	0	0
05040001 09 04	Town of Brewster-Sugar Creek	33.11	3	4Ax	4Ah	0	0
05040001 10 01	Upper South Fork Sugar Creek	35.03	3	4A	4A	0	0
05040001 10 02	East Branch South Fork Sugar Creek	28.20	3	4Ax	4Ah	0	0
05040001 10 03	Indian Trail Creek	16.38	3	4Ax	4Ah	0	0
05040001 10 04	Walnut Creek	31.67	3	4A	4Ah	0	0
05040001 10 05	Lower South Fork Sugar Creek	26.54	3	4Ax	4Ah	0	0
05040001 11 01	Headwaters Middle Fork Sugar Creek	27.73	3	4Ax	1ht	0	0
05040001 11 02	Misers Run-Middle Fork Sugar Creek	19.53	3	4Ax	4Ah	0	0
05040001 11 03	Beach City Reservoir-Sugar Creek	17.57	3	4A	4Ah	0	0
05040001 11 04	Broad Run	19.65	3	4Ax	4Ah	0	0
05040001 11 05	Brandywine Creek-Sugar Creek	36.91	3	4A	4A	0	0
05040001 12 01	Pigeon Run	9.57	3	4A	1ht	0	0
05040001 12 02	City of Massillon-Tuscarawas River	14.32	3	4Ah	3t	0	0
05040001 12 03	Wolf Creek-Tuscarawas River	52.14	3	4A	4Ah	0	0
05040001 12 04	Wolf Run-Tuscarawas River	37.17	3	4A	4Ah	0	0
05040001 13 01	Spencer Creek	24.03	3	5h	5	0	6
05040001 13 02	Headwaters Stillwater Creek	13.58	3	5h	1	0	4
05040001 13 03	Boggs Fork	36.74	3i	5h	5	0	8
05040001 13 04	Buttermilk Creek-Stillwater Creek	47.99	1	1h	3i	0	0
05040001 14 01	Skull Fork	46.37	3	5h	5	0	7
05040001 14 02	Brushy Fork	70.03	1	5h	5	0	3
05040001 14 03	Craborchard Creek-Stillwater Creek	42.84	1	5h	1	0	2
05040001 15 01	Clear Fork	24.98	3	5h	5	0	4
05040001 15 02	Standingstone Fork	16.41	3	5h	5	0	2
05040001 15 03	Upper Little Stillwater Creek	29.72	1	1h	3	5	5
05040001 15 04	Middle Little Stillwater Creek	25.24	3	1h	5	0	1
05040001 15 05	Lower Little Stillwater Creek	14.69	3	1h	5	0	3
05040001 16 01	Laurel Creek	28.73	3	5h	5	0	7
05040001 16 02	Crooked Creek	18.97	3	5h	1	0	3
05040001 16 03	Weaver Run-Stillwater Creek	16.12	1	1h	5	0	1
05040001 16 04	Town of Uhrichsville-Stillwater Creek	29.02	3i	5h	5	0	7
05040001 17 01	Stone Creek	38.47	3	4A	4Ah	0	0
05040001 17 02	Oldtown Creek	19.26	3	4A	4Ah	0	0
05040001 17 03	Beaverdam Creek	21.97	3	4A	4A	0	0
05040001 17 04	Pone Run-Tuscarawas River	21.39	3	4A	3t	0	0

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040001 18 01	Dunlap Creek	25.41	3	4A	4Ah	0	0
05040001 18 02	Mud Run-Tuscarawas River	52.38	3	4A	4Ah	0	0
05040001 18 03	Buckhorn Creek	23.32	3	4A	4Ah	0	0
05040001 18 04	Blue Ridge Run-Tuscarawas River	22.66	3	4A	3t	0	0
05040001 19 01	Evans Creek	24.25	3i	4A	1ht	0	0
05040001 19 02	West Fork White Eyes Creek	20.95	3	4A	1ht	0	0
05040001 19 03	White Eyes Creek	33.09	3	4A	4Ah	0	0
05040001 19 04	Morgan Run-Tuscarawas River	38.32	3	4A	4Ah	0	0
05040002 01 01	Marsh Run	20.84	3	5h	5	3i	7
05040002 01 02	Headwaters Black Fork Mohican River	39.47	3	5h	5	3i	7
05040002 01 03	Brubaker Creek	23.00	3	5h	5	0	2
05040002 01 04	Whetstone Creek	17.14	3	5h	1	0	4
05040002 01 05	Shipp Creek-Black Fork Mohican River	61.62	3	5h	5	0	7
05040002 02 01	Village of Pavonia-Black Fork Mohican River	31.94	5h	1h	5	0	5
05040002 02 02	Seymour Run-Black Fork	21.65	1h	3	3	0	0
05040002 02 03	Headwaters Rocky Fork	29.41	5h	5h	5	0	6
05040002 02 04	Outlet Rocky Fork	47.81	5h	5h	5	0	9
05040002 02 05	Charles Mill-Black Fork Mohican River	8.97	5	1h	5	0	3
05040002 03 01	Headwaters Clear Fork Mohican River	33.78	5	1h	3i	5	7
05040002 03 02	Cedar Fork	47.69	3	5h	1	0	4
05040002 03 03	Town of Lexington-Clear Fork Mohican River	29.63	3	5h	5	0	9
05040002 04 01	Honey Creek-Clear Fork Mohican River	24.63	3	5h	1	0	5
05040002 04 02	Possum Run	15.62	3	5h	1	0	4
05040002 04 03	Slater Run-Clear Fork Mohican River	22.89	3	5h	1	0	5
05040002 04 04	Pine Run	14.15	3	1h	1	0	0
05040002 04 05	Switzer Creek-Clear Fork Mohican River	29.37	5	1h	1	0	2
05040002 05 01	Upper Muddy Fork Mohican River	28.59	3	5h	4C	0	3
05040002 05 02	Middle Muddy Fork Mohican River	27.54	3	5h	1	0	1
05040002 05 03	Lower Muddy Fork Mohican River	49.58	3	5h	5	0	6
05040002 06 01	Lang Creek	34.13	3	5h	1	0	3
05040002 06 02	Orange Creek	37.52	3	5h	1	0	3
05040002 06 03	Katotawa Creek	13.53	3	5h	1	0	4
05040002 06 04	Oldtown Run	23.12	3	5h	1	0	4
05040002 06 05	Jerome Fork-Mohican River	35.55	3i	5h	5	0	7
05040002 06 06	Glenn Run-Jerome Fork Mohican River	17.86	3	5h	1	0	1
05040002 07 01	Grab Run	34.18	3	5h	1	0	1
05040002 07 02	Mohicanville Dam-Lake Fork Mohican River	24.53	3	5h	5	0	6
05040002 07 03	Plum Run-Lake Fork Mohican River	20.90	3	5h	1	0	5
05040002 08 01	Honey Creek	17.32	3	5h	1	0	3

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040002 08 02	Town of Perrysville-Black Fork Mohican River	17.76	5	5h	4n	0	7
05040002 08 03	Big Run-Black Fork Mohican River	19.26	5	5h	4n	0	8
05040002 08 04	Sigafoos Run-Mohican River	28.45	3	3	3	0	0
05040002 08 05	Negro Run-Mohican River	28.64	3	5h	1	0	4
05040002 08 06	Flat Run-Mohican River	27.41	3	3	3	0	0
05040003 01 01	Headwaters North Branch Kokosing River	45.29	1	5h	5	0	7
05040003 01 02	East Branch Kokosing River	31.58	1	5h	1	0	4
05040003 01 03	Job Run-North Branch Kokosing River	20.87	3i	1h	1	0	0
05040003 02 01	Headwaters Kokosing River	36.42	3	5h	5	0	7
05040003 02 02	Mile Run-Kokosing River	38.60	3	5h	5	0	6
05040003 02 03	Granny Creek-Kokosing River	25.60	3i	5h	1	0	3
05040003 03 01	Dry Creek	33.93	3	1h	1	0	0
05040003 03 02	Armstrong Run-Kokosing River	17.06	3	5h	1	0	4
05040003 03 03	Big Run	31.06	3	5h	1	0	3
05040003 03 04	Delano Run-Kokosing River	32.95	5	5h	5	0	12
05040003 03 05	Little Schenck Creek	16.26	3	5h	1	0	1
05040003 03 06	Schenck Creek	24.99	3	5h	1	0	3
05040003 03 07	Indianfield Run-Kokosing River	23.70	1	5h	1	0	5
05040003 04 01	Little Jelloway Creek	19.55	1	5h	5	0	7
05040003 04 02	Jelloway Creek	54.51	3	5h	5	0	6
05040003 04 03	Brush Run-Kokosing River	32.29	1	1h	1	0	0
05040003 05 01	Headwaters Killbuck Creek	22.18	3	5h	1	0	2
05040003 05 02	Little Killbuck Creek-Killbuck Creek	33.58	3	1h	5	0	3
05040003 05 03	Rathburn Run-Little Killbuck Creek	20.97	3	5h	1	0	4
05040003 05 04	Cedar Run-Killbuck Creek	39.39	3	5h	1	0	5
05040003 05 05	Clear Creek-Killbuck Creek	22.60	3	5h	1	0	5
05040003 06 01	Little Apple Creek	12.83	3	5h	5	0	5
05040003 06 02	Apple Creek	38.89	3	5h	1	0	1
05040003 06 03	Shreve Creek	15.98	3	5h	5	0	4
05040003 06 04	Jennings Ditch-Killbuck Creek	41.59	3	5h	5	0	9
05040003 06 05	North Branch Salt Creek	16.45	3	5h	5	0	2
05040003 06 06	Salt Creek	27.17	3	5h	1	0	4
05040003 06 07	Tea Run-Killbuck Creek	18.28	3	5h	3ih	0	5
05040003 07 01	Paint Creek	30.38	3	5h	1	0	1
05040003 07 02	Martins Creek	22.97	3	5h	3i	0	1
05040003 07 03	Honey Run-Killbuck Creek	15.91	3	5h	1	0	5
05040003 07 04	Black Creek	35.24	3	5h	1	0	3
05040003 07 05	Shrimplin Creek-Killbuck Creek	47.56	3	5h	5	0	9
05040003 08 01	Wolf Creek	26.74	3	5h	1	0	3

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040003 08 02	Headwaters Doughty Creek	32.87	3	5h	5	0	5
05040003 08 03	Bucks Run-Doughty Creek	28.14	3	5h	1	0	3
05040003 08 04	Big Run-Killbuck Creek	27.40	1	5h	1	0	6
05040003 08 05	Bucklew Run-Killbuck Creek	32.05	1	5h	1	0	5
05040003 09 01	Mohawk Creek	25.58	3	5h	1	0	3
05040003 09 02	Dutch Run-Walhonding River	15.85	3	5h	1	0	3
05040003 09 03	Beaver Run	14.08	3	5h	5	0	6
05040003 09 04	Simmons Run	16.47	3	5h	5	0	6
05040003 09 05	Darling Run-Walhonding River	15.95	3	5h	4n	0	3
05040003 09 06	Headwaters Mill Creek	26.92	3	5h	5	0	5
05040003 09 07	Spoon Creek-Mill Creek	24.28	3	5h	5	0	5
05040003 09 08	Crooked Creek-Walhonding River	18.33	3	5h	4n	0	1
05040004 01 01	Headwaters Wakatomika Creek	32.86	5h	4Ahx	1ht	0	2
05040004 01 02	Winding Fork	21.38	5h	4Ahx	4Ah	0	2
05040004 01 03	Brushy Fork	27.62	5h	4Ahx	4Ah	0	2
05040004 01 04	Jug Run-Wakatomika Creek	36.45	1h	4Ahx	1ht	0	0
05040004 02 01	Black Run-Wakatomika Creek	35.44	5h	4Ahx	4Ah	0	2
05040004 02 02	Mill Fork	24.25	5h	4Ahx	4Ah	0	2
05040004 02 03	Little Wakatomika Creek	37.47	5h	4Ahx	4Ah	0	2
05040004 02 04	Town of Frazeysburg-Wakatomika Creek	18.91	1h	4Ahx	4Ah	0	0
05040004 03 01	Robinson Run-Muskingum River	34.16	3	1h	5	0	1
05040004 03 02	Village of Adams Mills-Muskingum River	19.24	3	5h	3	0	1
05040004 03 03	North Branch Symmes Creek	14.92	3	5h	1	0	3
05040004 03 04	South Branch Symmes Creek-Symmes Creek	17.28	3	5h	4n	0	2
05040004 03 05	Blount Run-Muskingum River	45.32	3	5h	5	0	8
05040004 04 01	Valley Run	29.43	3	4Ah	4A	0	0
05040004 04 02	Headwaters Jonathon Creek	28.00	3	4Ah	1	0	0
05040004 04 03	Turkey Run	14.26	3	4Ah	1	0	0
05040004 04 04	Buckeye Fork	23.30	3i	1h	5	0	4
05040004 04 05	Kent Run	22.82	3	4Ah	1	3i	0
05040004 04 06	Thompson Run	15.46	3	4Ah	1	0	0
05040004 04 07	Painter Creek-Jonathon Creek	60.61	3i	4Ah	4C	5	5
05040004 05 01	Black Fork	28.75	3	4Ah	4A	0	0
05040004 05 02	Upper Moxahala Creek	39.08	3	1h	4A	0	0
05040004 05 03	Middle Moxahala Creek	18.64	3	1h	4A	0	0
05040004 05 04	Lower Moxahala Creek	22.11	3	4Ah	4A	0	0
05040004 06 01	Little Salt Creek	14.73	3	4Ah	1	0	0
05040004 06 02	Headwaters Salt Creek	46.10	3	4Ah	1	0	0
05040004 06 03	Buffalo Fork	27.55	3	4Ah	1	0	0

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040004 06 04	Boggs Creek	18.21	3	4Ah	1	0	0
05040004 06 05	Manns Fork Salt Creek	19.81	3i	4Ah	1	0	0
05040004 06 06	Mouth Salt Creek	18.48	3	4Ah	1	0	0
05040004 07 01	Mans Fork	28.13	3	1h	1	0	0
05040004 07 02	Headwaters Meigs Creek	35.79	3	1h	1	0	0
05040004 07 03	Dyes Fork	45.05	3	1h	1	0	0
05040004 07 04	Fourmile Run-Meigs Creek	33.31	3	5h	1	0	4
05040004 08 01	Brush Creek	24.97	3	5h	5	0	3
05040004 08 02	Flat Run-Muskingum River	19.31	3	5h	1	0	4
05040004 08 03	Duncan Run-Muskingum River	21.36	3	5h	5	0	5
05040004 08 04	Island Run	13.52	3	5h	4n	0	4
05040004 08 05	Blue Rock Creek-Muskingum River	23.20	3	1h	4n	0	0
05040004 08 06	Oilspring Run-Muskingum River	22.01	3	1h	5	0	1
05040004 08 07	Bald Eagle Run	10.94	3	5h	1	0	4
05040004 08 08	Bell Creek-Muskingum River	25.10	3	5h	1	0	4
05040004 08 09	Olney Run-Muskingum River	22.19	3	5h	1	0	4
05040004 09 01	South West Branch Wolf Creek	22.11	3	5h	1	0	3
05040004 09 02	Headwaters South Branch Wolf Creek	40.73	3	5h	5	0	6
05040004 09 03	Plumb Run-South Branch Wolf Creek	16.75	3	5h	5	0	7
05040004 10 01	Headwaters West Branch Wolf Creek	55.48	3	5h	4n	0	3
05040004 10 02	Aldridge Run-West Branch Wolf Creek	35.07	3	5h	1	0	3
05040004 10 03	Coal Run	21.86	3	5h	1	0	1
05040004 10 04	Hayward Run-Wolf Creek	41.89	3	5h	5	0	7
05040004 11 01	Headwaters Olive Green Creek	30.52	3	5h	1	0	4
05040004 11 02	Keith Fork	15.03	3	5h	1	0	4
05040004 11 03	Little Olive Green Creek	18.12	3	5h	1	0	4
05040004 11 04	Reasoners Run-Olive Green Creek	19.41	1	5h	5	0	6
05040004 11 05	Congress Run-Muskingum River	21.18	3	1h	5	0	1
05040004 12 01	Big Run	18.24	3	1h	1	0	0
05040004 12 02	Rainbow Creek	18.81	3	5h	1	0	2
05040004 12 03	Cat Creek-Muskingum River	32.53	3	5h	1	0	4
05040004 12 04	Devol Run-Muskingum River	20.70	3	5h	4n	0	3
05040005 01 01	Headwaters Seneca Fork	29.19	3	5h	1	0	1
05040005 01 02	Beaver Creek	23.33	3	5h	5	0	4
05040005 01 03	Glady Run-Seneca Fork	41.33	3	5h	5	0	4
05040005 01 04	Depue Run-Seneca Fork	24.24	3i	1h	3	0	0
05040005 01 05	Opossum Run-Seneca Fork	32.47	3	5h	5	0	4
05040005 02 01	Yoker Creek	23.25	3	5h	1	0	3
05040005 02 02	Headwaters Collins Fork	33.92	3	5h	5	0	4

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040005 02 03	South Fork Buffalo Creek-Buffalo Creek	19.11	3	5h	5	0	6
05040005 02 04	North Fork Buffalo Creek-Buffalo Creek	30.93	3	5h	5	0	5
05040005 02 05	Crane Run-Buffalo Fork	14.04	3	5h	5	0	4
05040005 02 06	Chapman Run	19.38	3i	5h	5	0	6
05040005 02 07	Trail Run-Wills Creek	22.98	1	5h	5	1	7
05040005 03 01	Headwaters Leatherwood Creek	35.09	3	5h	5	0	7
05040005 03 02	Hawkins Run-Leatherwood Creek	56.58	3	5h	1	0	3
05040005 04 01	Brushy Fork	19.75	3	5h	1	0	3
05040005 04 02	Headwaters Salt Fork	55.75	3	5h	5	0	6
05040005 04 03	Clear Fork	15.51	3	5h	1	0	3
05040005 04 04	Rocky Fork	20.34	3	5h	1	0	3
05040005 04 05	Salt Fork Lake-Sugartree Fork	26.37	3i	5h	1	0	3
05040005 04 06	Beeham Run-Salt Fork	21.83	1	1h	5	0	1
05040005 05 01	North Crooked Creek	17.78	3	5h	1	1	5
05040005 05 02	Headwaters Crooked Creek	16.01	3	5h	5	0	6
05040005 05 03	Peters Creek-Crooked Creek	27.74	3	5h	5	0	7
05040005 05 04	Sarchet Run-Wills Creek	27.20	3i	5h	1	0	4
05040005 05 05	Indian Camp Run	18.41	3	5h	1	0	3
05040005 05 06	Headwaters Birds Run	14.35	3	5h	1	0	3
05040005 05 07	Johnson Fork-Birds Run	16.76	3	5h	5	0	5
05040005 05 08	Wolf Run-Wills Creek	26.79	1h	3	5	0	1
05040005 06 01	Bacon Run	15.70	1h	5h	5	0	4
05040005 06 02	Twomile Run-Wills Creek	24.60	1h	5h	5	0	6
05040005 06 03	White Eyes Creek	43.70	1h	5h	5	0	3
05040005 06 04	Wills Creek Dam-Wills Creek	27.14	1	1h	3	0	0
05040005 06 05	Mouth Wills Creek	11.77	1h	3	3	0	0
05040006 01 01	Otter Fork Licking River	28.27	3	5h	5	0	7
05040006 01 02	Headwaters North Fork Licking River	32.96	3	5h	5	0	7
05040006 01 03	Sycamore Creek	30.66	3	5h	1	0	3
05040006 01 04	Vance Creek-North Fork Licking River	18.93	3	5h	5	0	7
05040006 02 01	Lake Fork Licking River	35.11	3	5h	1	0	4
05040006 02 02	Clear Fork Licking River	22.07	3	5h	1	0	2
05040006 02 03	Dog Hollow Run-North Fork Licking River	24.56	3	5h	1	0	5
05040006 02 04	Dry Creek	24.60	3	5h	1	0	2
05040006 02 05	Log Pond Run-North Fork Licking River	22.96	3	5h	5	1	8
05040006 03 01	Headwaters Raccoon Creek	27.01	3	5h	5	0	4
05040006 03 02	Lobdell Creek	18.98	3	5h	5	0	6
05040006 03 03	Moots Run-Raccoon Creek	25.69	3	5h	1	0	4
05040006 03 04	Salt Run-Raccoon Creek	30.93	3	5h	1	0	3

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040006 04 01	Muddy Fork	14.01	3	5h	5	0	3
05040006 04 02	Headwaters South Fork Licking River	15.43	3	5h	1	0	3
05040006 04 03	Buckeye Lake	27.06	1	5h	5	0	8
05040006 04 04	Buckeye Lake Reservoir Feeder	17.23	3	5h	1	0	2
05040006 04 05	Town of Kirkersville-South Fork Licking River	17.16	3	5h	1	0	4
05040006 04 06	Bell Run-South Fork Licking River	25.98	3	5h	1	0	2
05040006 04 07	Ramp Creek	16.84	3	5h	1	0	4
05040006 04 08	Dutch Fork	21.76	3	5h	1	0	3
05040006 04 09	Beaver Run-South Fork Licking River	29.92	3	5h	1	0	6
05040006 05 01	Claylick Creek	20.76	5h	5h	1	0	5
05040006 05 02	Lost Run	22.98	5h	5h	1	0	3
05040006 05 03	Rocky Fork	55.52	1	5h	1	0	4
05040006 05 04	Bowling Green Run-Licking River	24.88	3	3	4n	0	0
05040006 06 01	Brushy Fork	18.32	3	5h	1	0	4
05040006 06 02	Big Run	25.08	1h	5h	3i	0	3
05040006 06 03	Dillon Lake-Licking River	47.07	1	5h	1	0	4
05040006 06 04	Timber Run-Licking River	37.26	3	5h	5	0	7
05060001 01 01	Cottonwood Ditch	19.52	3	5h	1	0	4
05060001 01 02	Headwaters Scioto River	76.32	3	5h	5	0	6
05060001 01 03	Taylor Creek	16.85	3	5h	1	0	4
05060001 01 04	Silver Creek-Scioto River	46.55	3	5h	5	0	6
05060001 02 01	Headwaters Rush Creek	60.73	3	5h	5	0	7
05060001 02 02	McDonald Creek	14.74	3	5h	5	0	5
05060001 02 03	Dudley Run-Rush Creek	29.86	5h	5h	5	0	7
05060001 03 01	Rock Fork	24.01	5h	5h	5	0	7
05060001 03 02	Headwaters Little Scioto River	47.52	3i	5h	5	0	6
05060001 03 03	City of Marion-Little Scioto River	22.16	3i	5	5	3i	7
05060001 03 04	Honey Creek-Little Scioto River	19.05	5h	5h	5	0	8
05060001 04 01	Gander Run-Scioto River	17.57	1h	5h	1	0	6
05060001 04 02	Panther Creek	23.15	5h	1h	5	0	3
05060001 04 03	Wolf Creek-Scioto River	22.47	5h	5h	4n	0	6
05060001 04 04	Wildcat Creek	22.43	5h	5h	5	0	4
05060001 04 05	Town of La Rue-Scioto River	19.84	1	5h	1	0	6
05060001 04 06	Glade Run-Scioto River	38.34	5h	5h	5	3i	12
05060001 05 01	Patton Run	15.79	3	5h	5	0	4
05060001 05 02	Davids Run-Scioto River	17.20	3	3	3	0	0
05060001 05 03	Kebler Run	14.32	3	5h	1	0	4
05060001 05 04	Fulton Creek	46.67	3	5h	5	0	5
05060001 05 05	Ottawa Creek-Scioto River	46.37	3	3	1	0	0

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060001 06 01	Upper Mill Creek	34.85	3	5h	1d	0	3
05060001 06 02	Middle Mill Creek	59.91	3	5h	5d	5	12
05060001 06 03	Blues Creek	37.06	3	1h	5d	0	1
05060001 06 04	Lower Mill Creek	47.24	1	5h	5d	0	6
05060001 07 01	Headwaters Bokes Creek	35.69	3	5h	4A	0	4
05060001 07 02	Brush Run-Bokes Creek	20.27	1	5h	4A	0	4
05060001 07 03	Smith Run-Bokes Creek	27.64	1	5h	4A	0	3
05060001 07 04	Moors Run-Scioto River	24.84	3	5h	5	0	6
05060001 08 01	Headwaters Olentangy River	49.56	1h	4Ah	4Ah	3i	1
05060001 08 02	Mud Run	20.41	5h	4Ahx	1ht	0	2
05060001 08 03	Flat Run	42.17	5h	4Ahx	1ht	0	2
05060001 08 04	Town of Caledonia-Olentangy River	21.72	5h	4Ahx	4Ah	0	2
05060001 09 01	Shaw Creek	29.90	5h	4Ahx	1ht	0	2
05060001 09 02	Headwaters Whetstone Creek	62.86	1h	4Ah	4Ah	0	0
05060001 09 03	Claypool Run-Whetstone Creek	21.63	1h	4Ahx	4Ah	0	0
05060001 10 01	Otter Creek-Olentangy River	22.86	5h	4Ahx	4Ah	0	2
05060001 10 02	Grave Creek	28.83	5h	4Ah	4A	0	2
05060001 10 03	Beaver Run-Olentangy River	24.04	1h	4Ahx	4Ah	0	0
05060001 10 04	Qu Qua Creek	16.91	5h	4Ahx	4Ah	0	2
05060001 10 05	Brandige Run-Olentangy River	29.79	1h	4Ahx	4Ch	0	0
05060001 10 06	Indian Run-Olentangy River	15.00	1h	4Ahx	1ht	0	0
05060001 10 07	Delaware Run-Olentangy River	43.89	1h	4Ahx	4A	3i	1
05060001 11 01	Deep Run-Olentangy River	48.91	1h	4Ah	4A	3i	0
05060001 11 02	Rush Run-Olentangy River	30.65	1h	4Ah	1ht	0	0
05060001 11 03	Mouth Olentangy River	32.00	1h	4Ahx	4A	0	0
05060001 12 01	Eversole Run	13.66	3i	5h	1	0	4
05060001 12 02	O'Shaughnessy Dam-Scioto River	16.72	1	5h	3	0	4
05060001 12 03	Indian Run	17.32	3	5h	5	0	4
05060001 12 04	Hayden Run-Scioto River	47.72	1	5h	5	0	5
05060001 12 05	Dry Run-Scioto River	24.64	3	5h	5	0	2
05060001 13 01	Culver Creek	13.22	3	4Ahx	4Ah	0	0
05060001 13 02	Headwaters Big Walnut Creek	55.33	3	4Ahx	4Ah	0	0
05060001 13 03	Rattlesnake Creek	22.08	3	4Ahx	4Ah	0	0
05060001 13 04	Perfect Creek-Big Walnut Creek	10.10	3	4Ahx	1ht	0	0
05060001 13 05	Little Walnut Creek	32.83	3	4Ahx	4Ah	0	0
05060001 13 06	Prairie Run-Big Walnut Creek	8.38	3	4Ah	4Ah	0	0
05060001 13 07	Duncan Run	16.79	3	4Ahx	4Ah	0	0
05060001 13 08	Hoover Reservoir-Big Walnut Creek	30.17	1	1d	3t	1	1
05060001 14 01	West Branch Alum Creek	29.47	1h	4Ah	4Ah	0	0

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060001 14 02	Headwaters Alum Creek	35.55	1h	4Ahx	4Ah	0	0
05060001 14 03	Big Run-Alum Creek	37.17	1h	1d	4Ah	1	0
05060001 14 04	Alum Creek Dam-Alum Creek	20.27	1	1d	3t	1	1
05060001 15 01	Rocky Fork Creek	30.39	3	4Ahx	5	0	1
05060001 15 02	City of Gahanna-Big Walnut Creek	15.91	3	4Ahx	4Ah	1	0
05060001 15 03	Headwaters Blacklick Creek	48.88	3	4Ahx	4Ah	0	0
05060001 15 04	Town of Brice-Blacklick Creek	15.06	3	4A	5d	0	2
05060001 15 05	Mason Run-Big Walnut Cr.	35.64	3	4Ahx	4Ah	0	0
05060001 16 01	Westerville Reservoir-Alum Creek	24.71	3	1d	4Ah	3i	0
05060001 16 02	Bliss Run-Alum Creek	52.92	3	4Ah	4A	0	0
05060001 16 03	Town of Lockbourne-Alum Creek	22.77	3	4Ahx	1ht	0	0
05060001 17 01	Pawpaw Creek	17.34	5h	4Ah	4Ah	0	2
05060001 17 02	Headwaters Walnut Creek	42.62	1h	4Ah	4Ah	0	0
05060001 17 03	Poplar Creek	17.43	5h	4Ah	4nh	0	2
05060001 17 04	Sycamore Creek	23.59	5h	4Ah	4A	0	2
05060001 17 05	Town of Carroll-Walnut Creek	37.12	1	4Ah	1ht	0	0
05060001 18 01	Georges Creek	14.25	5h	4Ah	4Ah	0	2
05060001 18 02	Tussing Ditch-Walnut Creek	22.93	5h	5h	1ht	0	6
05060001 18 03	Turkey Run	14.60	5h	4Ah	4Ah	0	2
05060001 18 04	Little Walnut Creek	30.09	5h	5h	1ht	0	6
05060001 18 05	Big Run-Walnut Creek	51.59	5	5h	4A	0	6
05060001 18 06	Mud Run-Walnut Creek	13.70	5h	5h	1ht	0	4
05060001 19 01	Headwaters Big Darby Creek	19.20	5h	4Ah	1d	0	2
05060001 19 02	Spain Creek-Big Darby Creek	63.62	1	4Ah	4A	0	0
05060001 19 03	Buck Run	29.88	5h	4Ah	1d	0	2
05060001 19 04	Sugar Run	20.48	5h	4Ah	4A	0	2
05060001 19 05	Robinson Run-Big Darby Creek	43.86	1	4Ah	1d	0	0
05060001 20 01	Headwaters Treacle Creek	19.46	5h	4Ah	1d	0	2
05060001 20 02	Proctor Run-Treacle Creek	17.43	5h	4Ah	4A	0	2
05060001 20 03	Headwaters Little Darby Creek	29.84	5h	4Ah	4A	0	2
05060001 20 04	Spring Fork	37.96	5h	4Ah	4A	0	2
05060001 20 05	Barron Creek-Little Darby Creek	37.40	1	4Ah	4A	0	0
05060001 20 06	Thomas Ditch-Little Darby Creek	36.20	1	4Ah	1d	0	0
05060001 21 01	Worthington Ditch-Big Darby Creek	58.86	1	5h	1d	0	3
05060001 21 02	Silver Ditch-Big Darby Creek	17.20	1	5h	1	0	4
05060001 22 01	Hellbranch Run	38.27	1h	5h	4A	0	3
05060001 22 02	Gay Run-Big Darby Creek	25.29	5h	5h	4n	0	6
05060001 22 03	Greenbrier Creek-Big Darby Creek	36.19	5	5h	1d	0	6
05060001 22 04	Lizard Run-Big Darby Creek	24.59	5	5h	1d	0	6

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060001 23 01	Scioto Big Run	24.64	3	5h	5	0	2
05060001 23 02	Kian Run-Scioto River	29.50	3	5h	5	0	2
05060001 23 03	Grant Run-Scioto River	43.58	3	5h	5	0	4
05060001 23 04	Grove Run-Scioto River	57.15	5h	5h	1	0	6
05060001 23 05	Dry Run	18.81	3	5h	5	0	7
05060001 23 06	Town of Circleville-Scioto River	13.69	3	3	3	0	0
05060002 01 01	Headwaters Deer Creek	17.13	3	5h	1	0	3
05060002 01 02	Richmond Ditch-Deer Creek	32.64	1	5h	4C	0	3
05060002 01 03	Glade Run	20.60	3	5h	5	0	6
05060002 01 04	Walnut Run	15.26	3	5h	5	0	6
05060002 01 05	Oak Run	26.77	3	5h	1	0	4
05060002 01 06	Turkey Run-Deer Creek	32.54	1	5h	1	0	4
05060002 02 01	South Fork Bradford Creek-Bradford Creek	30.04	3	5h	1	0	1
05060002 02 02	Sugar Run	23.02	3	5h	5	0	4
05060002 02 03	Opossum Run	19.50	3	5h	1	0	3
05060002 02 04	Town of Mount Sterling-Deer Creek	31.42	1	5h	1	0	4
05060002 02 05	Deer Creek Lake-Deer Creek	27.70	1	5h	5	0	5
05060002 02 06	Buskirk Creek	18.67	3	5h	5	0	4
05060002 02 07	Deer Creek Dam-Deer Creek	14.50	3i	5h	4C	0	2
05060002 03 01	Dry Run	20.80	3	5h	3i	0	3
05060002 03 02	Hay Run	29.10	3	5h	4n	0	3
05060002 03 03	Waugh Creek	20.43	3	5h	1	0	1
05060002 03 04	State Run-Deer Creek	31.25	3i	5h	1	0	4
05060002 04 01	Hargus Creek	19.78	5h	5h	1	0	6
05060002 04 02	Yellowbud Creek	36.58	5h	5h	5	0	9
05060002 04 03	Lick Run-Scioto River	30.30	3	5h	1	0	2
05060002 04 04	Congo Creek	16.69	5h	5h	1	0	5
05060002 04 05	Scippo Creek	35.10	5	5h	5	0	8
05060002 04 06	Blackwater Creek-Scioto River	23.94	3	5h	5	0	3
05060002 05 01	Kinnikinnick Creek	36.22	3	5h	5	0	7
05060002 05 02	Dry Run-Scioto River	33.94	3	5h	3i	0	3
05060002 05 03	Lick Run-Scioto River	26.95	5	5h	3i	0	6
05060002 06 01	Beech Fork	19.93	5h	5h	4Ah	0	6
05060002 06 02	Headwaters Salt Creek	27.86	5h	5h	4Ah	0	6
05060002 06 03	Laurel Run	54.57	5h	5h	4Ah	0	5
05060002 06 04	Pine Creek	40.46	5h	5h	4Ah	0	6
05060002 06 05	Blue Creek-Salt Creek	31.99	1h	5h	1ht	0	2
05060002 07 01	Pigeon Creek	46.23	3	5h	5h	0	6
05060002 07 02	Middle Fork Salt Creek	62.73	3	5h	4Ah	0	4

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060002 08 01	Headwaters Little Salt Creek	33.69	3	5h	4A	0	2
05060002 08 02	Buckeye Creek	19.07	3i	1h	4Ah	1	0
05060002 08 03	Horse Creek-Little Salt Creek	23.03	3i	5h	4A	1	4
05060002 08 04	Pigeon Creek	30.16	3	5h	4Ah	0	2
05060002 08 05	Sour Run-Little Salt Creek	32.59	5h	1h	1t	0	2
05060002 09 01	East Fork Queer Creek	13.85	5h	5h	1ht	0	4
05060002 09 02	Queer Creek	21.20	5	5h	4nh	0	6
05060002 09 03	Pretty Run	17.59	5h	1h	1ht	0	2
05060002 09 04	Pike Run	23.42	5h	5h	5h	0	8
05060002 09 05	Village of Eagle Mills-Salt Creek	16.91	5h	5h	1h	0	4
05060002 09 06	Poe Run-Salt Creek	39.20	5	5h	1h	0	6
05060002 10 01	Indian Creek	23.36	5h	5h	1	0	4
05060002 10 02	Dry Run	17.25	5h	5h	4n	0	3
05060002 10 03	Headwaters Walnut Creek	35.71	5h	5h	1	0	6
05060002 10 04	Lick Run-Walnut Creek	23.49	5h	5h	1	0	6
05060002 10 05	Stony Creek-Scioto River	31.10	1	1h	4n	0	0
05060002 11 01	Carrs Run	13.74	3	5h	5	0	5
05060002 11 02	Left Fork Crooked Creek	17.75	3	5h	4n	0	4
05060002 11 03	Crooked Creek	25.08	3	5h	1	0	4
05060002 11 04	Pee Pee Creek	36.24	5	1h	4n	0	2
05060002 11 05	Meadow Run-Scioto River	44.15	3	5h	1	0	2
05060002 12 01	Headwaters Sunfish Creek	36.02	3	5h	1	0	4
05060002 12 02	Headwaters Morgan Fork	21.03	1	1h	4C	0	0
05060002 12 03	Left Fork Morgan Fork-Morgan Fork	13.50	3	1h	1	0	0
05060002 12 04	Grassy Fork-Sunfish Creek	18.39	3	5h	1	0	4
05060002 12 05	Chenoweth Fork	29.85	3	5h	4n	0	4
05060002 12 06	Leeth Creek-Sunfish Creek	25.66	5	5h	1	0	5
05060002 13 01	No Name Creek	16.19	3	1h	1	0	0
05060002 13 02	Headwaters Big Beaver Creek	39.93	3	5h	1	0	3
05060002 13 03	Little Beaver Creek-Big Beaver Creek	30.34	1h	5h	5	0	6
05060002 13 04	Boswell Run-Scioto River	18.35	3	1h	3	0	0
05060002 14 01	Churn Creek	17.87	3	4Ah	5h	0	4
05060002 14 02	Mill Creek	17.23	3	4Ah	5h	0	2
05060002 14 03	Turkey Creek	16.91	3	4Ah	4nh	0	0
05060002 14 04	Turkey Run-South Fork Scioto Brush Creek	21.30	3	4Ah	4nh	0	0
05060002 14 05	Rocky Fork	22.91	3	4Ah	4nh	0	0
05060002 14 06	Beech Fork-South Fork Scioto Brush Creek	16.77	3	1h	5h	0	1
05060002 15 01	Headwaters Scioto Brush Creek	30.40	3	4Ah	5h	0	4
05060002 15 02	Rarden Creek	18.72	3	4Ah	4Ah	0	0

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060002 15 03	Jaybird Branch-Scioto Brush Creek	16.45	3	4Ah	4Ah	0	0
05060002 15 04	Dunlap Creek-Scioto Brush Creek	28.75	3	4Ah	5h	0	3
05060002 15 05	Bear Creek	19.17	3	4Ah	5h	0	3
05060002 15 06	McCullough Creek	19.82	3	4Ah	4nh	0	0
05060002 15 07	Duck Run-Scioto Brush Creek	26.85	3	4Ah	5h	0	4
05060002 16 01	Camp Creek	32.03	3	5h	1	0	4
05060002 16 02	Big Run-Scioto River	38.36	5h	1h	5	0	6
05060002 16 03	Bear Creek-Scioto River	46.78	3	5h	5	0	7
05060002 16 04	Pond Creek	26.05	3	5h	4n	0	4
05060002 16 05	Carroll Run-Scioto River	16.05	3	3	3	0	0
05060003 01 01	Headwaters Paint Creek	40.51	5h	4Ah	3i	0	2
05060003 01 02	East Fork Paint Creek	51.90	5h	4Ah	4Ah	0	2
05060003 01 03	Town of Washington Court House-Paint Creek	27.22	1h	4Ah	4Ah	3i	0
05060003 02 01	Headwaters Sugar Creek	44.20	3	4Ah	4Ah	0	0
05060003 02 02	Camp Run-Sugar Creek	37.32	3	4Ah	4Ah	0	0
05060003 03 01	Wilson Creek	21.48	3	4Ah	5h	0	1
05060003 03 02	Grassy Branch	13.13	3	1h	4Ah	0	0
05060003 03 03	West Branch Rattlesnake Creek	24.78	3	4Ah	4Ah	0	0
05060003 03 04	Headwaters Rattlesnake Creek	45.08	3	1d	4Ah	0	0
05060003 03 05	Waddle Ditch-Rattlesnake Creek	25.24	3	4Ah	4Ah	0	0
05060003 04 01	South Fork Lees Creek	19.97	3	4Ah	4Ah	0	0
05060003 04 02	Middle Fork Lees Creek	17.20	3	1h	1h	0	0
05060003 04 03	Lees Creek	39.66	3	4Ah	4Ah	0	0
05060003 04 04	Walnut Creek	14.86	3	4Ah	1h	0	0
05060003 04 05	Hardin Creek	21.28	3	1h	1h	0	0
05060003 04 06	Fall Creek	15.12	3	1h	5h	0	3
05060003 04 07	Big Branch-Rattlesnake Creek	20.48	3i	4Ah	1h	0	0
05060003 05 01	South Fork Rocky Fork	10.36	1h	3	1h	0	0
05060003 05 02	Clear Creek	45.29	1h	4Ah	5h	3i	4
05060003 05 03	Headwaters Rocky Fork	33.32	1h	1d	1h	0	0
05060003 05 04	Rocky Fork Lake-Rocky Fork	24.78	1h	3	5	0	4
05060003 05 05	Franklin Branch-Rocky Fork	30.58	1h	4Ah	4A	0	0
05060003 06 01	Indian Creek-Paint Creek	46.16	5h	4Ah	4Ah	0	2
05060003 06 02	Farmers Run-Paint Creek	31.06	5h	4Ah	4Ah	0	2
05060003 06 03	Cliff Creek-Paint Creek	17.53	1	3	3	0	0
05060003 07 01	Buckskin Creek	39.88	3	4Ah	4Ah	0	0
05060003 07 02	Upper Twin Creek	14.30	3	4Ah	1h	0	0
05060003 07 03	Lower Twin Creek	16.60	3	4Ah	3i	0	0
05060003 07 04	Sulphur Lick-Paint Creek	51.32	3	4Ah	4Ah	0	0

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060003 08 01	Thompson Creek	10.41	3	4Ah	1h	0	0
05060003 08 02	Headwaters North Fork Paint Creek	15.57	3	1h	1h	0	0
05060003 08 03	Headwaters Compton Creek	31.28	3	4Ah	1h	0	0
05060003 08 04	Mills Branch-Compton Creek	28.79	3	4Ah	1h	0	0
05060003 08 05	Mud Run-North Fork Paint Creek	34.48	1h	4Ah	1h	0	0
05060003 09 01	Herrod Creek	15.49	3	3	3	0	0
05060003 09 02	Little Creek	23.25	3	4Ah	1h	0	0
05060003 09 03	Oldtown Run-North Fork Paint Creek	43.98	3	4Ah	4Ah	0	0
05060003 09 04	Biers Run-North Fork Paint Creek	31.32	3	4Ah	1h	0	0
05060003 10 01	Black Run	9.82	3	1h	1h	0	0
05060003 10 02	Ralston Run	13.78	3	4Ah	4Ah	0	0
05060003 10 03	City of Chillicothe-Paint Creek	42.51	3	4Ah	1h	0	0
05080001 01 01	North Fork Great Miami River	21.70	1h	4Ah	1	0	0
05080001 01 02	South Fork Great Miami River	51.35	1h	4Ah	1	0	0
05080001 01 03	Indian Lake-Great Miami River	27.38	1	3	4A	0	0
05080001 02 01	Willow Creek	14.31	3	1h	4A	0	0
05080001 02 02	Headwaters Muchnippi Creek	20.78	3	4Ah	1	0	0
05080001 02 03	Little Muchnippi Creek	35.81	3	4Ah	4A	0	0
05080001 02 04	Calico Creek-Muchnippi Creek	18.21	3	1h	4A	0	0
05080001 03 01	Cherokee Mans Run	17.71	5h	3	1	0	2
05080001 03 02	Rennick Creek-Great Miami River	28.94	5h	4Ah	4A	0	2
05080001 03 03	Rum Creek	28.55	5h	4Ah	4A	0	2
05080001 03 04	Blue Jacket Creek	13.10	5h	4Ah	1	0	2
05080001 03 05	Bokengehalas Creek	27.74	5h	4Ah	4A	0	2
05080001 03 06	Brandywine Creek-Great Miami River	33.30	5h	4Ah	4A	0	2
05080001 04 01	McKees Creek	17.86	5h	4Ah	1	0	2
05080001 04 02	Lee Creek	22.68	5h	4Ah	1	0	2
05080001 04 03	Stoney Creek	22.26	1	4Ah	1	0	0
05080001 04 04	Indian Creek	15.96	5h	4Ah	3i	0	2
05080001 04 05	Plum Creek	28.62	5h	4Ah	1	0	2
05080001 04 06	Turkeyfoot Creek-Great Miami River	37.46	5h	5h	4A	0	8
05080001 05 01	Headwaters Loramie Creek	43.11	3	4Ah	5	0	1
05080001 05 02	Mile Creek	62.72	3	4Ah	4A	0	0
05080001 05 03	Lake Loramie-Loramie Creek	41.16	1	4Ah	5	0	4
05080001 06 01	Nine Mile Creek	26.14	3	4Ah	1	0	0
05080001 06 02	Painter Creek-Loramie Creek	27.14	3	4Ah	4A	0	0
05080001 06 03	Turtle Creek	35.84	3	1h	4A	0	0
05080001 06 04	Mill Creek-Loramie Creek	27.77	3	4Ah	1	0	0
05080001 07 01	Leatherwood Creek	16.94	3	5h	1	0	4

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05080001 07 02	Mosquito Creek	38.30	1	5h	4C	3i	4
05080001 07 03	Brush Creek-Great Miami River	30.19	3	5h	3i	0	4
05080001 07 04	Rush Creek	18.78	3	5h	4n	0	3
05080001 07 05	Garbry Creek-Great Miami River	43.83	1h	3	3	5	5
05080001 08 01	Spring Creek	25.47	3	1h	1	0	0
05080001 08 02	Headwaters Lost Creek	14.10	3	5h	1	0	4
05080001 08 03	East Branch Lost Creek	14.35	3	1h	1	0	0
05080001 08 04	Little Lost Creek-Lost Creek	31.74	3	1h	1	0	0
05080001 08 05	Peter's Creek-Great Miami River	52.45	3	1h	1	0	0
05080001 09 01	South Fork Stillwater River	13.93	1h	5h	4A	0	3
05080001 09 02	Headwaters Stillwater River	14.33	1h	3	4A	0	0
05080001 09 03	North Fork Stillwater River	18.92	1h	5h	4A	0	1
05080001 09 04	Boyd Creek	14.09	1h	5h	1d	0	1
05080001 09 05	Woodington Run-Stillwater River	33.86	1h	5h	1d	0	3
05080001 09 06	Town of Beamsville-Stillwater River	19.62	1h	5h	4A	0	4
05080001 10 01	Dismal Creek	8.42	3i	5h	4C	0	3
05080001 10 02	Kraut Creek	21.42	3	5h	1d	0	3
05080001 10 03	West Branch Greenville Creek	25.82	3	5h	1d	0	4
05080001 10 04	Headwaters Greenville Creek	14.31	1	5h	4n	0	3
05080001 11 01	Mud Creek	29.97	3	5h	5d	3i	7
05080001 11 02	Bridge Creek-Greenville Creek	20.27	1	5h	4n	3i	3
05080001 11 03	Dividing Branch-Greenville Creek	47.82	5	5h	1d	0	6
05080001 12 01	Indian Creek	19.92	1h	5h	4A	0	3
05080001 12 02	Swamp Creek	43.32	1h	5h	4A	0	4
05080001 12 03	Trotters Creek	18.80	1h	5h	4A	0	3
05080001 12 04	Harris Creek	17.91	1h	5h	4A	0	1
05080001 12 05	Town of Covington-Stillwater River	21.66	1	5h	4A	0	4
05080001 13 01	Little Painter Creek	12.28	3	5h	1d	0	1
05080001 13 02	Painter Creek	35.06	3	5h	4n	0	1
05080001 13 03	Canyon Run-Stillwater River	44.99	3	5h	3it	0	4
05080001 14 01	Brush Creek	23.07	3	5h	4A	0	1
05080001 14 02	Ludlow Creek	41.23	1	5h	4n	0	2
05080001 14 03	Brush Creek	16.41	3	5h	1d	0	4
05080001 14 04	Jones Run-Stillwater River	17.15	3	5h	1d	0	3
05080001 14 05	Mill Creek-Stillwater River	23.65	3	5h	4n	0	2
05080001 14 06	Town of Irvington-Stillwater River	26.23	3	5h	3it	0	4
05080001 15 01	Machochee Creek	18.95	5h	3	1	0	2
05080001 15 02	Headwaters Mad River	36.74	5h	3	1ht	0	2
05080001 15 03	Kings Creek	44.06	5h	3	4Ah	0	2

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05080001 15 04	Glady Creek-Mad River	34.79	5h	5h	4Ah	0	6
05080001 16 01	Muddy Creek	22.80	5h	3	4Ah	0	2
05080001 16 02	Dugan Run	23.48	5h	3	4Ah	0	2
05080001 16 03	Nettle Creek	27.88	5h	5h	4Ah	0	5
05080001 16 04	Anderson Creek	18.44	5h	3	1ht	0	2
05080001 16 05	Storms Creek	9.17	5h	3	1ht	0	2
05080001 16 06	Chapman Creek	24.26	5h	3	5	0	4
05080001 16 07	Bogles Run-Mad River	27.34	5h	5h	4Ah	0	6
05080001 17 01	East Fork Buck Creek	28.75	3	3	1ht	0	0
05080001 17 02	Headwaters Buck Creek	30.53	3	3	1ht	0	0
05080001 17 03	Sinking Creek	13.14	3i	3	1ht	0	0
05080001 17 04	Beaver Creek	25.77	3	3	1ht	0	0
05080001 17 05	Clarence J Brown Lake-Buck Creek	24.11	1h	3	4Ah	0	0
05080001 17 06	City of Springfield-Buck Creek	18.27	3	3	1ht	0	0
05080001 18 01	Moore Run	18.42	5h	3	4Ah	0	2
05080001 18 02	Pondy Creek-Mad River	16.74	5h	5h	4nh	0	7
05080001 18 03	Mill Creek	16.03	5h	3	1ht	0	2
05080001 18 04	Donnels Creek	26.13	5h	3	4nh	0	2
05080001 18 05	Rock Run-Mad River	20.99	5h	5h	4Ah	0	6
05080001 18 06	Jackson Creek-Mad River	30.64	5h	3	1ht	0	2
05080001 19 01	Mud Creek	22.60	5h	3	4Ah	0	2
05080001 19 02	Mud Run	26.17	5h	3	4Ah	0	2
05080001 19 03	Huffman Dam-Mad River	28.59	3	5h	3iht	0	4
05080001 19 04	City of Dayton-Mad River	22.58	3	3	4Ah	0	0
05080001 20 01	East Fork Honey Creek	13.00	3	5h	1	0	4
05080001 20 02	West Fork Honey Creek	20.91	3	5h	1	0	4
05080001 20 03	Indian Creek	25.85	3	5h	1	0	4
05080001 20 04	Pleasant Run-Honey Creek	30.40	3	5h	5	0	8
05080001 20 05	Poplar Creek-Great Miami River	54.46	5h	5h	3	0	5
05080002 01 01	North Branch Wolf Creek	23.75	5h	5h	1	0	5
05080002 01 02	Headwaters Wolf Creek	23.05	5h	5h	5	0	6
05080002 01 03	Dry Run-Wolf Creek	23.68	5	5h	1	0	6
05080002 01 04	Holes Creek	27.13	5h	5h	5	0	8
05080002 01 05	Town of Oakwood-Great Miami River	26.47	3	3	3	0	0
05080002 01 06	Opossum Creek-Great Miami River	19.01	3	1h	1	0	0
05080002 02 01	Millers Fork	24.56	5h	5h	4Ah	0	5
05080002 02 02	Headwaters Twin Creek	44.20	5h	5h	4Ah	0	5
05080002 02 03	Swamp Creek	17.52	5h	4Ah	5h	0	5
05080002 02 04	Price Creek	29.23	5h	4Ah	4Ah	0	2

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05080002 02 05	Lesley Run-Twin Creek	41.61	1h	4Ah	4Ah	0	0
05080002 03 01	Bantas Fork	34.82	5h	1t	5h	0	5
05080002 03 02	Aukerman Creek	20.85	5h	3	1h	0	2
05080002 03 03	Toms Run	25.73	5h	1h	4Ah	0	2
05080002 03 04	Town of Gratis-Twin Creek	33.01	1h	5h	1h	0	3
05080002 03 05	Little Twin Creek	22.71	5h	5h	4nh	0	5
05080002 03 06	Town of Germantown-Twin Creek	22.34	1h	1h	1h	0	0
05080002 04 01	Headwaters Bear Creek	32.37	3	5h	1	0	3
05080002 04 02	Mouth Bear Creek	21.14	3	1h	1	0	0
05080002 04 03	Clear Creek	53.01	3	5h	1	0	4
05080002 04 04	Dry Run-Great Miami River	32.47	3	3	3	0	0
05080002 05 01	Headwaters Sevenmile Creek	42.14	1h	3	1h	0	0
05080002 05 02	Paint Creek	22.79	1h	5h	1h	0	2
05080002 05 03	Beasley Run-Sevenmile Creek	27.92	1h	5h	1h	0	2
05080002 05 04	Rush Run-Sevenmile Creek	27.25	1	3	1h	0	0
05080002 05 05	Ninemile Creek-Sevenmile Creek	17.00	1h	3	1h	0	0
05080002 06 01	Headwaters Four Mile Creek	38.31	1h	1h	1h	0	0
05080002 06 02	Little Four Mile Creek	13.74	1h	5h	5h	0	7
05080002 06 03	East Fork Four Mile Creek-Four Mile Creek	15.84	1h	1h	1h	0	0
05080002 06 04	Acton Lake Dam-Four Mile Creek	41.37	1	5h	5	0	8
05080002 06 05	Cotton Run-Four Mile Creek	51.33	1h	5h	5h	0	5
05080002 07 01	Elk Creek	47.62	5h	1h	4n	0	2
05080002 07 02	Browns Run-Great Miami River	32.02	3	1h	1	0	0
05080002 07 03	Shaker Creek	21.44	5h	3	5h	0	3
05080002 07 04	Dicks Creek	27.71	5h	5h	5	0	10
05080002 07 05	Gregory Creek	29.69	5h	1h	1	0	2
05080002 07 06	Town of New Miami-Great Miami River	30.68	3i	3	3	0	0
05080002 08 02	Brandywine Creek-Indian Creek	5.79	3	3	3	0	0
05080002 08 03	Beals Run-Indian Creek	65.76	5h	5h	4nh	0	6
05080002 09 01	Pleasant Run	20.20	5h	5h	5	0	9
05080002 09 02	Banklick Creek-Great Miami River	44.08	3i	5h	5h	0	5
05080002 09 03	Paddys Run	16.30	5h	3	4nh	0	2
05080002 09 04	Dry Run-Great Miami River	28.84	3	3	5h	0	3
05080002 09 05	Taylor Creek	26.66	5h	5h	5	0	6
05080002 09 06	Jordan Creek-Great Miami River	22.74	3	3	3	0	0
05080002 09 07	Doublelick Run-Great Miami River	6.70	3	3	3	0	0
05080003 07 01	Headwaters Middle Fork East Fork Whitewater River	12.99	3	5	3x	0	1
05080003 07 02	Headwaters East Fork Whitewater River	33.04	3	5	3x	0	3
05080003 07 03	Mud Creek-Middle Fork East Fork Whitewater River	7.17	3	3	3x	0	0

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05080003 07 04	Rocky Fork-East Fork Whitewater River	6.94	3	5	3x	0	1
05080003 07 07	Short Creek-East Fork Whitewater River	0.18	3	3	3x	0	0
05080003 07 08	Elkhorn Creek	9.26	3	3	3x	0	0
05080003 08 07	Headwaters Dry Fork Whitewater River	2.29	3	5	1hx	0	1
05080003 08 08	Howard Creek-Dry Fork Whitewater River	32.62	3	5	5	0	6
05080003 08 09	Lee Creek-Dry Fork Whitewater River	21.65	3	5	5	0	7
05080003 08 10	Jameson Creek-Whitewater River	17.94	3	5h	4n	0	2
05090101 01 01	Chickamauga Creek	30.95	3	5	5	0	7
05090101 01 03	Long Run-Ohio River	14.43	3	3	3	0	0
05090101 02 01	East Branch Raccoon Creek	20.12	3	5	1d	0	1
05090101 02 02	West Branch Raccoon Creek	22.72	3	5	5	0	2
05090101 02 03	Brushy Fork	33.67	3	5	5	0	4
05090101 02 04	Twomile Run-Raccoon Creek	16.31	3	5	5	0	6
05090101 02 05	Town of Zaleski-Raccoon Creek	42.94	1h	5	5	0	7
05090101 03 01	Hewett Fork	40.57	3	5	5	0	6
05090101 03 02	Headwaters Elk Fork	43.80	3	5	5	0	5
05090101 03 03	Flat Run-Elk Fork	16.20	3	5	5	0	6
05090101 03 04	Flat Run-Raccoon Creek	54.55	3i	5	5	0	8
05090101 04 01	Headwaters Little Raccoon Creek	59.96	1h	5	5	3i	8
05090101 04 02	Dickason Run	27.22	3	5	5	0	4
05090101 04 03	Meadow Run-Little Raccoon Creek	39.36	3i	5	5	0	8
05090101 04 04	Deer Creek-Little Raccoon Creek	28.29	3i	5	5	0	4
05090101 05 01	Pierce Run	12.70	3	5	1d	0	3
05090101 05 02	Strongs Run	17.35	3	5	5	0	4
05090101 05 03	Flatlick Run-Raccoon Creek	43.17	3i	5	5	0	9
05090101 05 04	Robinson Run-Raccoon Creek	21.74	1	5	5	0	8
05090101 06 01	Indian Creek	21.83	3	5	1	0	1
05090101 06 02	Barren Creek-Raccoon Creek	22.12	3	5	3i	0	1
05090101 06 03	Mud Creek-Raccoon Creek	38.80	3	3i	1	0	0
05090101 06 04	Bullskin Creek	14.44	3	5	1	0	3
05090101 06 05	Claylick Run-Raccoon Creek	43.59	3	5	5	0	4
05090101 07 03	Swan Creek	16.75	3	5	1	0	1
05090101 07 04	Flatfoot Creek-Ohio River	11.48	3	3	3	0	0
05090101 07 06	Little Indian Guyan Creek	14.94	3	5	1	0	1
05090101 07 07	Johns Creek-Indian Guyan Creek	33.77	3	5	1	0	1
05090101 07 08	Wolf Creek-Indian Guyan Creek	28.46	3	5	5	0	3
05090101 07 09	Paddy Creek-Ohio River	33.99	3	3	5	0	4
05090101 08 01	Dirtyface Creek	13.46	3	1	1	0	0
05090101 08 02	Black Fork	49.38	3	1	5	0	2

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05090101 08 03	Headwaters Symmes Creek	56.44	3	5	4n	0	1
05090101 09 01	Sand Fork	42.42	3	5	5	0	7
05090101 09 02	Buffalo Creek	17.56	3	5	4n	0	4
05090101 09 03	Camp Creek-Symmes Creek	40.24	1	5	4n	0	6
05090101 10 01	Johns Creek	22.68	3	5	1	0	3
05090101 10 02	Long Creek	15.56	3	5	1	0	1
05090101 10 03	Pigeon Creek-Symmes Creek	18.51	1	5	1	0	3
05090101 10 04	Aaron Creek-Symmes Creek	58.34	1	5	1	0	5
05090101 10 05	McKinney Creek-Symmes Creek	22.08	3i	5	1	0	3
05090101 10 07	Buffalo Creek-Ohio River	14.87	3	5	1	0	1
05090103 01 01	Solida Creek-Ohio River	16.31	3	5h	5	0	4
05090103 01 03	Ice Creek	39.05	5	5h	5	0	9
05090103 01 04	Storms Creek	37.20	1	1h	5	0	4
05090103 01 05	Pond Run-Ohio River	16.01	3	1h	3i	0	0
05090103 01 06	Ginat Creek	13.57	3	5h	5	0	4
05090103 01 07	Grays Branch-Ohio River	8.14	3	5h	3i	0	4
05090103 02 01	Hales Creek	32.30	5h	5h	1	0	6
05090103 02 02	Headwaters Pine Creek	33.34	5h	1h	5	0	6
05090103 02 03	Little Pine Creek	29.52	5h	5h	5	0	6
05090103 02 04	Howard Run-Pine Creek	38.70	1	5h	1	0	4
05090103 02 05	Lick Run-Pine Creek	50.28	1	1h	5	0	3
05090103 05 01	Headwaters Little Scioto River	20.21	3	5h	1	0	3
05090103 05 02	Sugarcamp Creek	14.42	3	5h	1	0	1
05090103 05 03	Holland Fork	34.74	3	1h	1	0	0
05090103 05 04	McDowell Creek-Little Scioto River	38.41	1h	5h	1	0	3
05090103 06 01	Headwaters Rocky Fork	26.24	3	5h	4n	0	4
05090103 06 02	Long Run	18.06	3	5h	5	0	7
05090103 06 03	McConnel Creek-Rocky Fork	24.71	1h	5h	1	0	4
05090103 06 04	Frederick Creek	15.70	3	5h	1	0	2
05090103 06 05	Wards Run-Little Scioto River	40.42	5	1h	1	0	2
05090103 06 06	Munn Run-Ohio River	26.32	3	5h	5	0	2
05090201 02 01	Headwaters Turkey Creek	16.31	1	5	4n	0	4
05090201 02 02	Odell Creek-Turkey Creek	30.95	3	1	4n	0	0
05090201 02 03	Pond Run	12.18	3	1	1	0	0
05090201 02 04	Briery Branch-Ohio River	7.22	3	5	1	0	1
05090201 02 05	Upper Twin Creek	17.27	3	1	1	0	0
05090201 02 06	Lower Twin Creek	16.04	3	1	1	0	0
05090201 02 07	Rock Run-Ohio River	9.39	3	5	1	0	3
05090201 02 09	Stout Run	14.10	3	5	4n	0	3

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05090201 02 10	Quicks Run-Ohio River	14.57	3	5	1	0	3
05090201 03 01	Headwaters Ohio Brush Creek	25.38	3	1h	4n	0	0
05090201 03 02	Elk Run	15.14	3	5h	4n	0	2
05090201 03 03	Baker Fork	43.97	3	5h	5	0	4
05090201 03 04	Middle Fork Ohio Brush Creek	20.43	3	1h	1	0	0
05090201 03 05	Flat Run-Ohio Brush Creek	24.87	3	1h	4n	0	0
05090201 04 01	Little West Fork Ohio Brush Creek	22.57	3	1h	5	0	1
05090201 04 02	Headwaters West Fork Ohio Brush Creek	38.87	3	1h	5	0	1
05090201 04 03	Cherry Fork	33.82	3	1h	5	0	1
05090201 04 04	Georges Creek-West Fork Ohio Brush Creek	38.74	3	1h	5	0	1
05090201 05 01	Little East Fork-Ohio Brush Creek	46.89	1	1h	4n	0	0
05090201 05 02	Lick Fork	31.70	1	1h	4n	0	0
05090201 05 03	Bundle Run-Ohio Brush Creek	17.23	1	1h	1	0	0
05090201 05 04	Cedar Run-Ohio Brush Creek	26.69	3	1h	1	0	0
05090201 05 05	Beasley Fork	18.22	3	5h	1	0	4
05090201 05 06	Soldiers Run-Ohio Brush Creek	29.84	5	1h	1	0	2
05090201 06 01	Crooked Creek-Ohio River	29.67	3	5	1	0	3
05090201 06 04	Big Threemile Creek	23.63	5h	3	5	0	6
05090201 06 05	Lawrence Creek-Ohio River	14.14	3	5	1	0	4
05090201 07 01	Headwaters West Fork Eagle Creek	39.51	3	3	5	0	4
05090201 07 02	Headwaters East Fork Eagle Creek	23.68	3	5	1	0	1
05090201 07 03	Hills Fork-East Fork Eagle Creek	24.35	3	3	1	0	0
05090201 07 04	Rattlesnake Creek-West Fork Eagle Creek	19.19	3	5	1	0	1
05090201 07 05	Eagle Creek	44.81	3	5	5	0	5
05090201 08 01	Redoak Creek	19.73	3	3	5	0	3
05090201 08 02	Headwaters Straight Creek	43.97	3	5	5	5	9
05090201 08 03	Evans Run-Straight Creek	23.53	3	5	4n	0	3
05090201 08 04	Lee Creek-Ohio River	6.78	3	3	1	0	0
05090201 09 01	Headwaters East Fork Whiteoak Creek	36.39	3	4Ah	1h	0	0
05090201 09 02	Slabcamp Run-East Fork Whiteoak Creek	43.72	3	4Ah	4Ah	0	0
05090201 09 03	Little North Fork-North Fork Whiteoak Creek	37.06	3	4Ah	4Ah	0	0
05090201 09 04	Flat Run-North Fork Whiteoak Creek	30.39	3	5h	4Ah	0	2
05090201 10 01	Sterling Run	29.64	3	4Ah	4A	4A	0
05090201 10 02	Miranda Run-Whiteoak Creek	39.80	3	1h	4Ah	0	0
05090201 10 03	Big Run-Whiteoak Creek	17.84	3	5	5d	0	9
05090201 11 02	Turtle Creek-Ohio River	8.31	3	3	3	0	0
05090201 11 03	West Branch Bullskin Creek	27.58	3	3i	1	0	0
05090201 11 04	Bullskin Creek	25.49	3	5h	5	0	8
05090201 11 06	Bear Creek-Ohio River	24.29	3i	5h	1	0	3

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05090201 11 07	Little Indian Creek-Ohio River	11.46	3	1h	1	0	0
05090201 12 01	Headwaters Big Indian Creek	21.52	3	1h	4n	0	0
05090201 12 02	North Fork Indian Creek-Big Indian Creek	18.42	3	1h	1	0	0
05090201 12 03	Boat Run-Ohio River	8.88	3	1h	1	0	0
05090201 12 04	Ferguson Run-Twelvemile Creek	19.51	3	5h	4n	0	3
05090201 12 06	Tenmile Creek	13.04	3	5h	1	0	1
05090201 12 08	Ninemile Creek-Ohio River	26.47	3	5h	5	0	8
05090202 01 01	Headwaters Little Miami River	31.25	5h	5h	4A	0	5
05090202 01 02	North Fork Little Miami River	35.70	5h	5h	5d	0	9
05090202 01 03	Buffenbarger Cemetery-Little Miami River	22.06	5h	5h	4A	0	5
05090202 01 04	Yellow Springs Creek-Little Miami River	39.60	5h	5h	1d	0	8
05090202 02 01	North Fork Massies Creek	30.96	5h	5h	5	0	9
05090202 02 02	South Fork Massies Creek	20.40	5h	5h	1d	0	6
05090202 02 03	Massies Creek	34.51	5h	5h	1d	0	4
05090202 02 04	Little Beaver Creek	26.48	5h	5h	5	0	7
05090202 02 05	Beaver Creek	22.67	5h	5h	5	0	9
05090202 02 06	Shawnee Creek-Little Miami River	32.07	5h	5h	5d	0	10
05090202 03 01	Headwaters Anderson Fork	35.74	3	5h	5	0	4
05090202 03 02	Painters Run-Anderson Fork	41.82	3	5h	5	0	8
05090202 03 03	Mouth Anderson Fork	16.94	3i	5h	4n	0	3
05090202 04 01	North Branch Caesar Creek	26.72	1h	5h	4n	0	3
05090202 04 02	Upper Caesar Creek	13.57	1h	5h	4n	0	3
05090202 04 03	South Branch Caesar Creek	18.97	1h	5h	5d	0	6
05090202 04 04	Middle Caesar Creek	30.09	1	1h	4n	0	0
05090202 04 05	Flat Fork	16.80	1h	1h	5	0	1
05090202 04 06	Lower Caesar Creek	41.18	1	1h	4n	5	5
05090202 05 01	Sugar Creek	33.80	5h	5h	4n	0	5
05090202 05 02	Town of Bellbrook-Little Miami River	14.18	5h	5h	1d	0	5
05090202 05 03	Glady Run	13.57	5h	5h	5d	0	7
05090202 05 04	Newman Run-Little Miami River	57.47	5	5h	4n	0	8
05090202 06 01	Dutch Creek	14.84	1h	3	1	0	0
05090202 06 02	Headwaters Todd Fork	33.44	1h	3	1	0	0
05090202 06 03	Lytle Creek	20.41	1h	4Ah	4A	0	0
05090202 06 04	Headwaters Cowan Creek	31.51	1h	3	4A	5	5
05090202 06 05	Wilson Creek-Cowan Creek	22.08	1	1h	4n	0	0
05090202 06 06	Little Creek-Todd Fork	24.39	1h	1h	1	0	0
05090202 07 01	East Fork Todd Fork	39.64	3i	4Ah	4n	0	0
05090202 07 02	Second Creek	19.96	3	4Ah	4A	5	5
05090202 07 03	First Creek	19.50	3	3	5	0	1

Section L1. Status of Watershed Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05090202 07 04	Lick Run-Todd Fork	35.69	3	4Ah	1	0	0
05090202 08 01	Ferris Run-Little Miami River	30.17	3	3	3	0	0
05090202 08 02	Little Muddy Creek	20.58	3	3	4A	0	0
05090202 08 03	Turtle Creek	44.91	3	5h	4n	0	2
05090202 08 04	Halls Creek-Little Miami River	20.47	3	3	3	0	0
05090202 09 01	Muddy Creek	15.86	3	4Ah	5	0	2
05090202 09 02	O'Bannon Creek	59.34	3	5h	4n	0	4
05090202 09 03	Salt Run-Little Miami River	35.30	3	5h	3	0	2
05090202 10 01	Turtle Creek	18.22	1h	5h	5	0	7
05090202 10 02	Headwaters East Fork Little Miami River	30.01	1	5h	5	0	8
05090202 10 03	Headwaters Dodson Creek	16.12	1h	3	5	0	4
05090202 10 04	Anthony Run-Dodson Creek	16.26	1h	5h	5	0	7
05090202 10 05	West Fork East Fork Little Miami River	28.88	1h	5h	5	5	12
05090202 10 06	Glady Creek-East Fork Little Miami River	41.44	1h	5h	5	0	5
05090202 11 01	Solomon Run-East Fork Little Miami River	42.96	1h	5h	5	0	6
05090202 11 02	Fivemile Creek-East Fork Little Miami River	42.56	1h	5h	5	0	7
05090202 11 03	Todd Run-East Fork Little Miami River	23.27	1h	3	5	0	3
05090202 12 01	Poplar Creek	24.68	1h	3	5	0	3
05090202 12 02	Cloverlick Creek	42.32	1h	5h	5	0	5
05090202 12 03	Lucy Run-East Fork Little Miami River	32.48	1	1h	5	5	7
05090202 12 04	Backbone Creek-East Fork Little Miami River	20.80	1h	5h	5	0	7
05090202 13 01	Headwaters Stonelick Creek	24.26	1	1h	5	5	6
05090202 13 02	Brushy Fork	14.92	1h	3	5	0	3
05090202 13 03	Moores Fork-Stonelick Creek	19.37	1h	5h	5	0	3
05090202 13 04	Lick Fork-Stonelick Creek	18.31	1	5h	1	0	3
05090202 13 05	Salt Run-East Fork Little Miami River	42.49	1	5h	5	0	8
05090202 14 01	Sycamore Creek	23.35	3	5h	5d	0	5
05090202 14 02	Polk Run-Little Miami River	16.96	3	5h	5d	0	5
05090202 14 03	Horner Run-Little Miami River	21.47	3	3	3	0	0
05090202 14 04	Duck Creek	15.45	3	3	5d	0	1
05090202 14 05	Dry Run-Little Miami River	17.78	3	3	5d	0	3
05090202 14 06	Clough Creek-Little Miami River	18.70	3	3	5d	0	1
05090203 01 01	East Fork Mill Creek-Mill Creek	47.28	5h	5h	5	0	7
05090203 01 02	West Fork Mill Creek	36.21	5h	1h	5	0	3
05090203 01 03	Sharon Creek-Mill Creek	31.80	5h	5h	5	0	7
05090203 01 04	Congress Run-Mill Creek	29.96	5h	3	5	0	3
05090203 01 05	West Fork-Mill Creek	23.62	5	3	5	0	5
05090203 02 01	Town of Newport-Ohio River	7.52	3	3	3	0	0
05090203 02 02	Dry Creek-Ohio River	17.35	3	5h	5	0	5

Section L1. Status of Watershed Assessment Units Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05090203 02 03	Muddy Creek	16.59	3	5h	5	0	2
05090203 02 04	Garrison Creek-Ohio River	6.60	3	3	3	0	0
05120101 01 01	Headwaters Wabash River	31.49	3	3	5hx	0	1
05120101 01 02	Stoney Creek-Wabash River	52.02	3	3	5hx	0	1
05120101 01 03	Toti Creek-Wabash River	32.31	3	3	5hx	0	1
05120101 02 01	Chickasaw Creek	18.63	5h	4Ahx	4Ah	0	2
05120101 02 02	Headwaters Beaver Creek	20.28	5h	4Ahx	4Ah	0	2
05120101 02 03	Coldwater Creek	19.36	5h	4Ah	4Ah	0	2
05120101 02 04	Grand Lake-St Marys	54.10	5	4Ahx	4Ah	5	7
05120101 03 01	Little Beaver Creek	14.10	3	4Ahx	4Ah	0	0
05120101 03 02	Hardin Creek-Beaver Creek	19.25	3	4Ah	4Ah	0	0
05120101 03 03	Prairie Creek-Beaver Creek	24.65	3	4Ahx	4Ah	0	0
05120101 04 01	Wilson Creek-Limberlost Creek	1.42	3	3	3	0	0
05120101 05 01	Hickory Branch-Wabash River	13.00	3	3	5hx	0	1
05120103 01 01	Little Mississinewa River	0.91	3	3	5hx	0	4
05120103 01 02	Gray Branch-Mississinewa River	26.27	3	3	5hx	0	4
05120103 01 03	Jordan Creek-Mississinewa River	3.13	3	3	5hx	0	4

Section L2. Status of Large River Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100005 90 01	Maumee River Mainstem (IN border to Tiffin River)	2315	5	5h	1	5	13
04100006 90 01	Tiffin River Mainstem (Brush Creek to mouth)	777	5	5h	1	0	8
04100007 90 01	Auglaize River Mainstem (Ottawa River to mouth)	2435	5	1h	1	0	2
04100008 90 01	Blanchard River Mainstem (Dukes Run to mouth)	771	5h	3	1	3i	3
04100009 90 01	Maumee River Mainstem (Tiffin River to Beaver Creek)	6058	5	5h	5	5	15
04100009 90 02	Maumee River Mainstem (Beaver Creek to Maumee Bay)	6608	5	5h	5	5	16
04100011 90 01	Sandusky River Mainstem (Tymochtee Creek to Wolf Creek)	1073	5	4Ah	4A	3i	3
04100011 90 02	Sandusky River Mainstem (Wolf Creek to Sandusky Bay)	1420	5	4Ah	4A	5	7
04110002 90 01	Cuyahoga River Mainstem (Brandywine Cr. to mouth); including old channel	809	5	4A	4A	0	2
04110004 90 01	Grand River Mainstem (Mill Creek to mouth)	705	5	4Ah	1	0	2
05030103 90 01	Mahoning River Mainstem (Eagle Creek to Pennsylvania Border)	1075	5	5h	5	0	11
05030204 90 01	Hocking River Mainstem (Scott Creek to Margaret Creek)	877	1	5h	1	0	4
05030204 90 02	Hocking River (Margaret Creek to Ohio River)	1197	1	5h	1	0	4
05040001 90 01	Tuscarawas River Mainstem (Chippewa Creek to Sandy Creek)	586	5h	5	4A	0	8
05040001 90 02	Tuscarawas River Mainstem (Sandy Creek to Stillwater Creek)	1870	5h	5	1	0	6
05040001 90 03	Tuscarawas River Mainstem (Stillwater Creek to Muskingum River)	2596	5h	5	1	0	6
05040002 90 01	Mohican River Mainstem (entire length)	1004	5	5h	1	0	8
05040003 90 01	Walhonding River Mainstem (entire length)	2256	1	1h	4C	0	0
05040004 90 01	Muskingum River Mainstem (Tuscarawas/Walhonding confluence to Licking River)	6071	5	5h	1	0	8
05040004 90 02	Muskingum River Mainstem (Licking River to Meigs Creek)	7480	5	5h	4C	0	6
05040004 90 03	Muskingum River Mainstem (Meigs Creek to Ohio River)	8051	5	5h	1	0	6
05040005 90 01	Wills Creek Mainstem (Salt Fork to mouth); excluding Wills Creek Lake	853	1	5h	5	0	8
05040006 90 01	Licking River Mainstem (entire length); excluding Dillon Lake	779	5	5h	5	0	8
05060001 90 01	Scioto River Mainstem (L. Scioto R. to Olentangy R.); excluding O'Shaughnessy and Griggs reservoirs	1068	5	3i	5	5	9
05060001 90 02	Scioto River Mainstem (Olentangy River to Big Darby Creek)	2641	5	5h	5	0	10
05060002 90 01	Scioto River Mainstem (Big Darby Creek to Paint Creek)	3866	5	5h	1	0	6
05060002 90 02	Scioto River Mainstem (Paint Creek to Sunfish Creek)	5936	5	1h	1	0	2
05060002 90 03	Scioto River Mainstem (Sunfish Creek to Ohio River)	6517	5	3	1	0	2
05060003 90 01	Paint Creek Mainstem (Paint Creek Lake dam to mouth)	1144	5h	5h	5	0	8
05080001 90 01	Great Miami River Mainstem (Tawawa Creek to Mad River)	1853	5	5h	5	3i	10
05080001 90 02	Stillwater River Mainstem (Greenville Creek to mouth)	676	1	5h	4C	0	4
05080001 90 03	Mad River Mainstem (Donnels Creek to mouth)	657	5	5h	4A	3i	6
05080002 90 01	Great Miami River Mainstem (Mad River to Four Mile Creek)	3298	5	5h	5	0	8
05080002 90 02	Great Miami River Mainstem (Four Mile Creek to Ohio River)	5371	5	5h	5	0	11
05080003 90 01	Whitewater River Mainstem (entire length)	1474	5	5	1	0	8
05090101 90 01	Raccoon Creek Mainstem (Little Raccoon Creek to mouth)	681	1	5	1	0	5
05090202 90 01	Little Miami River Mainstem (Caesar Creek to O'Bannon Creek)	1086	5h	4Ah	1	0	2

05090202 90 02	Little Miami River Mainstem (O'Bannon Creek to Ohio River)	1757	5	4Ah	5	0	4

Section L3. Status of Lake Erie Assessment Units

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
041202000101	Lake Erie Islands Shoreline (≤3m)	4.99	5	5	5	5	14
041202000201	Lake Erie Western Basin Shoreline (≤3m)	47.88	5	5	5	5	17
041202000202	Lake Erie Sandusky Basin Shoreline (≤3m)	68.01	5	5	5	5	16
041202000203	Lake Erie Central Basin Shoreline (≤3m)	13.39	5	5	5	0	9
041202000301	Lake Erie Western Basin Open Water (>3m)	527.30	3i	5	3	5	10
041202000302	Lake Erie Sandusky Basin Open Water (>3m)	361.71	3i	3	3	5	5
041202000303	Lake Erie Central Basin Open Water (>3m)	2544.98	3i	3	3	5	5

Section L4. Section 303(d) List of Prioritized Impaired Waters

Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
041202000201	Lake Erie Western Basin Shoreline (<=3m)	47.88	5	5	5	5	17
04100009 90 02	Maumee River Mainstem (Beaver Creek to Maumee Bay)	6608	5	5h	5	5	16
041202000202	Lake Erie Sandusky Basin Shoreline (<=3m)	68.01	5	5	5	5	16
04100009 90 01	Maumee River Mainstem (Tiffin River to Beaver Creek)	6058	5	5h	5	5	15
05030103 08 06	Burgess Run-Yellow Creek	20.19	5h	5h	5	5	15
041202000101	Lake Erie Islands Shoreline (<=3m)	4.99	5	5	5	5	14
04100005 90 01	Maumee River Mainstem (IN border to Tiffin River)	2315	5	5h	1	5	13
04100007 12 06	Big Run-Flatrock Creek	48.28	5	5h	5	1	12
05040003 03 04	Delano Run-Kokosing River	32.95	5	5h	5	0	12
05060001 04 06	Glade Run-Scioto River	38.34	5h	5h	5	3i	12
05060001 06 02	Middle Mill Creek	59.91	3	5h	5d	5	12
05090202 10 05	West Fork East Fork Little Miami River	28.88	1h	5h	5	5	12
05030103 90 01	Mahoning River Mainstem (Eagle Creek to Pennsylvania Border)	1075	5	5h	5	0	11
05080002 90 02	Great Miami River Mainstem (Four Mile Creek to Ohio River)	5371	5	5h	5	0	11
04100006 03 03	Flat Run-Tiffin River	33.17	5	5h	5	3i	11
04100007 06 04	Dry Fork-Little Auglaize River	57.07	1	5h	1	5	11
04110002 02 03	Lake Rockwell-Cuyahoga River	61.33	5	5	4Ah	5	11
05060001 90 02	Scioto River Mainstem (Olentangy River to Big Darby Creek)	2641	5	5h	5	0	10
05080001 90 01	Great Miami River Mainstem (Tawawa Creek to Mad River)	1853	5	5h	5	3i	10
04100003 02 04	West Branch St Joseph River	14.76	5	5h	5	0	10
04100004 02 05	Prairie Creek-St Marys River	42.22	5	5h	5	0	10
04100004 03 03	Yankee Run-St Marys River	59.44	5	5h	5	0	10
04100006 05 02	Brush Creek	66.01	5h	5h	5	0	10
04100012 02 04	Mouth Vermilion River	28.13	5	5h	5h	1	10
04110003 01 05	Lower Ashtabula River	18.27	5	5h	5	0	10
05030103 08 05	Headwaters Yellow Creek	19.36	3	5h	5	5	10
05080002 07 04	Dicks Creek	27.71	5h	5h	5	0	10
05090202 02 06	Shawnee Creek-Little Miami River	32.07	5h	5h	5d	0	10
041202000301	Lake Erie Western Basin Open Water (>3m)	527.30	3i	5	3	5	10
05060001 90 01	Scioto River Mainstem (L. Scioto R. to Olentangy R.); excluding O'Shaughnessy and Griggs reservoirs	1068	5	3i	5	5	9
04100001 03 07	Heldman Ditch-Ottawa River	28.15	5	5h	5	0	9
04100003 03 03	Eagle Creek	35.00	5h	5h	5	0	9
04100004 01 02	Center Branch St Marys River	29.00	5h	5h	5	0	9
04100004 02 04	Twelvemile Creek	23.58	5h	5h	5	0	9
04100009 06 03	Haskins Road Ditch-Maumee River	15.73	3	5h	1	5	9
04100011 12 03	Green Creek	30.78	1	5h	4A	5	9
04110001 01 08	Baker Creek-West Branch Rocky River	26.08	5	5h	5	0	9

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04110001 02 02	Baldwin Creek-East Branch Rocky River	36.58	1	5	5	1	9
04110001 02 03	Rocky River	25.34	5	5h	5	0	9
04110002 05 04	Town of Twinsburg-Tinkers Creek	55.53	5h	5h	5	0	9
05030101 10 02	Salem Creek	15.30	5h	5h	5	0	9
05030106 03 01	Crabapple Creek	19.66	5h	5h	5	0	9
05030106 03 03	Cox Run-Wheeling Creek	39.30	5	5h	5	1	9
05040001 04 04	Muddy Fork	17.14	5h	5h	5	0	9
05040001 04 05	Reeds Run-Still Fork	19.47	5h	5h	5	0	9
05040001 04 06	Headwaters Sandy Creek	32.13	5	5h	5	0	9
05040001 06 06	Indian Run-Sandy Creek	39.78	5h	5	5	0	9
05040002 02 04	Outlet Rocky Fork	47.81	5h	5h	5	0	9
05040002 03 03	Town of Lexington-Clear Fork Mohican River	29.63	3	5h	5	0	9
05040003 06 04	Jennings Ditch-Killbuck Creek	41.59	3	5h	5	0	9
05040003 07 05	Shrimplin Creek-Killbuck Creek	47.56	3	5h	5	0	9
05060002 04 02	Yellowbud Creek	36.58	5h	5h	5	0	9
05080002 09 01	Pleasant Run	20.20	5h	5h	5	0	9
05090101 05 03	Flatlick Run-Raccoon Creek	43.17	3i	5	5	0	9
05090103 01 03	Ice Creek	39.05	5	5h	5	0	9
05090201 08 02	Headwaters Straight Creek	43.97	3	5	5	5	9
05090201 10 03	Big Run-Whiteoak Creek	17.84	3	5	5d	0	9
05090202 01 02	North Fork Little Miami River	35.70	5h	5h	5d	0	9
05090202 02 01	North Fork Massies Creek	30.96	5h	5h	5	0	9
05090202 02 05	Beaver Creek	22.67	5h	5h	5	0	9
041202000203	Lake Erie Central Basin Shoreline (<=3m)	13.39	5	5	5	0	9
04100006 90 01	Tiffin River Mainstem (Brush Creek to mouth)	777	5	5h	1	0	8
05040001 90 01	Tuscarawas River Mainstem (Chippewa Creek to Sandy Creek)	586	5h	5	4A	0	8
05040002 90 01	Mohican River Mainstem (entire length)	1004	5	5h	1	0	8
05040004 90 01	Muskingum River Mainstem (Tuscarawas/Walhonding confluence to Licking River)	6071	5	5h	1	0	8
05040005 90 01	Wills Creek Mainstem (Salt Fork to mouth); excluding Wills Creek Lake	853	1	5h	5	0	8
05040006 90 01	Licking River Mainstem (entire length); excluding Dillon Lake	779	5	5h	5	0	8
05060003 90 01	Paint Creek Mainstem (Paint Creek Lake dam to mouth)	1144	5h	5h	5	0	8
05080002 90 01	Great Miami River Mainstem (Mad River to Four Mile Creek)	3298	5	5h	5	0	8
05080003 90 01	Whitewater River Mainstem (entire length)	1474	5	5	1	0	8
04100003 03 01	Nettle Creek	21.96	1	5h	5	0	8
04100003 05 05	Willow Run-St Joseph River	12.35	5	5h	1	0	8
04100004 03 04	Duck Creek	11.68	5h	5h	5	0	8
04100007 03 06	Lima Reservoir-Ottawa River	27.36	5	4Ah	5	5	8

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04100009 03 02	Lower Bad Creek	41.46	1	5h	1	5	8
04110001 01 01	Plum Creek	12.87	5h	5h	5	0	8
04110002 01 03	Tare Creek-Cuyahoga River	22.92	5h	5	4Ah	0	8
04110002 03 05	Fish Creek-Cuyahoga River	35.41	5h	5	4A	0	8
04110002 05 01	Pond Brook	16.62	5h	5h	5	0	8
05030101 06 10	Bieler Run-Little Beaver Creek	7.36	5h	5h	1ht	0	8
05030101 10 01	Upper Cross Creek	23.29	5h	5h	5	0	8
05030202 02 05	Walker Run-West Branch Shade River	27.69	3	5h	5	0	8
05030202 09 02	Campaign Creek	46.61	3	5h	5	0	8
05040001 06 05	Armstrong Run-Sandy Creek	32.20	5	5h	1	0	8
05040001 08 05	Dog Run-Conotton Creek	35.23	3i	5	5	0	8
05040001 13 03	Boggs Fork	36.74	3i	5h	5	0	8
05040002 08 03	Big Run-Black Fork Mohican River	19.26	5	5h	4n	0	8
05040004 03 05	Blount Run-Muskingum River	45.32	3	5h	5	0	8
05040006 02 05	Log Pond Run-North Fork Licking River	22.96	3	5h	5	1	8
05040006 04 03	Buckeye Lake	27.06	1	5h	5	0	8
05060001 03 04	Honey Creek-Little Scioto River	19.05	5h	5h	5	0	8
05060002 04 05	Scippo Creek	35.10	5	5h	5	0	8
05060002 09 04	Pike Run	23.42	5h	5h	5h	0	8
05080001 04 06	Turkeyfoot Creek-Great Miami River	37.46	5h	5h	4A	0	8
05080001 20 04	Pleasant Run-Honey Creek	30.40	3	5h	5	0	8
05080002 01 04	Holes Creek	27.13	5h	5h	5	0	8
05080002 06 04	Acton Lake Dam-Four Mile Creek	41.37	1	5h	5	0	8
05090101 03 04	Flat Run-Raccoon Creek	54.55	3i	5	5	0	8
05090101 04 01	Headwaters Little Raccoon Creek	59.96	1h	5	5	3i	8
05090101 04 03	Meadow Run-Little Raccoon Creek	39.36	3i	5	5	0	8
05090101 05 04	Robinson Run-Raccoon Creek	21.74	1	5	5	0	8
05090201 11 04	Bullskin Creek	25.49	3	5h	5	0	8
05090201 12 08	Ninemile Creek-Ohio River	26.47	3	5h	5	0	8
05090202 01 04	Yellow Springs Creek-Little Miami River	39.60	5h	5h	1d	0	8
05090202 03 02	Painters Run-Anderson Fork	41.82	3	5h	5	0	8
05090202 05 04	Newman Run-Little Miami River	57.47	5	5h	4n	0	8
05090202 10 02	Headwaters East Fork Little Miami River	30.01	1	5h	5	0	8
05090202 13 05	Salt Run-East Fork Little Miami River	42.49	1	5h	5	0	8
04100011 90 02	Sandusky River Mainstem (Wolf Creek to Sandusky Bay)	1420	5	4Ah	4A	5	7
04100001 03 02	Halfway Creek	2.53	5h	5h	5	0	7
04100001 03 04	Headwaters Tenmile Creek	39.94	1h	5h	5	0	7
04100001 03 05	North Tenmile Creek	1.05	5h	5h	5	0	7

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04100001 03 06	Tenmile Creek	11.24	5h	5h	5	0	7
04100004 01 04	Kopp Creek	33.82	5h	5h	5	0	7
04100004 01 06	Fourmile Creek-St Marys River	16.50	5	5h	5	0	7
04100004 03 01	Little Black Creek	24.95	5h	5h	5	0	7
04100006 02 04	Mill Creek	31.97	3	5h	5	0	7
04100006 03 01	Bates Creek-Tiffin River	29.29	1	5h	5	1	7
04100006 04 01	Upper Lick Creek	28.00	3	5h	5	0	7
04100006 05 01	Beaver Creek	45.14	5h	5h	5	0	7
04100006 05 03	Village of Stryker-Tiffin River	25.25	5	5h	1	0	7
04100006 06 02	Mud Creek	26.60	1h	5h	5	0	7
04100007 04 03	Honey Run	13.27	5h	4Ah	4A	5	7
04100007 10 04	Lower Blue Creek	48.13	3i	5h	5	0	7
04100007 12 05	Wildcat Creek-Flatrock Creek	38.99	3	5h	5	0	7
04100012 05 03	Frink Run	29.77	3	5	4A	1	7
04100012 05 05	Unnamed Creek "C"	15.97	3	5	5d	0	7
04110001 01 02	North Branch West Branch Rocky River	25.07	5h	5h	5	0	7
04110002 01 04	Ladue Reservoir-Bridge Creek	38.79	5	1h	4Ah	5	7
04110002 03 03	Wingfoot Lake outlet-Little Cuyahoga River	30.79	5	5h	5	0	7
04110002 05 02	Headwaters Tinkers Creek	25.25	5h	5h	5	0	7
04110003 02 03	Arcola Creek	23.53	3	5h	5	0	7
04110004 01 02	Headwaters Grand River	33.21	5h	4Ah	4A	5	7
05030102 01 04	Frontal Pymatuning Reservoir	35.74	5h	5h	5	0	7
05030106 02 02	Middle Fork Short Creek	24.16	3	5h	5	0	7
05030202 02 02	Kingsbury Creek	21.45	3	5h	5	0	7
05030202 02 04	Elk Run-Middle Branch Shade River	17.57	3	5h	5	0	7
05030202 09 01	Kyger Creek	30.49	3	5h	5	0	7
05040001 01 04	Wolf Creek	39.16	5h	4A	4Ah	5	7
05040001 14 01	Skull Fork	46.37	3	5h	5	0	7
05040001 16 01	Laurel Creek	28.73	3	5h	5	0	7
05040001 16 04	Town of Uhrichsville-Stillwater Creek	29.02	3i	5h	5	0	7
05040002 01 01	Marsh Run	20.84	3	5h	5	3i	7
05040002 01 02	Headwaters Black Fork Mohican River	39.47	3	5h	5	3i	7
05040002 01 05	Shipp Creek-Black Fork Mohican River	61.62	3	5h	5	0	7
05040002 03 01	Headwaters Clear Fork Mohican River	33.78	5	1h	3i	5	7
05040002 06 05	Jerome Fork-Mohican River	35.55	3i	5h	5	0	7
05040002 08 02	Town of Perrysville-Black Fork Mohican River	17.76	5	5h	4n	0	7
05040003 01 01	Headwaters North Branch Kokosing River	45.29	1	5h	5	0	7
05040003 02 01	Headwaters Kokosing River	36.42	3	5h	5	0	7

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05040003 04 01	Little Jelloway Creek	19.55	1	5h	5	0	7
05040004 09 03	Plumb Run-South Branch Wolf Creek	16.75	3	5h	5	0	7
05040004 10 04	Hayward Run-Wolf Creek	41.89	3	5h	5	0	7
05040005 02 07	Trail Run-Wills Creek	22.98	1	5h	5	1	7
05040005 03 01	Headwaters Leatherwood Creek	35.09	3	5h	5	0	7
05040005 05 03	Peters Creek-Crooked Creek	27.74	3	5h	5	0	7
05040006 01 01	Otter Fork Licking River	28.27	3	5h	5	0	7
05040006 01 02	Headwaters North Fork Licking River	32.96	3	5h	5	0	7
05040006 01 04	Vance Creek-North Fork Licking River	18.93	3	5h	5	0	7
05040006 06 04	Timber Run-Licking River	37.26	3	5h	5	0	7
05060001 02 01	Headwaters Rush Creek	60.73	3	5h	5	0	7
05060001 02 03	Dudley Run-Rush Creek	29.86	5h	5h	5	0	7
05060001 03 01	Rock Fork	24.01	5h	5h	5	0	7
05060001 03 03	City of Marion-Little Scioto River	22.16	3i	5	5	3i	7
05060001 23 05	Dry Run	18.81	3	5h	5	0	7
05060002 05 01	Kinnikinnick Creek	36.22	3	5h	5	0	7
05060002 16 03	Bear Creek-Scioto River	46.78	3	5h	5	0	7
05080001 11 01	Mud Creek	29.97	3	5h	5d	3i	7
05080001 18 02	Pondy Creek-Mad River	16.74	5h	5h	4nh	0	7
05080002 06 02	Little Four Mile Creek	13.74	1h	5h	5h	0	7
05080003 08 09	Lee Creek-Dry Fork Whitewater River	21.65	3	5	5	0	7
05090101 01 01	Chickamauga Creek	30.95	3	5	5	0	7
05090101 02 05	Town of Zaleski-Raccoon Creek	42.94	1h	5	5	0	7
05090101 09 01	Sand Fork	42.42	3	5	5	0	7
05090103 06 02	Long Run	18.06	3	5h	5	0	7
05090202 02 04	Little Beaver Creek	26.48	5h	5h	5	0	7
05090202 05 03	Glady Run	13.57	5h	5h	5d	0	7
05090202 10 01	Turtle Creek	18.22	1h	5h	5	0	7
05090202 10 04	Anthony Run-Dodson Creek	16.26	1h	5h	5	0	7
05090202 11 02	Fivemile Creek-East Fork Little Miami River	42.56	1h	5h	5	0	7
05090202 12 03	Lucy Run-East Fork Little Miami River	32.48	1	1h	5	5	7
05090202 12 04	Backbone Creek-East Fork Little Miami River	20.80	1h	5h	5	0	7
05090203 01 01	East Fork Mill Creek-Mill Creek	47.28	5h	5h	5	0	7
05090203 01 03	Sharon Creek-Mill Creek	31.80	5h	5h	5	0	7
05120101 02 04	Grand Lake-St Marys	54.10	5	4Ahx	4Ah	5	7
05040001 90 02	Tuscarawas River Mainstem (Sandy Creek to Stillwater Creek)	1870	5h	5	1	0	6
05040001 90 03	Tuscarawas River Mainstem (Stillwater Creek to Muskingum River)	2596	5h	5	1	0	6
05040004 90 02	Muskingum River Mainstem (Licking River to Meigs Creek)	7480	5	5h	4C	0	6

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05040004 90 03	Muskingum River Mainstem (Meigs Creek to Ohio River)	8051	5	5h	1	0	6
05060002 90 01	Scioto River Mainstem (Big Darby Creek to Paint Creek)	3866	5	5h	1	0	6
05080001 90 03	Mad River Mainstem (Donnels Creek to mouth)	657	5	5h	4A	3i	6
04100001 03 01	Shantee Creek	14.60	5h	5h	5	0	6
04100001 03 03	Prairie Ditch	18.63	5h	5h	1	0	6
04100001 03 08	Sibley Creek-Ottawa River	21.58	5	5h	5	0	6
04100003 03 05	Bear Creek	22.37	5h	5h	1	0	6
04100004 01 05	Sixmile Creek	17.61	5h	5h	5	0	6
04100004 02 01	Hussey Creek	12.37	5h	5h	5	0	6
04100004 03 02	Black Creek	29.52	5h	5h	5	0	6
04100005 02 04	Gordon Creek	42.85	3	5h	5	0	6
04100005 02 06	Platter Creek	21.68	3	5h	5	0	6
04100006 02 02	Deer Creek-Bean Creek	22.49	3	5h	5	0	6
04100006 04 03	Prairie Creek	29.78	3	5h	5	0	6
04100006 06 01	Lost Creek	32.33	3	5h	5	0	6
04100007 04 02	Dug Run-Ottawa River	28.04	5h	4Ah	5	0	6
04100007 05 02	Plum Creek	39.84	5h	4Ah	5	0	6
04100007 08 02	Upper Town Creek	14.40	3	5h	5	0	6
04100007 08 04	Lower Town Creek	38.72	5	5h	1	1	6
04100007 10 01	Upper Prairie Creek	15.29	3	5h	5	0	6
04100007 12 07	Little Flatrock Creek	17.83	3	5h	5	0	6
04100009 01 03	School Creek	38.87	3	5h	5	0	6
04100009 01 04	Middle South Turkeyfoot Creek	36.24	3i	5h	5	0	6
04100009 04 02	North Turkeyfoot Creek	50.01	1	5h	5p	3i	6
04100009 05 09	Lower Beaver Creek	16.78	5	5h	1	0	6
04100010 03 01	North Branch Portage River	64.41	5	4Ah	5	0	6
04100010 06 02	Packer Creek	34.49	5h	5	4Ah	0	6
04100011 01 03	Mills Creek	42.17	3i	5h	4A	3i	6
04100011 02 04	Raccoon Creek	34.41	3i	4Ah	5	5	6
04100012 01 03	Southwest Branch Vermilion River	31.16	5h	5h	5h	0	6
04100012 02 02	East Fork Vermilion River	35.05	5h	3	5	0	6
04100012 02 03	Town of Wakeman-Vermilion River	28.91	5h	3	5h	0	6
04110001 01 03	Headwaters West Branch Rocky River	22.98	5h	5h	5	0	6
04110001 01 07	Plum Creek	17.54	5h	5h	5	0	6
04110001 07 02	Mouth Beaver Creek	25.44	3	5h	5	0	6
04110002 01 01	East Branch Reservoir-East Branch Cuyahoga River	18.58	1	5	4Ah	5	6
04110002 01 02	West Branch Cuyahoga River	35.98	5h	5h	4Ah	0	6
04110002 01 06	Sawyer Brook-Cuyahoga River	20.44	1h	5	4Ah	0	6

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04110002 02 02	Feeder Canal-Breakneck Creek	45.04	5h	5h	4Ah	1	6
04110003 01 02	West Branch Ashtabula River	27.70	5h	5h	1	0	6
04110003 01 03	Upper Ashtabula River	15.50	5h	5h	1	0	6
04110003 03 02	Headwaters Aurora Branch	37.50	3	5h	5d	0	6
04120101 06 05	Marsh Run-Conneaut Creek	36.71	3	5h	3	0	6
05030101 04 01	East Branch Middle Fork Little Beaver Creek	31.02	5h	5h	4Ah	0	6
05030101 08 02	Headwaters North Fork Yellow Creek	26.53	5h	5h	4Ah	0	6
05030101 10 04	McIntyre Creek	27.37	1h	5h	5	0	6
05030101 10 05	Lower Cross Creek	47.30	5	5h	5	0	6
05030102 03 04	Booth Run-Pymatuning Creek	33.96	1	5h	4C	0	6
05030102 06 02	Little Yankee Run	41.72	3	5h	5	0	6
05030103 08 09	Coffee Run-Mahoning River	15.60	5	5h	5h	0	6
05030106 02 07	Dry Fork-Short Creek	20.49	5	5h	1	0	6
05030106 03 04	Flat Run-Wheeling Creek	23.29	5h	5h	5	0	6
05030106 12 01	Rush Run	12.48	3	5h	5	0	6
05030202 02 03	Headwaters Middle Branch Shade River	40.09	3	5h	5	0	6
05030202 03 03	Big Run-East Branch Shade River	17.49	5h	5h	1	0	6
05040001 13 01	Spencer Creek	24.03	3	5h	5	0	6
05040002 02 03	Headwaters Rocky Fork	29.41	5h	5h	5	0	6
05040002 05 03	Lower Muddy Fork Mohican River	49.58	3	5h	5	0	6
05040002 07 02	Mohicanville Dam-Lake Fork Mohican River	24.53	3	5h	5	0	6
05040003 02 02	Mile Run-Kokosing River	38.60	3	5h	5	0	6
05040003 04 02	Jelloway Creek	54.51	3	5h	5	0	6
05040003 08 04	Big Run-Killbuck Creek	27.40	1	5h	1	0	6
05040003 09 03	Beaver Run	14.08	3	5h	5	0	6
05040003 09 04	Simmons Run	16.47	3	5h	5	0	6
05040004 09 02	Headwaters South Branch Wolf Creek	40.73	3	5h	5	0	6
05040004 11 04	Reasoners Run-Olive Green Creek	19.41	1	5h	5	0	6
05040005 02 03	South Fork Buffalo Creek-Buffalo Creek	19.11	3	5h	5	0	6
05040005 02 06	Chapman Run	19.38	3i	5h	5	0	6
05040005 04 02	Headwaters Salt Fork	55.75	3	5h	5	0	6
05040005 05 02	Headwaters Crooked Creek	16.01	3	5h	5	0	6
05040005 06 02	Twomile Run-Wills Creek	24.60	1h	5h	5	0	6
05040006 03 02	Lobdell Creek	18.98	3	5h	5	0	6
05040006 04 09	Beaver Run-South Fork Licking River	29.92	3	5h	1	0	6
05060001 01 02	Headwaters Scioto River	76.32	3	5h	5	0	6
05060001 01 04	Silver Creek-Scioto River	46.55	3	5h	5	0	6
05060001 03 02	Headwaters Little Scioto River	47.52	3i	5h	5	0	6

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05060001 04 01	Gander Run-Scioto River	17.57	1h	5h	1	0	6
05060001 04 03	Wolf Creek-Scioto River	22.47	5h	5h	4n	0	6
05060001 04 05	Town of La Rue-Scioto River	19.84	1	5h	1	0	6
05060001 06 04	Lower Mill Creek	47.24	1	5h	5d	0	6
05060001 07 04	Moors Run-Scioto River	24.84	3	5h	5	0	6
05060001 18 02	Tussing Ditch-Walnut Creek	22.93	5h	5h	1ht	0	6
05060001 18 04	Little Walnut Creek	30.09	5h	5h	1ht	0	6
05060001 18 05	Big Run-Walnut Creek	51.59	5	5h	4A	0	6
05060001 22 02	Gay Run-Big Darby Creek	25.29	5h	5h	4n	0	6
05060001 22 03	Greenbrier Creek-Big Darby Creek	36.19	5	5h	1d	0	6
05060001 22 04	Lizard Run-Big Darby Creek	24.59	5	5h	1d	0	6
05060001 23 04	Grove Run-Scioto River	57.15	5h	5h	1	0	6
05060002 01 03	Glade Run	20.60	3	5h	5	0	6
05060002 01 04	Walnut Run	15.26	3	5h	5	0	6
05060002 04 01	Hargus Creek	19.78	5h	5h	1	0	6
05060002 05 03	Lick Run-Scioto River	26.95	5	5h	3i	0	6
05060002 06 01	Beech Fork	19.93	5h	5h	4Ah	0	6
05060002 06 02	Headwaters Salt Creek	27.86	5h	5h	4Ah	0	6
05060002 06 04	Pine Creek	40.46	5h	5h	4Ah	0	6
05060002 07 01	Pigeon Creek	46.23	3	5h	5h	0	6
05060002 09 02	Queer Creek	21.20	5	5h	4nh	0	6
05060002 09 06	Poe Run-Salt Creek	39.20	5	5h	1h	0	6
05060002 10 03	Headwaters Walnut Creek	35.71	5h	5h	1	0	6
05060002 10 04	Lick Run-Walnut Creek	23.49	5h	5h	1	0	6
05060002 13 03	Little Beaver Creek-Big Beaver Creek	30.34	1h	5h	5	0	6
05060002 16 02	Big Run-Scioto River	38.36	5h	1h	5	0	6
05080001 11 03	Dividing Branch-Greenville Creek	47.82	5	5h	1d	0	6
05080001 15 04	Glady Creek-Mad River	34.79	5h	5h	4Ah	0	6
05080001 16 07	Bogles Run-Mad River	27.34	5h	5h	4Ah	0	6
05080001 18 05	Rock Run-Mad River	20.99	5h	5h	4Ah	0	6
05080002 01 02	Headwaters Wolf Creek	23.05	5h	5h	5	0	6
05080002 01 03	Dry Run-Wolf Creek	23.68	5	5h	1	0	6
05080002 08 03	Beals Run-Indian Creek	65.76	5h	5h	4nh	0	6
05080002 09 05	Taylor Creek	26.66	5h	5h	5	0	6
05080003 08 08	Howard Creek-Dry Fork Whitewater River	32.62	3	5	5	0	6
05090101 02 04	Twomile Run-Raccoon Creek	16.31	3	5	5	0	6
05090101 03 01	Hewett Fork	40.57	3	5	5	0	6
05090101 03 03	Flat Run-Elk Fork	16.20	3	5	5	0	6

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05090101 09 03	Camp Creek-Symmes Creek	40.24	1	5	4n	0	6
05090103 02 01	Hales Creek	32.30	5h	5h	1	0	6
05090103 02 02	Headwaters Pine Creek	33.34	5h	1h	5	0	6
05090103 02 03	Little Pine Creek	29.52	5h	5h	5	0	6
05090201 06 04	Big Threemile Creek	23.63	5h	3	5	0	6
05090202 02 02	South Fork Massies Creek	20.40	5h	5h	1d	0	6
05090202 04 03	South Branch Caesar Creek	18.97	1h	5h	5d	0	6
05090202 11 01	Solomon Run-East Fork Little Miami River	42.96	1h	5h	5	0	6
05090202 13 01	Headwaters Stonelick Creek	24.26	1	1h	5	5	6
05090101 90 01	Raccoon Creek Mainstem (Little Raccoon Creek to mouth)	681	1	5	1	0	5
04100003 03 02	Cogswell Cemetery-St Joseph River	9.76	5	5h	1	0	5
04100003 03 06	West Buffalo Cemetery-St Joseph River	13.72	5h	5h	1	0	5
04100003 05 01	Bluff Run-St Joseph River	23.74	5h	5h	1	0	5
04100003 05 02	Big Run	3.01	5h	5h	1	0	5
04100003 05 03	Russell Run-St Joseph River	17.98	5h	5h	1	0	5
04100004 01 01	Muddy Creek	16.46	5h	5h	1	0	5
04100005 02 08	Snooks Run-Maumee River	24.95	3	5h	5	0	5
04100007 02 03	Sims Run-Auglaize River	28.80	1	4Ahx	4Ah	5	5
04100007 03 05	Lost Creek	17.41	1	1d	4A	5	5
04100007 10 05	Town of Charloe-Auglaize River	21.95	3	5h	5	0	5
04100009 05 07	Cutoff Ditch	22.06	5	5h	1	0	5
04100010 02 02	East Branch Portage River	36.15	1	4Ah	5	3i	5
04100010 06 01	Upper Toussaint Creek	74.00	5h	5	4Ah	0	5
04100010 06 03	Lower Toussaint Creek	30.67	5	5	4Ah	0	5
04100011 12 02	Beaver Creek	29.30	3i	4Ah	4A	5	5
04100012 01 05	Indian Creek-Vermilion River	34.51	5h	3	5h	0	5
04100012 04 03	Walnut Creek-West Branch Huron River	23.69	1	4Ax	1d	5	5
04100012 06 03	Norwalk Creek	20.54	1h	4Ax	1d	5	5
04110001 06 01	French Creek	38.44	5h	4Ah	5	0	5
04110002 02 01	Potter Creek-Breakneck Creek	34.18	5h	5h	4Ah	0	5
04110003 01 01	East Branch Ashtabula River	35.32	5h	5h	4n	0	5
04110003 02 02	Wheeler Creek-Frontal Lake Erie	32.83	3	5h	5	0	5
04110003 04 02	Griswold Creek-Chagrin River	76.54	5h	4Ah	5	0	5
04110003 05 03	Euclid Creek	23.31	3	5h	5	0	5
04110004 04 03	Town of Jefferson-Mill Creek	28.17	5	4Ah	5	0	5
04120101 07 03	Town of North Kingsville-Frontal Lake Erie	23.57	3	5h	5	0	5
05030101 04 04	Lisbon Creek-Middle Fork Little Beaver Creek	19.72	5h	5h	4Ah	0	5
05030101 06 02	Honey Creek	9.82	5h	5h	4Ah	0	5

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030101 08 04	Hollow Rock Run-Yellow Creek	39.29	5	5h	4A	0	5
05030102 03 02	Sugar Creek-Pymatuning Creek	35.18	3	5h	5	0	5
05030102 06 01	Yankee Run	44.81	3	5h	5	0	5
05030103 05 03	Lower Mosquito Creek	40.92	5	5h	5	0	5
05030103 07 03	Lower Meander Creek	30.68	1	5h	5	1	5
05030106 09 01	North Fork Captina Creek	32.72	1h	5h	1	1	5
05030106 09 04	Piney Creek-Captina Creek	29.07	3i	5h	1	0	5
05030106 12 02	Salt Run-Ohio River	20.82	3	5h	5	0	5
05030201 01 01	Upper Sunfish Creek	35.10	3	1h	1	5	5
05030201 01 03	Middle Sunfish Creek	19.88	3	5h	1	0	5
05030202 03 01	Horse Cave Creek	18.40	5h	5h	1	0	5
05030202 03 02	Headwaters East Branch Shade River	37.53	5h	5h	1	0	5
05040001 06 01	Hugle Run	21.40	5h	5h	1	0	5
05040001 06 02	Pipe Run	27.71	5h	5h	4n	0	5
05040001 06 03	Black Run	16.39	5h	5h	1	0	5
05040001 06 04	Little Sandy Creek	21.15	5h	5h	1	0	5
05040001 06 07	Beal Run-Sandy Creek	22.85	5	1h	5	0	5
05040001 08 03	Thompson Run-Conotton Creek	24.96	3	5	1	0	5
05040001 15 03	Upper Little Stillwater Creek	29.72	1	1h	3	5	5
05040002 02 01	Village of Pavonia-Black Fork Mohican River	31.94	5h	1h	5	0	5
05040002 04 01	Honey Creek-Clear Fork Mohican River	24.63	3	5h	1	0	5
05040002 04 03	Slater Run-Clear Fork Mohican River	22.89	3	5h	1	0	5
05040002 07 03	Plum Run-Lake Fork Mohican River	20.90	3	5h	1	0	5
05040003 03 07	Indianfield Run-Kokosing River	23.70	1	5h	1	0	5
05040003 05 04	Cedar Run-Killbuck Creek	39.39	3	5h	1	0	5
05040003 05 05	Clear Creek-Killbuck Creek	22.60	3	5h	1	0	5
05040003 06 01	Little Apple Creek	12.83	3	5h	5	0	5
05040003 06 07	Tea Run-Killbuck Creek	18.28	3	5h	3ih	0	5
05040003 07 03	Honey Run-Killbuck Creek	15.91	3	5h	1	0	5
05040003 08 02	Headwaters Doughty Creek	32.87	3	5h	5	0	5
05040003 08 05	Bucklew Run-Killbuck Creek	32.05	1	5h	1	0	5
05040003 09 06	Headwaters Mill Creek	26.92	3	5h	5	0	5
05040003 09 07	Spoon Creek-Mill Creek	24.28	3	5h	5	0	5
05040004 04 07	Painter Creek-Jonathon Creek	60.61	3i	4Ah	4C	5	5
05040004 08 03	Duncan Run-Muskingum River	21.36	3	5h	5	0	5
05040005 02 04	North Fork Buffalo Creek-Buffalo Creek	30.93	3	5h	5	0	5
05040005 05 01	North Crooked Creek	17.78	3	5h	1	1	5
05040005 05 07	Johnson Fork-Birds Run	16.76	3	5h	5	0	5

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040006 02 03	Dog Hollow Run-North Fork Licking River	24.56	3	5h	1	0	5
05040006 05 01	Claylick Creek	20.76	5h	5h	1	0	5
05060001 02 02	McDonald Creek	14.74	3	5h	5	0	5
05060001 05 04	Fulton Creek	46.67	3	5h	5	0	5
05060001 12 04	Hayden Run-Scioto River	47.72	1	5h	5	0	5
05060002 02 05	Deer Creek Lake-Deer Creek	27.70	1	5h	5	0	5
05060002 04 04	Congo Creek	16.69	5h	5h	1	0	5
05060002 06 03	Laurel Run	54.57	5h	5h	4Ah	0	5
05060002 11 01	Carrs Run	13.74	3	5h	5	0	5
05060002 12 06	Leeth Creek-Sunfish Creek	25.66	5	5h	1	0	5
05080001 07 05	Garbry Creek-Great Miami River	43.83	1h	3	3	5	5
05080001 16 03	Nettle Creek	27.88	5h	5h	4Ah	0	5
05080001 20 05	Poplar Creek-Great Miami River	54.46	5h	5h	3	0	5
05080002 01 01	North Branch Wolf Creek	23.75	5h	5h	1	0	5
05080002 02 01	Millers Fork	24.56	5h	5h	4Ah	0	5
05080002 02 02	Headwaters Twin Creek	44.20	5h	5h	4Ah	0	5
05080002 02 03	Swamp Creek	17.52	5h	4Ah	5h	0	5
05080002 03 01	Bantas Fork	34.82	5h	1t	5h	0	5
05080002 03 05	Little Twin Creek	22.71	5h	5h	4nh	0	5
05080002 06 05	Cotton Run-Four Mile Creek	51.33	1h	5h	5h	0	5
05080002 09 02	Banklick Creek-Great Miami River	44.08	3i	5h	5h	0	5
05090101 03 02	Headwaters Elk Fork	43.80	3	5	5	0	5
05090101 10 04	Aaron Creek-Symmes Creek	58.34	1	5	1	0	5
05090201 07 05	Eagle Creek	44.81	3	5	5	0	5
05090202 01 01	Headwaters Little Miami River	31.25	5h	5h	4A	0	5
05090202 01 03	Buffenbarger Cemetery-Little Miami River	22.06	5h	5h	4A	0	5
05090202 04 06	Lower Caesar Creek	41.18	1	1h	4n	5	5
05090202 05 01	Sugar Creek	33.80	5h	5h	4n	0	5
05090202 05 02	Town of Bellbrook-Little Miami River	14.18	5h	5h	1d	0	5
05090202 06 04	Headwaters Cowan Creek	31.51	1h	3	4A	5	5
05090202 07 02	Second Creek	19.96	3	4Ah	4A	5	5
05090202 10 06	Glady Creek-East Fork Little Miami River	41.44	1h	5h	5	0	5
05090202 12 02	Cloverlick Creek	42.32	1h	5h	5	0	5
05090202 14 01	Sycamore Creek	23.35	3	5h	5d	0	5
05090202 14 02	Polk Run-Little Miami River	16.96	3	5h	5d	0	5
05090203 01 05	West Fork-Mill Creek	23.62	5	3	5	0	5
05090203 02 02	Dry Creek-Ohio River	17.35	3	5h	5	0	5
041202000302	Lake Erie Sandusky Basin Open Water (>3m)	361.71	3i	3	3	5	5

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
041202000303	Lake Erie Central Basin Open Water (>3m)	2544.98	3i	3	3	5	5
05030204 90 01	Hocking River Mainstem (Scott Creek to Margaret Creek)	877	1	5h	1	0	4
05030204 90 02	Hocking River (Margaret Creek to Ohio River)	1197	1	5h	1	0	4
05080001 90 02	Stillwater River Mainstem (Greenville Creek to mouth)	676	1	5h	4C	0	4
05090202 90 02	Little Miami River Mainstem (O'Bannon Creek to Ohio River)	1757	5	4Ah	5	0	4
04100002 03 04	Little Bear Creek-Bear Creek	6.47	3	5h	5	0	4
04100003 03 04	Village of Montpelier-St Joseph River	20.83	5h	5h	1	0	4
04100004 01 03	East Branch St Marys River	21.26	5h	5h	5	0	4
04100004 03 05	Town of Willshire-St Marys River	11.21	1	5h	1	0	4
04100005 02 03	Marie DeLarme Creek	23.09	3	5h	1	0	4
04100005 02 07	Sulphur Creek-Maumee River	18.22	3	5h	1	0	4
04100006 04 02	Middle Lick Creek	30.86	3	5h	5	0	4
04100006 06 03	Webb Run	20.39	3	5h	4n	0	4
04100007 02 04	Sixmile Creek-Auglaize River	29.90	5	5h	4Ah	0	4
04100007 06 01	Kyle Prairie Creek	19.05	3	5h	1	0	4
04100007 06 02	Long Prairie Creek-Little Auglaize River	26.19	3	5h	1	0	4
04100007 07 01	Hagerman Creek	16.15	3	5h	1	0	4
04100007 08 01	Dog Creek	57.69	5	5h	1	0	4
04100007 08 03	Maddox Creek	33.76	3	5h	1	0	4
04100007 10 03	Middle Blue Creek	19.45	3	5h	1	0	4
04100009 04 03	Dry Creek-Maumee River	27.36	3	5h	1	0	4
04100009 05 05	Brush Creek	25.11	3	5h	1	0	4
04100009 06 01	Tontogany Creek	45.30	3	5h	1	0	4
04100010 02 03	Town of Bloomdale-South Branch Portage River	53.57	3i	4Ah	5	3i	4
04100011 08 06	Lower Honey Creek	35.56	3	5h	1ht	0	4
04100011 09 03	Greasy Run-Sycamore Creek	23.99	3	5h	4Ah	0	4
04100012 04 04	Holliday Lake	13.73	3	5	4A	0	4
04100012 05 01	Mud Run	15.54	3	5	4A	0	4
04100012 05 02	Slate Run	31.01	3	5	4A	0	4
04100012 05 04	Seymour Creek	16.20	3	5	4A	0	4
04110001 01 05	City of Medina-West Branch Rocky River	26.37	1	5h	1	0	4
04110001 01 06	Cossett Creek-West Branch Rocky River	41.44	1	5h	4n	0	4
04110001 02 01	Headwaters East Branch Rocky River	40.56	1	5h	1	0	4
04110001 06 02	Black River	35.38	5	4Ah	5	0	4
04110001 07 01	Headwaters Beaver Creek	19.38	3	5h	5	0	4
04110003 01 04	Middle Ashtabula River	30.35	1h	5h	1	0	4
04110003 02 01	Indian Creek-Frontal Lake Erie	29.21	3	5h	4n	0	4

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04110003 02 04	McKinley Creek-Frontal Lake Erie	29.67	3	5h	5	0	4
04110003 03 01	Silver Creek	13.83	3	5h	1t	0	4
04110003 03 03	McFarland Creek-Aurora Branch	20.42	3	5h	4A	0	4
04110003 03 04	Beaver Creek-Chagrin River	47.48	3	5h	4A	0	4
05030101 06 06	Leslie Run-Bull Creek	19.36	5h	5h	4Ah	0	4
05030101 07 03	Upper North Fork	19.17	5h	5h	1h	0	4
05030102 03 01	Headwaters Pymatuning Creek	60.96	3	5h	4n	0	4
05030102 03 03	Stratton Creek-Pymatuning Creek	19.23	3	5h	4n	0	4
05030103 03 02	Headwaters West Branch Mahoning River	31.11	5h	4Ah	5h	0	4
05030103 03 04	Kirwin Reservoir-West Branch Mahoning River	37.29	5	4Ah	5h	1	4
05030103 05 01	Upper Mosquito Creek	25.85	3	5h	4n	0	4
05030103 06 01	Duck Creek	33.24	3	5h	5	0	4
05030103 06 02	Mud Creek	14.19	3	5h	5	0	4
05030103 07 02	Middle Meander Creek	32.34	3	5h	4n	0	4
05030103 07 05	Little Squaw Creek-Mahoning River	26.14	3	5h	4C	0	4
05030103 08 01	Headwaters Mill Creek	37.05	3	5h	5	0	4
05030103 08 02	Indian Run	14.28	3	5h	5	0	4
05030103 08 03	Andersons Run-Mill Creek	27.11	1	5h	5	0	4
05030103 08 07	Dry Run-Mahoning River	25.38	3	5h	4n	3i	4
05030106 02 03	North Fork Short Creek	22.16	3	5h	5	0	4
05030106 02 05	Perrin Run-Short Creek	26.22	3	5h	1	0	4
05030106 07 02	Upper McMahon Creek	38.11	1	5h	1	0	4
05030106 12 04	Glenns Run-Ohio River	22.15	3	5h	5	0	4
05030201 06 01	Rich Fork	22.41	3	5h	1	0	4
05030201 06 02	Cranenest Fork	26.31	3	5h	1	0	4
05030201 06 03	Wolfpen Run-Little Muskingum River	21.25	3	5h	1	0	4
05030201 06 04	Witten Fork	42.36	3	5h	1	0	4
05030201 06 05	Straight Fork-Little Muskingum River	36.70	3	5h	1	0	4
05030201 07 02	Archers Fork	18.55	3	5h	1	0	4
05030201 07 05	Eightmile Creek-Little Muskingum River	41.68	5	5h	1	0	4
05030201 09 01	Headwaters West Fork Duck Creek	74.68	1h	5h	4Ah	1	4
05030201 10 06	Mill Creek-Ohio River	26.37	3	5h	3i	0	4
05030202 01 03	Headwaters Little Hocking River	35.55	3	5h	1	0	4
05030202 01 04	West Branch Little Hocking River	39.45	3	5h	1	0	4
05030202 01 05	Little West Branch Little Hocking River-Little Hocking River	27.31	3	5h	1	0	4
05030202 03 04	Spruce Creek-Shade River	18.80	5h	5h	1	0	4
05030202 07 04	Little Leading Creek	25.51	3	5h	4A	0	4
05030204 01 02	Headwaters Rush Creek	45.54	3	5	4Ah	3i	4

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030204 10 01	Willow Creek-Hocking River	31.64	1h	5h	4Ah	0	4
05040001 02 03	Little Chippewa Creek	32.16	5h	5h	4Ah	0	4
05040001 08 01	Cold Spring Run-Indian Fork	32.86	3	5	5	0	4
05040001 13 02	Headwaters Stillwater Creek	13.58	3	5h	1	0	4
05040001 15 01	Clear Fork	24.98	3	5h	5	0	4
05040002 01 04	Whetstone Creek	17.14	3	5h	1	0	4
05040002 03 02	Cedar Fork	47.69	3	5h	1	0	4
05040002 04 02	Possum Run	15.62	3	5h	1	0	4
05040002 06 03	Katotawa Creek	13.53	3	5h	1	0	4
05040002 06 04	Oldtown Run	23.12	3	5h	1	0	4
05040002 08 05	Negro Run-Mohican River	28.64	3	5h	1	0	4
05040003 01 02	East Branch Kokosing River	31.58	1	5h	1	0	4
05040003 03 02	Armstrong Run-Kokosing River	17.06	3	5h	1	0	4
05040003 05 03	Rathburn Run-Little Killbuck Creek	20.97	3	5h	1	0	4
05040003 06 03	Shreve Creek	15.98	3	5h	5	0	4
05040003 06 06	Salt Creek	27.17	3	5h	1	0	4
05040004 04 04	Buckeye Fork	23.30	3i	1h	5	0	4
05040004 07 04	Fourmile Run-Meigs Creek	33.31	3	5h	1	0	4
05040004 08 02	Flat Run-Muskingum River	19.31	3	5h	1	0	4
05040004 08 04	Island Run	13.52	3	5h	4n	0	4
05040004 08 07	Bald Eagle Run	10.94	3	5h	1	0	4
05040004 08 08	Bell Creek-Muskingum River	25.10	3	5h	1	0	4
05040004 08 09	Olney Run-Muskingum River	22.19	3	5h	1	0	4
05040004 11 01	Headwaters Olive Green Creek	30.52	3	5h	1	0	4
05040004 11 02	Keith Fork	15.03	3	5h	1	0	4
05040004 11 03	Little Olive Green Creek	18.12	3	5h	1	0	4
05040004 12 03	Cat Creek-Muskingum River	32.53	3	5h	1	0	4
05040005 01 02	Beaver Creek	23.33	3	5h	5	0	4
05040005 01 03	Glady Run-Seneca Fork	41.33	3	5h	5	0	4
05040005 01 05	Opossum Run-Seneca Fork	32.47	3	5h	5	0	4
05040005 02 02	Headwaters Collins Fork	33.92	3	5h	5	0	4
05040005 02 05	Crane Run-Buffalo Fork	14.04	3	5h	5	0	4
05040005 05 04	Sarchet Run-Wills Creek	27.20	3i	5h	1	0	4
05040005 06 01	Bacon Run	15.70	1h	5h	5	0	4
05040006 02 01	Lake Fork Licking River	35.11	3	5h	1	0	4
05040006 03 01	Headwaters Raccoon Creek	27.01	3	5h	5	0	4
05040006 03 03	Moots Run-Raccoon Creek	25.69	3	5h	1	0	4
05040006 04 05	Town of Kirkersville-South Fork Licking River	17.16	3	5h	1	0	4

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05040006 04 07	Ramp Creek	16.84	3	5h	1	0	4
05040006 05 03	Rocky Fork	55.52	1	5h	1	0	4
05040006 06 01	Brushy Fork	18.32	3	5h	1	0	4
05040006 06 03	Dillon Lake-Licking River	47.07	1	5h	1	0	4
05060001 01 01	Cottonwood Ditch	19.52	3	5h	1	0	4
05060001 01 03	Taylor Creek	16.85	3	5h	1	0	4
05060001 04 04	Wildcat Creek	22.43	5h	5h	5	0	4
05060001 05 01	Patton Run	15.79	3	5h	5	0	4
05060001 05 03	Kebler Run	14.32	3	5h	1	0	4
05060001 07 01	Headwaters Bokes Creek	35.69	3	5h	4A	0	4
05060001 07 02	Brush Run-Bokes Creek	20.27	1	5h	4A	0	4
05060001 12 01	Eversole Run	13.66	3i	5h	1	0	4
05060001 12 02	O'Shaughnessy Dam-Scioto River	16.72	1	5h	3	0	4
05060001 12 03	Indian Run	17.32	3	5h	5	0	4
05060001 18 06	Mud Run-Walnut Creek	13.70	5h	5h	1ht	0	4
05060001 21 02	Silver Ditch-Big Darby Creek	17.20	1	5h	1	0	4
05060001 23 03	Grant Run-Scioto River	43.58	3	5h	5	0	4
05060002 01 05	Oak Run	26.77	3	5h	1	0	4
05060002 01 06	Turkey Run-Deer Creek	32.54	1	5h	1	0	4
05060002 02 02	Sugar Run	23.02	3	5h	5	0	4
05060002 02 04	Town of Mount Sterling-Deer Creek	31.42	1	5h	1	0	4
05060002 02 06	Buskirk Creek	18.67	3	5h	5	0	4
05060002 03 04	State Run-Deer Creek	31.25	3i	5h	1	0	4
05060002 07 02	Middle Fork Salt Creek	62.73	3	5h	4Ah	0	4
05060002 08 03	Horse Creek-Little Salt Creek	23.03	3i	5h	4A	1	4
05060002 09 01	East Fork Queer Creek	13.85	5h	5h	1ht	0	4
05060002 09 05	Village of Eagle Mills-Salt Creek	16.91	5h	5h	1h	0	4
05060002 10 01	Indian Creek	23.36	5h	5h	1	0	4
05060002 11 02	Left Fork Crooked Creek	17.75	3	5h	4n	0	4
05060002 11 03	Crooked Creek	25.08	3	5h	1	0	4
05060002 12 01	Headwaters Sunfish Creek	36.02	3	5h	1	0	4
05060002 12 04	Grassy Fork-Sunfish Creek	18.39	3	5h	1	0	4
05060002 12 05	Chenoweth Fork	29.85	3	5h	4n	0	4
05060002 14 01	Churn Creek	17.87	3	4Ah	5h	0	4
05060002 15 01	Headwaters Scioto Brush Creek	30.40	3	4Ah	5h	0	4
05060002 15 07	Duck Run-Scioto Brush Creek	26.85	3	4Ah	5h	0	4
05060002 16 01	Camp Creek	32.03	3	5h	1	0	4
05060002 16 04	Pond Creek	26.05	3	5h	4n	0	4

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060003 05 02	Clear Creek	45.29	1h	4Ah	5h	3i	4
05060003 05 04	Rocky Fork Lake-Rocky Fork	24.78	1h	3	5	0	4
05080001 05 03	Lake Loramie-Loramie Creek	41.16	1	4Ah	5	0	4
05080001 07 01	Leatherwood Creek	16.94	3	5h	1	0	4
05080001 07 02	Mosquito Creek	38.30	1	5h	4C	3i	4
05080001 07 03	Brush Creek-Great Miami River	30.19	3	5h	3i	0	4
05080001 08 02	Headwaters Lost Creek	14.10	3	5h	1	0	4
05080001 09 06	Town of Beamsville-Stillwater River	19.62	1h	5h	4A	0	4
05080001 10 03	West Branch Greenville Creek	25.82	3	5h	1d	0	4
05080001 12 02	Swamp Creek	43.32	1h	5h	4A	0	4
05080001 12 05	Town of Covington-Stillwater River	21.66	1	5h	4A	0	4
05080001 13 03	Canyon Run-Stillwater River	44.99	3	5h	3it	0	4
05080001 14 03	Brush Creek	16.41	3	5h	1d	0	4
05080001 14 06	Town of Irvington-Stillwater River	26.23	3	5h	3it	0	4
05080001 16 06	Chapman Creek	24.26	5h	3	5	0	4
05080001 19 03	Huffman Dam-Mad River	28.59	3	5h	3iht	0	4
05080001 20 01	East Fork Honey Creek	13.00	3	5h	1	0	4
05080001 20 02	West Fork Honey Creek	20.91	3	5h	1	0	4
05080001 20 03	Indian Creek	25.85	3	5h	1	0	4
05080002 04 03	Clear Creek	53.01	3	5h	1	0	4
05090101 02 03	Brushy Fork	33.67	3	5	5	0	4
05090101 04 02	Dickason Run	27.22	3	5	5	0	4
05090101 04 04	Deer Creek-Little Raccoon Creek	28.29	3i	5	5	0	4
05090101 05 02	Strongs Run	17.35	3	5	5	0	4
05090101 06 05	Claylick Run-Raccoon Creek	43.59	3	5	5	0	4
05090101 07 09	Paddy Creek-Ohio River	33.99	3	3	5	0	4
05090101 09 02	Buffalo Creek	17.56	3	5	4n	0	4
05090103 01 01	Solida Creek-Ohio River	16.31	3	5h	5	0	4
05090103 01 04	Storms Creek	37.20	1	1h	5	0	4
05090103 01 06	Ginat Creek	13.57	3	5h	5	0	4
05090103 01 07	Grays Branch-Ohio River	8.14	3	5h	3i	0	4
05090103 02 04	Howard Run-Pine Creek	38.70	1	5h	1	0	4
05090103 06 01	Headwaters Rocky Fork	26.24	3	5h	4n	0	4
05090103 06 03	McConnel Creek-Rocky Fork	24.71	1h	5h	1	0	4
05090201 02 01	Headwaters Turkey Creek	16.31	1	5	4n	0	4
05090201 03 03	Baker Fork	43.97	3	5h	5	0	4
05090201 05 05	Beasley Fork	18.22	3	5h	1	0	4
05090201 06 05	Lawrence Creek-Ohio River	14.14	3	5	1	0	4

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05090201 07 01	Headwaters West Fork Eagle Creek	39.51	3	3	5	0	4
05090202 02 03	Massies Creek	34.51	5h	5h	1d	0	4
05090202 03 01	Headwaters Anderson Fork	35.74	3	5h	5	0	4
05090202 09 02	O'Bannon Creek	59.34	3	5h	4n	0	4
05090202 10 03	Headwaters Dodson Creek	16.12	1h	3	5	0	4
05120103 01 01	Little Mississinewa River	0.91	3	3	5hx	0	4
05120103 01 02	Gray Branch-Mississinewa River	26.27	3	3	5hx	0	4
05120103 01 03	Jordan Creek-Mississinewa River	3.13	3	3	5hx	0	4
04100008 90 01	Blanchard River Mainstem (Dukes Run to mouth)	771	5h	3	1	3i	3
04100011 90 01	Sandusky River Mainstem (Tymochtee Creek to Wolf Creek)	1073	5	4Ah	4A	3i	3
04100003 01 06	Clear Fork-East Branch St Joseph River	24.82	1	5h	4n	0	3
04100003 04 02	Headwaters Fish Creek	7.82	3	5h	1	0	3
04100003 04 06	Cornell Ditch-Fish Creek	6.19	3i	5h	1	0	3
04100004 02 03	Blierdofer Ditch	14.57	5h	5h	1	0	3
04100004 04 01	Twentyseven Mile Creek	24.88	3	5h	1	0	3
04100006 02 05	Stag Run-Bean Creek	14.45	3	5h	1	0	3
04100006 03 02	Leatherwood Creek	17.34	5h	1h	5	0	3
04100006 04 04	Lower Lick Creek	17.39	3i	5h	1	0	3
04100006 05 04	Coon Creek-Tiffin River	30.21	3	5h	4n	0	3
04100007 10 02	Upper Blue Creek	24.79	3	5h	1	0	3
04100007 12 01	Headwaters Flatrock Creek	9.89	3	5h	1	0	3
04100007 12 08	Sixmile Creek	28.31	3	5h	1	0	3
04100007 12 09	Eagle Creek-Auglaize River	34.27	3	5h	5	3i	3
04100008 02 03	Findlay Upground Reservoirs-Blanchard River	22.50	5h	4Ah	4Ah	3i	3
04100009 01 01	West Creek	15.95	3	5h	1	0	3
04100009 01 06	Lower South Turkeyfoot Creek	13.79	3i	5h	1	0	3
04100009 02 01	Preston Run-Maumee River	17.09	3	5h	1	0	3
04100009 02 02	Benien Creek	24.03	3	5h	1	0	3
04100009 05 01	Big Creek	21.52	3	5h	1	0	3
04100009 05 02	Hammer Creek	25.09	3	5h	1	0	3
04100010 05 02	Portage River	48.86	5	4Ah	5	0	3
04100011 04 03	Headwaters Middle Sandusky River	37.44	5h	4Ah	4Ah	3i	3
04100011 08 05	Middle Honey Creek	41.31	3	5h	4Ah	3i	3
04100011 14 03	Little Muddy Creek	28.58	3	5h	4A	0	3
04100012 01 01	Clear Creek-Vermilion River	22.22	5h	3	5h	0	3
04100012 01 02	Buck Creek	20.88	5h	3	5h	0	3
04100012 01 04	New London Upground Reservoir-Vermilion River	31.05	1	3	5h	3i	3
04100012 02 01	East Branch Vermilion River	37.52	5h	3	5h	0	3

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04100012 05 06	Mouth West Branch Huron River	21.51	5	1	1d	1	3
04110001 03 01	East Fork of East Branch Black River	14.17	5h	4Ah	5d	0	3
04110001 04 02	Salt Creek-East Branch Black River	33.93	5	4Ah	4n	0	3
04110001 05 05	Plum Creek	13.81	5h	4Ah	5d	0	3
04110001 05 06	Lower West Branch Black River	39.18	5	4Ah	4A	3i	3
04110002 03 04	City of Akron-Little Cuyahoga River	19.66	5h	5h	4A	0	3
04110004 03 05	Plumb Creek-Grand River	19.24	5	4Ah	1	0	3
05030101 05 02	Headwaters West Fork Little Beaver Creek	17.82	3	5h	4Ah	0	3
05030101 06 05	Headwaters Bull Creek	18.29	5h	5h	4Ah	0	3
05030101 10 03	Middle Cross Creek	14.49	5h	5h	1	0	3
05030103 01 02	Beech Creek	31.64	3	4Ah	5h	0	3
05030103 01 03	Fish Creek-Mahoning River	56.70	5	4Ah	5h	1	3
05030103 02 03	Mill Creek	32.42	5h	4Ah	5h	0	3
05030103 02 04	Island Creek-Mahoning River	29.05	5h	4Ah	5h	3i	3
05030103 03 01	Kale Creek	25.52	5h	4Ah	5h	0	3
05030103 07 01	Upper Meander Creek	23.09	3	5h	4n	0	3
05030103 08 04	Crab Creek	21.07	3	5h	1	0	3
05030106 03 02	Headwaters Wheeling Creek	25.52	5h	1h	5	0	3
05030106 07 03	Little McMahon Creek	14.92	3	1h	5	1	3
05030106 09 03	Bend Fork	27.02	3	5h	1	0	3
05030201 07 04	Fifteen Mile Creek	20.52	3	5h	1	0	3
05030202 01 02	Mile Run-Ohio River	21.08	3	5h	1	0	3
05030202 01 06	Sandy Creek-Ohio River	18.20	3	5h	1	0	3
05030202 07 01	Headwaters Leading Creek	13.37	3	5h	4A	0	3
05030202 08 03	Oldtown Creek-Ohio River	17.78	1h	5h	1	0	3
05040001 01 05	Portage Lakes-Tuscarawas River	36.87	5	4A	5d	0	3
05040001 04 01	Conser Run	15.51	5h	5h	4n	0	3
05040001 04 02	Middle Branch Sandy Creek	15.57	5h	5h	1	0	3
05040001 04 03	Pipes Fork-Still Fork	34.81	5h	5h	1	0	3
05040001 05 02	East Branch Nimishillen Creek	46.62	5h	4Ah	5	0	3
05040001 05 03	West Branch Nimishillen Creek	46.69	5h	4Ah	5	0	3
05040001 05 04	City of Canton-Middle Branch Nimishillen Creek	26.02	5	4Ah	5h	0	3
05040001 05 05	Sherrick Run-Nimishillen Creek	22.75	5	4Ah	5h	0	3
05040001 07 07	Headwaters Lower Conotton Creek	29.50	3	5	1	0	3
05040001 14 02	Brushy Fork	70.03	1	5h	5	0	3
05040001 15 05	Lower Little Stillwater Creek	14.69	3	1h	5	0	3
05040001 16 02	Crooked Creek	18.97	3	5h	1	0	3
05040002 02 05	Charles Mill-Black Fork Mohican River	8.97	5	1h	5	0	3

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05040002 05 01	Upper Muddy Fork Mohican River	28.59	3	5h	4C	0	3
05040002 06 01	Lang Creek	34.13	3	5h	1	0	3
05040002 06 02	Orange Creek	37.52	3	5h	1	0	3
05040002 08 01	Honey Creek	17.32	3	5h	1	0	3
05040003 02 03	Granny Creek-Kokosing River	25.60	3i	5h	1	0	3
05040003 03 03	Big Run	31.06	3	5h	1	0	3
05040003 03 06	Schenck Creek	24.99	3	5h	1	0	3
05040003 05 02	Little Killbuck Creek-Killbuck Creek	33.58	3	1h	5	0	3
05040003 07 04	Black Creek	35.24	3	5h	1	0	3
05040003 08 01	Wolf Creek	26.74	3	5h	1	0	3
05040003 08 03	Bucks Run-Doughty Creek	28.14	3	5h	1	0	3
05040003 09 01	Mohawk Creek	25.58	3	5h	1	0	3
05040003 09 02	Dutch Run-Walhonding River	15.85	3	5h	1	0	3
05040003 09 05	Darling Run-Walhonding River	15.95	3	5h	4n	0	3
05040004 03 03	North Branch Symmes Creek	14.92	3	5h	1	0	3
05040004 08 01	Brush Creek	24.97	3	5h	5	0	3
05040004 09 01	South West Branch Wolf Creek	22.11	3	5h	1	0	3
05040004 10 01	Headwaters West Branch Wolf Creek	55.48	3	5h	4n	0	3
05040004 10 02	Aldridge Run-West Branch Wolf Creek	35.07	3	5h	1	0	3
05040004 12 04	Devol Run-Muskingum River	20.70	3	5h	4n	0	3
05040005 02 01	Yoker Creek	23.25	3	5h	1	0	3
05040005 03 02	Hawkins Run-Leatherwood Creek	56.58	3	5h	1	0	3
05040005 04 01	Brushy Fork	19.75	3	5h	1	0	3
05040005 04 03	Clear Fork	15.51	3	5h	1	0	3
05040005 04 04	Rocky Fork	20.34	3	5h	1	0	3
05040005 04 05	Salt Fork Lake-Sugartree Fork	26.37	3i	5h	1	0	3
05040005 05 05	Indian Camp Run	18.41	3	5h	1	0	3
05040005 05 06	Headwaters Birds Run	14.35	3	5h	1	0	3
05040005 06 03	White Eyes Creek	43.70	1h	5h	5	0	3
05040006 01 03	Sycamore Creek	30.66	3	5h	1	0	3
05040006 03 04	Salt Run-Raccoon Creek	30.93	3	5h	1	0	3
05040006 04 01	Muddy Fork	14.01	3	5h	5	0	3
05040006 04 02	Headwaters South Fork Licking River	15.43	3	5h	1	0	3
05040006 04 08	Dutch Fork	21.76	3	5h	1	0	3
05040006 05 02	Lost Run	22.98	5h	5h	1	0	3
05040006 06 02	Big Run	25.08	1h	5h	3i	0	3
05060001 04 02	Panther Creek	23.15	5h	1h	5	0	3
05060001 06 01	Upper Mill Creek	34.85	3	5h	1d	0	3

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060001 07 03	Smith Run-Bokes Creek	27.64	1	5h	4A	0	3
05060001 21 01	Worthington Ditch-Big Darby Creek	58.86	1	5h	1d	0	3
05060001 22 01	Hellbranch Run	38.27	1h	5h	4A	0	3
05060002 01 01	Headwaters Deer Creek	17.13	3	5h	1	0	3
05060002 01 02	Richmond Ditch-Deer Creek	32.64	1	5h	4C	0	3
05060002 02 03	Opossum Run	19.50	3	5h	1	0	3
05060002 03 01	Dry Run	20.80	3	5h	3i	0	3
05060002 03 02	Hay Run	29.10	3	5h	4n	0	3
05060002 04 06	Blackwater Creek-Scioto River	23.94	3	5h	5	0	3
05060002 05 02	Dry Run-Scioto River	33.94	3	5h	3i	0	3
05060002 10 02	Dry Run	17.25	5h	5h	4n	0	3
05060002 13 02	Headwaters Big Beaver Creek	39.93	3	5h	1	0	3
05060002 15 04	Dunlap Creek-Scioto Brush Creek	28.75	3	4Ah	5h	0	3
05060002 15 05	Bear Creek	19.17	3	4Ah	5h	0	3
05060003 04 06	Fall Creek	15.12	3	1h	5h	0	3
05080001 07 04	Rush Creek	18.78	3	5h	4n	0	3
05080001 09 01	South Fork Stillwater River	13.93	1h	5h	4A	0	3
05080001 09 05	Woodington Run-Stillwater River	33.86	1h	5h	1d	0	3
05080001 10 01	Dismal Creek	8.42	3i	5h	4C	0	3
05080001 10 02	Kraut Creek	21.42	3	5h	1d	0	3
05080001 10 04	Headwaters Greenville Creek	14.31	1	5h	4n	0	3
05080001 11 02	Bridge Creek-Greenville Creek	20.27	1	5h	4n	3i	3
05080001 12 01	Indian Creek	19.92	1h	5h	4A	0	3
05080001 12 03	Trotters Creek	18.80	1h	5h	4A	0	3
05080001 14 04	Jones Run-Stillwater River	17.15	3	5h	1d	0	3
05080002 03 04	Town of Gratis-Twin Creek	33.01	1h	5h	1h	0	3
05080002 04 01	Headwaters Bear Creek	32.37	3	5h	1	0	3
05080002 07 03	Shaker Creek	21.44	5h	3	5h	0	3
05080002 09 04	Dry Run-Great Miami River	28.84	3	3	5h	0	3
05080003 07 02	Headwaters East Fork Whitewater River	33.04	3	5	3x	0	3
05090101 05 01	Pierce Run	12.70	3	5	1d	0	3
05090101 06 04	Bullskin Creek	14.44	3	5	1	0	3
05090101 07 08	Wolf Creek-Indian Guyan Creek	28.46	3	5	5	0	3
05090101 10 01	Johns Creek	22.68	3	5	1	0	3
05090101 10 03	Pigeon Creek-Symmes Creek	18.51	1	5	1	0	3
05090101 10 05	McKinney Creek-Symmes Creek	22.08	3i	5	1	0	3
05090103 02 05	Lick Run-Pine Creek	50.28	1	1h	5	0	3
05090103 05 01	Headwaters Little Scioto River	20.21	3	5h	1	0	3

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05090103 05 04	McDowell Creek-Little Scioto River	38.41	1h	5h	1	0	3
05090201 02 07	Rock Run-Ohio River	9.39	3	5	1	0	3
05090201 02 09	Stout Run	14.10	3	5	4n	0	3
05090201 02 10	Quicks Run-Ohio River	14.57	3	5	1	0	3
05090201 06 01	Crooked Creek-Ohio River	29.67	3	5	1	0	3
05090201 08 01	Redoak Creek	19.73	3	3	5	0	3
05090201 08 03	Evans Run-Straight Creek	23.53	3	5	4n	0	3
05090201 11 06	Bear Creek-Ohio River	24.29	3i	5h	1	0	3
05090201 12 04	Ferguson Run-Twelvemile Creek	19.51	3	5h	4n	0	3
05090202 03 03	Mouth Anderson Fork	16.94	3i	5h	4n	0	3
05090202 04 01	North Branch Caesar Creek	26.72	1h	5h	4n	0	3
05090202 04 02	Upper Caesar Creek	13.57	1h	5h	4n	0	3
05090202 11 03	Todd Run-East Fork Little Miami River	23.27	1h	3	5	0	3
05090202 12 01	Poplar Creek	24.68	1h	3	5	0	3
05090202 13 02	Brushy Fork	14.92	1h	3	5	0	3
05090202 13 03	Moores Fork-Stonelick Creek	19.37	1h	5h	5	0	3
05090202 13 04	Lick Fork-Stonelick Creek	18.31	1	5h	1	0	3
05090202 14 05	Dry Run-Little Miami River	17.78	3	3	5d	0	3
05090203 01 02	West Fork Mill Creek	36.21	5h	1h	5	0	3
05090203 01 04	Congress Run-Mill Creek	29.96	5h	3	5	0	3
04100007 90 01	Auglaize River Mainstem (Ottawa River to mouth)	2435	5	1h	1	0	2
04110002 90 01	Cuyahoga River Mainstem (Brandywine Cr. to mouth); including old channel	809	5	4A	4A	0	2
04110004 90 01	Grand River Mainstem (Mill Creek to mouth)	705	5	4Ah	1	0	2
05060002 90 02	Scioto River Mainstem (Paint Creek to Sunfish Creek)	5936	5	1h	1	0	2
05060002 90 03	Scioto River Mainstem (Sunfish Creek to Ohio River)	6517	5	3	1	0	2
05090202 90 01	Little Miami River Mainstem (Caesar Creek to O'Bannon Creek)	1086	5h	4Ah	1	0	2
04100003 05 06	Sol Shank Ditch-St Joseph River	1.23	5h	3	3	0	2
04100004 02 02	Eightmile Creek	22.45	5h	1h	4C	0	2
04100005 02 01	Zuber Cutoff	29.84	3	5h	5	0	2
04100006 06 04	Buckskin Creek-Tiffin River	20.96	5h	1h	4n	0	2
04100007 01 01	Headwaters Auglaize River	42.40	5h	4Ahx	1ht	0	2
04100007 01 02	Blackhoof Creek	16.30	5h	4Ahx	4Ah	0	2
04100007 01 03	Wrestle Creek-Auglaize River	29.88	5h	4Ahx	4Ah	0	2
04100007 01 04	Pusheta Creek	34.65	5h	4Ahx	1ht	0	2
04100007 02 01	Two Mile Creek	31.72	5h	4Ahx	4Ah	0	2
04100007 03 01	Upper Hog Creek	21.68	5h	3	1	0	2
04100007 03 02	Middle Hog Creek	30.44	5h	4Ah	1	0	2
04100007 03 03	Little Hog Creek	22.23	5h	4Ah	4A	0	2

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04100007 03 04	Lower Hog Creek	16.11	5h	4Ah	4A	0	2
04100007 04 01	Little Ottawa River	16.42	5h	4Ah	4A	0	2
04100007 04 04	Pike Run	13.24	5h	4Ah	1	0	2
04100007 04 05	Leatherwood Ditch	13.46	5h	4Ah	1	0	2
04100007 04 06	Beaver Run-Ottawa River	20.84	5h	4Ah	1	0	2
04100007 05 01	Sugar Creek	64.14	5h	4Ah	1	0	2
04100007 05 03	Village of Kalida-Ottawa River	20.58	5h	4Ah	1	0	2
04100007 06 03	Wolf Ditch-Little Auglaize River	21.20	1	5h	1	0	2
04100007 07 02	West Branch Prairie Creek	50.54	1	5h	1	0	2
04100007 09 01	Upper Jennings Creek	26.99	5h	4Ahx	1ht	0	2
04100007 09 02	West Jennings Creek	13.95	5h	4Ahx	1ht	0	2
04100007 09 03	Lower Jennings Creek	28.13	5h	4Ah	4Ah	0	2
04100007 09 06	Prairie Creek	13.80	5h	4Ahx	4Ah	0	2
04100008 01 01	Cessna Creek	23.21	5h	4Ah	4Ah	0	2
04100008 01 02	Headwaters Blanchard River	19.66	5h	4Ah	4Ah	0	2
04100008 01 03	The Outlet-Blanchard River	34.10	5h	4Ah	4Ah	0	2
04100008 01 04	Potato Run	27.85	5h	4Ah	4Ah	0	2
04100008 01 05	Ripley Run-Blanchard River	36.94	5h	4Ah	4Ah	0	2
04100008 02 01	Brights Ditch	28.45	5h	4Ah	3i	0	2
04100008 02 02	The Outlet	38.36	5h	4Ah	1h	0	2
04100008 02 04	Lye Creek	27.56	5h	4Ah	4A	0	2
04100008 02 05	City of Findlay Riverside Park-Blanchard River	16.22	5	4Ah	4Ah	3i	2
04100008 03 01	Upper Eagle Creek	26.37	5h	4Ah	4Ah	0	2
04100008 03 02	Lower Eagle Creek	34.01	5h	4Ah	4Ah	0	2
04100008 03 03	Aurand Run	18.03	5h	4Ah	1h	0	2
04100008 03 04	Howard Run-Blanchard River	36.28	5h	4Ah	4Ah	0	2
04100008 05 01	Tiderishi Creek	19.17	5h	4Ah	4Ah	0	2
04100008 05 02	Ottawa Creek	44.92	5h	4Ah	4Ah	0	2
04100008 05 03	Moffitt Ditch	13.54	5h	4Ah	4Ah	0	2
04100008 05 04	Dukes Run	15.02	5h	4Ah	4Ah	0	2
04100008 05 05	Dutch Run	14.76	5h	4Ah	1h	0	2
04100009 05 04	Upper Yellow Creek	34.63	3	5h	1	0	2
04100009 08 04	Heilman Ditch-Swan Creek	36.88	5	4A	4A	0	2
04100010 02 04	Rhodes Ditch-South Branch Portage River	20.66	5	4Ah	1	0	2
04100010 03 02	Town of Pemberville-Portage River	18.06	5h	4Ah	1	0	2
04100010 04 01	Sugar Creek	59.39	5h	4Ah	4A	0	2
04100010 04 02	Larcarpe Creek Outlet #4-Portage River	27.89	5h	4Ah	4A	0	2
04100010 05 01	Little Portage River	32.63	5h	4Ah	4A	0	2

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04100011 04 01	Headwaters Paramour Creek-Sandusky River	27.95	5h	4Ah	4Ah	0	2
04100011 04 02	Loss Creek-Sandusky River	24.26	5h	4Ahx	4A	0	2
04100011 04 04	Grass Run	24.52	5h	4Ahx	4Ah	0	2
04100011 04 05	Headwaters Lower Sandusky River	24.07	5h	4Ahx	4Ah	0	2
04100011 06 04	Spring Run	29.94	3	5h	4Ah	0	2
04100011 06 05	Mouth Tymochtee Creek	26.11	1h	5h	4Ah	0	2
04100011 07 02	Town of Upper Sandusky-Sandusky River	29.07	5h	4Ah	4Ah	3i	2
04100011 07 03	Negro Run	13.66	5h	4Ahx	1ht	0	2
04100011 07 04	Cranberry Run-Sandusky River	21.38	5h	4Ahx	4Ah	0	2
04100011 07 05	Sugar Run-Sandusky River	18.69	5h	4Ahx	4Ah	0	2
04100011 14 04	Town of Lindsey-Muddy Creek	24.12	5	4Ah	4A	0	2
04100012 03 04	Old Woman Creek	26.49	3	5h	4Ah	0	2
04100012 06 04	Mouth East Branch Huron River	15.29	5	4Ax	1d	1	2
04100012 06 06	Huron River-Frontal Lake Erie	44.81	5	1t	1d	0	2
04110001 01 04	Mallet Creek	18.04	5h	1h	1	0	2
04110001 02 04	Cahoon Creek-Frontal Lake Erie	38.43	3	5h	5	0	2
04110001 03 02	Headwaters West Fork East Branch Black River	43.41	5h	4Ah	4n	0	2
04110001 04 03	Willow Creek	22.58	5h	4Ah	4A	0	2
04110001 04 04	Jackson Ditch-East Branch Black River	33.63	5	4Ah	4C	0	2
04110001 05 01	Charlemont Creek	26.08	1h	4Ah	5d	1	2
04110001 05 02	Upper West Branch Black River	40.13	5h	4Ah	4A	0	2
04110001 05 04	Middle West Branch Black River	25.68	5h	4Ah	4A	0	2
04110001 07 03	Quarry Creek-Frontal Lake Erie	25.59	3	5h	5	0	2
04110002 01 05	Black Brook	12.72	5h	3	1ht	0	2
04110002 03 01	Plum Creek	12.97	5h	3i	1ht	0	2
04110002 04 02	Yellow Creek	31.21	5h	4Ah	4A	0	2
04110002 04 03	Furnace Run	20.30	5h	4Ah	4A	0	2
04110002 04 04	Brandywine Creek	27.06	5h	4Ahx	4Ah	0	2
04110002 04 05	Boston Run-Cuyahoga River	46.44	5	4Ax	4A	0	2
04110002 05 03	Headwaters Chippewa Creek	17.82	5h	3	4Ah	0	2
04110003 05 01	Marsh Creek-Frontal Lake Erie	28.33	3	5h	5	0	2
04110003 05 04	Doan Brook-Frontal Lake Erie	45.29	3	5h	5	0	2
04110004 01 01	Dead Branch	24.17	5h	4Ah	3i	0	2
04110004 01 03	Baughman Creek	18.44	5h	4Ah	4n	0	2
04110004 01 06	Swine Creek	31.00	5h	4Ah	1	0	2
04110004 02 01	Upper Rock Creek	26.02	5h	4Ah	3i	0	2
04110004 02 03	Lower Rock Creek	23.56	5h	1d	4A	0	2
04110004 03 01	Phelps Creek	29.36	5h	4Ah	4n	0	2

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
04110004 03 02	Hoskins Creek	26.87	5h	4Ah	4A	0	2
04110004 03 03	Mill Creek-Grand River	35.81	5h	4Ah	4A	0	2
04110004 03 04	Mud Creek	21.07	5h	4Ah	4A	0	2
04110004 05 01	Three Brothers Creek-Grand River	21.71	5h	4Ah	4n	0	2
04110004 05 02	Bronson Creek-Grand River	36.11	5	4Ah	4n	0	2
04120101 07 02	Turkey Creek-Frontal Lake Erie	1.32	3	3	5	0	2
05030101 04 02	Headwaters Middle Fork Little Beaver Creek	41.42	5h	3	4Ah	0	2
05030101 04 03	Stone Mill Run-Middle Fork Little Beaver Creek	31.65	5h	3	4Ah	3i	2
05030101 04 05	Elk Run-Middle Fork Little Beaver Creek	24.72	5h	3	4Ah	0	2
05030101 06 01	Longs Run	14.81	5h	3	4Ah	0	2
05030101 06 03	Headwaters North Fork Little Beaver Creek	20.07	5h	3	1ht	0	2
05030101 06 04	Little Bull Creek	17.45	5h	3	1ht	0	2
05030101 06 07	Dilworth Run-North Fork Little Beaver Creek	3.02	5h	3	1ht	0	2
05030101 06 08	Brush Run-North Fork Little Beaver Creek	12.11	5h	3	1ht	0	2
05030101 06 09	Rough Run-Little Beaver Creek	18.11	5h	3	1ht	0	2
05030101 07 01	Headwaters Yellow Creek	31.99	5h	4Ah	4Ah	0	2
05030101 07 02	Elkhorn Creek	33.56	5h	4Ah	1h	0	2
05030101 07 04	Long Run-Yellow Creek	34.23	5	4Ah	4nh	0	2
05030101 08 01	Town Fork	25.99	1	5h	4Ah	0	2
05030101 08 03	Salt Run-North Fork Yellow Creek	28.73	5h	4Ah	4Ah	0	2
05030103 02 01	Deer Creek	37.56	1	4Ah	4Ah	1	2
05030103 02 02	Willow Creek	20.02	5h	4Ah	4Ah	0	2
05030103 03 03	Barrel Run	12.43	5h	4Ah	4Ah	0	2
05030103 03 06	Charley Run Creek-Mahoning River	33.16	5	4Ah	4Ah	1	2
05030103 04 01	Headwaters Eagle Creek	20.79	5h	4Ah	4nh	0	2
05030103 04 02	South Fork Eagle Creek	26.18	5h	4Ah	1h	0	2
05030103 04 03	Camp Creek-Eagle Creek	26.30	5h	4Ah	4Ah	0	2
05030103 04 04	Tinkers Creek	16.48	5h	4Ah	4Ah	0	2
05030103 05 02	Middle Mosquito Creek	71.50	1	5h	1	1	2
05030103 06 03	City of Warren-Mahoning River	40.38	3	5h	5	0	2
05030106 07 04	Lower McMahon Creek	25.77	5	1h	1	0	2
05030106 09 02	South Fork Captina Creek	35.99	1	5h	4n	1	2
05030106 09 05	Pea Vine Creek-Captina Creek	38.02	5	1h	1	0	2
05030201 07 03	Wingett Run-Little Muskingum River	36.34	1	5h	1	0	2
05030201 09 02	Buffalo Run-West Fork Duck Creek	31.80	5h	3	4Ah	0	2
05030201 09 03	New Years Creek-Duck Creek	25.47	5h	3	4Ah	0	2
05030201 09 04	Sugar Creek-Duck Creek	17.72	5	3	4Ah	0	2
05030202 02 01	Headwaters West Branch Shade River	22.19	3	5h	5	0	2

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05030202 07 06	Parker Run-Leading Creek	42.91	3	5h	4A	0	2
05030204 03 01	Headwaters Clear Creek	47.79	3	5h	1h	0	2
05030204 03 02	Mouth Clear Creek	43.69	3i	5h	1h	0	2
05030204 04 02	Baldwin Run	12.61	5h	4Ah	1	0	2
05030204 04 03	Pleasant Run	17.71	5h	4Ah	1ht	0	2
05030204 04 04	Tarhe Run-Hocking River	20.64	5h	4Ah	4Ah	0	2
05030204 04 05	Buck Run-Hocking River	32.05	5h	4Ah	4Ah	0	2
05030204 05 01	Little Monday Creek	25.15	3	5h	4Ah	0	2
05030204 05 02	Lost Run-Monday Creek	36.54	3	5h	4A	0	2
05030204 05 03	Snow Fork	27.28	3	5h	4Ah	0	2
05030204 05 04	Kitchen Run-Monday Creek	27.02	3	5h	4A	0	2
05030204 06 02	Scott Creek	23.68	5h	1h	4Ah	0	2
05030204 06 03	Oldtown Creek	13.81	5h	1h	1ht	0	2
05030204 06 04	Fivemile Creek	14.22	5h	1h	4Ah	0	2
05040001 01 01	Headwaters Tuscarawas River	35.82	5h	4A	4A	0	2
05040001 01 02	Pigeon Creek	24.70	5h	4A	4Ah	0	2
05040001 01 03	Hudson Run	13.76	5h	4A	4Ah	0	2
05040001 02 01	Headwaters Chippewa Creek	22.35	5h	4Ah	4A	0	2
05040001 02 02	Hubbard Creek-Chippewa Creek	21.80	5h	4Ah	4Ah	0	2
05040001 02 04	River Styx	29.55	5h	4Ah	4Ah	0	2
05040001 02 05	Tommy Run-Chippewa Creek	36.68	5h	4Ah	4Ah	0	2
05040001 02 06	Red Run	15.16	5h	4Ah	4Ah	0	2
05040001 02 07	Silver Creek-Chippewa Creek	30.24	5h	4Ah	4Ah	0	2
05040001 03 01	Pancake Creek-Tuscarawas River	22.61	5h	1d	4Ah	0	2
05040001 03 03	Lake Lucern-Nimisila Creek	14.15	5h	4A	1ht	0	2
05040001 03 04	Fox Run	14.19	5h	4A	4Ah	0	2
05040001 03 06	Headwaters Newman Creek	24.88	5h	4A	4Ah	0	2
05040001 03 07	Town of North Lawrence-Newman Creek	14.59	5h	4A	1ht	0	2
05040001 05 01	Swartz Ditch-Middle Branch Nimishillen Creek	25.27	5h	4Ah	4Ah	0	2
05040001 05 06	Town of East Sparta-Nimishillen Creek	20.58	5	4Ah	4Ah	0	2
05040001 08 04	Huff Run	13.94	3	5	5	0	2
05040001 14 03	Craborchard Creek-Stillwater Creek	42.84	1	5h	1	0	2
05040001 15 02	Standingstone Fork	16.41	3	5h	5	0	2
05040002 01 03	Brubaker Creek	23.00	3	5h	5	0	2
05040002 04 05	Switzer Creek-Clear Fork Mohican River	29.37	5	1h	1	0	2
05040003 05 01	Headwaters Killbuck Creek	22.18	3	5h	1	0	2
05040003 06 05	North Branch Salt Creek	16.45	3	5h	5	0	2
05040004 01 01	Headwaters Wakatomika Creek	32.86	5h	4Ahx	1ht	0	2

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040004 01 02	Winding Fork	21.38	5h	4Ahx	4Ah	0	2
05040004 01 03	Brushy Fork	27.62	5h	4Ahx	4Ah	0	2
05040004 02 01	Black Run-Wakatomika Creek	35.44	5h	4Ahx	4Ah	0	2
05040004 02 02	Mill Fork	24.25	5h	4Ahx	4Ah	0	2
05040004 02 03	Little Wakatomika Creek	37.47	5h	4Ahx	4Ah	0	2
05040004 03 04	South Branch Symmes Creek-Symmes Creek	17.28	3	5h	4n	0	2
05040004 12 02	Rainbow Creek	18.81	3	5h	1	0	2
05040006 02 02	Clear Fork Licking River	22.07	3	5h	1	0	2
05040006 02 04	Dry Creek	24.60	3	5h	1	0	2
05040006 04 04	Buckeye Lake Reservoir Feeder	17.23	3	5h	1	0	2
05040006 04 06	Bell Run-South Fork Licking River	25.98	3	5h	1	0	2
05060001 08 02	Mud Run	20.41	5h	4Ahx	1ht	0	2
05060001 08 03	Flat Run	42.17	5h	4Ahx	1ht	0	2
05060001 08 04	Town of Caledonia-Olentangy River	21.72	5h	4Ahx	4Ah	0	2
05060001 09 01	Shaw Creek	29.90	5h	4Ahx	1ht	0	2
05060001 10 01	Otter Creek-Olentangy River	22.86	5h	4Ahx	4Ah	0	2
05060001 10 02	Grave Creek	28.83	5h	4Ah	4A	0	2
05060001 10 04	Qu Qua Creek	16.91	5h	4Ahx	4Ah	0	2
05060001 12 05	Dry Run-Scioto River	24.64	3	5h	5	0	2
05060001 15 04	Town of Brice-Blacklick Creek	15.06	3	4A	5d	0	2
05060001 17 01	Pawpaw Creek	17.34	5h	4Ah	4Ah	0	2
05060001 17 03	Poplar Creek	17.43	5h	4Ah	4nh	0	2
05060001 17 04	Sycamore Creek	23.59	5h	4Ah	4A	0	2
05060001 18 01	Georges Creek	14.25	5h	4Ah	4Ah	0	2
05060001 18 03	Turkey Run	14.60	5h	4Ah	4Ah	0	2
05060001 19 01	Headwaters Big Darby Creek	19.20	5h	4Ah	1d	0	2
05060001 19 03	Buck Run	29.88	5h	4Ah	1d	0	2
05060001 19 04	Sugar Run	20.48	5h	4Ah	4A	0	2
05060001 20 01	Headwaters Treacle Creek	19.46	5h	4Ah	1d	0	2
05060001 20 02	Proctor Run-Treacle Creek	17.43	5h	4Ah	4A	0	2
05060001 20 03	Headwaters Little Darby Creek	29.84	5h	4Ah	4A	0	2
05060001 20 04	Spring Fork	37.96	5h	4Ah	4A	0	2
05060001 23 01	Scioto Big Run	24.64	3	5h	5	0	2
05060001 23 02	Kian Run-Scioto River	29.50	3	5h	5	0	2
05060002 02 07	Deer Creek Dam-Deer Creek	14.50	3i	5h	4C	0	2
05060002 04 03	Lick Run-Scioto River	30.30	3	5h	1	0	2
05060002 06 05	Blue Creek-Salt Creek	31.99	1h	5h	1ht	0	2
05060002 08 01	Headwaters Little Salt Creek	33.69	3	5h	4A	0	2

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05060002 08 04	Pigeon Creek	30.16	3	5h	4Ah	0	2
05060002 08 05	Sour Run-Little Salt Creek	32.59	5h	1h	1t	0	2
05060002 09 03	Pretty Run	17.59	5h	1h	1ht	0	2
05060002 11 04	Pee Pee Creek	36.24	5	1h	4n	0	2
05060002 11 05	Meadow Run-Scioto River	44.15	3	5h	1	0	2
05060002 14 02	Mill Creek	17.23	3	4Ah	5h	0	2
05060003 01 01	Headwaters Paint Creek	40.51	5h	4Ah	3i	0	2
05060003 01 02	East Fork Paint Creek	51.90	5h	4Ah	4Ah	0	2
05060003 06 01	Indian Creek-Paint Creek	46.16	5h	4Ah	4Ah	0	2
05060003 06 02	Farmers Run-Paint Creek	31.06	5h	4Ah	4Ah	0	2
05080001 03 01	Cherokee Mans Run	17.71	5h	3	1	0	2
05080001 03 02	Rennick Creek-Great Miami River	28.94	5h	4Ah	4A	0	2
05080001 03 03	Rum Creek	28.55	5h	4Ah	4A	0	2
05080001 03 04	Blue Jacket Creek	13.10	5h	4Ah	1	0	2
05080001 03 05	Bokengehalas Creek	27.74	5h	4Ah	4A	0	2
05080001 03 06	Brandywine Creek-Great Miami River	33.30	5h	4Ah	4A	0	2
05080001 04 01	McKees Creek	17.86	5h	4Ah	1	0	2
05080001 04 02	Lee Creek	22.68	5h	4Ah	1	0	2
05080001 04 04	Indian Creek	15.96	5h	4Ah	3i	0	2
05080001 04 05	Plum Creek	28.62	5h	4Ah	1	0	2
05080001 14 02	Ludlow Creek	41.23	1	5h	4n	0	2
05080001 14 05	Mill Creek-Stillwater River	23.65	3	5h	4n	0	2
05080001 15 01	Machochee Creek	18.95	5h	3	1	0	2
05080001 15 02	Headwaters Mad River	36.74	5h	3	1ht	0	2
05080001 15 03	Kings Creek	44.06	5h	3	4Ah	0	2
05080001 16 01	Muddy Creek	22.80	5h	3	4Ah	0	2
05080001 16 02	Dugan Run	23.48	5h	3	4Ah	0	2
05080001 16 04	Anderson Creek	18.44	5h	3	1ht	0	2
05080001 16 05	Storms Creek	9.17	5h	3	1ht	0	2
05080001 18 01	Moore Run	18.42	5h	3	4Ah	0	2
05080001 18 03	Mill Creek	16.03	5h	3	1ht	0	2
05080001 18 04	Donnels Creek	26.13	5h	3	4nh	0	2
05080001 18 06	Jackson Creek-Mad River	30.64	5h	3	1ht	0	2
05080001 19 01	Mud Creek	22.60	5h	3	4Ah	0	2
05080001 19 02	Mud Run	26.17	5h	3	4Ah	0	2
05080002 02 04	Price Creek	29.23	5h	4Ah	4Ah	0	2
05080002 03 02	Aukerman Creek	20.85	5h	3	1h	0	2
05080002 03 03	Toms Run	25.73	5h	1h	4Ah	0	2

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05080002 05 02	Paint Creek	22.79	1h	5h	1h	0	2
05080002 05 03	Beasley Run-Sevenmile Creek	27.92	1h	5h	1h	0	2
05080002 07 01	Elk Creek	47.62	5h	1h	4n	0	2
05080002 07 05	Gregory Creek	29.69	5h	1h	1	0	2
05080002 09 03	Paddys Run	16.30	5h	3	4nh	0	2
05080003 08 10	Jameson Creek-Whitewater River	17.94	3	5h	4n	0	2
05090101 02 02	West Branch Raccoon Creek	22.72	3	5	5	0	2
05090101 08 02	Black Fork	49.38	3	1	5	0	2
05090103 06 04	Frederick Creek	15.70	3	5h	1	0	2
05090103 06 05	Wards Run-Little Scioto River	40.42	5	1h	1	0	2
05090103 06 06	Munn Run-Ohio River	26.32	3	5h	5	0	2
05090201 03 02	Elk Run	15.14	3	5h	4n	0	2
05090201 05 06	Soldiers Run-Ohio Brush Creek	29.84	5	1h	1	0	2
05090201 09 04	Flat Run-North Fork Whiteoak Creek	30.39	3	5h	4Ah	0	2
05090202 08 03	Turtle Creek	44.91	3	5h	4n	0	2
05090202 09 01	Muddy Creek	15.86	3	4Ah	5	0	2
05090202 09 03	Salt Run-Little Miami River	35.30	3	5h	3	0	2
05090203 02 03	Muddy Creek	16.59	3	5h	5	0	2
05120101 02 01	Chickasaw Creek	18.63	5h	4Ahx	4Ah	0	2
05120101 02 02	Headwaters Beaver Creek	20.28	5h	4Ahx	4Ah	0	2
05120101 02 03	Coldwater Creek	19.36	5h	4Ah	4Ah	0	2
04100001 03 09	Detwiler Ditch-Frontal Lake Erie	8.13	3	1h	5	0	1
04100007 11 03	Lower Powell Creek	12.87	3i	5h	4A	0	1
04100009 01 05	Little Turkeyfoot Creek	23.12	3	5h	1	0	1
04100009 02 03	Wade Creek-Maumee River	37.31	3	5h	1	0	1
04100009 02 04	Garret Creek	28.59	3	5h	1	0	1
04100009 02 05	Oberhaus Creek	24.00	3	5h	1	0	1
04100009 02 06	Village of Napoleon-Maumee River	21.33	3	5h	1	0	1
04100009 02 07	Creager Cemetery-Maumee River	17.91	3	5h	1	0	1
04100009 04 01	Konzen Ditch	25.21	3	1h	1	3i	1
04100009 05 03	Upper Beaver Creek	16.71	3	5h	1	0	1
04100009 05 08	Middle Beaver Creek	23.46	3i	5h	1	0	1
04100009 06 02	Sugar Creek-Maumee River	21.72	3	5h	1	0	1
04100009 07 02	Fewless Creek-Swan Creek	28.34	3	4A	4A	3i	1
04100010 01 01	Rader Creek	32.71	3	4Ah	4A	3i	1
04100010 01 03	Rocky Ford	73.53	3	4Ah	4A	3i	1
04100012 06 01	Headwaters East Branch Huron River	28.94	3	4Ax	5d	0	1
04110001 06 03	Heider Ditch-Frontal Lake Erie	26.30	3	4Ah	5d	0	1

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030101 05 04	Patterson Creek-West Fork Little Beaver Creek	52.42	3	5h	4Ah	0	1
05030103 04 06	Chocolate Run-Mahoning River	16.57	3	4Ah	5h	0	1
05030103 07 04	Squaw Creek	18.63	3	3	5	0	1
05030106 02 01	South Fork Short Creek	14.48	3	1h	5	0	1
05030106 02 04	Piney Fork	22.58	3	5h	1	0	1
05030106 02 06	Little Short Creek	17.63	3	1h	5	0	1
05030106 12 07	Pipe Creek-Ohio River	24.14	3	1h	5	0	1
05030106 12 08	Big Run-Ohio River	7.78	3	3	5h	0	1
05030201 10 09	Cow Creek-Ohio River	24.50	3	5h	3i	0	1
05030202 08 02	Groundhog Creek-Ohio River	21.77	1h	5h	1	0	1
05030202 08 04	West Creek-Ohio River	19.71	1h	5h	4n	0	1
05030202 08 05	Broad Run-Ohio River	22.66	1h	3	5	0	1
05030204 01 01	Center Branch	24.83	1h	4Ah	4Ah	3i	1
05040001 07 01	Headwaters Upper Conotton Creek	13.95	3	3i	5	0	1
05040001 07 02	Irish Creek	18.85	3	5	1	0	1
05040001 07 03	Dining Fork	14.79	3	5	1	0	1
05040001 07 04	Headwaters Middle Conotton Creek	15.21	3	5	1	0	1
05040001 07 05	North Fork McGuire Creek	26.67	3	5	1	0	1
05040001 08 02	Pleasant Valley Run-Indian Fork	37.49	1	1	5	1	1
05040001 15 04	Middle Little Stillwater Creek	25.24	3	1h	5	0	1
05040001 16 03	Weaver Run-Stillwater Creek	16.12	1	1h	5	0	1
05040002 05 02	Middle Muddy Fork Mohican River	27.54	3	5h	1	0	1
05040002 06 06	Glenn Run-Jerome Fork Mohican River	17.86	3	5h	1	0	1
05040002 07 01	Grab Run	34.18	3	5h	1	0	1
05040003 03 05	Little Schenck Creek	16.26	3	5h	1	0	1
05040003 06 02	Apple Creek	38.89	3	5h	1	0	1
05040003 07 01	Paint Creek	30.38	3	5h	1	0	1
05040003 07 02	Martins Creek	22.97	3	5h	3i	0	1
05040003 09 08	Crooked Creek-Walhonding River	18.33	3	5h	4n	0	1
05040004 03 01	Robinson Run-Muskingum River	34.16	3	1h	5	0	1
05040004 03 02	Village of Adams Mills-Muskingum River	19.24	3	5h	3	0	1
05040004 08 06	Oilspring Run-Muskingum River	22.01	3	1h	5	0	1
05040004 10 03	Coal Run	21.86	3	5h	1	0	1
05040004 11 05	Congress Run-Muskingum River	21.18	3	1h	5	0	1
05040005 01 01	Headwaters Seneca Fork	29.19	3	5h	1	0	1
05040005 04 06	Beeham Run-Salt Fork	21.83	1	1h	5	0	1
05040005 05 08	Wolf Run-Wills Creek	26.79	1h	3	5	0	1
05060001 06 03	Blues Creek	37.06	3	1h	5d	0	1

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060001 08 01	Headwaters Olentangy River	49.56	1h	4Ah	4Ah	3i	1
05060001 10 07	Delaware Run-Olentangy River	43.89	1h	4Ahx	4A	3i	1
05060001 13 08	Hoover Reservoir-Big Walnut Creek	30.17	1	1d	3t	1	1
05060001 14 04	Alum Creek Dam-Alum Creek	20.27	1	1d	3t	1	1
05060001 15 01	Rocky Fork Creek	30.39	3	4Ahx	5	0	1
05060002 02 01	South Fork Bradford Creek-Bradford Creek	30.04	3	5h	1	0	1
05060002 03 03	Waugh Creek	20.43	3	5h	1	0	1
05060002 14 06	Beech Fork-South Fork Scioto Brush Creek	16.77	3	1h	5h	0	1
05060003 03 01	Wilson Creek	21.48	3	4Ah	5h	0	1
05080001 05 01	Headwaters Loramie Creek	43.11	3	4Ah	5	0	1
05080001 09 03	North Fork Stillwater River	18.92	1h	5h	4A	0	1
05080001 09 04	Boyd Creek	14.09	1h	5h	1d	0	1
05080001 12 04	Harris Creek	17.91	1h	5h	4A	0	1
05080001 13 01	Little Painter Creek	12.28	3	5h	1d	0	1
05080001 13 02	Painter Creek	35.06	3	5h	4n	0	1
05080001 14 01	Brush Creek	23.07	3	5h	4A	0	1
05080003 07 01	Headwaters Middle Fork East Fork Whitewater River	12.99	3	5	3x	0	1
05080003 07 04	Rocky Fork-East Fork Whitewater River	6.94	3	5	3x	0	1
05080003 08 07	Headwaters Dry Fork Whitewater River	2.29	3	5	1hx	0	1
05090101 02 01	East Branch Raccoon Creek	20.12	3	5	1d	0	1
05090101 06 01	Indian Creek	21.83	3	5	1	0	1
05090101 06 02	Barren Creek-Raccoon Creek	22.12	3	5	3i	0	1
05090101 07 03	Swan Creek	16.75	3	5	1	0	1
05090101 07 06	Little Indian Guyan Creek	14.94	3	5	1	0	1
05090101 07 07	Johns Creek-Indian Guyan Creek	33.77	3	5	1	0	1
05090101 08 03	Headwaters Symmes Creek	56.44	3	5	4n	0	1
05090101 10 02	Long Creek	15.56	3	5	1	0	1
05090101 10 07	Buffalo Creek-Ohio River	14.87	3	5	1	0	1
05090103 05 02	Sugarcamp Creek	14.42	3	5h	1	0	1
05090201 02 04	Briery Branch-Ohio River	7.22	3	5	1	0	1
05090201 04 01	Little West Fork Ohio Brush Creek	22.57	3	1h	5	0	1
05090201 04 02	Headwaters West Fork Ohio Brush Creek	38.87	3	1h	5	0	1
05090201 04 03	Cherry Fork	33.82	3	1h	5	0	1
05090201 04 04	Georges Creek-West Fork Ohio Brush Creek	38.74	3	1h	5	0	1
05090201 07 02	Headwaters East Fork Eagle Creek	23.68	3	5	1	0	1
05090201 07 04	Rattlesnake Creek-West Fork Eagle Creek	19.19	3	5	1	0	1
05090201 12 06	Tenmile Creek	13.04	3	5h	1	0	1
05090202 04 05	Flat Fork	16.80	1h	1h	5	0	1

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05090202 07 03	First Creek	19.50	3	3	5	0	1
05090202 14 04	Duck Creek	15.45	3	3	5d	0	1
05090202 14 06	Clough Creek-Little Miami River	18.70	3	3	5d	0	1
05120101 01 01	Headwaters Wabash River	31.49	3	3	5hx	0	1
05120101 01 02	Stoney Creek-Wabash River	52.02	3	3	5hx	0	1
05120101 01 03	Toti Creek-Wabash River	32.31	3	3	5hx	0	1
05120101 05 01	Hickory Branch-Wabash River	13.00	3	3	5hx	0	1
05040003 90 01	Walhonding River Mainstem (entire length)	2256	1	1h	4C	0	0
04100002 03 01	Headwaters Bear Creek	17.72	3	1h	1	0	0
04100002 03 03	Nile Ditch	2.33	3	3	3	0	0
04100003 01 04	Bird Creek-East Branch St Joseph River	0.40	3	3	3	0	0
04100003 04 05	Town of Alvarado-Fish Creek	2.64	3	3	3	0	0
04100004 04 04	Little Blue Creek	1.12	3	3	3	0	0
04100005 02 02	North Chaney Ditch-Maumee River	14.42	3	3	3	0	0
04100005 02 05	Sixmile Cutoff-Maumee River	15.70	3	3	1	0	0
04100006 02 01	Silver Creek-Bean Creek	3.09	3	3	3	0	0
04100006 02 03	Old Bean Creek	33.33	3	1h	1	0	0
04100007 01 05	Dry Run-Auglaize River	24.23	3i	4Ah	4Ah	0	0
04100007 02 02	Village of Buckland-Auglaize River	9.98	1	4Ahx	1ht	0	0
04100007 07 03	Prairie Creek	39.22	1	1h	1	0	0
04100007 08 05	Middle Creek	16.40	3i	1h	1	0	0
04100007 08 06	Burt Lake-Little Auglaize River	13.93	1	1h	1	0	0
04100007 09 04	Big Run-Auglaize River	21.03	1	4Ah	1ht	0	0
04100007 09 05	Lapp Ditch-Auglaize River	21.23	3	4Ahx	1ht	0	0
04100007 09 07	Town of Oakwood-Auglaize River	16.50	3	4Ahx	3t	0	0
04100007 11 01	North Powell Creek	46.81	3	3	4A	0	0
04100007 11 02	Upper Powell Creek	38.83	3i	3	4A	0	0
04100007 12 04	Brown Ditch-Flatrock Creek	0.49	3	3	3	0	0
04100008 04 01	Binkley Ditch-Little Riley Creek	14.36	3	4Ah	4Ah	0	0
04100008 04 02	Upper Riley Creek	14.35	3	4Ah	4Ah	0	0
04100008 04 03	Marsh Run-Little Riley Creek	16.25	3	4Ah	4Ah	0	0
04100008 04 04	Middle Riley Creek	15.62	3	4Ah	4Ah	0	0
04100008 04 05	Lower Riley Creek	25.14	3	4A	4Ah	0	0
04100008 05 06	Village of Gilboa-Blanchard River	41.20	3	4Ah	1h	0	0
04100008 06 01	Cranberry Creek	45.26	3	4Ah	1h	0	0
04100008 06 02	Pike Run-Blanchard River	28.64	3	4Ah	4Ah	3i	0
04100008 06 03	Miller City Cutoff	22.64	3	4Ah	4Ah	0	0
04100008 06 04	Bear Creek	12.67	3	4Ah	1h	0	0

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04100008 06 05	Deer Creek-Blanchard River	39.36	3	4Ah	4Ah	0	0
04100009 01 02	Upper South Turkeyfoot Creek	21.03	3	1	1	0	0
04100009 03 01	Upper Bad Creek	22.81	3	1h	1	0	0
04100009 05 06	Lower Yellow Creek	22.67	3i	1h	1	0	0
04100009 05 10	Lick Creek-Maumee River	23.39	3	3	3	0	0
04100009 07 01	Ai Creek	50.83	3	4A	4A	0	0
04100009 07 03	Gale Run-Swan Creek	16.91	3	4A	4A	0	0
04100009 08 01	Upper Blue Creek	20.28	3	4A	3i	0	0
04100009 08 02	Lower Blue Creek	24.49	3	4A	4A	0	0
04100009 08 03	Wolf Creek	27.16	3	4A	4A	0	0
04100009 09 01	Grassy Creek Diversion	24.78	3	4A	3i	0	0
04100009 09 02	Grassy Creek	13.68	3	1d	4A	0	0
04100009 09 03	Crooked Creek-Maumee River	18.89	3	3	3	0	0
04100009 09 04	Delaware Creek-Maumee River	19.25	3i	4A	4A	0	0
04100010 01 02	Needles Creek	31.42	3	4Ah	4A	0	0
04100010 01 04	Town of Rudolph-Middle Branch Portage River	31.14	3	4Ah	1	0	0
04100010 02 01	Bull Creek	30.47	3	4Ah	1d	0	0
04100010 02 05	Cessna Ditch-Middle Branch Portage River	25.44	3	4Ah	1	0	0
04100010 05 03	Lacarpe Creek-Frontal Lake Erie	40.30	3	3	3	0	0
04100010 07 01	Turtle Creek-Frontal Lake Erie	40.66	3	4A	4A	0	0
04100010 07 02	Crane Creek-Frontal Lake Erie	56.48	3	4A	4A	0	0
04100010 07 03	Cedar Creek-Frontal Lake Erie	58.05	3	4A	4A	0	0
04100010 07 04	Wolf Creek-Frontal Lake Erie	15.16	3	1d	3i	0	0
04100010 07 05	Berger Ditch	16.06	3	4A	4A	0	0
04100010 07 06	Otter Creek-Frontal Lake Erie	18.13	3	4A	4A	0	0
04100011 01 01	Sawmill Creek	14.28	3	4Ah	1	0	0
04100011 01 02	Pipe Creek-Frontal Sandusky Bay	48.54	3	4Ah	4A	0	0
04100011 02 01	Frontal South Side of Sandusky Bay	43.42	3	4Ah	4A	0	0
04100011 02 02	Strong Creek	15.87	3	4Ah	3	0	0
04100011 02 03	Pickerel Creek	48.48	3i	4Ah	4A	0	0
04100011 02 05	South Creek	22.00	3	4Ah	4A	0	0
04100011 03 01	Brandywine Creek-Broken Sword Creek	55.30	3	4Ahx	4A	0	0
04100011 03 02	Indian Run-Broken Sword Creek	39.04	3	4Ahx	4Ah	0	0
04100011 05 01	Prairie Run	15.35	3	4Ahx	1ht	0	0
04100011 05 02	Headwaters Tymochtee Creek	19.12	3	4Ahx	4Ah	0	0
04100011 05 03	Carroll Ditch	17.81	3	4Ahx	3iht	0	0
04100011 05 04	Paw Paw Run	16.80	3	4Ahx	4Ah	0	0
04100011 05 05	Reevhorn Run	14.27	3	4Ahx	3iht	0	0

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04100011 05 06	Upper Little Tymochtee Creek	20.69	3	4Ahx	4Ah	0	0
04100011 05 07	Lower Little Tymochtee Creek	14.56	3	4Ahx	4Ah	0	0
04100011 05 08	Warpole Creek	20.68	3	4Ahx	3iht	0	0
04100011 05 09	Enoch Creek-Tymochtee Creek	35.17	3	4Ahx	4Ah	0	0
04100011 06 01	Oak Run	15.30	3	3	3t	0	0
04100011 06 02	Baughman Run-Tymochtee Creek	27.34	3	3	4Ah	0	0
04100011 06 03	Hart Ditch-Little Tymochtee Creek	31.52	3	3	4Ah	0	0
04100011 07 01	Little Sandusky River	36.04	1h	4Ahx	4Ah	0	0
04100011 08 01	Brokenknife Creek	18.90	3	3	4Ah	0	0
04100011 08 02	Upper Honey Creek	40.96	3	3	4Ah	0	0
04100011 08 03	Aicholz Ditch	18.04	3	3	4Ah	0	0
04100011 08 04	Silver Creek	24.62	3	3	4Ah	0	0
04100011 09 01	Taylor Run	19.29	3	3	4Ah	0	0
04100011 09 02	Headwaters Sycamore Creek	40.55	3	3	1ht	0	0
04100011 09 04	Thorn Run-Sandusky River	21.36	3	3	4Ah	0	0
04100011 09 05	Mile Run-Sandusky River	16.69	3	3	4Ah	0	0
04100011 10 01	East Branch East Branch Wolf Creek	21.90	3	4Ah	4A	0	0
04100011 10 02	Town of New Riegel-East Branch Wolf Creek	33.40	3	4Ah	4A	0	0
04100011 10 03	Snuff Creek-East Branch Wolf Creek	29.22	3	4Ah	1	0	0
04100011 10 04	Wolf Creek	73.45	3	4Ah	4A	0	0
04100011 11 01	Rock Creek	34.78	3	3	4Ah	0	0
04100011 11 02	Morrison Creek	20.34	3	3	4Ah	0	0
04100011 11 03	Willow Creek-Sandusky River	16.62	3	3	4Ah	0	0
04100011 11 04	Sugar Creek	13.52	3	3i	1	0	0
04100011 11 05	Spicer Creek-Sandusky River	30.86	3	3	4A	0	0
04100011 12 01	Westerhouse Ditch	20.68	3	4Ah	1	0	0
04100011 13 01	Muskellunge Creek	46.31	3i	4Ah	4A	0	0
04100011 13 02	Indian Creek-Sandusky River	37.59	3	4Ah	3i	0	0
04100011 13 03	Mouth Sandusky River	24.85	3	3	4A	0	0
04100011 14 01	Gries Ditch	13.93	3	4Ah	1	0	0
04100011 14 02	Town of Helena-Muddy Creek	45.21	3	4Ah	1	0	0
04100011 14 05	North Side Sandusky Bay Frontal	26.53	3	3	3	0	0
04100012 03 01	Sugar Creek-Frontal Lake Erie	19.50	3	3	4Ah	0	0
04100012 03 02	Chappel Creek	23.99	3	3	4Ah	0	0
04100012 03 03	Cranberry Creek-Frontal Lake Erie	12.64	3	3	3t	0	0
04100012 04 01	Marsh Run	31.49	3	4Ax	1d	0	0
04100012 04 02	Town of Plymouth-West Branch Huron River	31.00	3	4A	4A	0	0
04100012 04 05	Peru Township-West Branch Huron River	32.30	1	4Ax	1d	0	0

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04100012 06 02	Cole Creek	23.05	3	4Ax	1d	0	0
04100012 06 05	Unnamed Creek "B"	18.16	3	4A	4A	0	0
04110001 03 03	Coon Creek-East Branch Black River	38.31	1h	4Ah	4C	0	0
04110001 04 01	Town of Litchfield-East Branch Black River	36.06	1	4Ah	1d	0	0
04110001 05 03	Wellington Creek	29.61	1	4Ah	4A	0	0
04110002 03 02	Mogadore Reservoir-Little Cuyahoga River	12.91	1	3	4Ah	0	0
04110002 04 01	Mud Brook	29.77	1h	4Ahx	4Ah	0	0
04110002 05 05	Willow Lake-Cuyahoga River	24.23	3	3	4A	0	0
04110002 06 01	Mill Creek	19.26	3	4Ahx	4A	0	0
04110002 06 02	Village of Independence-Cuyahoga River	16.97	3	4Ahx	4A	0	0
04110002 06 03	Big Creek	37.37	3	4Ahx	4A	0	0
04110002 06 04	Cuyahoga Heights-Cuyahoga River	19.08	3	4Ax	4A	0	0
04110002 06 05	City of Cleveland-Cuyahoga River	23.58	3	4Ahx	3t	0	0
04110003 04 01	East Branch Chagrin River	51.33	3	4Ahx	4A	0	0
04110003 04 03	Town of Willoughby-Chagrin River	17.97	3	4Ahx	4A	0	0
04110003 05 02	City of Euclid-Frontal Lake Erie	20.57	3	3	3	0	0
04110004 01 04	Center Creek-Grand River	31.43	3	4Ah	4A	0	0
04110004 01 05	Coffee Creek-Grand River	19.03	3	4Ah	1	0	0
04110004 02 02	Middle Rock Creek	21.37	1h	4Ah	4A	0	0
04110004 04 01	Griggs Creek	20.68	1h	4Ah	4nh	0	0
04110004 04 02	Peters Creek-Mill Creek	54.81	1h	4Ah	4Ah	0	0
04110004 06 01	Coffee Creek-Grand River	22.01	3	4Ah	3ih	0	0
04110004 06 02	Mill Creek	20.99	3	4Ah	1h	0	0
04110004 06 03	Village of Mechanicsville-Grand River	16.62	3	3	3	0	0
04110004 06 04	Paine Creek	28.83	3	4Ah	4nh	0	0
04110004 06 05	Talcott Creek-Grand River	19.32	3	1h	3ih	0	0
04110004 06 06	Big Creek	50.42	3	4Ah	4Ah	0	0
04110004 06 07	Red Creek-Grand River	26.30	3i	4Ah	4Ah	0	0
04120101 06 03	West Branch Conneaut Creek	1.18	3	3	1	0	0
05030101 05 01	Cold Run	14.48	3	3	1ht	3i	0
05030101 05 03	Brush Creek	27.20	3	3	4Ah	0	0
05030101 11 02	Little Yellow Creek	22.75	1h	3	4A	0	0
05030101 11 03	Carpenter Run-Ohio River	22.48	1h	3	4A	0	0
05030101 11 06	Hardin Run-Ohio River	18.53	1h	1h	1	0	0
05030101 11 07	Island Creek	26.35	3	1h	1	0	0
05030101 11 09	Wills Creek-Ohio River	26.32	3	1h	1	0	0
05030102 01 05	Pymatuning Reservoir	5.07	1	3	3	0	0
05030102 04 01	Sugar Run-Shenango River	0.28	3	3	3	0	0

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05030102 06 03	McCullough Run-Shenango River	7.84	3	3	3	0	0
05030102 06 06	Deer Creek-Shenango River	0.69	3	3	3	0	0
05030103 01 01	Beaver Run-Mahoning River	41.14	3	4Ah	4Ah	0	0
05030103 03 05	Town of Newton Falls-West Branch Mahoning River	27.53	1	4Ah	4Ah	0	0
05030103 04 05	Mouth Eagle Creek	20.70	1	4Ah	1h	0	0
05030103 08 08	Hickory Run	5.87	3	3	3	0	0
05030106 07 01	Williams Creek	12.38	3	1h	1	0	0
05030106 09 06	Cat Run-Captina Creek	17.45	3i	1h	4n	0	0
05030106 12 05	Boggs Run-Ohio River	6.41	3	3	3	0	0
05030106 12 06	Wegee Creek-Ohio River	17.48	3	1h	4n	0	0
05030201 01 02	Piney Fork	15.61	3	1h	1	0	0
05030201 01 04	Lower Sunfish Creek	43.12	3i	1h	1	0	0
05030201 07 01	Clear Fork Little Muskingum River	48.82	3	1h	1	0	0
05030201 08 01	Upper East Fork Duck Creek	31.64	3	3	4Ah	0	0
05030201 08 02	Middle Fork Duck Creek	26.50	3	3	4Ah	0	0
05030201 08 03	Middle East Fork Duck Creek	40.33	3	3	4Ah	0	0
05030201 08 04	Paw Paw Creek	23.42	3	3	4Ah	0	0
05030201 08 05	Lower East Fork Duck Creek	14.33	3	3	4Ah	0	0
05030201 10 01	Stillhouse Run-Ohio River	10.08	3	3	3t	0	0
05030201 10 02	Opossum Creek	25.31	3	1h	1	0	0
05030201 10 04	Haynes Run-Ohio River	14.09	3	3	3	0	0
05030201 10 05	Patton Run-Ohio River	22.63	3	3	3i	0	0
05030201 10 07	Leith Run-Ohio River	20.59	3	1h	3i	0	0
05030201 10 10	Bull Creek-Ohio River	3.35	3	3	3	0	0
05030202 04 04	Forked Run-Ohio River	27.95	1h	3	4n	0	0
05030202 07 02	Mud Fork	13.25	3	3	4A	0	0
05030202 07 03	Ogden Run-Leading Creek	23.89	3	1h	1t	0	0
05030202 07 05	Thomas Fork	31.13	3	1h	4A	0	0
05030202 09 04	Crooked Creek-Ohio River	11.72	3	3	4n	0	0
05030204 01 03	Clark Run-Rush Creek	28.49	3	4Ah	4Ah	0	0
05030204 02 01	Headwaters Little Rush Creek	28.42	1	4Ah	1ht	0	0
05030204 02 02	Indian Creek-Little Rush Creek	32.93	3	4Ah	4Ah	0	0
05030204 02 03	Raccoon Run	27.35	3	4Ah	4Ah	0	0
05030204 02 04	Turkey Run-Rush Creek	47.34	1	4Ah	4Ah	0	0
05030204 04 01	Headwaters Hocking River	47.66	1h	4Ah	4Ah	0	0
05030204 06 01	Clear Fork	16.03	1	4Ah	4Ah	0	0
05030204 06 05	Harper Run-Hocking River	26.94	3	4Ah	4Ah	0	0
05030204 06 06	Dorr Run-Hocking River	32.79	3	4Ah	4Ah	0	0

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05030204 07 01	East Branch Sunday Creek	33.13	1h	4Ah	4Ah	0	0
05030204 07 02	Dotson Creek-Sunday Creek	24.18	3	4Ah	4A	0	0
05030204 07 03	West Branch Sunday Creek	42.49	3	4Ah	4A	0	0
05030204 07 04	Greens Run-Sunday Creek	39.06	3	4Ah	4A	0	0
05030204 08 01	Hamley Run-Hocking River	22.21	3	4Ah	4Ah	0	0
05030204 08 02	Headwaters Margaret Creek	33.07	3	4Ah	4Ah	0	0
05030204 08 03	Factory Creek-Margaret Creek	26.93	3	4Ah	4Ah	0	0
05030204 08 04	Coates Run-Hocking River	19.61	3	4Ah	1ht	0	0
05030204 09 01	Miners and Hyde Forks	16.55	3	4Ah	1ht	0	0
05030204 09 02	McDougall Branch	37.56	3	4Ah	1ht	0	0
05030204 09 03	Kasler Creek-Federal Creek	15.51	3	4Ah	4nh	0	0
05030204 09 04	Sharps Fork	35.71	3	4Ah	4Ah	0	0
05030204 09 05	Big Run-Federal Creek	39.36	3	4Ah	4A	0	0
05030204 10 02	Piper Run-Hocking River	20.57	3	3	3t	0	0
05030204 10 03	Fourmile Creek	16.19	1h	3	1ht	0	0
05030204 10 04	Frost Run-Hocking River	41.84	3	3	4Ah	0	0
05040001 03 02	Nimisila Reservoir-Nimisila Creek	17.41	1	4A	4Ah	0	0
05040001 03 05	Town of Canal Fulton-Tuscarawas River	14.49	3	4Ah	3t	0	0
05040001 03 08	Sippo Creek	18.09	1	4A	4Ah	0	0
05040001 03 09	West Sippo Creek-Tuscarawas River	29.63	3	4A	4Ah	0	0
05040001 07 06	McGuire Creek	22.97	3	1	4C	0	0
05040001 09 01	Little Sugar Creek	18.19	3	4A	4Ah	0	0
05040001 09 02	Town of Smithville-Sugar Creek	28.17	3	4A	4Ah	0	0
05040001 09 03	North Fork Sugar Creek	18.01	3	4A	4Ah	0	0
05040001 09 04	Town of Brewster-Sugar Creek	33.11	3	4Ax	4Ah	0	0
05040001 10 01	Upper South Fork Sugar Creek	35.03	3	4A	4A	0	0
05040001 10 02	East Branch South Fork Sugar Creek	28.20	3	4Ax	4Ah	0	0
05040001 10 03	Indian Trail Creek	16.38	3	4Ax	4Ah	0	0
05040001 10 04	Walnut Creek	31.67	3	4A	4Ah	0	0
05040001 10 05	Lower South Fork Sugar Creek	26.54	3	4Ax	4Ah	0	0
05040001 11 01	Headwaters Middle Fork Sugar Creek	27.73	3	4Ax	1ht	0	0
05040001 11 02	Misers Run-Middle Fork Sugar Creek	19.53	3	4Ax	4Ah	0	0
05040001 11 03	Beach City Reservoir-Sugar Creek	17.57	3	4A	4Ah	0	0
05040001 11 04	Broad Run	19.65	3	4Ax	4Ah	0	0
05040001 11 05	Brandywine Creek-Sugar Creek	36.91	3	4A	4A	0	0
05040001 12 01	Pigeon Run	9.57	3	4A	1ht	0	0
05040001 12 02	City of Massillon-Tuscarawas River	14.32	3	4Ah	3t	0	0
05040001 12 03	Wolf Creek-Tuscarawas River	52.14	3	4A	4Ah	0	0

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040001 12 04	Wolf Run-Tuscarawas River	37.17	3	4A	4Ah	0	0
05040001 13 04	Buttermilk Creek-Stillwater Creek	47.99	1	1h	3i	0	0
05040001 17 01	Stone Creek	38.47	3	4A	4Ah	0	0
05040001 17 02	Oldtown Creek	19.26	3	4A	4Ah	0	0
05040001 17 03	Beaverdam Creek	21.97	3	4A	4A	0	0
05040001 17 04	Pone Run-Tuscarawas River	21.39	3	4A	3t	0	0
05040001 18 01	Dunlap Creek	25.41	3	4A	4Ah	0	0
05040001 18 02	Mud Run-Tuscarawas River	52.38	3	4A	4Ah	0	0
05040001 18 03	Buckhorn Creek	23.32	3	4A	4Ah	0	0
05040001 18 04	Blue Ridge Run-Tuscarawas River	22.66	3	4A	3t	0	0
05040001 19 01	Evans Creek	24.25	3i	4A	1ht	0	0
05040001 19 02	West Fork White Eyes Creek	20.95	3	4A	1ht	0	0
05040001 19 03	White Eyes Creek	33.09	3	4A	4Ah	0	0
05040001 19 04	Morgan Run-Tuscarawas River	38.32	3	4A	4Ah	0	0
05040002 02 02	Seymour Run-Black Fork	21.65	1h	3	3	0	0
05040002 04 04	Pine Run	14.15	3	1h	1	0	0
05040002 08 04	Sigafoos Run-Mohican River	28.45	3	3	3	0	0
05040002 08 06	Flat Run-Mohican River	27.41	3	3	3	0	0
05040003 01 03	Job Run-North Branch Kokosing River	20.87	3i	1h	1	0	0
05040003 03 01	Dry Creek	33.93	3	1h	1	0	0
05040003 04 03	Brush Run-Kokosing River	32.29	1	1h	1	0	0
05040004 01 04	Jug Run-Wakatomika Creek	36.45	1h	4Ahx	1ht	0	0
05040004 02 04	Town of Frazeysburg-Wakatomika Creek	18.91	1h	4Ahx	4Ah	0	0
05040004 04 01	Valley Run	29.43	3	4Ah	4A	0	0
05040004 04 02	Headwaters Jonathon Creek	28.00	3	4Ah	1	0	0
05040004 04 03	Turkey Run	14.26	3	4Ah	1	0	0
05040004 04 05	Kent Run	22.82	3	4Ah	1	3i	0
05040004 04 06	Thompson Run	15.46	3	4Ah	1	0	0
05040004 05 01	Black Fork	28.75	3	4Ah	4A	0	0
05040004 05 02	Upper Moxahala Creek	39.08	3	1h	4A	0	0
05040004 05 03	Middle Moxahala Creek	18.64	3	1h	4A	0	0
05040004 05 04	Lower Moxahala Creek	22.11	3	4Ah	4A	0	0
05040004 06 01	Little Salt Creek	14.73	3	4Ah	1	0	0
05040004 06 02	Headwaters Salt Creek	46.10	3	4Ah	1	0	0
05040004 06 03	Buffalo Fork	27.55	3	4Ah	1	0	0
05040004 06 04	Boggs Creek	18.21	3	4Ah	1	0	0
05040004 06 05	Manns Fork Salt Creek	19.81	3i	4Ah	1	0	0
05040004 06 06	Mouth Salt Creek	18.48	3	4Ah	1	0	0

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05040004 07 01	Mans Fork	28.13	3	1h	1	0	0
05040004 07 02	Headwaters Meigs Creek	35.79	3	1h	1	0	0
05040004 07 03	Dyes Fork	45.05	3	1h	1	0	0
05040004 08 05	Blue Rock Creek-Muskingum River	23.20	3	1h	4n	0	0
05040004 12 01	Big Run	18.24	3	1h	1	0	0
05040005 01 04	Depue Run-Seneca Fork	24.24	3i	1h	3	0	0
05040005 06 04	Wills Creek Dam-Wills Creek	27.14	1	1h	3	0	0
05040005 06 05	Mouth Wills Creek	11.77	1h	3	3	0	0
05040006 05 04	Bowling Green Run-Licking River	24.88	3	3	4n	0	0
05060001 05 02	Davids Run-Scioto River	17.20	3	3	3	0	0
05060001 05 05	Ottawa Creek-Scioto River	46.37	3	3	1	0	0
05060001 09 02	Headwaters Whetstone Creek	62.86	1h	4Ah	4Ah	0	0
05060001 09 03	Claypool Run-Whetstone Creek	21.63	1h	4Ahx	4Ah	0	0
05060001 10 03	Beaver Run-Olentangy River	24.04	1h	4Ahx	4Ah	0	0
05060001 10 05	Brandige Run-Olentangy River	29.79	1h	4Ahx	4Ch	0	0
05060001 10 06	Indian Run-Olentangy River	15.00	1h	4Ahx	1ht	0	0
05060001 11 01	Deep Run-Olentangy River	48.91	1h	4Ah	4A	3i	0
05060001 11 02	Rush Run-Olentangy River	30.65	1h	4Ah	1ht	0	0
05060001 11 03	Mouth Olentangy River	32.00	1h	4Ahx	4A	0	0
05060001 13 01	Culver Creek	13.22	3	4Ahx	4Ah	0	0
05060001 13 02	Headwaters Big Walnut Creek	55.33	3	4Ahx	4Ah	0	0
05060001 13 03	Rattlesnake Creek	22.08	3	4Ahx	4Ah	0	0
05060001 13 04	Perfect Creek-Big Walnut Creek	10.10	3	4Ahx	1ht	0	0
05060001 13 05	Little Walnut Creek	32.83	3	4Ahx	4Ah	0	0
05060001 13 06	Prairie Run-Big Walnut Creek	8.38	3	4Ah	4Ah	0	0
05060001 13 07	Duncan Run	16.79	3	4Ahx	4Ah	0	0
05060001 14 01	West Branch Alum Creek	29.47	1h	4Ah	4Ah	0	0
05060001 14 02	Headwaters Alum Creek	35.55	1h	4Ahx	4Ah	0	0
05060001 14 03	Big Run-Alum Creek	37.17	1h	1d	4Ah	1	0
05060001 15 02	City of Gahanna-Big Walnut Creek	15.91	3	4Ahx	4Ah	1	0
05060001 15 03	Headwaters Blacklick Creek	48.88	3	4Ahx	4Ah	0	0
05060001 15 05	Mason Run-Big Walnut Cr.	35.64	3	4Ahx	4Ah	0	0
05060001 16 01	Westerville Reservoir-Alum Creek	24.71	3	1d	4Ah	3i	0
05060001 16 02	Bliss Run-Alum Creek	52.92	3	4Ah	4A	0	0
05060001 16 03	Town of Lockbourne-Alum Creek	22.77	3	4Ahx	1ht	0	0
05060001 17 02	Headwaters Walnut Creek	42.62	1h	4Ah	4Ah	0	0
05060001 17 05	Town of Carroll-Walnut Creek	37.12	1	4Ah	1ht	0	0
05060001 19 02	Spain Creek-Big Darby Creek	63.62	1	4Ah	4A	0	0

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Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060001 19 05	Robinson Run-Big Darby Creek	43.86	1	4Ah	1d	0	0
05060001 20 05	Barron Creek-Little Darby Creek	37.40	1	4Ah	4A	0	0
05060001 20 06	Thomas Ditch-Little Darby Creek	36.20	1	4Ah	1d	0	0
05060001 23 06	Town of Circleville-Scioto River	13.69	3	3	3	0	0
05060002 08 02	Buckeye Creek	19.07	3i	1h	4Ah	1	0
05060002 10 05	Stony Creek-Scioto River	31.10	1	1h	4n	0	0
05060002 12 02	Headwaters Morgan Fork	21.03	1	1h	4C	0	0
05060002 12 03	Left Fork Morgan Fork-Morgan Fork	13.50	3	1h	1	0	0
05060002 13 01	No Name Creek	16.19	3	1h	1	0	0
05060002 13 04	Boswell Run-Scioto River	18.35	3	1h	3	0	0
05060002 14 03	Turkey Creek	16.91	3	4Ah	4nh	0	0
05060002 14 04	Turkey Run-South Fork Scioto Brush Creek	21.30	3	4Ah	4nh	0	0
05060002 14 05	Rocky Fork	22.91	3	4Ah	4nh	0	0
05060002 15 02	Rarden Creek	18.72	3	4Ah	4Ah	0	0
05060002 15 03	Jaybird Branch-Scioto Brush Creek	16.45	3	4Ah	4Ah	0	0
05060002 15 06	McCullough Creek	19.82	3	4Ah	4nh	0	0
05060002 16 05	Carroll Run-Scioto River	16.05	3	3	3	0	0
05060003 01 03	Town of Washington Court House-Paint Creek	27.22	1h	4Ah	4Ah	3i	0
05060003 02 01	Headwaters Sugar Creek	44.20	3	4Ah	4Ah	0	0
05060003 02 02	Camp Run-Sugar Creek	37.32	3	4Ah	4Ah	0	0
05060003 03 02	Grassy Branch	13.13	3	1h	4Ah	0	0
05060003 03 03	West Branch Rattlesnake Creek	24.78	3	4Ah	4Ah	0	0
05060003 03 04	Headwaters Rattlesnake Creek	45.08	3	1d	4Ah	0	0
05060003 03 05	Waddle Ditch-Rattlesnake Creek	25.24	3	4Ah	4Ah	0	0
05060003 04 01	South Fork Lees Creek	19.97	3	4Ah	4Ah	0	0
05060003 04 02	Middle Fork Lees Creek	17.20	3	1h	1h	0	0
05060003 04 03	Lees Creek	39.66	3	4Ah	4Ah	0	0
05060003 04 04	Walnut Creek	14.86	3	4Ah	1h	0	0
05060003 04 05	Hardin Creek	21.28	3	1h	1h	0	0
05060003 04 07	Big Branch-Rattlesnake Creek	20.48	3i	4Ah	1h	0	0
05060003 05 01	South Fork Rocky Fork	10.36	1h	3	1h	0	0
05060003 05 03	Headwaters Rocky Fork	33.32	1h	1d	1h	0	0
05060003 05 05	Franklin Branch-Rocky Fork	30.58	1h	4Ah	4A	0	0
05060003 06 03	Cliff Creek-Paint Creek	17.53	1	3	3	0	0
05060003 07 01	Buckskin Creek	39.88	3	4Ah	4Ah	0	0
05060003 07 02	Upper Twin Creek	14.30	3	4Ah	1h	0	0
05060003 07 03	Lower Twin Creek	16.60	3	4Ah	3i	0	0
05060003 07 04	Sulphur Lick-Paint Creek	51.32	3	4Ah	4Ah	0	0

Section L4. Section 303(d) List of Prioritized Impaired Waters Assessment Unit	Assessment Unit Name	Sq. Mi. in Ohio	Human Health	Recre-ation	Aquatic Life	PDW Supply	Priority Points
05060003 08 01	Thompson Creek	10.41	3	4Ah	1h	0	0
05060003 08 02	Headwaters North Fork Paint Creek	15.57	3	1h	1h	0	0
05060003 08 03	Headwaters Compton Creek	31.28	3	4Ah	1h	0	0
05060003 08 04	Mills Branch-Compton Creek	28.79	3	4Ah	1h	0	0
05060003 08 05	Mud Run-North Fork Paint Creek	34.48	1h	4Ah	1h	0	0
05060003 09 01	Herrod Creek	15.49	3	3	3	0	0
05060003 09 02	Little Creek	23.25	3	4Ah	1h	0	0
05060003 09 03	Oldtown Run-North Fork Paint Creek	43.98	3	4Ah	4Ah	0	0
05060003 09 04	Biers Run-North Fork Paint Creek	31.32	3	4Ah	1h	0	0
05060003 10 01	Black Run	9.82	3	1h	1h	0	0
05060003 10 02	Ralston Run	13.78	3	4Ah	4Ah	0	0
05060003 10 03	City of Chillicothe-Paint Creek	42.51	3	4Ah	1h	0	0
05080001 01 01	North Fork Great Miami River	21.70	1h	4Ah	1	0	0
05080001 01 02	South Fork Great Miami River	51.35	1h	4Ah	1	0	0
05080001 01 03	Indian Lake-Great Miami River	27.38	1	3	4A	0	0
05080001 02 01	Willow Creek	14.31	3	1h	4A	0	0
05080001 02 02	Headwaters Muchnippi Creek	20.78	3	4Ah	1	0	0
05080001 02 03	Little Muchnippi Creek	35.81	3	4Ah	4A	0	0
05080001 02 04	Calico Creek-Muchnippi Creek	18.21	3	1h	4A	0	0
05080001 04 03	Stoney Creek	22.26	1	4Ah	1	0	0
05080001 05 02	Mile Creek	62.72	3	4Ah	4A	0	0
05080001 06 01	Nine Mile Creek	26.14	3	4Ah	1	0	0
05080001 06 02	Painter Creek-Loramie Creek	27.14	3	4Ah	4A	0	0
05080001 06 03	Turtle Creek	35.84	3	1h	4A	0	0
05080001 06 04	Mill Creek-Loramie Creek	27.77	3	4Ah	1	0	0
05080001 08 01	Spring Creek	25.47	3	1h	1	0	0
05080001 08 03	East Branch Lost Creek	14.35	3	1h	1	0	0
05080001 08 04	Little Lost Creek-Lost Creek	31.74	3	1h	1	0	0
05080001 08 05	Peter's Creek-Great Miami River	52.45	3	1h	1	0	0
05080001 09 02	Headwaters Stillwater River	14.33	1h	3	4A	0	0
05080001 17 01	East Fork Buck Creek	28.75	3	3	1ht	0	0
05080001 17 02	Headwaters Buck Creek	30.53	3	3	1ht	0	0
05080001 17 03	Sinking Creek	13.14	3i	3	1ht	0	0
05080001 17 04	Beaver Creek	25.77	3	3	1ht	0	0
05080001 17 05	Clarence J Brown Lake-Buck Creek	24.11	1h	3	4Ah	0	0
05080001 17 06	City of Springfield-Buck Creek	18.27	3	3	1ht	0	0
05080001 19 04	City of Dayton-Mad River	22.58	3	3	4Ah	0	0
05080002 01 05	Town of Oakwood-Great Miami River	26.47	3	3	3	0	0

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05080002 01 06	Opossum Creek-Great Miami River	19.01	3	1h	1	0	0
05080002 02 05	Lesley Run-Twin Creek	41.61	1h	4Ah	4Ah	0	0
05080002 03 06	Town of Germantown-Twin Creek	22.34	1h	1h	1h	0	0
05080002 04 02	Mouth Bear Creek	21.14	3	1h	1	0	0
05080002 04 04	Dry Run-Great Miami River	32.47	3	3	3	0	0
05080002 05 01	Headwaters Sevenmile Creek	42.14	1h	3	1h	0	0
05080002 05 04	Rush Run-Sevenmile Creek	27.25	1	3	1h	0	0
05080002 05 05	Ninemile Creek-Sevenmile Creek	17.00	1h	3	1h	0	0
05080002 06 01	Headwaters Four Mile Creek	38.31	1h	1h	1h	0	0
05080002 06 03	East Fork Four Mile Creek-Four Mile Creek	15.84	1h	1h	1h	0	0
05080002 07 02	Browns Run-Great Miami River	32.02	3	1h	1	0	0
05080002 07 06	Town of New Miami-Great Miami River	30.68	3i	3	3	0	0
05080002 08 02	Brandywine Creek-Indian Creek	5.79	3	3	3	0	0
05080002 09 06	Jordan Creek-Great Miami River	22.74	3	3	3	0	0
05080002 09 07	Doublelick Run-Great Miami River	6.70	3	3	3	0	0
05080003 07 03	Mud Creek-Middle Fork East Fork Whitewater River	7.17	3	3	3x	0	0
05080003 07 07	Short Creek-East Fork Whitewater River	0.18	3	3	3x	0	0
05080003 07 08	Elkhorn Creek	9.26	3	3	3x	0	0
05090101 01 03	Long Run-Ohio River	14.43	3	3	3	0	0
05090101 06 03	Mud Creek-Raccoon Creek	38.80	3	3i	1	0	0
05090101 07 04	Flatfoot Creek-Ohio River	11.48	3	3	3	0	0
05090101 08 01	Dirtyface Creek	13.46	3	1	1	0	0
05090103 01 05	Pond Run-Ohio River	16.01	3	1h	3i	0	0
05090103 05 03	Holland Fork	34.74	3	1h	1	0	0
05090201 02 02	Odell Creek-Turkey Creek	30.95	3	1	4n	0	0
05090201 02 03	Pond Run	12.18	3	1	1	0	0
05090201 02 05	Upper Twin Creek	17.27	3	1	1	0	0
05090201 02 06	Lower Twin Creek	16.04	3	1	1	0	0
05090201 03 01	Headwaters Ohio Brush Creek	25.38	3	1h	4n	0	0
05090201 03 04	Middle Fork Ohio Brush Creek	20.43	3	1h	1	0	0
05090201 03 05	Flat Run-Ohio Brush Creek	24.87	3	1h	4n	0	0
05090201 05 01	Little East Fork-Ohio Brush Creek	46.89	1	1h	4n	0	0
05090201 05 02	Lick Fork	31.70	1	1h	4n	0	0
05090201 05 03	Bundle Run-Ohio Brush Creek	17.23	1	1h	1	0	0
05090201 05 04	Cedar Run-Ohio Brush Creek	26.69	3	1h	1	0	0
05090201 07 03	Hills Fork-East Fork Eagle Creek	24.35	3	3	1	0	0
05090201 08 04	Lee Creek-Ohio River	6.78	3	3	1	0	0
05090201 09 01	Headwaters East Fork Whiteoak Creek	36.39	3	4Ah	1h	0	0

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05090201 09 02	Slabcamp Run-East Fork Whiteoak Creek	43.72	3	4Ah	4Ah	0	0
05090201 09 03	Little North Fork-North Fork Whiteoak Creek	37.06	3	4Ah	4Ah	0	0
05090201 10 01	Sterling Run	29.64	3	4Ah	4A	4A	0
05090201 10 02	Miranda Run-Whiteoak Creek	39.80	3	1h	4Ah	0	0
05090201 11 02	Turtle Creek-Ohio River	8.31	3	3	3	0	0
05090201 11 03	West Branch Bullskin Creek	27.58	3	3i	1	0	0
05090201 11 07	Little Indian Creek-Ohio River	11.46	3	1h	1	0	0
05090201 12 01	Headwaters Big Indian Creek	21.52	3	1h	4n	0	0
05090201 12 02	North Fork Indian Creek-Big Indian Creek	18.42	3	1h	1	0	0
05090201 12 03	Boat Run-Ohio River	8.88	3	1h	1	0	0
05090202 04 04	Middle Caesar Creek	30.09	1	1h	4n	0	0
05090202 06 01	Dutch Creek	14.84	1h	3	1	0	0
05090202 06 02	Headwaters Todd Fork	33.44	1h	3	1	0	0
05090202 06 03	Lytle Creek	20.41	1h	4Ah	4A	0	0
05090202 06 05	Wilson Creek-Cowan Creek	22.08	1	1h	4n	0	0
05090202 06 06	Little Creek-Todd Fork	24.39	1h	1h	1	0	0
05090202 07 01	East Fork Todd Fork	39.64	3i	4Ah	4n	0	0
05090202 07 04	Lick Run-Todd Fork	35.69	3	4Ah	1	0	0
05090202 08 01	Ferris Run-Little Miami River	30.17	3	3	3	0	0
05090202 08 02	Little Muddy Creek	20.58	3	3	4A	0	0
05090202 08 04	Halls Creek-Little Miami River	20.47	3	3	3	0	0
05090202 14 03	Horner Run-Little Miami River	21.47	3	3	3	0	0
05090203 02 01	Town of Newport-Ohio River	7.52	3	3	3	0	0
05090203 02 04	Garrison Creek-Ohio River	6.60	3	3	3	0	0
05120101 03 01	Little Beaver Creek	14.10	3	4Ahx	4Ah	0	0
05120101 03 02	Hardin Creek-Beaver Creek	19.25	3	4Ah	4Ah	0	0
05120101 03 03	Prairie Creek-Beaver Creek	24.65	3	4Ahx	4Ah	0	0
05120101 04 01	Wilson Creek-Limberlost Creek	1.42	3	3	3	0	0

L5. Category 4B Demonstrations Contained in Approved Ohio TMDLs to Date

Ohio EPA expects to use the 4B alternative in conjunction with total maximum daily loads (TMDLs) to efficiently address water quality impairments in the future. Though the 4B category does not currently appear in Ohio's 303(d) list, the concept of a 4B alternative is used to address certain impairments.

Because Ohio EPA typically completes TMDLs on a watershed basis, it makes sense to include discussion of 4B demonstrations in TMDL reports as approval of a TMDL is sought, then to report on progress in integrated reports. As new 4B demonstrations accumulate, they will be collected into future integrated reports. Progress on individual 4B projects will be reported in subsequent integrated reports until the impairment is resolved or until a decision is made that the 4B will not be sufficient to address the impairment and a TMDL is scheduled.

This section presents the 4B discussions as they appeared in the respective TMDL reports, with updates on status. Text that is not original to this report appears with a border to the left; plans and dates are not changed from the original, so some text may appear to be outdated. The table below shows the locations of the original 4B demonstrations as included with TMDL reports and where updates are included in this report.

Name of Watershed	Location of 4B in TMDL Report	Date of TMDL Approval	Updated Sections in 2018 IR	Page Number
White Oak Creek Watershed	Appendix H	2/25/2010	L5.1.1.4	L-87
Twin Creek Watershed	Appendix B	3/4/2010	L5.1.2.4	L-92
Walnut Creek Watershed	Appendix B	5/4/2010	L5.1.3.4	L-96
Great Miami River (upper) Watershed	Appendix E	3/26/2012	L5.2.1.3	L-109

L5.1 Projects included in the 2012 Integrated Report

After completion of the *2010 Integrated Report* and before completion of the *2014 Integrated Report*, Ohio submitted three 4B alternatives as part of approved TMDLs: Town Run (White Oak Creek Watershed TMDL Report); Twin Creek (Twin Creek Watershed TMDL Report); and Sycamore Creek (Walnut Creek Watershed TMDL Report). Together with TMDLs approved for other impairments to the aquatic life use, the 4B work should bring the streams into attainment with water quality standards.

L5.1.1 Town Run (White Oak Creek Watershed)

Impairment of biological water quality standards and high ammonia concentrations have been measured in Town Run, a tributary to White Oak Creek at river mile (RM) 6.95. Town Run is a high gradient bedrock substrate headwater stream that is fed by ground water. The City of Georgetown WWTP discharges to Town Run at RM 0.80. The biological impairment and high ammonia concentrations are resulting from the Georgetown WWTP effluent discharge. Ohio EPA proposes that this impairment be handled through a category 4B alternative instead of a total maximum daily load (TMDL). Further details are discussed below. Additional information is available in the main text of the TMDL and in the biological and water quality study publication.

Ohio EPA is addressing the phosphorus and nitrate-nitrite impairments via a TMDL analysis expected to be completed in 2009.

Identification of segment and statement of problem causing the impairment

Ohio EPA measured the water quality in the White Oak Creek watershed in 2006, collecting biological, chemical and physical data. The following paragraph from Ohio EPA's water quality report summarizes the problems observed in Town Run:

"Biological sampling in Town Run (RM 0.9 in 2008) found a marginally good community of macroinvertebrates and a reproducing population of the cold water indicator two-lined salamander upstream from the Georgetown WWTP discharge (RM 0.80). Downstream from the WWTP discharge (RM 0.7 in 2008) the macroinvertebrate community was very poor and there was no observed reproduction of the two-lined salamander. High concentrations of Ammonia-N (median of 3.24 mg/L), Phosphorus-T (median of 3.04 mg/L), and Nitrate-Nitrite-N (median of 6.39 mg/L) were recorded downstream from the WWTP discharge in 2006." (***epa.ohio.gov/portals/35/documents/WhiteOakCreekTSD2006.pdf***, p. 9)

During Ohio EPA's water quality survey of the White Oak Creek watershed in 2006, five sets of chemical samples were collected at sites upstream and downstream of the Georgetown WWTP. Upstream of the WWTP, the median value for ammonia was 0.05 mg/L. Downstream of the WWTP, the ammonia value was 3.24 mg/L. The median ammonia value of the Georgetown WWTP effluent was 4.07 mg/L.

Biological impact was significant, resulting in a listing on the 303(d) list. Upstream of the WWTP, Town Run is fully attaining the Aquatic Life Use, but downstream of the WWTP the use is not attained.

Description of pollution controls and how they will achieve water quality standards

Town Run is effluent-dominated downstream from the Georgetown WWTP. The drainage area upstream of the WWTP discharge is only 1.3 square miles.

The median flow of the Georgetown WWTP from 2002-2006 was 0.47 million gallons per day (MGD) with 23.8 percent (420/1764) of the flow dates being over the facility's design capacity of 0.80 MGD.

The critical period for ammonia in such an effluent-dominated stream is late summer when ambient temperatures are highest and stream flows are lowest. Calculating a load to meet water quality standards during the summer is protective of other time periods. A winter load is calculated to meet the needs of Ohio EPA's permitting program.

By reducing the effluent concentration of ammonia from Georgetown, water quality standards for ammonia and the Aquatic Life Use in Town Run are expected to be met.

The nonpoint source load is zero because of the limited drainage area above the WWTP's discharge point. At the critical condition, no upstream flow would be expected.

Loadings for point sources can be calculated using a mass-balance equation. In this case, since upstream flow equals zero, the allocation for the Georgetown WWTP is equal to the water quality standards (WQS). The ammonia WQS for exceptional warmwater habitat (EWH)/coldwater habitat (CWH) is 0.6 mg/L during summer and 1.93 mg/L during winter.

Thus, the load allocated to the Georgetown WWTP = (WQS) x (Effluent flow) x (conversion factor):

Summer: 0.6 mg/L x 0.8 MGD x (factor) = 1.82 kg/day
Winter: 1.93 mg/L x 0.8 MGD x (factor) = 5.85 kg/day

An estimate or projection of the time when WQS will be met

After the Georgetown WWTP meets the new ammonia permit limit (by November 2014), the ammonia limit should be met. The water body is expected to respond to the load reduction, but recovery will not be instantaneous. Ohio EPA will monitor the stream for recovery.

Schedule for implementing pollution controls

The Georgetown NPDES permit expires on February 28, 2010. Prior to that date, Ohio EPA will issue a new permit with a 30-day average limit on effluent ammonia of 0.6 mg/L (summer) and 1.93 mg/L (winter).

Officials at the Georgetown WWTP have contracted with an engineering firm and they have produced a plan to upgrade the WWTP to achieve compliance with the new ammonia limits. The WWTP upgrade will be completed by November 2014.

Ohio EPA will monitor Georgetown's progress toward meeting the permit limits by following up on the construction activity and reviewing monthly effluent reports.

Monitoring plan to track effectiveness of pollution controls

As a part of its NPDES permit, the Georgetown WWTP measures and reports ammonia concentrations in its effluent and in Town Run upstream and downstream of its discharge point. The sampling will be conducted twice per week and reported monthly. The facility's monthly discharge monitoring reports are reviewed by permit staff in Ohio EPA's Southwest District Office. Ohio EPA staff will also conduct facility inspections approximately annually.

After the Georgetown ammonia reductions have been in place for at least one year, Ohio EPA will revisit the area to determine if progress toward meeting the Aquatic Life Use is being made. This work would follow Ohio EPA's protocol for sampling the aquatic biology and chemistry.

Commitment to revise pollution controls, as necessary

The SWDO surface water manager will initiate a reexamination of the implementation strategy if significant progress is not being made by the end of the next NPDES permit cycle for Georgetown.

Ohio EPA will report on the progress of any approved 4B in future 303(d) lists.

L5.1.1.1 First Report on Town Run 4B Demonstration (*2012 Integrated Report*)

A permit was issued to the Georgetown WWTP effective on September 1, 2010. Final effluent limitations for ammonia are 0.60 mg/L (summer monthly average) and 1.76 mg/L (winter monthly average). Those limits must be met beginning on September 1, 2014.

L5.1.1.2 Second Report on Town Run 4B Demonstration (*2014 Integrated Report*)

The Georgetown WWTP is under construction in fall 2013 to make improvements to meet the new nitrogen-ammonia and total phosphorus limits. The upgrade is scheduled to be completed by September 1, 2014, but upgrades are currently ahead of schedule. Follow-up sampling will take place in 2015 or 2016, so results will likely be available for the 2018 Integrated Report.

L5.1.1.3 Third Report on Town Run 4B Demonstration (*2016 Integrated Report*)

The Georgetown WWTP did not complete its scheduled upgrades by September 1, 2014, due to contractor issues. The WWTP upgrades were completed on July 1, 2015, and all treatment improvements should help meet the nitrogen-ammonia and total phosphorus limits. Follow up sampling will take place in 2016.

L5.1.1.4 Fourth Report on Town Run 4B Demonstration (*2018 Integrated Report*)

The Georgetown WWTP experienced some violations of the phosphorus and ammonia limits of their permit during 2015-2016. These violations occurred because of either high flows; high influent concentrations of phosphorus due to sludge dewatering; and/or learning curve on the adjustment of the ferric chloride feed to these factors. The below table details the violations for phosphorous and ammonia that have occurred since the NPDES permit effective date of November 1, 2015. The facility has been in compliance with the permit limits from September 2016 to September 2017. Ohio EPA conducted follow up sampling in Town Run in 2016. The results indicate the stream is still impaired and are being evaluated for further restoration actions.

Violations for phosphorus and ammonia since 11/1/2015 (effective date)

Reporting Period	Parameter	Limit Type	Limit	Reported Value	Violation Date
Jul 2015	Phosphorus, Total (P)	30D Qty	4.2 kg/day	4.25711 kg/day	7/1/2015
Jul 2015	Phosphorus, Total (P)	7D Qty	6.3 kg/day	6.67065 kg/day	7/22/2015
Aug 2015	Nitrogen, Ammonia (NH3)	7D Conc	0.90 mg/L	0.94333 mg/L	8/15/2015
Sep 2015	Phosphorus, Total (P)	30D Conc	1.0 mg/L	1.0475 mg/L	9/1/2015
Sep 2015	Phosphorus, Total (P)	7D Conc	1.5 mg/L	1.8 mg/L	9/22/2015
Dec 2015	Phosphorus, Total (P)	7D Qty	6.3 kg/day	6.7105 kg/day	12/1/2015
Jul 2016	Nitrogen, Ammonia (NH3)	7D Qty	3.8 kg/day	4.4491 kg/day	7/22/2016
Jul 2016	Phosphorus, Total (P)	7D Qty	6.3 kg/day	6.41985 kg/day	7/22/2016
Aug 2016	Phosphorus, Total (P)	7D Qty	6.3 kg/day	7.42163 kg/day	8/15/2016

L5.1.2 Twin Creek

The main stem of Twin Creek (in assessment unit 05080002 030) was identified as impaired by total phosphorus during the field sampling in 2005; organic enrichment was later added to the list of causes upon further investigation in the summer of 2009. Upstream of the WWTP in the City of Lewisburg, the stream was in attainment of its aquatic life use. Downstream of the treatment plant, the aquatic life in the stream was partially supporting the use. The City of Lewisburg WWTP discharges to Twin Creek at river mile (RM) 35.2. No impairment to Twin Creek upstream of Lewisburg or downstream at RM 33.6 was found. The biological impairment (between the WWTP and RM 33.6) is resulting from the Lewisburg WWTP effluent discharge. Ohio EPA proposes that this impairment be handled through a category 4B alternative instead of a total maximum daily load (TMDL). Further details are discussed below. Additional information is available in the main text of the TMDL and in the forthcoming biological and water quality study publication.

Identification of segment and statement of problem causing the impairment

An Invertebrate Community Index (ICI) of 38 was garnered at RM 34.9, which was below the Exceptional Warmwater Habitat (EWH) criterion. In 2005, excessive phosphorus due to either the Lewisburg WWTP, herbicide runoff from an upstream municipal park, or contaminated storm water was considered potential contributors to this impairment. However, new information obtained during an inspection of the Lewisburg WWTP in September 2009 revealed that biological solids were being discharged directly into Twin Creek from the wastewater plant. Gray and brown sewage sludge was observed in Twin Creek from Lewisburg's outfall downstream to at least the Salem Road Bridge, with thick algal mats coating the heaviest deposits. Black anoxic muck was also observed under many of the substrates. Because of these new findings, it is apparent that nutrient enrichment was a secondary cause of impairment to Twin Creek at RM 34.9. Organic enrichment attributable to improper solids management at the Lewisburg WWTP is now considered the primary cause of impairment to the macroinvertebrate community at RM 34.9.

Further information regarding the 2005 findings is available in the Biological and Water Quality Study of Twin Creek and Select Tributaries 2005, available on Ohio EPA web site (***epa.ohio.gov/portals/35/documents/TwinCreek2007TSD.pdf***). This report will be amended to reflect the 2009 observations.

Ohio EPA included nutrient enrichment for this assessment unit in the *2008 Integrated Report* (303(d) list), available at (***epa.ohio.gov/dsw/tmdl/2008IntReport/2008OhioIntegratedReport.aspx***). The *2010 Integrated Report* will add organic enrichment as an impairment cause for this assessment unit.

The primary issue with the Lewisburg WWTP is that biological solids or sludge is making its way into the stream resulting in the stream conditions described above. Sludge in the creek will contribute nutrients (phosphorus) and bacteria as well as smothering the substrate. Biological solids are largely made up of sewage treatment micro-organisms, living and dead. Micro-organisms contain phosphorus compounds (e.g., nucleic acids, ADP, ATP). Biosolids from WWTPs are frequently used as an agricultural soil amendment with some fertilizer value. Lewisburg's 2008 annual sewage sludge report included the following analyses results (on a dry weight basis): TKN = 35,000 mg/kg; NH_3-N = 8590 mg/kg; and phosphorus = 15,900 mg/kg.

This information demonstrates there is a nutrient content to Lewisburg's sludge.

In September 2009 there appeared to be both structural and operational problems. Clarified water was overflowing only portions of the clarifier weirs; this may have been caused by the weirs not being level and sections of the weir being clogged with algae. The net result was that the clarifiers were being short circuited. Compounding the problem was the fact that Lewisburg was not wasting sufficient amounts of sludge from the clarifiers to the sludge digesters. This resulted in old sludge denitrifying and floating to the surface of the clarifiers, which was then discharged to Twin Creek. Plant operating logs also documented difficulty in balancing flow between the two clarifiers during rain, which compromised clarifier performance still further. The appearance of the aeration tanks indicated that the mixed liquor suspended solids were being maintained at higher levels than necessary and that the biological solids in the tank were old.

Description of pollution controls and how they will achieve water quality standards

The Village of Lewisburg operates a sewer collection system and a wastewater treatment facility that handles domestic and industrial sewage for a population of about 1,800. The Lewisburg WWTP holds a NPDES permit (1PB00019*HD).

Lewisburg has been reporting substantial compliance with its NPDES effluent limits over the life of the current permit. Ohio EPA now believes that compositing effluent samples using multiple grab samples (as allowed by the NPDES permit) did not provide a true reflection of effluent quality. Recent inspections have also revealed quality control issues with the sampling and analyses, casting doubt on the reported effluent data.

Lewisburg has been required in inspection reports and Notices of Violation to take actions to eliminate the problems resulting in discharge of solids to Twin Creek. The Village has since utilized the assistance of Ohio EPA’s Compliance Assistance Unit and has engaged an engineering firm that is reviewing plant operations. Lewisburg began implementing changes recommended by Ohio EPA’s Compliance Assistance Unit in November 2009.

Ohio EPA anticipates that the operational problems contributing to the discharge of solids can be resolved well before the NPDES permit is renewed in April 2010. Ohio EPA NPDES permits staff from the Southwest District office will closely monitor operational changes.

The draft renewal of the Lewisburg WWTP NPDES permit, (scheduled for issuance April 1, 2010) contains additional requirements that will address the impairment in Twin Creek downstream of the WWTP discharge. Ohio EPA intends to revisit the Twin Creek sampling sites in Lewisburg in September 2011. If the operational improvements have been properly implemented and yet the ICI at RM 34.9 cannot be demonstrated to comply with EWH criteria due to organic enrichment from the WWTP, Lewisburg will be required by a modification to its NPDES permit to comply with a schedule that leads to compliance with an initial total phosphorus limit of 1.0 mg/L by April 2015.

A complicating factor is that Preble County, at the request of the Village of Lewisburg, cleared bank vegetation and removed gravel bars and woody debris from the creek in the vicinity of RM 34.9 during the summer of 2009. This work was done to protect the Knapke Lane bridge pier and reduce bank erosion. It is unlikely that the target ICI score can be attained at that location unless the creek habitat is restored.

A loading analysis to address the organic enrichment impairment is not necessary given the scope of the operational problems at the Lewisburg WWTP and the ability of the facility to correct the problem.

Although it is difficult to predict how much of the secondary nutrient enrichment problem is associated with the operational problems, a simple analysis of chemical data provides guidance on point source loading.

The 2005 data collected in Twin Creek by Ohio EPA show a significant change in total phosphorus concentration at the WWTP's entry into the stream. The median in-stream concentration of total phosphorus upstream of Lewisburg's outfall was 0.038 mg/L. The median in-stream concentration downstream of Lewisburg was 0.239 mg/L. The exceptional warmwater habitat (EWH) in-stream target from *Association Between Nutrients, Habitat, and the Aquatic Biota of Ohio Rivers and Streams* is 0.08 mg/L (***epa.ohio.gov/portals/35/documents/assoc_load.pdf***).

A simple loading analysis using the five sets of samples collected in 2005 yields the following total phosphorus loads:

Stream capacity (based on 0.08 mg/L target) = 1.303 kg/d Margin of safety (5 percent) = 0.065 kg/d

Load allocation (from nonpoint sources) = 0.856 kg/d Wasteload allocation (Lewisburg WWTP) = 0.382 kg/d

A wasteload allocation of 0.382 kg/d equates to an effluent concentration of 0.39 mg/L total phosphorus at the WWTP's design flow. The 95th percentile of effluent total phosphorus reported by Lewisburg over the current permit is 3.69 mg/L, although there is uncertainty because of concerns with laboratory practices.

Ohio EPA intends to apply an initial phosphorus limit of 1.0 mg/L that would be triggered if fixing the WWTP's operational problems fails to result in attainment of WQS. While the loading analysis results indicate that this limit will not meet the phosphorus target concentration, it does represent a significant (approximately 72 percent) reduction in phosphorus load from the Lewisburg WWTP. This limit should provide enough in-stream nutrient reduction to improve aquatic life while imposing achievable NPDES limits. Any further reduction in effluent limits should be evaluated after this limit is being attained and an evaluation of the biological condition of the stream has been completed.

An estimate or projection of the time when WQS will be met

The next NPDES permit for Lewisburg's WWTP will be issued in 2010. Ohio EPA anticipates that Lewisburg will be able to eliminate the discharge of biosolids to the creek before the permit is renewed. This will significantly reduce the solids and nutrient load to the creek. Ohio EPA expects that the stream will respond to improved operation within two years of making the changes.

Ohio EPA proposes to measure the ICI at RM 34.9 by September 2011. If the ICI does not comply with EWH criterion due to organic enrichment at that time Lewisburg will be given three years to come into compliance with a permit limit for TP of 1.0 mg/L (that is, by April 2015).

Schedule for implementing pollution controls

Any compliance schedule placed in the NPDES permit will allow three years (2012-2015) to implement new controls to reduce TP in effluent if the ICI score is not in attainment by September 2011. It is expected that operational improvements to reduce organic enrichment and, if needed, effluent controls to reduce TP, will sufficiently improve water quality within five years such that the macroinvertebrate community will be able to recover to full attainment.

Monitoring plan to track effectiveness of pollution controls

The City of Lewisburg WWTP is required to submit monthly Discharge Monitoring Reports for effluent quality from the WWTP and upstream and downstream of its discharge point.

The renewed permit will require 24-hour flow composited effluent sampling at Lewisburg, which will provide a much-improved picture of effluent quality. The operations assistance provided by Ohio EPA to the WWTP will include attention to quality control issues so that concerns with past facility monitoring will be resolved.

Following Ohio EPA's Permit Guidance, at upstream and downstream stations, pH, dissolved oxygen and temperature will be monitored once per month year-round. Total phosphorus, bacteria and ammonia–nitrogen will be added to both upstream and downstream stations at a frequency of once per month during the summer season.

The facility's monthly discharge monitoring reports are reviewed by permit staff in Ohio EPA's Southwest District Office. Ohio EPA staff will also conduct unannounced facility inspections at least twice annually until all identified operational and process changes have been completed.

After the Lewisburg operational improvements have been in place for at least one year, Ohio EPA will return to monitor Twin Creek at RM 34.9 by September 2011 to determine if progress toward meeting the Aquatic Life Use is being made. This work would follow Ohio EPA's protocol for sampling the aquatic biology and chemistry. If sufficient progress is not being made, Ohio EPA will evaluate the options available under NPDES authority, including additional operations assistance and enforcement.

Ohio EPA will report progress in its integrated report until the impairment has been eliminated.

Commitment to revise pollution controls, as necessary

The SWDO surface water manager will initiate a reexamination of the implementation strategy if significant progress is not being made by the end of the next NPDES permit cycle for Lewisburg.

Ohio EPA will report on the progress of any approved 4B in future 303(d) lists.

L5.1.2.1 First Report on Twin Creek 4B Demonstration (*2012 Integrated Report*)

Addressing organic solids issues at the Lewisburg WWTP has proven more difficult than originally anticipated. Ohio EPA is continuing to work with the WWTP to address compliance issues.

L5.1.2.2 Second Report on Twin Creek 4B Demonstration (*2014 Integrated Report*)

A permit to install for WWTP improvements was approved on July 10, 2013. The approved upgrades include a fine spiral screen and continuously backwashed tertiary filters. The Village has been awarded Ohio Public Works Commission funding for completion of the project. The expected date of completion of construction is July 2014. The improvements are expected to reduce the solids being discharged from the treatment plant and therefore the associated organic enrichment, which is expected in turn to result in attainment of the designated aquatic life use.

L5.1.2.3 Third Report on Twin Creek 4B Demonstration (*2016 Integrated Report*)

The following upgrades have been completed and are on-line:

- A new fine spiral screen;

- Upgrade of the existing circular aeration tanks to a zoned system to support biological nutrient removal (BNR) processes;
- All new mechanical equipment installed in the existing clarifiers;
- Addition of tertiary moving bed sand filters;
- Ultraviolet (UV) disinfection upgrade;
- New generator;
- Sludge pumping upgrades for both the return activated sludge (RAS) and waste activated sludge (WAS); and
- Sludge storage improvements.

Operators are trying to optimize the WWTP operations with small changes such as fine bubble diffusers in the sludge holding tank. There have been challenges trying to meet the 1 mg/L total phosphorus limit. Ohio EPA's Compliance Assistance Unit (CAU) has assisted with the operations at the plant. Other TMDL requirements were incorporated into the facility's NPDES permit when the permit was modified in April 2015.

L5.1.2.4 Fourth Report on Twin Creek 4B Demonstration (*2018 Integrated Report*)

During the timeframe of January 1, 2016, through September 19, 2017, Lewisburg WWTP has been operating at an average of 106.7 percent of the designed flow rate. The average Phosphorus, Total (P) for 2016 was 1.26 mg/L and the average for 2017 (to date 9/19/17) is 1.12 mg/L. Improvements have been made, but the Lewisburg WWTP is still inconsistent in compliance for Phosphorus, Total (P).

Through the NPDES permit, Ohio EPA has given the Village of Lewisburg until March 1, 2020, to complete further necessary improvements for complying with the total phosphorus limit. Ohio EPA follow-up monitoring in Twin Creek should not proceed until construction of the additional improvements have been completed.

L5.1.3 Sycamore Creek (Walnut Creek Watershed)

Problem causing the impairment.

Ohio EPA measured the water quality in the Walnut Creek watershed in 2005, collecting biological, chemical and physical data. Impairment of biological water quality standards (OAC 3745-1-07) was measured at six sites on Sycamore Creek, a tributary to Walnut Creek.

Three sites in Sycamore Creek met the biological criteria and three did not. The most upstream site (river mile (RM) 12.2) was impaired due to organic enrichment (probably due to septic systems), and then two sites (RMs 9.6 and 4.7) met the criteria. The next two sites (RM 4.18 (Hill Road) and 2.6 (Busey Road) partially met the criteria. The stream recovered to fully meet the criteria at the most downstream site (RM 0.2).

The City of Pickerington WWTP discharges to Sycamore Creek at RM 4.35. No impairment to Sycamore Creek immediately upstream of Pickerington or downstream of RM 2.6 was measured. The biological impairment is resulting from the Pickerington WWTP effluent discharge.

The site at RM 4.18 only partially met the WWH biological criteria. The fish community was in very good condition while qualitative invertebrate sampling revealed a low-to-fair community. This is likely caused by the proximity of the Pickerington WWTP to this sampling station and documented chronic toxicity of effluent to *Ceriodaphnia* (Ohio EPA, 2006, Bioassay Report 06-3447-C). Both fish and invertebrate communities improved at Sycamore Creek sites downstream of RM 4.18.

The chemical water quality criterion for total dissolved solids (1500 mg/L) was exceeded in Sycamore Creek downstream of the Pickerington WWTP (2110, 1950, 1710 mg/L).

Link between the source of the problem and the specific listed impairments

High total dissolved solids (TDS) concentrations result from the Pickerington WWTP discharge. The WWTP accepts a waste stream from the Pickerington water treatment facility which uses a Zeolite process to treat drinking water. This process creates a wastewater high in dissolved solids which the WWTP does not effectively treat. This high dissolved solids waste gets passed through the WWTP and into Sycamore Creek.

Bioassay testing results on the Pickerington effluent and mixing zone have confirmed TDS-related impairment to the invertebrate community as well by demonstrating negative effects (immotility, death) to *Ceriodaphnia*. Mayfly populations found downstream of the WWTP are impaired revealing only 2 mayfly taxa (compared with 8 found upstream of the discharge point) plus a variety of TDS tolerant and facultative invertebrates as well. The two sites upstream and the site at the mouth were in full attainment of WWH biological standards with moderately good (qualitative assessments at RM 9.6 and 4.7) to exceptional (ICI=50 at RM 0.2) communities of invertebrates.

Low fish MIWB scores found at RM 2.6 provide further evidence of a problem with excessive TDS in-stream contributing to reduced numbers of fish.

Further information regarding the 2005 findings is available in the Biological and Water Quality Study of Walnut Creek and Select Tributaries 2005, available on Ohio EPA web site (***epa.ohio.gov/portals/35/documents/WalnutCreek2005TSD.pdf***).

Ohio EPA included total dissolved solids for this assessment unit in the *2008 Integrated Report* (303(d) list), available at (***epa.ohio.gov/dsw/tmdl/2008IntReport/2008OhioIntegratedReport.aspx***).

Description of pollution controls and how they will achieve water quality standards

The City of Pickerington operates a sewer collection system and a wastewater treatment facility and is regulated under a NPDES permit (4PB00017*LD).

The existing Pickerington wastewater plant has an average daily design flow of 1.6 MGD. Pickerington is expanding its wastewater plant to an average design flow of 3.2 MGD to accommodate new development within its service area. Along with other improvements, for solids handling the City will construct two new aerobic digesters and new sludge drying beds for storage.

The permit requires the development of a method to control discharges of elevated dissolved solids. Both interim and final effluent concentrations of dissolved solids are present in the permit (calculated by wasteload allocation) which should serve to ameliorate the violations of the WQS in Sycamore Creek (see the NPDES permit fact sheet for the Pickerington WWTP: ***wwwapp.epa.ohio.gov/dsw/permits/permit_list.php***).

Point and nonpoint source loadings that will achieve water quality standards.

The allowable loading is based on the beneficial uses assigned to the receiving waterbody in OAC 3745-1. Dischargers are allocated pollutant loadings/concentrations based on the Ohio Water Quality Standards (OAC 3745-1). TDS was allocated using the mass-balance method, using the following general equation:

Discharger WLA = [(downstream flow x WQS) - (upstream flow x background concentration)] / discharge flow.

See the permit fact sheet (***wwwapp.epa.ohio.gov/dsw/permits/permit_list.php***) for details.

The continuous discharge from the WWTP into Sycamore Creek at low stream flows during the summer represent the critical condition for the aquatic ecosystem. The WLA calculation accounts for the nonpoint source load in the equation. See the permit fact sheet (***wwwapp.epa.ohio.gov/dsw/permits/permit_list.php***) for details.

All loads in kg/d	Existing WWTP Flow	Expanded WWTP Flow
TMDL	11,022	20,433
LA	666	666
WLA	10,356	19,767

An estimate or projection of the time when WQS will be met

The NPDES permit requires the City of Pickerington to meet the final effluent limitations in the permit within 25 months of the effective date of the permit (in 2010). WQS should be met soon after as macroinvertebrates can recover quickly (6 months to a year) once the stressor is removed.

Schedule for implementing pollution controls

Reference the NPDES permit fact sheet for scheduling information (***wwwapp.epa.ohio.gov/dsw/permits/permit_list.php***).

Monitoring plan to track effectiveness of pollution controls

The City of Pickerington WWTP is required to submit monthly Discharge Monitoring Reports for effluent quality from the WWTP and upstream and downstream of its discharge point.

The permit requires 24-hour composite sampling for TDS of the WWTP effluent, to be completed three times per week year-round. In addition, the WWTP will collect an ambient grab sample for TDS at sites both upstream and downstream of the discharge into Sycamore Creek; they will use a laboratory of their choice.

The facility's monthly discharge monitoring reports are reviewed by permit staff in Ohio EPA's Central District Office. Ohio EPA staff will also conduct unannounced facility inspections until all identified operational and process changes have been completed.

Water chemistry and macroinvertebrate community health will be monitored following the construction and new plant start up. After the Pickerington WWTP improvements have been in place for at least one year, Ohio EPA will return to monitor Sycamore Creek to determine if progress toward meeting the Aquatic Life Use is being made. This work would follow Ohio EPA's protocol for sampling the aquatic biology and chemistry. If sufficient progress is not being made, Ohio EPA will evaluate the options available under NPDES authority, including operations assistance and enforcement.

Ohio EPA will report progress in its integrated report until the impairment has been eliminated.

Future monitoring

City of Pickerington (far field monitoring for TDS in the NPDES permit, analysis by a laboratory of their choice) and Ohio EPA DSW, CDO WQ (chemistry, with analysis by Ohio EPA DES) and EAS (macroinvertebrates).

Cost estimates

Five work days for two people to sample chemistry, 1 work day for two people to do qualitative macroinvertebrate monitoring, and the associated standard lab costs for TDS samples.

Analysis of the results and annual reporting

Ohio EPA, CDO, DSW WQ staff will examine both data from Ohio EPA sampling and that generated by Pickerington. EAS macroinvertebrate staff will analyze their own data. Ohio EPA CDO staff will complete the reporting necessary for this 4B demonstration.

Revising the implementation strategy and corresponding pollution controls

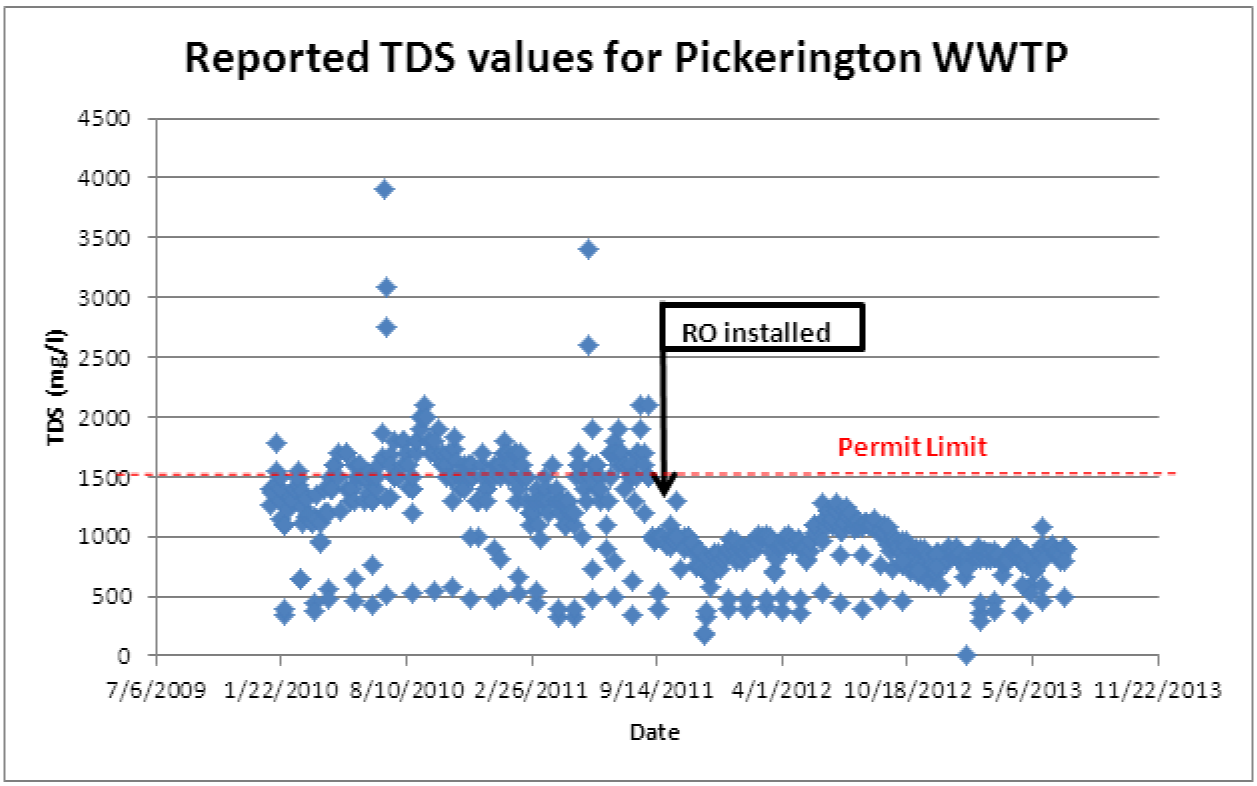
The CDO surface water manager will initiate a reexamination of the implementation strategy if significant progress is not being made by the end of the next NPDES permit cycle for Pickerington.

L5.1.3.1 First Report on Sycamore Creek 4B Demonstration (*2012 Integrated Report*)

The City of Pickerington replaced their ion exchange water treatment plant with a reverse osmosis water treatment plant in order to address the NPDES TDS effluent limit violations at their WWTP. Very soon after the new plant began operating, Pickerington returned to compliance with the NPDES permit conditions implementing the water quality criterion for TDS. Ohio EPA expects this to eliminate any impairment in Sycamore Creek.

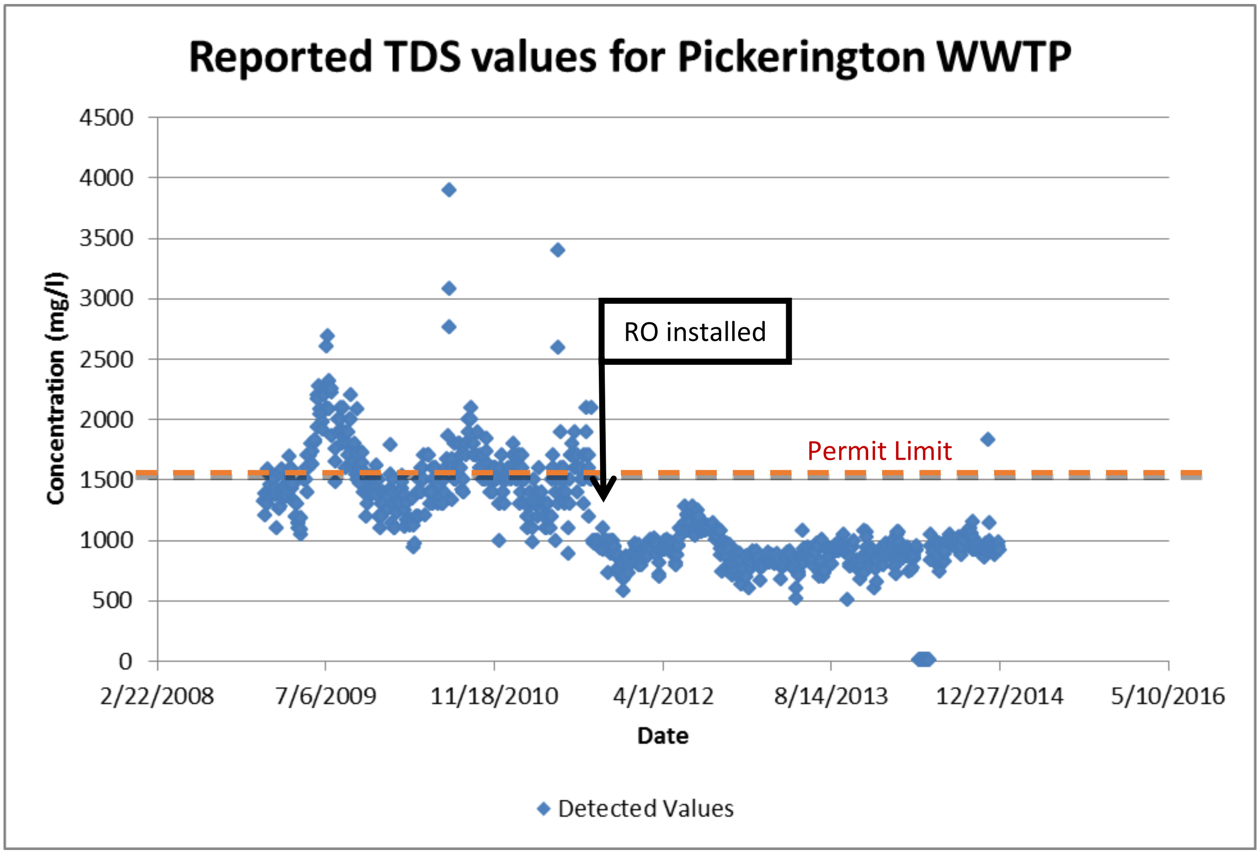
L5.1.3.2 Second Report on Sycamore Creek 4B Demonstration (*2014 Integrated Report*)

Sycamore Creek has not been reevaluated for aquatic life use support since the *2012 Integrated Report*. However, the facility has not reported any TDS violations since the reverse osmosis system was put in place (see figure below).



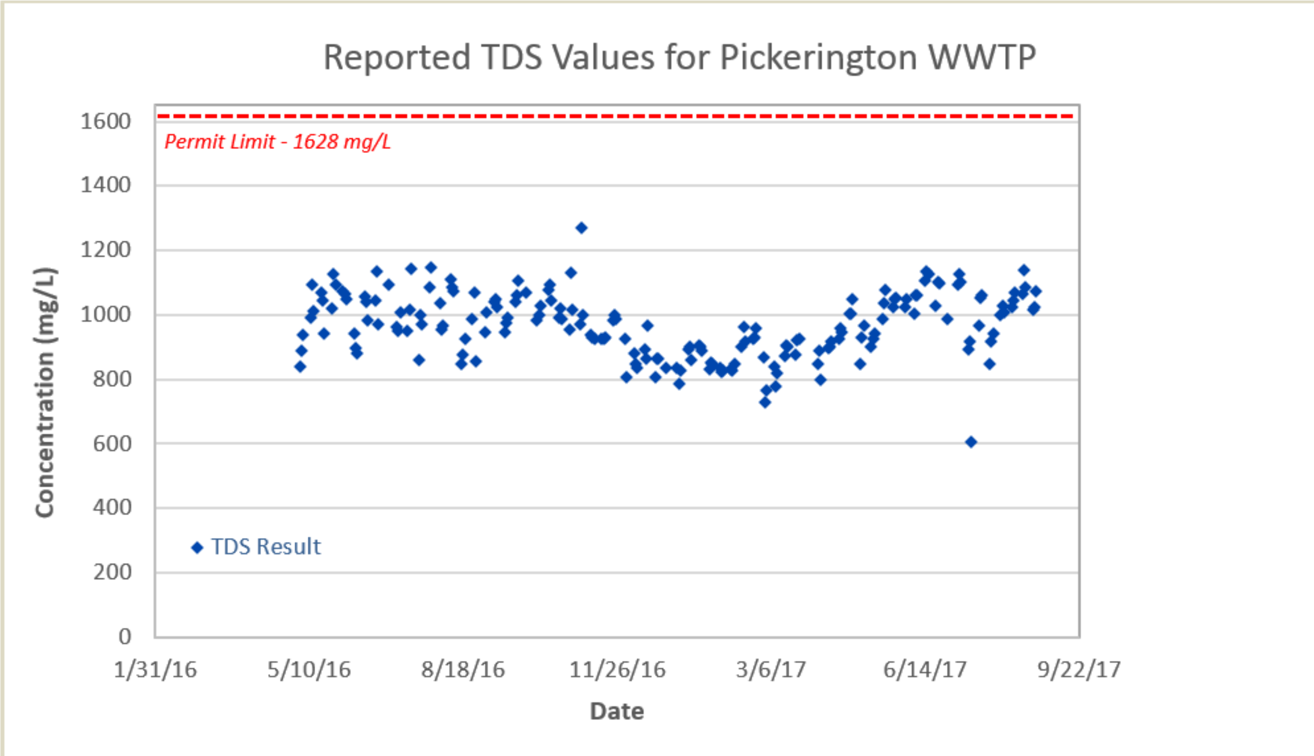
L5.1.3.3 Third Report on Sycamore Creek 4B Demonstration (*2016 Integrated Report*)

Sycamore Creek has not been reevaluated for aquatic life use support since the *2012 Integrated Report*. However, the facility has not reported any TDS violations since the reverse osmosis (RO) system was put in place (see figure below). Pickerington's permit limit for TDS is 1,628 mg/L. On November 24, 2014, an exceedance of the permit limit for TDS was detected; however, the limit is based on a monthly average, which for November was approximately 1022 mg/L, well below the established limit. Therefore, compliance with the permit was maintained.



L5.1.3.4 Fourth Report on Sycamore Creek 4B Demonstration (*2018 Integrated Report*)

Since the Third Report on Sycamore Creek 4B Demonstration (*2016 Integrated Report*), there has been no exceedances of the Pickerington WWTP NPDES permit limit for total dissolved solids (TDS). Pickerington's permit limit for TDS is 1,628 mg/L. The mean concentration for TDS from May 2016 to September 2017 is 968 mg/L. Compliance with the permit is being maintained. Follow up monitoring by Ohio EPA is anticipated for the 2019 field season.



L5.2 Projects included in the 2014 Integrated Report

After completion of the *2012 Integrated Report* and before completion of the *2016 Integrated Report*, Ohio submitted one 4B alternative as part of an approved TMDL: Great Miami River (upper) watershed TMDL Report. Together with TMDLs approved for other impairments to the aquatic life use, the 4B work should bring the river into attainment with water quality standards.

L5.2.1 Great Miami River (Great Miami River (upper) Watershed)

During the 2008 field survey, Ohio EPA identified that the Great Miami River at river mile 158.15 was partially supporting its warmwater habitat aquatic life use. Identified causes of impairment included habitat alteration, siltation, flow alteration, and organic enrichment/dissolved oxygen (DO). Ohio EPA proposes that the organic enrichment/DO cause of impairment be handled through a category 4B alternative instead of a total maximum daily load (TMDL). Further details are discussed below.

Additional information is available in the main text of the TMDL report and in the biological and water quality study publication (***epa.ohio.gov/portals/35/documents/Upper_GMR_TSD_2008.pdf***).

Identification of segment and statement of problem causing the impairment

The Great Miami River upstream of the WWTP is in partial attainment of its aquatic life use because of habitat alteration, siltation, flow alteration, and organic enrichment/DO. Organic enrichment/DO is partially attributed to an upstream WWTP at RM 158.15 – Indian Lake/Logan County (OH0036641).

Other sources include Indian Lake overflow of warm water in summer months and sediment from Cherokee Mans Run. Downstream of the WWTP, the river is sluggish from the effects of the low head dam impoundment in Quincy. This sluggish water is not allowing effective re-aeration of river water, which exacerbates the DO stresses caused by nutrient enrichment and sewage solids from the Logan County Indian Lake WWTP. The result is partial attainment downstream at Notestine Road (RM 153.45). Proper treatment of wastewater will help to alleviate the impacts to this stressed section of the Great Miami River.

The Logan County Indian Lake Sanitary Sewer District has an Infiltration/Inflow (I/I) problem in the collection system. Hydraulic surges during storm events overwhelm the collection and treatment systems causing a secondary treatment bypass. The result is the discharge of undertreated sewage with ammonia and solids entering the Great Miami River at RM 158.15, contributing to partial attainment due to low macroinvertebrate performance at Notestine Road (RM 153.45).

Description of pollution controls and how they will achieve water quality standards

On March 6, 2009 the Logan County Board of Commissioners was issued a NPDES permit number 1PK00002*KD for the discharge of treated waste water to the Great Miami River. This permit includes a compliance schedule for the elimination of a secondary treatment system bypass. This bypass allows for the discharge of primary treated waste water to go directly to the Great Miami River. The bypass contributes to additional organic and nutrient loadings to the river. The permit compliance schedule address both phase 1 and phase 2 projects designed to eliminate secondary treatment system bypasses at the plant. The phase 1 projects also will address several collection system overflows. The schedule requires completion of phase 1 projects by no later than July 1, 2011. The phase 2 projects are scheduled for completion by no later than July 1, 2016. On June 26, 2007 Permit to Install (PTI) 597728 was issued to the Logan County Water Pollution Control District. This PTI includes the following upgrades: a new 24" force main and lift station in the slough area; new influent fine screens; a new equalization tank (1.55 million gallons); conversion of existing primary clarifiers to equalization (0.5 million gallons); a new UV disinfection system; conversion of the anaerobic digesters to aerobic digester; and the addition of a new belt press and septage receiving station. The majority of the phase 1 projects were competed in early 2010. With the completion of this work the number of bypasses and collection system overflows has been reduced significantly. This will result in a reduction of loadings to the Great Miami River. With the completion of the phase 2 upgrades, all discharges from the plant will need to meet the water quality standards. This should eliminate any water quality impacts downstream resulting from treatment plant discharges.

Aquatic life use was assessed during the summer of 2008 while the WWTP facility was undergoing construction improvements (entitled Phase I). To address one of the causes of impairment, discharge monitoring report (DMR) data and a violations history from this facility were explored for any recognizable changes in performance before and after completion of Phase I. Other causes and sources of impairment (i.e., siltation, habitat alteration) are addressed in the TMDL project report under loading development.

Phase I construction was completed in late December 2009. The quantitative analysis contained herein contrasts the Indian Lake WWTP performance prior to (January 2005 to December 2009) and following (January 2010 to May 2011) completion of Phase I construction. To summarize, the comparison shows the following changes:

- Reduction in nutrient concentrations for final outfall (station 001) based on review of total phosphorus, ammonia, and nitrite/nitrate effluent data;
- Increase in influent (station 601) concentration of carbonaceous BOD (CBOD) and total suspended solids (TSS);
- Decrease in TSS spikes from final outfall (station 001);
- Reduction in number of bypass occurrences around secondary treatment (station 602); and
- Reduction in number of limit violations (TSS, ammonia, and pH) for final outfall (station 001).

While the improvements in effluent quality and WWTP operations are clearly manifest in 2010, they are somewhat confounded in 2011 due to anomalous meteorological and hydrological conditions within February through May. The upper GMR basin received considerable rainfall and experienced correspondingly high stream flow during late winter to mid spring 2011. Figure E-1 shows a frequency distribution of flow magnitude by percent exceedance for the GMR at Sidney OH for a record of over 25 years of daily flow. This gage is located 28 miles (river miles) downstream of the WWTP outfall. Flows during this period were consistently in the high percentile of non-exceedance. Flow produced from these rain events were exceeded 15 percent or lower over time (or *not* exceeded 85 percent or higher over time). Hence, some of unexpected results (discussed below by topic) following completion of Phase I construction can be explained by these anomalous high flows experienced within the WWTP collection area.

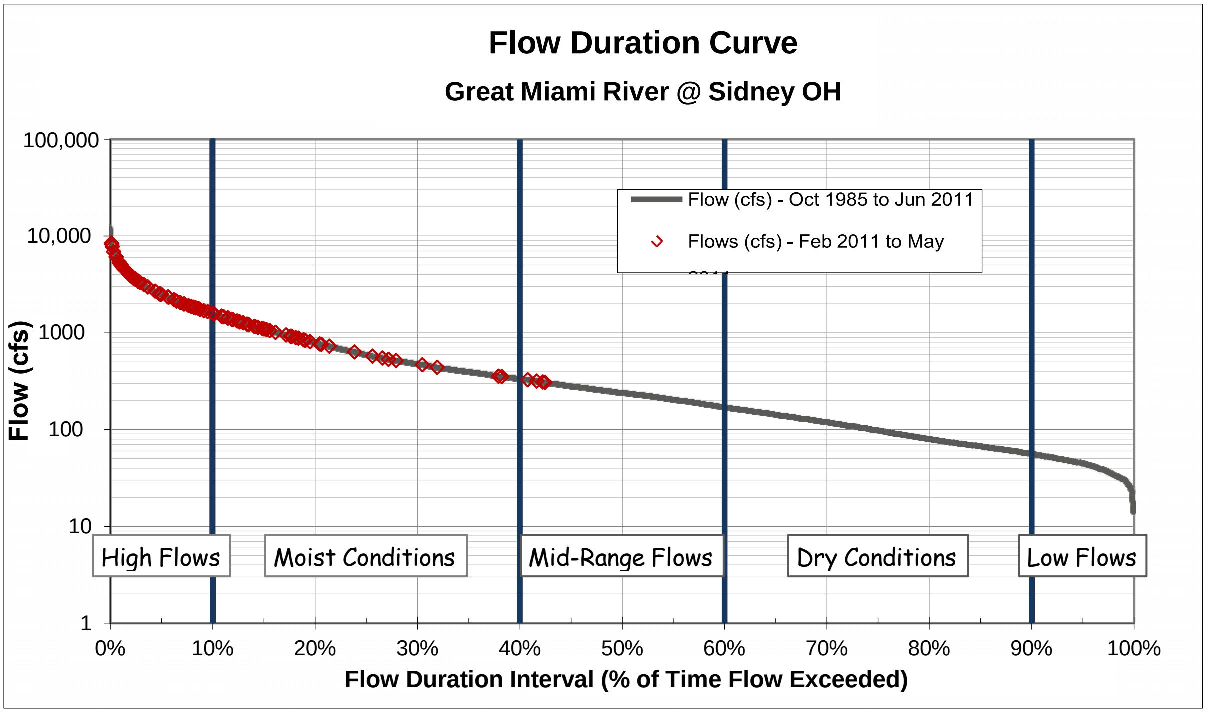


Figure E-1 Flow duration curve for data collected at USGS automatic gauge 03261500 (Great Miami River at Sidney OH) for the period October 1985 through June 2011. Flows during 2011 that occurred between February 16 and May 31 are highlighted in red. All values reported as average daily flow in cubic feet per second (cfs).

Nutrient Loading (Station 001)

When examining loadings for total phosphorus and ammonia from the final outfall, there is a progressive decline from 2005 to 2010 for both summer season (Figure E-2) and annual (Figure E-3) compilations. However, mean daily loadings increased in 2011 (annual compilation) for total phosphorus but not for ammonia (Figure E-3). For nitrite and nitrate effluent loadings, there was no consistent decline in magnitude; though for the 2009 and 2010 summer season, magnitudes were considerably lower than in the previous four years (2005-2008) (Figure E-2). This decline was also apparent for annual nitrite and nitrate loadings – 2009 to 2011 was noticeably lower than in the 2005- 2008 period (Figure E-3).

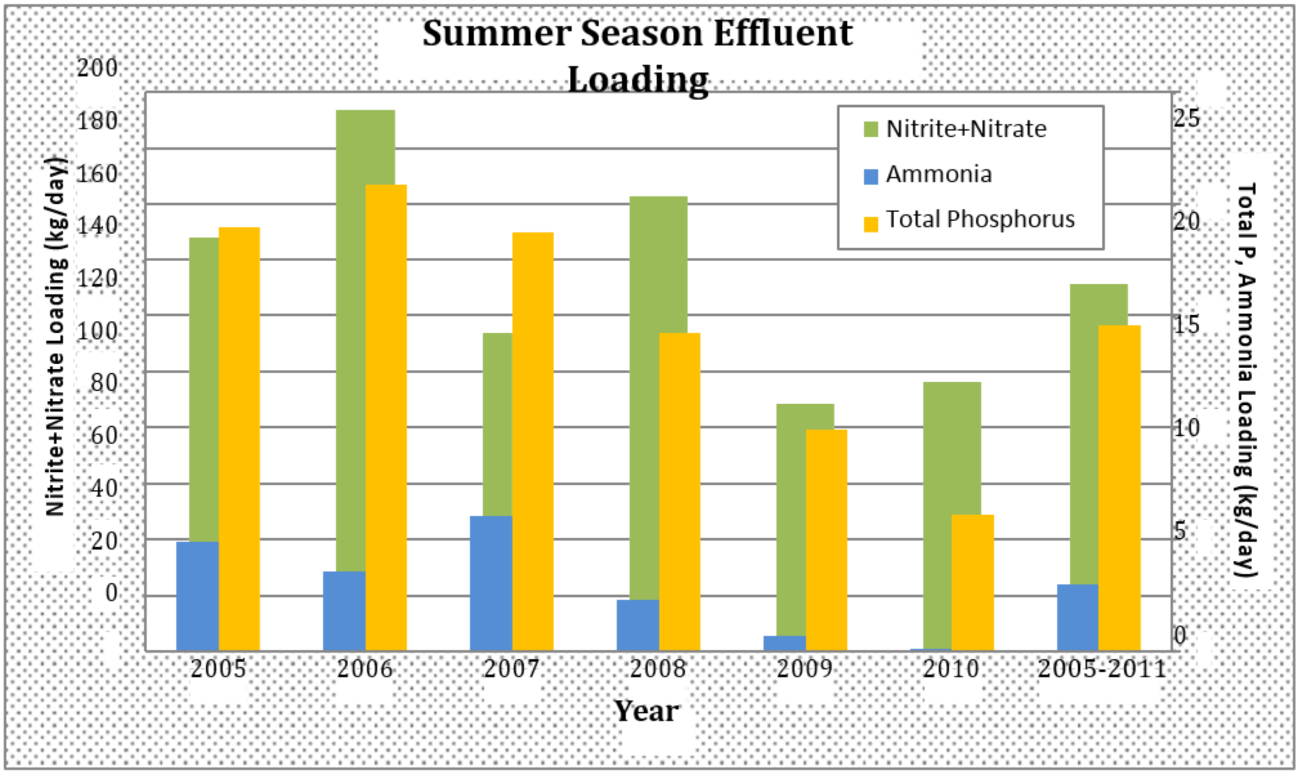


Figure E-2 — Mean loading (in kg/day) of total phosphorus, ammonia, and nitrite+nitrate by year for summer season (June to September) observations for Station 001 (final outfall) of Indian Lake WWTP. The overall seven- year summer season mean loading is also shown.

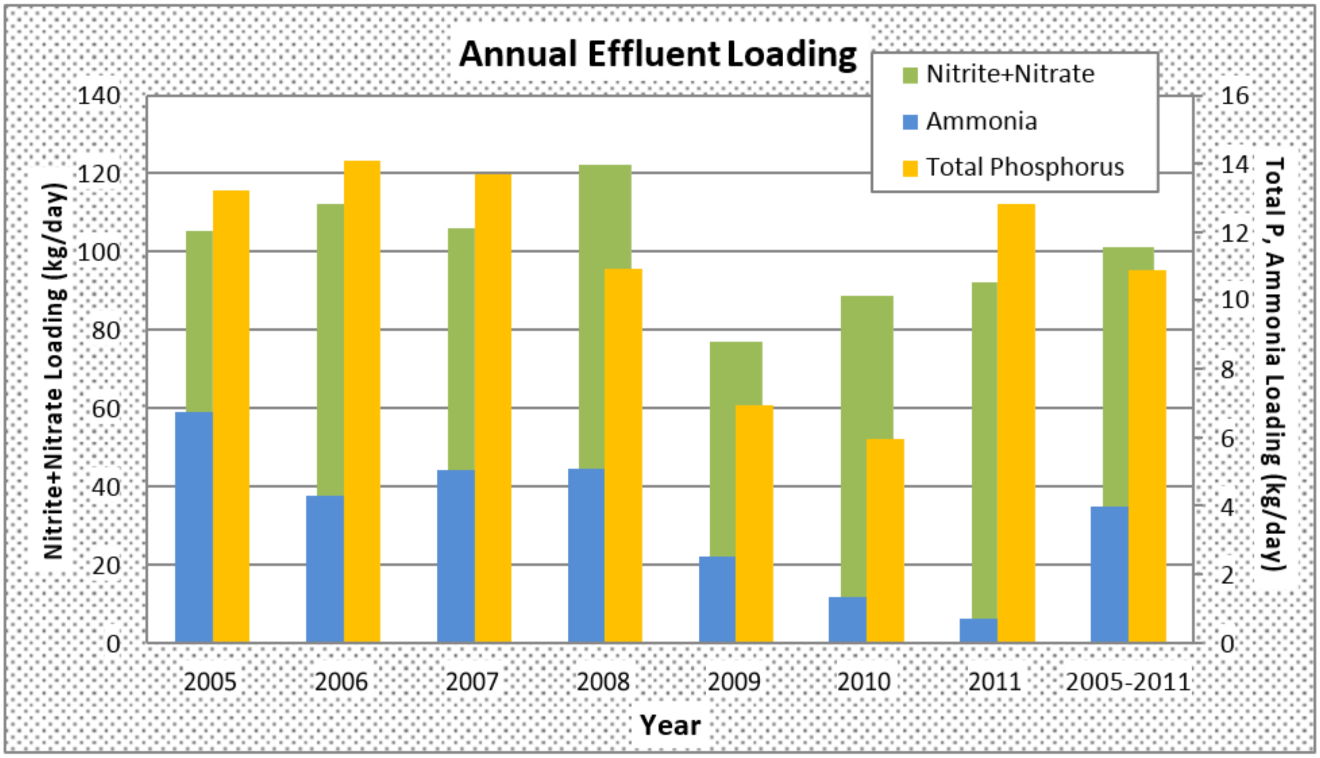


Figure E-3 — Mean loading (in kg/day) of total phosphorus, ammonia, and nitrite+nitrate by year for annual (January to December) observations for Station 001 (final outfall) of Indian Lake WWTP. The overall seven-year annual mean loading is also shown.

Influent Concentration (Station 601)

Concentrations of 5-day carbonaceous BOD (CBOD5) and total suspended solids (TSS) were examined for the influent station (station 601) to Indian Lake WWTP. Figure E-4 (summer) and Figure E-5 (annual) are included to show mean concentrations by year and overall for both CBOD5 and TSS. The overall (2005-2011) mean concentration is shown as a seven-year "normal". Concentrations of influent TSS increased markedly in 2009, and subsequently in 2010 and 2011, to reflect improved changes in septage receiving (from HSTS). A reconfigured influent screening system changed the location of influent monitoring to now measure 100 percent of incoming septage.

The increased concentration seen in 2010 (summer and annual) and 2011 (annual only) compared to the 2005-2008 period can further be explained by completion of Phase I improvements on the wastewater *collection system*. The resultant increase in concentration for both of these parameters suggests improved capture of waste from the collection system – there is less dilution flow from I/I problems and reduced storm water overflow from a slough area into the wastewater stream.

The increasing multi-year trend in influent concentration for both TSS and CBOD5 are further supported by Figure E-6 and Figure E-7, respectively, which show a time series with a 60-day running average and a large gain in the spring of 2009.

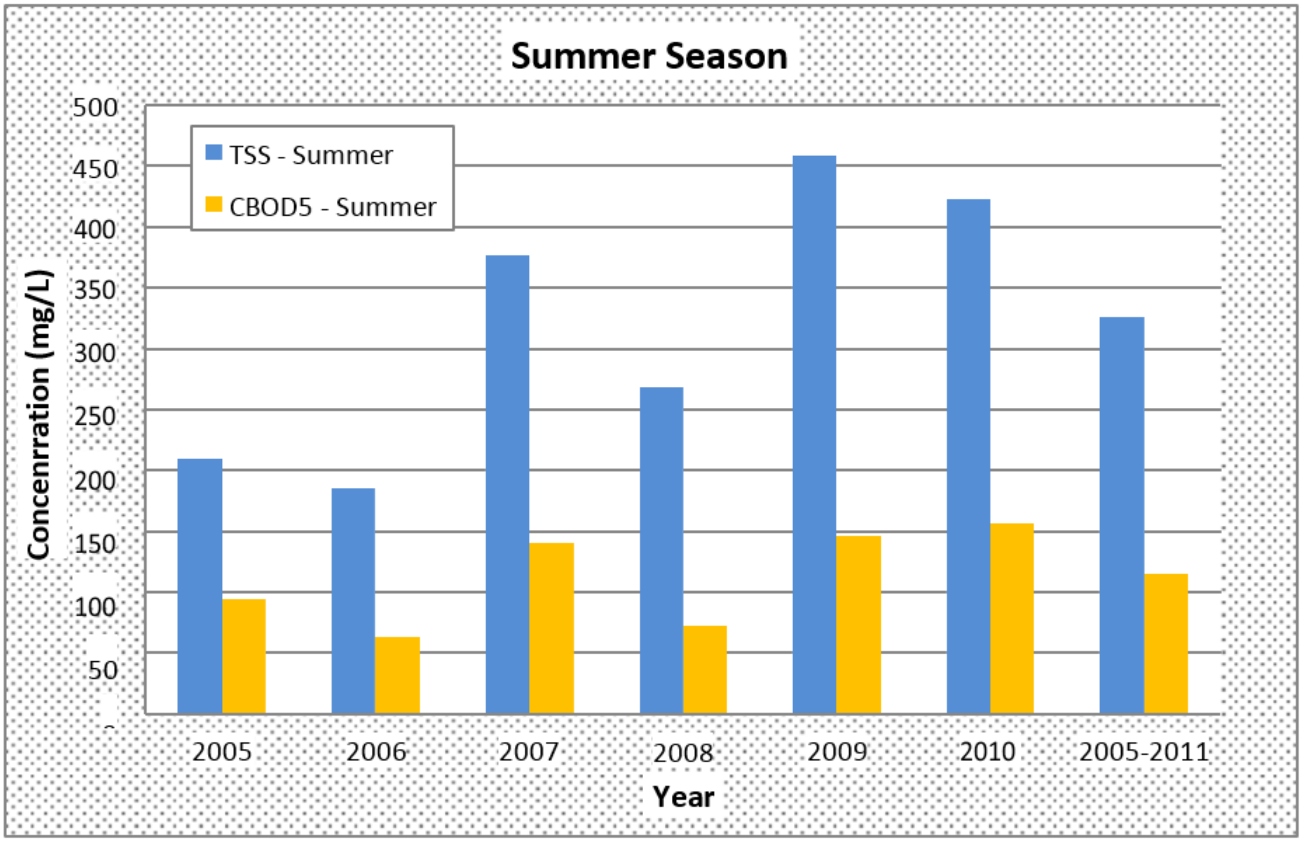


Figure E-4 — Mean concentration (in mg/L) of CBOD 5-day and TSS by year for summer season (June to September) observations for Station 601 (influent) of Indian Lake WWTP. The overall seven-year summer season mean concentration is also shown.

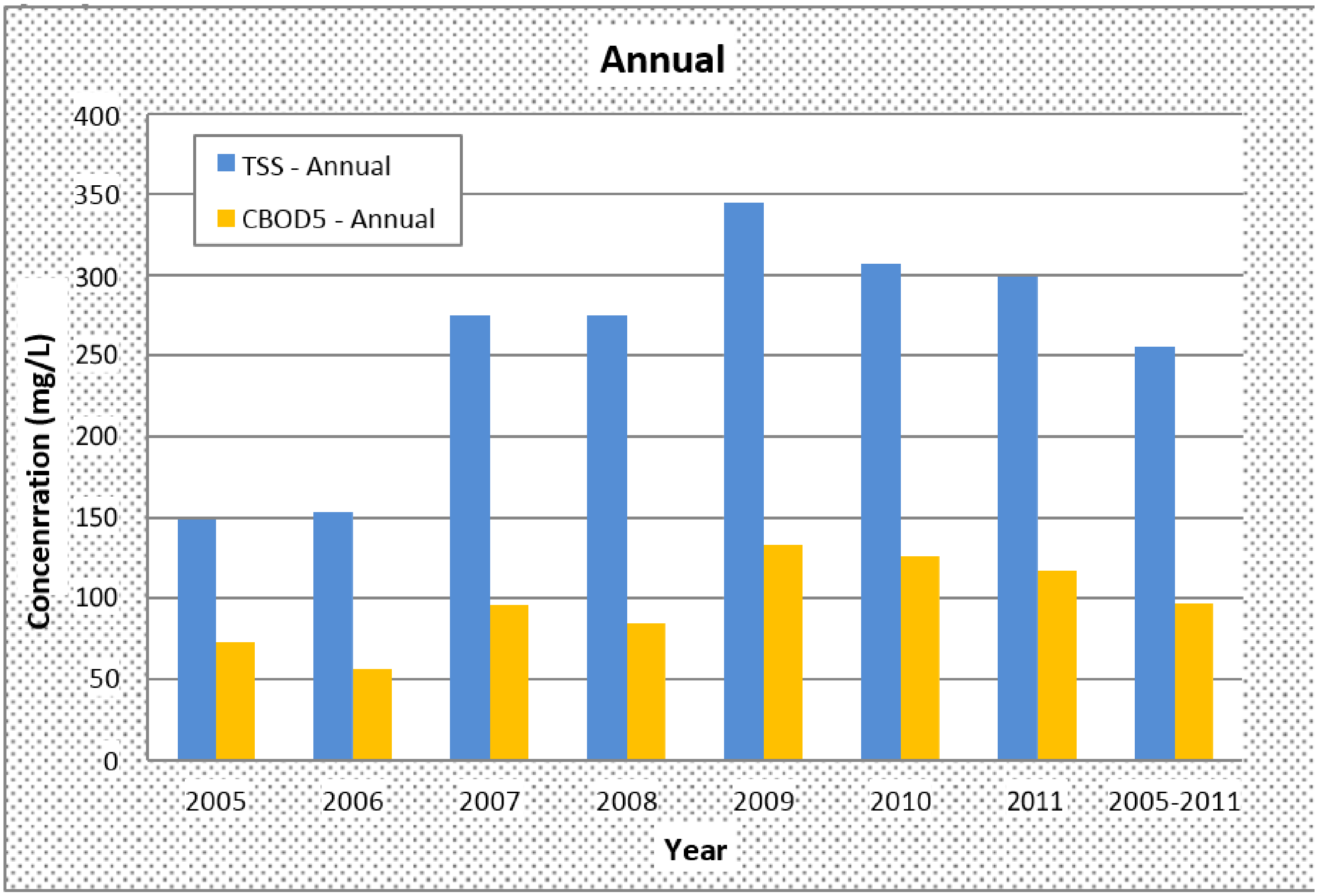


Figure E-5 — Mean concentration (in mg/L) of CBOD 5-day and TSS by year for annual (January to December) observations for Station 601 (influent) of Indian Lake WWTP. The overall seven-year annual mean concentration is also shown.

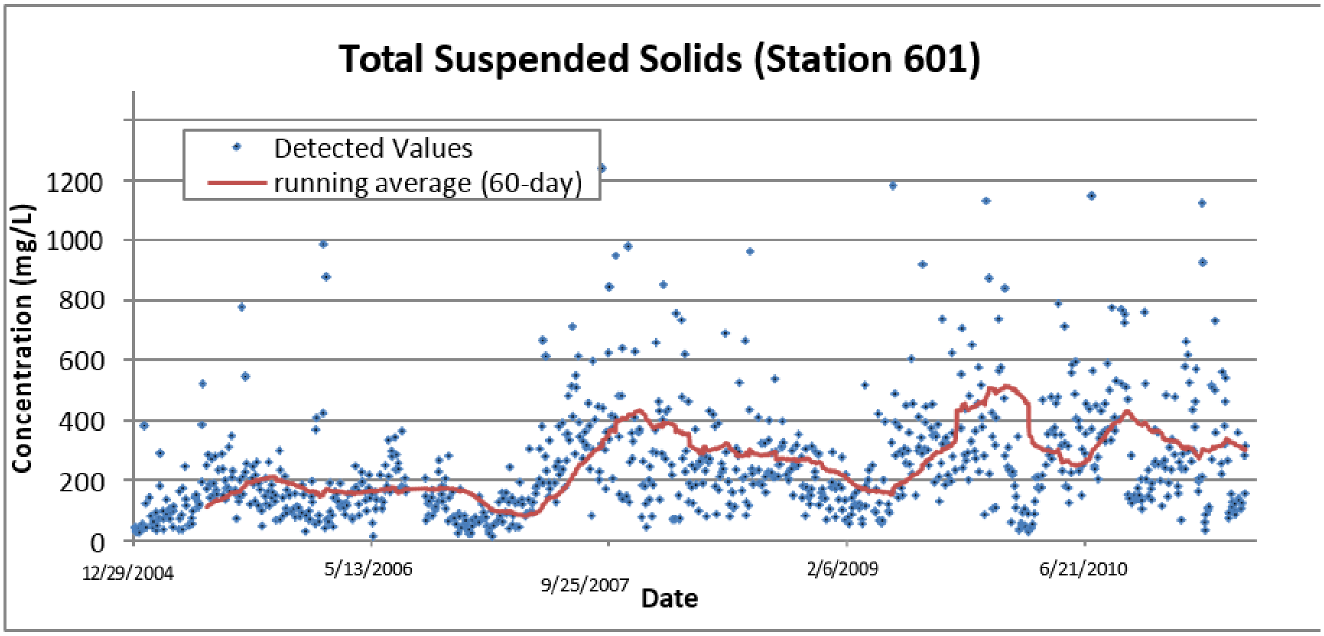


Figure E-6 — Time series of TSS from January 2005 to May 2011 for station 601 for Indian Lake WWTP. A 60-day running average was also computed and overlaid (solid red line) on the individual observations.

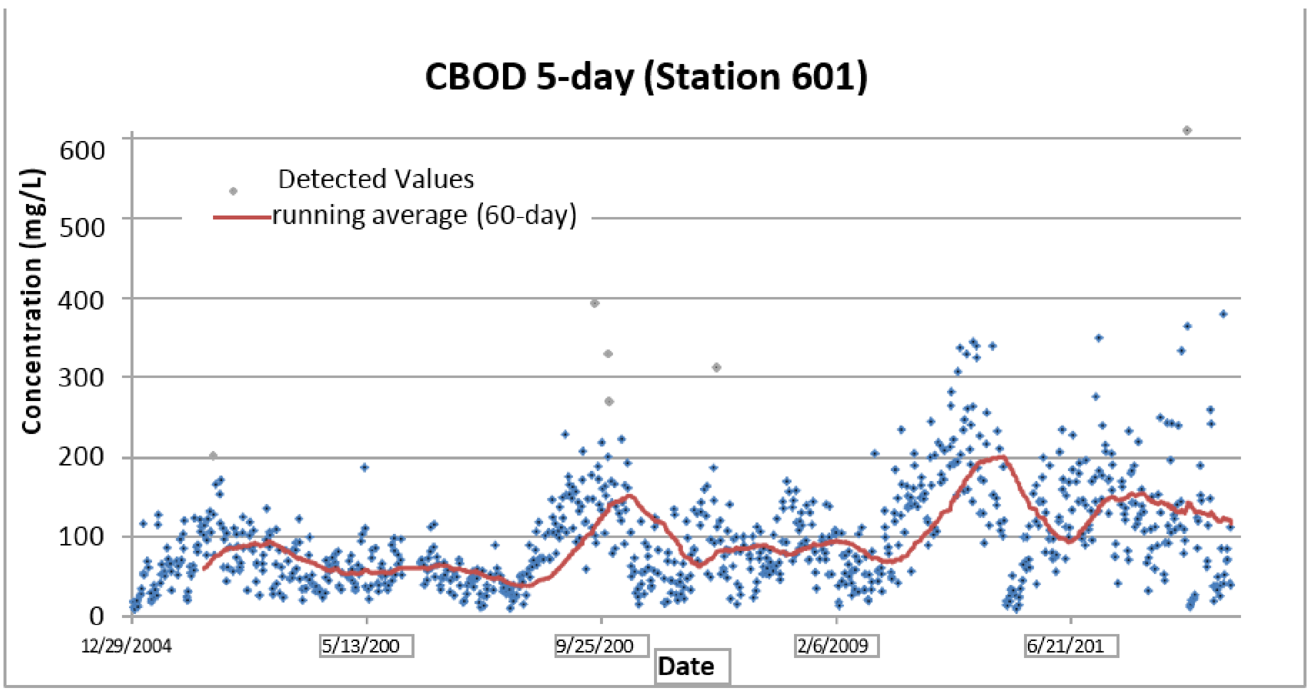


Figure E-7 — Time series of CBOD5 from January 2005 to May 2011 for station 601 for Indian Lake WWTP. A 60- day running average was also computed and overlaid (solid red line) on the individual observations.

Total Suspended Solids – Peak Events (Station 001)

A peak event is a high loading event and is defined here as a daily TSS load that exceeds 500 kg/day. The TSS permit limit for station 001 for this facility is 522 kg/day (weekly or average criterion). There were 34 of these events between 2005 and 2009 (Figure E-8). Performance following Phase I completion showed no high loading events for all 2010, and for those that occurred in 2011 – 6 of 7 events occurred in early March 2011.

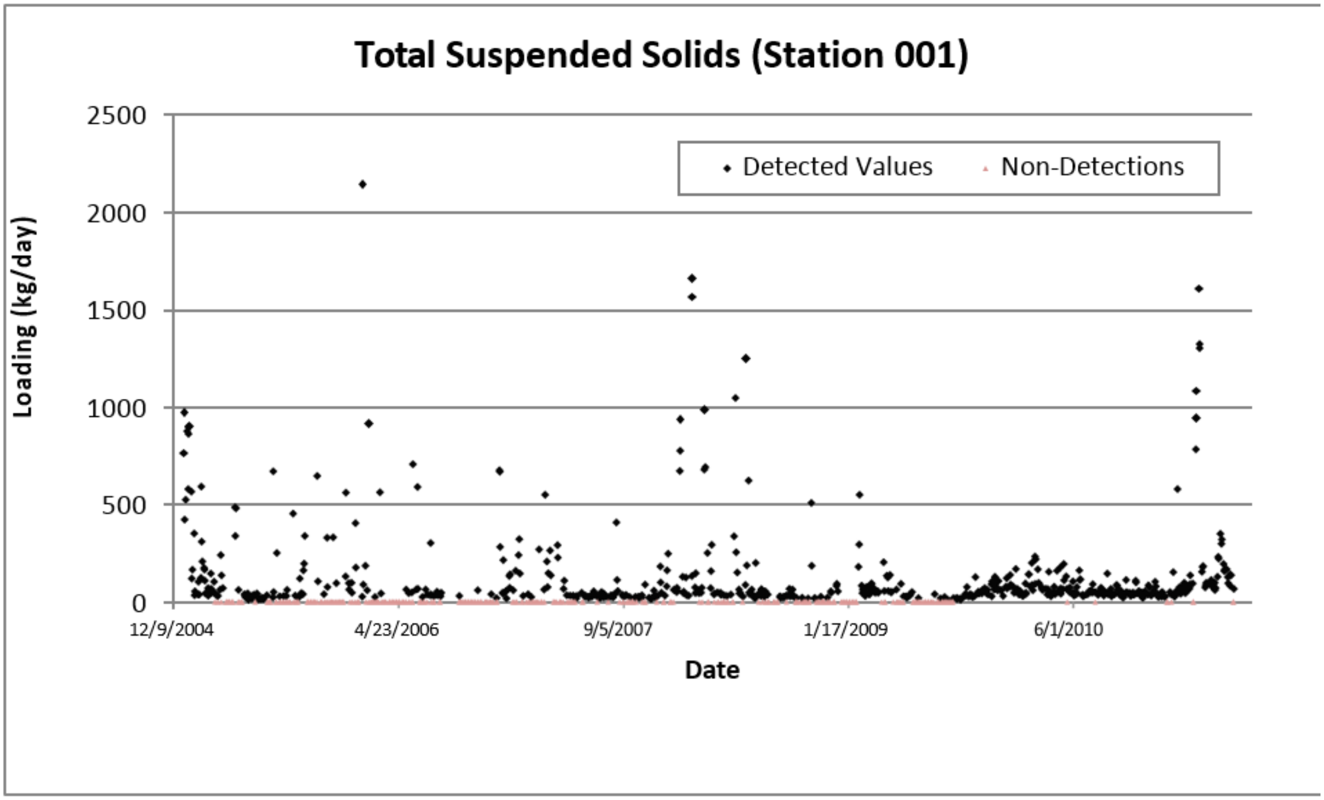


Figure E-8 — Time series of daily total suspended solid loads (kg/day) for Indian Lake WWTP for station 001 for the period January 2005 to May 2011.

Bypass Occurrence (Station 602)

Indian Lake WWTP bypass information such as number of occurrences per year and total and average volume of flow per year was examined and showed a marked decrease once Phase I was completed (Table E-1). A bypass event avoids secondary wastewater treatment and poses potentially significant harm to the receiving water. However, once into 2011 the number of bypass occurrences increased to 11 but all 11 events occurred after 2/17/2011 when the GMR basin, and corresponding WWTP collection area, experienced high percentile flood flows (Figure E-1). DMR data was only available to 5/27/2011 which is still within this identified high flow period. The sharp increase in 2011 also reflects the treatment plant's elimination of several bypasses *within the collection system*. Thus, all the flow that enters the system now makes it completely to the plant. The new expanded equalization system at the WWTP, as part of Phase I construction, will help capture more material before it is bypassed *at the plant*.

Table E-1 Summary of bypass information for Indian Lake WWTP (station 602) for the period 8/1/2006 to 5/26/2011.

Year	Number of Occurrences	Total Volume (MG)	Avg Volume per Occurrence (MG)
2006	9	22.4	2.49
2007	20	72.8	3.64
2008	22	84.8	3.85
2009	22	29.7	1.35
2010	6	12.1	2.02
2011 (5 months)	11	179.6	16.3

Limit Violations (Station 001)

A review of violations of permit limits for Indian Lake WWTP was made and is summarized in Table E-2 below. Both concentration and loading limit violations were considered and for both average (monthly) and maximum (weekly) statistical periods. While found in the review, violations for total chlorine residual were omitted because of insignificance to the impairment cause (DO/organic enrichment).

Since completion of Phase I, there was a considerable reduction in number of violations (Table E-2). The four TSS violation events that occurred after Phase I completion all occurred in early March 2011.

Table E-2 — Summary of limit violations for Indian Lake WWTP (station 001) for the period January 2005 to May 2011. Violations for total chlorine residual are omitted.

	Number of Limit Violations	
Parameter (code)	2005 - 2009	2010 - May 2011
TSS (00530)	8	4
pH (61942)	1	0
ammonia (00610)	7	0

Conclusion

The partial impairment of aquatic-life use that exists at RM 153.45 (Notestine Rd) of the GMR (12-digit HUC 05080001-03-02) is caused by multiple stressors and sources. While the predominant stresses are habitat alteration and siltation – a low gradient river system choked by sediment, a secondary stress is organic enrichment and low DO produced by an upstream POTW. The Agency aquatic-life use assessment was conducted and completed in 2008 but the POTW was in the midst of constructing improvements to minimize their bypass (of secondary treatment) occurrence and volume. The first phase (Phase I) of construction was completed in late December 2009. The above analysis described effluent quality and behavior by comparing results prior to and following this completion date. Though WWTP performance was confounded by high flows in early 2011 (February through May), 2010 performance was considerably better than that observed in the prior four years (2005-2008). Phase II construction will begin soon and address treatment levels needed to meet permit and water quality standards. The goal is that completion of Phase I and Phase II construction will, with high likelihood, remove the stressor of impairment associated with organic enrichment and low dissolved oxygen.

An estimate or projection of the time when WQS will be met

The June 2011 NPDES permit Part I, C-Schedule of Compliance paragraph f, gives April 1, 2017 as the date the Indian Lake Water Pollution Control Facility wastewater works will attain final compliance. Re-evaluation of biological water quality standards shall begin no earlier than the field season of 2018.

Schedule for implementing pollution controls

On July 13, 2011, the Logan County Board of Commissioners were issued NPDES number 1PK00002*LD. This permit contains a compliance schedule for completion of phase 2 projects that will address secondary treatment system bypassing at the plant. The permit schedule includes the following compliance dates:

- Submit an approvable "No Feasible Alternatives Analysis by no later than October 1, 2012.
- Submit a general plan for upgrades design to eliminate the secondary bypass by no later than April 1, 2013.
- Submit a Permit to Install for treatment system upgrades by no later than April 1, 2014.
- Complete treatment system upgrades by no later than July 1, 2016.
- Attain final compliance with NPDES permit limits and conditions by no later than April 1, 2017.

With the completion of the phase 2 projects, the Logan County Water Pollution Control District Indian Lake plant should be in compliance with their NPDES permit conditions, thus eliminating any effluent- derived water quality impacts downstream.

Monitoring plan to track effectiveness of pollution controls

As part of their NPDES permit, Indian Lake Water Pollution Control Facility wastewater works measures and reports plant bypasses at station 602 monthly. In addition, outfall 001 will report TSS, $cBOD_5$, phosphorus, ammonia and nitrate/nitrite discharges to the Great Miami River monthly. Sampling is done three times a week for TSS, $CBOD_5$, and NH_3. Phosphorus and NO_2/NO_3 will be sampled once a week. SSO discharges will be reported within 24 hours of the occurrence. The facility's monthly discharge monitoring reports are reviewed by permit staff in Ohio EPA's Southwest District Office. Inspection of the facility will be done every two years starting in 2012.

No earlier than the field season of 2018, Ohio EPA will sample the impaired section of Great Miami River (RM 153.45, Notestine Rd.) for chemistry, fish and macroinvertebrates. The chemistry will be sampled at one location and five sampling events will be completed. The fish will be sampled at one location with two passes each. The macroinvertebrates will be evaluated on one sampling event. This work will follow Ohio EPA's protocol for sampling the aquatic biology and chemistry. The sampling will take place during the summer/fall sampling season with analysis by Ohio EPA's laboratory and reporting to Southwest District Office.

Commitment to revise pollution controls, as necessary

The SWDO surface water manager will initiate a reexamination of the implementation strategy if significant progress is not being made by the end of the next NPDES permit cycle for Indian Lake.

Ohio EPA will report on the progress of any approved 4B in future 303(d) lists.

L5.2.1.1 First Report on Great Miami River 4B Demonstration (*2014 Integrated Report*)

The facility completed a Phase One study / upgrade ($ 10,000,000) in 2011. Phase One projects included new influent screens, two MGD in equalization, a new express force main and lift station, and upgrades to the solids handling systems (belt press and septage receiving). The sewer district reported seven SSOs and several secondary bypasses in 2013.

In addition, the sewer district has hired two consultants to work on aspects of the project. The district has begun a Capacity Management Operations and Maintenance program to oversee the collection system. New sewer use regulations have been implemented. In 2012 the district installed rain gauges and 18 flow meters. A model of the sewer is being developed. As part of the phase 2 work, the district is looking at treatment plant alternatives, maximizing existing treatment systems, and high rate treatment. The district is on schedule to meet the next deadline.

L5.2.1.2 Second Report on Great Miami River 4B Demonstration (*2016 Integrated Report*)

The Indian Lake Water Pollution Control District operates a 4.6 MGD WWTP that discharges directly to the Great Miami River. The plant serves the surrounding lake community as well as the communities of Lakeview, Russells Point, Belle Center and Huntsville. Excessive I/I into the collection system has contributed to collection system bypasses and blending at the plant (blended flows are screened and disinfected before recombining with the final effluent).

In response the district performed a No Feasible Alternatives Analysis (2006) of both the collection and treatment systems. An adaptive management approach was selected. A two-phase schedule was developed. Phase I work was completed in 2010. This phase included upgrades to the influent pump station; construction of new equalization basins (1.5 million gallons); installation of UV disinfection; updates to the bio solids dewatering equipment; and construction of a new pump station and force main was added to the Slough area.

As part of the Phase II work, the district is working on expansion of peak secondary and disinfection treatment capacities (peak 6.0 MGD plus). A PTI application for UV system upgrades was submitted in September 2014. The district is upgrading the final clarifier weirs, baffles and mechanisms to allow for treatment of peak flows. With the completion of this work the amount of flow that receives complete secondary treatment will be significantly increased.

The schedule for implementation of the No Feasible Alternatives Analysis Phase II projects has been inserted in the district's NPDES permit. As part of an adaptive approach the district is evaluating the effectiveness of infiltration removal verses additional treatment. The district believes if I/I into the system can be reduced by 30 percent, elimination of all wet weather overflows and bypasses will occur. The NPDES permit schedule includes the following dates:

- Study (model) and complete enough I/I projects to get to a 10 percent I/I reduction. (September 1, 2021)
- Study (model) and complete enough I/I projects to get to a 20 percent I/I reduction. (September 1, 2027)
- Study (model) and complete enough I/I projects to get to a 30 percent I/I reduction. (September 1, 2032)

With the completion of the various projects the impacts to the receiving stream should be diminished. Through the adaptive approach the district will be able to evaluate and prioritize projects that will provide the biggest improvements in the shortest time.

L5.2.1.3 third Report on Great Miami River 4B Demonstration (*2018 Integrated Report*)

On Sept. 1, 2016, construction was completed on the WWTP upgrade that included: new aeration blowers; final clarifier drives, launders, collectors and weirs; UV disinfection up to 6 MGD; and influent monitoring. This upgrade was part of the Logan County's Phase II work. Since construction was completed, the Logan County Commissioners have reported ten dissolved oxygen violations. They attributed these violations to short-term operational/equipment issues rather than infrastructure deficiencies.

Reporting Period	Parameter	Limit Type	Limit	Reported Value	Violation Date
November 2016	Dissolved Oxygen	1D Conc	5.0	3.4	11/10/2016
November 2016	Dissolved Oxygen	1D Conc	5.0	4.9	11/28/2016
April 2017	Dissolved Oxygen	1D Conc	5.0	4.5	4/12/2017
May 2017	Dissolved Oxygen	1D Conc	5.0	4.6	5/22/2017
July 2017	Dissolved Oxygen	1D Conc	5.0	4.5	7/5/2017
July 2017	Dissolved Oxygen	1D Conc	5.0	4.3	7/10/2017
July 2017	pH, Minimum	1D Conc	6.5	6.19	7/6/2017
July 2017	E. coli	7D Conc	284	840.046	7/8/2017
August 2017	Dissolved Oxygen	1D Conc	5.0	4.7	8/2/2017
August 2017	Dissolved Oxygen	1D Conc	5.0	3.7	8/3/2017
August 2017	Dissolved Oxygen	1D Conc	5.0	4.7	8/16/2017
August 2017	Dissolved Oxygen	1D Conc	5.0	4.9	8/23/2017

In accordance with the NPDES permit compliance schedule, the county is still on track for eliminating wet weather overflows and bypasses through an adaptive, inflow and infiltration reduction approach.

Section

M

An Overview of Ground Water Quality in Ohio

M1. Introduction

Section M summarizes water quality assessment data for Ohio's major aquifers based on information requested in the *2006 Integrated Reports Guidance* and the *1997 Guidelines for Preparation of the Comprehensive State Water Quality Assessments*.

Ground water protection programs for Ohio are briefly summarized in Section M2 as required by section 106(e) of the Clean Water Act. Programs to monitor, evaluate and protect ground water resources are implemented by various state, federal and local agencies. Ohio EPA is the designated agency for monitoring and evaluating ground water quality and assessing ground water contamination problems. Within Ohio EPA, the Division of Drinking and Ground Waters (DDAGW) carries out these functions and coordinates various ground water monitoring efforts within the agency and with other state programs. Short program descriptions are provided with links to program-based web pages to provide the most current information.

Ohio's three major aquifer types are described briefly in Section M3. Where possible, the water quality data are associated with major aquifer types. The aquifer descriptions allow the reader to associate water quality with geologic settings.

Sections M4 and M5 summarize sites with verified ground water contamination and identify the major nonpoint sources of ground water contamination in Ohio. These data were obtained from various sources including:

- Potential contaminant sources inventoried as part of Ohio EPA – DDAGW's Source Water Assessment and Protection (SWAP) program;
- Ground Water Impacts Database (maintained by Ohio EPA – DDAGW);
- Underground injection control sites identified in Ohio EPA – DDAGW and Ohio Department of Natural Resources (ODNR) – Division of Oil and Gas Resource Management databases;
- Leaking and formerly leaking underground storage tanks from Ohio Department of Commerce – Division of Fire Marshal's Bureau of Underground Storage Tank Regulations (BUSTR) databases;
- Federal databases listing Department of Development/Department of Energy (DOD/DOE) facilities and National Priorities List/Comprehensive Environmental Response, Compensation and Liability Act (NPL/CERCLA) sites; and
- Resource Conservation and Recovery Act (RCRA) Corrective Action site with ground water contamination in Ohio obtained from the U.S. EPA RCRA Info Database.

In many instances, these data are not associated with the geologic setting of the impacted aquifer, so statewide summaries are provided.

Section M6 summarizes ground water quality impairments by parameter within Ohio's major aquifers. Two primary data sets are used in this analysis: the drinking water compliance data for public water systems; and the Ambient Ground Water Quality Monitoring Program (AGWQMP) data. The public water system compliance data represents treated (post-processing) water distributed to the public. AGWQMP is an Ohio EPA - DDAGW program created to monitor raw (untreated) ground water. The goal is to collect, maintain and analyze raw ground water quality data to measure long-term changes in the water quality of major aquifer systems. Since Ohio does not have statewide ground water quality standards, comparisons to primary maximum contaminant levels (MCLs), secondary maximum contaminant levels (SMCLs), health advisory levels (HALs), action levels (lead and copper) and drinking water health advisory levels were applied.

Section M7 briefly discusses a few special studies being performed by Ohio EPA which lead to suggestions for future ground water monitoring efforts. Section M8 presents conclusions and recommendations for future direction concerning statewide ground water monitoring and protection of Ohio's major aquifers.

M2. Ohio's Ground Water Programs

State Coordinating Committee on Ground Water — The State Coordinating Committee on Ground Water (SCCGW) was created in 1992 by the directors of the state agencies that have ground water program responsibilities. The purpose is to promote and guide the implementation of coordinated, comprehensive and effective ground water protection and management programs for Ohio. The SCCGW is composed of ground water technical or management staff from seven state agencies, two federal agencies and The Ohio State University Extension office. Information about the SCCGW bi-monthly meetings and meeting summaries are available on the SCCGW website: ***epa.ohio.gov/ddagw/SCCGW.aspx***.

Ohio Ground Water Protection Programs — Programs to monitor, evaluate and protect ground water resources in Ohio are administered by federal, state and local agencies. Ohio EPA is the designated state ground water quality management agency. The ODNR - Division of Water Resources is responsible for evaluation of the quantity of ground water resources. Ground water-related activities at the state level are also conducted by the Ohio Departments of Agriculture, Commerce (Division of State Fire Marshal), Health and Transportation. The United States Geological Survey (USGS), Ohio Water Science Center, contributes to these efforts with water resource research. Table M-1 (based on Table 5-2, U.S. EPA 305(b) Guidelines, 1997) summarizes agencies responsible for administering the various ground water programs in Ohio.

Program Websites

ODA - Ohio Department of Agriculture

- Pesticide and Fertilizer Regulation Program — ***agri.ohio.gov/apps/odaprs/pestfert-prs-index.aspx***
- Livestock Environmental Permitting Program — ***agri.ohio.gov/divs/dlep/dlep.aspx***

ODH - Ohio Department of Health

- Private Water Systems — ***www.odh.ohio.gov/odhprograms/eh/water/PrivateWaterSystems/main.aspx***
- Sewage Treatment Systems Program — ***www.odh.ohio.gov/odhPrograms/eh/sewage/sewage1.aspx***

ODNR - Ohio Department of Natural Resources (*ohiodnr.gov/*)

- Division of Water Resources — ***water.ohiodnr.gov/***
- Division of Mineral Resources — ***minerals.ohiodnr.gov/***
- Division of Oil and Gas Resources — ***oilandgas.ohiodnr.gov/***
- Division of Geologic Survey — ***geosurvey.ohiodnr.gov/***

Ohio EPA - Ohio Environmental Protection Agency (*epa.ohio.gov*)

- Division of Drinking and Ground Waters — ***epa.ohio.gov/ddagw/***
- Division of Surface Water — ***epa.ohio.gov/dsw/***
- Division of Environmental and Financial Assistance — ***epa.ohio.gov/defa/***
- Office of Compliance Assistance and Pollution Prevention — ***epa.ohio.gov/ocapp/***
- Division of Materials and Waste Management — ***epa.ohio.gov/dmwm/***
- Division of Environmental Response and Revitalization — ***epa.ohio.gov/derr/***

OWRC – Ohio Water Resource Council (*epa.ohio.gov/dsw/owrc.aspx*)

SCCGW – State Coordinating Committee on Ground Water (*epa.ohio.gov/ddagw/SCCGW.aspx*)

SFM/BUSTR – State Fire Marshall/Bureau of Underground Storage Tank Regulations (*com.ohio.gov/fire/*)

Table M-1 Summary of Ohio ground water protection programs.

Programs or Activities	State Activity	Implementation Status*	Responsible Agency
Active SARA Title III Program	✓	E	Ohio EPA – DERR
Ambient ground water monitoring system	✓	E	Ohio EPA – DDAGW
Aquifer vulnerability assessment	✓	CE	ODNR – DWR Ohio EPA – DDAGW
Aquifer mapping	✓	CE	ODNR – DWR Ohio EPA – DDAGW
Aquifer characterization	✓	CE	ODNR – DWR
Comprehensive data management system	✓	UR [a]	OWRC
Consolidated cleanup standards	NA		
Ground water best management practices	✓	E	ODNR; ODA
Ground water legislation	✓	UR [b]	All Agencies
Ground water classification	✓	E [c]	Ohio EPA; ODNR
Ground water quality standards (program specific)	✓	E [d]	Ohio EPA
Ground water quality investigations	✓	CE	Ohio EPA DDAGW
Interagency coordination for ground water protection initiatives	✓	E	OWRC; SCCGW
Nonpoint source controls	✓	CE	ODA; Ohio EPA; ODNR
Pesticide State Management Plan	✓	E [e]	ODA
Pollution Prevention Program	✓	E	Ohio EPA – DEFA (OCAPP)
Resource Conservation and Recovery Act (RCRA) Primacy	✓	E	Ohio EPA – DERR
Source Water Assessment Program	✓	E	Ohio EPA – DDAGW
State Property Clean-up Programs	✓	E	Ohio EPA – DERR
Susceptibility assessment for drinking water/wellhead protection	✓	E	Ohio EPA – DDAGW
State septic system regulations	✓	E [f]	ODH; Ohio EPA
Underground storage tank installation requirements	✓	E	SFM/BUSTR
Underground Storage Tank Remediation Fund	✓	E [g]	SFM/BUSTR
Underground Storage Tank Permit Program	✓	E	SFM/BUSTR
Underground Injection Control Program	✓	E [h]	Ohio EPA – DDAGW ODNR – DMRM
Well abandonment regulations	✓	E [i]	ODNR; Ohio EPA – DDAGW; ODH
Wellhead Protection Program (EPA-approved)	✓	E [j]	Ohio EPA – DDAGW
Well installation regulations	✓	E [k]	Ohio EPA; ODH

*** Table Notes: E** – Established; **CE** – Continuing Effort; **UD** – Under Development; **UR** – Under Revision

[a] Data management occurring on an agency/division level; Improvements in search engines make development of multi-agency databases a low priority.

[b] Rules are required to be reviewed every five years by state statute.

[c] Established through program-specific classifications.

[d] Standards are program-specific.

[e] ODA received cooperative commitment from other Ohio agencies for the Generic Pesticide Management Plan. The requirement for Specific Pesticide Management Plan was dropped.

[f] The updated Household Sewage Treatment Systems Rules became effective on Jan. 1, 2015 (Ohio Revised Code (ORC) Chapter 3718 and Ohio Administrative Code Chapter 3701-29). Larger systems are regulated by Ohio EPA under separate regulations.

[g] Remediation funds are available from the Petroleum Underground Storage Tank Release Compensation Fund

[h] Ohio EPA regulates Class I and V injection wells; ODNR regulates Class II and III injection wells.

[i] Revised guidance for sealing wells was completed March 2015 by SCCGW workgroup: Regulations and Technical Guidance for Sealing Unused Water Wells and Boreholes

[j] Wellhead Protection Program has evolved to the Source Water Protection Program.

[k] Technical Guidance for Well Construction and Ground Water Protection prepared by SCCGW (2000). Private Water System rules (OAC 3701-28) were last updated in 2011. Revised Water Well Standards (OAC 3745-7) for public water systems are out for comment.

M3. Ohio's Major Aquifers

Introduction

Ohio has abundant surface and ground water resources. Average rainfall ranges between 30 and 44 inches/year (increasing from northwest to southeast), which drives healthy stream flows. Infiltration of a small portion of this rainfall (3-16 inches) recharges the aquifers and keeps the streams flowing between rains. Ohio's aquifers can be divided into three major types as illustrated in Figure M-1. The sand and gravel buried valley aquifers (in blue) are distributed through the state. The valleys filled by these sands and gravels are cut into sandstone and shale in the eastern half of the state (in tans) and into carbonate aquifers (in greens) in the western half. The buried valley aquifers are productive aquifers. The sandstone and carbonate aquifers generally provide sufficient production for water wells except where dominated by shale, as in southwest and southeast Ohio. An Ohio EPA report, *Major Aquifers in Ohio and Associated Water Quality* (2015), provides more detailed descriptions of these aquifers.

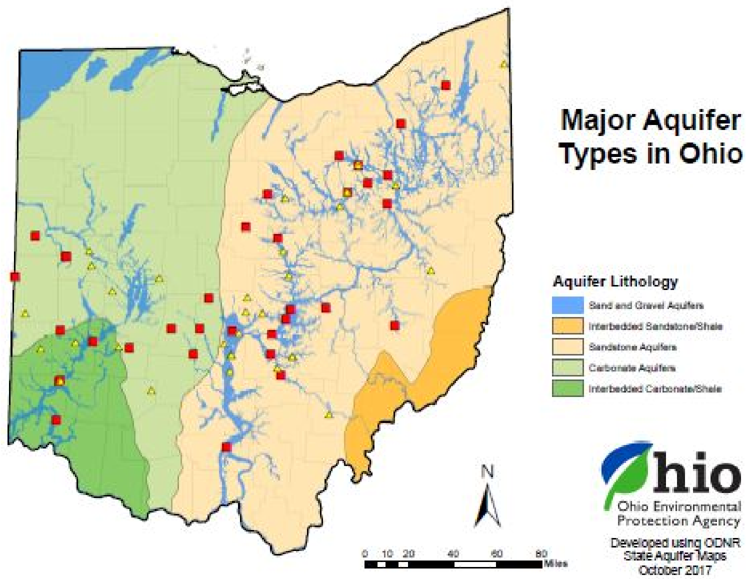


Figure M-1 — Aquifer Types in Ohio modified from ODNR Glacial and Bedrock Aquifer Maps (ODNR, 2000; ***water.ohiodnr.gov/maps/statewide-aquifer-maps****).*

Characterizing Aquifers

In a continuing effort to characterize ground water quality for the professional/technical community and the public, Ohio EPA-DDAGW is writing technical reports and fact sheets on the distribution of specific parameters in Ohio. The goal of the technical reports is to provide water quality information from the major aquifers, indicate areas with elevated concentrations and identify geologic and geochemical controls. This information is useful for assessing local ground water quality, water resource planning and evaluating areas where specific water treatment may be necessary. A series of parallel fact sheets targeted for the public provide basic information on the distribution of the selected parameters in ground water. The information in the fact sheets is presented in a less technical format, addresses health effects, outlines treatment options and provides links to additional information.

Since the *Ohio 2016 Integrated Report*, a draft technical report and fact sheet on iron and manganese has been developed. The documents are based on data from AGWQMP.

Iron and Manganese in Ohio's Ground Water

Iron and manganese in ground water are controlled by three factors: the distribution of iron and manganese minerals in aquifers; the local redox conditions; and, to a lesser degree, pH. Iron is the fourth, and manganese the twelfth, most abundant element in the Earth's crust. They commonly occur in minerals or as coatings and cements in soils and rocks. Iron is widespread and exhibits similar concentrations in ground water in all major aquifers (Figure M-2). Ohio's sandstone aquifers exhibit slightly lower iron than the sand and gravel and carbonate aquifers. AGWQMP data shows manganese at lower concentrations than iron, and the carbonate aquifers show significantly lower manganese than the sandstone and sand and gravel aquifers (Figure M-3). The Pennsylvanian aquifers and associated buried valley aquifers exhibit the highest manganese, presumably due to association with the Pennsylvanian coal measures.

Both iron and manganese exhibit multiple valence states, and the minerals that include them are susceptible to changes in redox conditions. In near surface conditions, iron and manganese are generally tied up in oxide and hydroxide minerals. When these minerals are exposed to low oxygen conditions, the oxide minerals break down and manganese and iron are released into ground water. At the water table, oxygen is exchanged with the atmosphere, the ground water is oxidized, oxide minerals are stable, and little manganese or iron are present in ground water. At greater depths below the water table, the conditions are more reduced, and the microbial reduction starts dissolving the oxide minerals after dissolved nitrate is consumed/reduced. This occurs in an organized sequence: O_2 and NO_3 are consumed, and then manganese and iron are sequentially mobilized. First, manganese is released and then iron in the oxide reduction processes, resulting in elevated manganese and iron. In local environments where pH is low, the acidic nature will increase metal mobilization. There are many areas in Ohio where manganese and iron in ground water exceed U.S. EPA's secondary maximum contaminant levels in deeper aquifers.

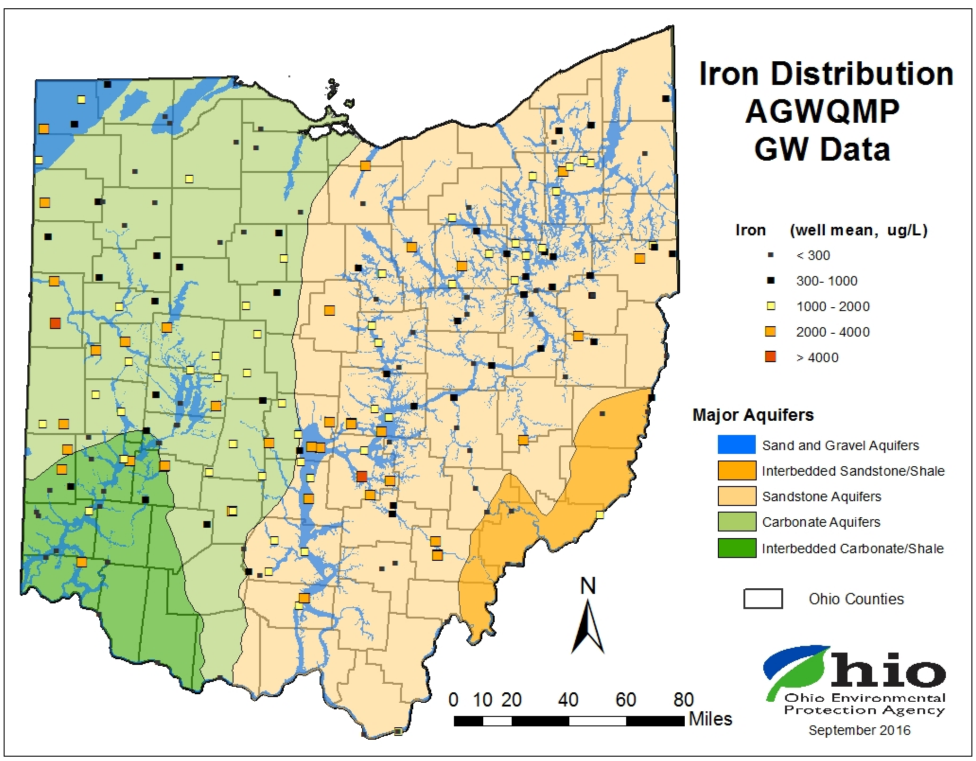


Figure M-2 — Iron distribution in AGWQMP wells, overlain on major aquifers.

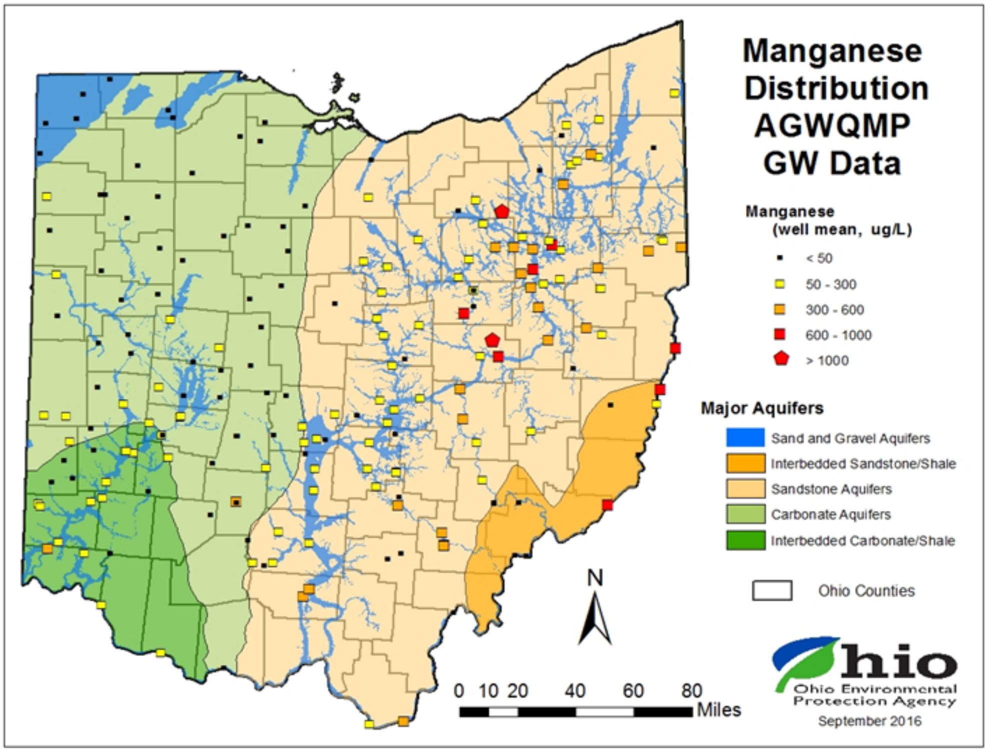


Figure M-3 — Manganese distribution in AGWQMP wells, overlain on major aquifers.

PFOA/PFOS Ground Water Sampling by Ohio EPA DDAGW

In addition to preparing technical papers and fact sheets on Ohio's ground water quality, Ohio EPA also conducts special investigations to characterize ground water contamination and determine its causes.

From September 2016 through January 2017, Ohio EPA's DDAGW sampled ground water at or near current or former portions of the following Ohio Air National Guard (OANG) facilities to determine concentrations of perfluorooctanoic acid (PFOA) and perfluorooctane sulfate (PFOS):

- Rickenbacker Air National Guard Base, Lockbourne, OH
- Springfield-Beckley Municipal Airport, Springfield, OH
- Mansfield Air National Guard Base, Mansfield, OH
- Toledo Air National Guard Base, Swanton, OH

The sampling was in partnership with the OANG, ODH and local health districts. Its purpose was to assess potential health risks to private well users due to PFOA and PFOS. These chemicals have been used in aqueous film forming foam (AFFF), which is known to have been applied to fight fuel-based fires at the airbases and could have entered the ground water due to releases during training, usage or storage.

Exposure to PFOA and PFOS above certain levels may result in adverse health effects, including developmental effects to fetuses during pregnancy or to breast-fed infants, cancer, liver damage, immune system effects and other issues. U.S. EPA has established a drinking water health advisory level for PFOA and PFOS at 70 parts per trillion (ppt).

While the National Guard Bureau (NGB) and the U.S. Air Force (USAF) had scheduled testing for PFOA and PFOS at the four bases in federal fiscal years 2017 and 2018, Ohio EPA and the OANG believed testing should be done sooner to ensure the drinking water is safe.

These Ohio EPA-DDAGW investigations were not intended to take the place of the anticipated detailed federal investigations; rather, they were focused only on evaluating off-base risks to private well users based on available information regarding local ground water conditions and the location of fire training areas.

Private wells were identified for sampling based on publicly available records, the locations of fire training areas determined from perfluorinated compounds preliminary assessment reports and input from base staff during pre-sampling visits, apparent ground water flow direction, consultation with local health departments, and field reconnaissance. Ohio EPA-DDAGW also evaluated the potential for sampling existing or newly installed monitoring wells on-base as a precursor to sampling off-base private wells.

For any exceedances of the U.S. EPA health advisory confirmed by resampling and caused by activities at a base, it was agreed the military would take action to reduce any health effect, such as providing bottled water, installation of water filtration equipment, or providing an alternative source, such as connection to a public water system.

Ohio EPA-DDAGW staff performed the ground water sampling, accompanied by local health department staff where appropriate. Private wells were sampled at an outdoor faucet to bypass any water softeners or point-of-use water filters and avoid the potential influence of items inside the home that could contain PFOA or PFOS, which have been used for many years to make carpets, clothing, fabrics for furniture, paper packaging for food, non-stick cookware, and other materials that are resistant to water, grease or stains.

The sampling protocol was consistent with DDAGW documents; however, the language was enhanced to emphasize the increased importance of factors that could influence PFOA/PFOS analysis at the parts per trillion level, including minimizing cross-contamination due to clothing, the vehicles used for travel and use of personal care products. Sample analysis were performed by Northern Lake Service Inc. (400 North Lane Avenue, Crandon, WI 54520) using U.S. EPA Method 537.

Results from sampling the four Air National Guard Bases

Nine private wells north-northwest of the northern boundary of the Springfield-Beckley Municipal Airport were sampled Nov. 29, 2016. All nine samples were found to be non-detect for PFOA and PFOS.

Two private wells northwest of Mansfield Lahm Airport (Mansfield Air National Guard Base) were sampled on Dec. 20, 2016, and one more was sampled on Jan. 3, 2017. All three samples were found to be non-detect for PFOA and PFOS.

The former Fire Training Area (FT-23) is located southeast of the current Rickenbacker Air National Guard Base property on land owned by the Columbus Regional Airport Authority (CRAA). On Aug. 31, and Sept. 1, 2016, CRAA installed four new shallow monitoring wells around FT-23. One of these monitoring wells was intended to be hydraulically upgradient of FT-23 while the other three were intended to be downgradient and were situated in between FT-23 and the identified off-base private wells.

Ohio EPA-DDAGW sampled MW-1, MW-2 and MW-3 on Sept. 14, 2016. MW-4 could not be sampled due to inadequate well development. Ohio EPA believes that the absence of detectable PFOA and PFOS in ground water samples from monitoring wells on CRAA property between FT-23 and the identified private wells in the London-Lancaster Road neighborhood to the east indicates that no health risks are occurring related to PFOA/PFOS.

From Dec. 13, 2016 through Jan. 31, 2017, 16 private wells to the east of the Toledo Air National Guard Base were sampled. While no PFOS was detected, PFOA was detected above the 70 ppt U.S. EPA HAL at one well, below the HAL but above the limit of quantitation at three wells, and below the limit of quantitation at three wells. The Ohio Air National Guard provided an alternative source of water for the residents at the home with the well above 70 ppt.

Results from Youngstown-Warren Airport/Air Reserve Station

The U.S. Air Force has begun the investigative process at Youngstown-Warren Air Reserve Station (YARS) regarding PFOA/PFOS. Ohio EPA partnered with the U.S. Air Force, ODH and the local health district to determine risk to domestic wells. Four private wells surrounding YARS were identified through their proximity to the identified fire training area. These wells were sampled on April 18 and April 25, 2017, and all four samples were found to be non-detect for PFOA/PFOS. Sampling protocols and analytical methodology used for these samples were the same as for the Ohio National Guard Bases noted above.

M4. Site-Specific Ground Water Contamination Summary

Table M-2 (based on Table 5-3, U.S. EPA 305(b) Guidelines, 1997) provides a summary of the sites that have verified ground water contamination in Ohio. These data come from various state programs and the quality of these data is variable. Because the specific hydrogeologic settings for many of these sites is not included in the databases or is unknown, only a statewide summary is provided. Additional information is provided below for each program or subset of sites listed in Table M-2.

Table M-2 — Ground water contamination summary.
Hydrogeologic Setting: Statewide Data Reporting Period: As of August 2017

Source Type	Number of sites	Number of sites that are listed and/or have confirmed releases	Number of sites with confirmed ground water contamination	Contaminants
NPL - U.S. EPA	38 proposed	30	30	Mostly VOCs and heavy metals; also, SVOCs, PCBs, PAHs and others
CERCLIS (non- NPL) - U.S. EPA	411	411	20	Varied
DOD/DOE	128[a]	71	68	Varied
LUST	34,992[b]	4,133	111[c]	BTEX
RCRA Corrective Action	254	206	206	VOCs, heavy metals, PCBs and others
Underground Injection	Class[d]: I -13 II – 408 III – 49 IV – 5 V – 48,586	 0 0 0 0 14,238	 0 0 0 0 NA	
State Sites [e]	776	776	264[f]	Varied GW Impacts
Nonpoint Sources	NA	NA	NA	

Notes: NA - Numbers not available
[a] Includes DOE, DOD, FUSRAP and FUD sites
[b] Includes only active LUST sites - Source: Ohio's State Fire Marshal, BUSTR
[c] Sites in Tier 2 or Tier 3 cleanup stages. Source: Ohio's State Fire Marshal, BUSTR
[d] Class I and V injection wells are regulated by Ohio EPA. Class II and Class III injection wells regulated by the Ohio Department of Natural Resources, Division of Oil and Gas Resources. Class IV injection wells are illegal in Ohio, except where approved as part of remediation plan.
[e] Facilities in Ohio EPA's ground water impacts database
[f] A site is considered to be contaminating ground water if the Uppermost Aquifer or Lower Aquifer is noted to be impacted, as documented in Ohio EPA's Ground Water Impacts database.

Federal National Priorities List (NPL): Currently, 38 sites in Ohio are on the NPL, most of which 30 have been found to be affecting ground water quality. The primary contaminants are volatile organic compounds (VOCs) and heavy metals. Other contaminants include semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs).

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) (non-NPL): Ohio has 411 sites in the federal CERCLIS database.

DOD/DOE: The 128 sites on this list are the Department of Defense (DOD)/Department of Energy (DOE) sites in Ohio, including those that are Formerly Used Defense Sites (FUDS) and Formerly Utilized Sites Remedial Action Program (FUSRAP) sites. Of these, 68 have had confirmed releases to ground water.

Leaking Underground Storage Tanks (LUST): In Ohio, underground storage tanks (USTs) are under the jurisdiction of the State Fire Marshal, Bureau of Underground Storage Tank Regulation (BUSTR). Current data indicates that approximately 35,000 sites have been found to be leaking. Of these, 5,312 have confirmed releases, with 111 having a release to ground water. The primary contaminants are the petroleum products of benzene, toluene, ethyl benzene and xylenes.

RCRA Corrective Action: Currently, 254 facilities are in RCRA corrective action. Of these, 206 have confirmed releases to ground water. The primary contaminants are VOCs and heavy metals. This information was obtained from the U.S. EPA RCRA Info Database.

Underground Injection: There are five classes of underground injection wells:

- Class I wells inject hazardous wastes or other wastewaters beneath the lowermost aquifer;
- Class II wells inject brines and other fluids associated with oil and gas production beneath the lowermost aquifer;
- Class III wells inject fluids associated with solution mining of minerals beneath the lowermost aquifer;
- Class IV wells inject hazardous or radioactive wastes into or above aquifers (these wells are banned unless authorized under a federal or state ground water remediation project);
- Class V wells comprise all injection wells not included in Classes I-IV;
- Class VI wells are regulated by U.S. EPA for carbon sequestration.

The Ohio Department of Natural Resources, Division of Oil and Gas Resources regulates Class II (409) and Class III (49) wells. The number of Class II brine injection wells (one of three types of Class II wells) has leveled as their use in disposal of fluids used in oil and gas drilling and shale gas development has slowed. In addition to the 217 active brine injection wells there are 20 wells that are between the permitted and active stage. The other types of Class II wells include 127 enhanced recovery wells and 64 annular disposal wells.

Ohio EPA DDAGW regulates Class I (13), Class IV (5) and Class V (48,586) wells. Although owners and operators of Class V wells are required to register or permit their wells, there are still many that are unknown and unregistered throughout the state.

State Sites: State sites include landfills, RCRA-regulated hazardous waste facilities, unregulated sites (pre-RCRA) and sites investigated through the Voluntary Action Program (VAP). Ground water contamination summary information concerning many of these sites is tracked in the ground water impacts database, maintained by Ohio EPA-DDAGW. The database consists of sites with verified contaminant release to ground water. As of August 2017, the database contained 776 sites. Of the 776 sites, 264 have affected ground water quality within the uppermost aquifer or lower aquifer.

M5. Major Sources of Ground Water Contamination

Data show much of Ohio's ground water is of high quality and has not been widely influenced by anthropogenic activities, but individual cases of contamination are documented every year from point (site-specific locations) and nonpoint sources. Ohio has a diverse economy and the state uses and produces a range of potential contaminants applied, stored and disposed of in various land use practices. Consequently, ground water quality is susceptible to contamination from a range of substances and a variety of land use activities. From a statewide perspective, major sources are discussed below.

The major sources of ground water contamination in Ohio are indicated in Table M-3. The major sources of ground water contamination in Ohio are indicated in Table M-3 (Table 5-1, U.S. EPA 305(b) Guidelines, 1997) by checks (✓). These data were obtained from two main sources: Ohio's Source Water Assessment and Protection (SWAP) program and DDAGW's ground water impacts database. The SWAP program has completed an inventory of the potential sources of ground water contamination in the delineated Drinking Water Source Protection Areas. This inventory is updated when the SWAP delineation is revised, for example, when new wells are approved. Of the active public water systems that use ground water, 99 percent have had an inventory conducted, an analysis of the aquifer's susceptibility to contamination completed and a determination of whether the ground water quality has been impacted by anthropogenic activities. The ground water impacts database provides information regarding sites where contamination of ground water has been confirmed. These data were evaluated and those sources of highest concern were given a check mark (✓) in Table M-3.

Some of the potentially high priority sources, indicated by (×), were selected based on professional knowledge of the types of sources that exist in Ohio. These sources, such as animal feedlots and mining, are limited in their extent, or are concentrated in regions of the state and may not be sited close to public water system well fields. Thus, they do not rank in the highest priority sources. However, where they are prevalent, these sources may be a threat to local ground water resources, especially in areas with sensitive hydrogeologic settings. Land use activities within sensitive areas have a greater potential of affecting ground water quality.

Contaminant Source Discussion - All sources listed in Table M-3 are potential contaminant sources in Ohio and each may cause ground water quality impacts at a local scale. The sources identified as highest priority or potentially high priority are listed below in the order presented in Table M-3 and discussed briefly to provide additional information.

(✓) Highest Priority Sources

Fertilizer Applications: Use and handling of fertilizers, manure and biosolids can cause ground water pollution. Human and animal biosolids used as fertilizer and chemical fertilizers contribute to nitrate contamination in ground water. Nitrate concentrations in ground water represent one of the better examples of the widespread distribution of nonpoint source pollution. Non-agricultural sources, such as lawn fertilization, sludge application and septic systems also contribute to localized nitrate ground water contamination. Public water systems utilizing sand and gravel aquifers have higher average nitrate levels than public water systems using sandstone and carbonate aquifers, primarily due to the higher vulnerability of unconsolidated aquifers and the shallower nature of the sand and gravel aquifers.

Storage Tanks (Underground and Above-ground): There are 5,312 USTs known to be leaking or undergoing remediation in Ohio. Of these, 1,321 are in drinking water source protection areas for public water systems using ground water. Above-ground tanks are also prevalent throughout Ohio, with 1,225 located in drinking water source protection areas for public water systems using ground water. Many of these are smaller tanks used to store fuel oil for heating individual homes and many are old and rusty with no containment in the event of a leak or spill. Leaking above-ground storage tanks (ASTs) from commercial and industrial facilities are less of an issue, although catastrophic failure can create significant pollution problems to both ground water and surface water. There are only 14 ASTs in the ground water impacts database known to be contaminating ground water from regulated hazardous waste facilities.

Landfills: Currently, there are 130 landfills with documented ground water contamination in Ohio. This constitutes 50 percent of the sites known to be affecting ground water quality based on information in Ohio EPA's ground water impacts database. Most likely, these are from older, unlined landfills (many of which are closed) or construction and demolition debris landfills (C&DD) with limited construction standards. The current siting, design and construction standards for landfills are more stringent than 20 years ago, resulting in new landfills with significantly lower potential to impact ground water quality. Efforts to monitor C&DD landfills and characterize associated ground water quality impacts were initiated in 2015.

Septic Systems: More than 1,000,000 household wastewater systems, primarily septic tanks and leach fields, or in some cases injection wells, are present throughout the rural and unsewered suburban areas of Ohio. A number of these systems are improperly located, poorly constructed or inadequately maintained and may cause bacterial and chemical contamination of ground water which may supply water to nearby wells. Improperly operated and maintained septic systems are considered significant contributors to elevated nitrate levels in ground water in vulnerable geologic settings (for example, shallow fractured bedrock and sand and gravel deposits). More than 1,960 septic systems are in drinking water source protection areas. There are 220 septic systems discharging to surface water and 1,740 systems discharging to tanks, leachfields/mounds. The updated Household Sewage Treatment Systems Rules became effective on Jan. 1, 2015 (Ohio Revised Code Chapter 3718 and Ohio Administrative Code 3701-29) and should help correct deficiencies of failing septic systems.

Shallow Injection Wells: Class V injection wells are widespread throughout the state. Ohio EPA has records for 60,910 Class V wells. Of these, 14,159 are listed as active and 3,914 are listed as temporarily abandoned. The rest (42,837) are reported to be closed and abandoned. Of the identified wells, the majority are mine backfill wells (35,721) used to inject grout into deep mines underneath roadways. The next largest segment of Class V wells (16,459) are used to inject fluids to assist in remediating contaminated aquifers. The last major segment of Class V wells are storm drainage wells. The fact that these wells are used to inject fluids directly into vulnerable aquifers in the State is the main cause for concern. These shallow injection wells provide a direct pathway for nonpoint source contamination and illegal waste disposal into vulnerable aquifers.

Hazardous Waste Sites: Ohio generates a large amount of hazardous waste. Legacy hazardous waste sites are a serious threat to ground water. There are 64 RCRA hazardous waste facilities, 18 Voluntary Action Program sites and 62 unregulated hazardous waste remediation sites (pre-1980) with documented releases to ground water (uppermost or lower aquifer) based on the ground water impacts database.

Pipelines and Sewer Lines: Pipelines and sewer lines all have potential for failure with release of the transported material. In addition, the construction of these lines, with the pipe embedded in permeable material, allows the trench to provide rapid flow paths for other surface contaminants. This is especially true if the trench is dug into fractured bedrock. Numerous gas, oil and industrial pipelines (1,145) and sewer lines (819) have been inventoried in drinking water source water protection areas.

Salt Storage and Road Salting: The widespread use of salt or mixtures of salt and sand for deicing roads has been documented as a nonpoint source contributor of sodium and chloride contamination of shallow ground water (Jones and Sroka 1997; Mullaney et al. 2009). Spreading of salt on roads certainly contributes to ground water quality impacts, but the greatest local impact is associated with salt storage. Seventy-six salt storage piles were identified directly in drinking water source protection areas with 47 of these located in sensitive aquifer settings. One hundred and twenty-four are within one-half mile of a source water protection area and 79 are within a half-mile of a designated sensitive aquifer. Most of these sites had adequate covering and pads. In addition to addressing these sites, Ohio is exploring ways to encourage implementation of best management practices for proper salt storage. Alternative chemicals like acetate-based deicers in combination with reduced salt usage are being promoted in pollution prevention programs. A workgroup, consisting of members from the Ohio Water Resources Council and the State Coordinating Committee on Ground Water, developed guidance for salt storage in 2013: *Recommendations for Salt Storage: Guidance for Protecting Ohio's Water Resources*, located on the web at: ***epa.ohio.gov/portals/35/owrc/SaltStorageGuidance.pdf***.

Suburban Runoff (including storm drains and storm water management): With expanding suburban areas, nonpoint source contamination from suburban/urban runoff is an increasing source of ground water contamination, in contrast with most of the other sources discussed. In addition, the practice of constructing storm water retention basins increases the likelihood that storm water runoff infiltrates into ground water. More than 1,250 storm drains are located within drinking water source protection areas, with many of these going directly to nearby water bodies. Elevated chloride is documented in urban areas within glacial aquifers by Mullaney et al. (2009) and positive trends in chloride concentrations in Ambient Ground Water Quality Monitoring data are present at some sites.

Small-Scale Manufacturing and Repair Shops: Small-scale manufacturing and repair shops include 1,693 facilities in drinking water source protection areas. These include: auto and boat repair shops and dealers; gas stations; junk yards; equipment rental and repair; machine shops; metal finishing and welding shops; and other various small businesses. These businesses typically handle chlorinated solvents (for cleaning) and petroleum products. Limited knowledge of best management practices for handling and disposing of these products increases the risk of impacting ground water.

Fire Training Facilities: Foams containing PFOA and PFOSs are known to have been applied to fight fuel-based fires at airbases and other fire training facilities. These chemicals could have entered the ground water due to releases during training, usage or storage. Ohio EPA has performed sampling in partnership with the Ohio Air National Guard (OANG), the Ohio Department of Health and local health districts to assess potential health risks to private well users. These Ohio EPA-DDAGW investigations were not intended to take the place of the upcoming detailed federal investigations; rather, they were focused on evaluating risks to private well users based on available information regarding local ground water conditions and the location of fire training areas.

(✖) Potentially High Priority Sources

Concentrated Animal Feeding Operations (CAFO): The growth of CAFOs in numbers and size makes them a significant potential source if the waste is not properly managed. The ground water threats associated with CAFOs are captured in other categories as well, such as manure, sludge and fertilizer application and surface impoundments, so they are not considered one of the 10 highest priority sources. Improper storage or management of the animal waste is the greatest threat to ground water contamination in sensitive hydrogeologic settings, but land application in solid or liquid form also poses risks for ground and surface water contamination.

Surface Impoundments: Surface impoundments are one of the most common waste disposal concerns at RCRA facilities. Historically, they have been a major source for ground water contamination. Older impoundments were not subject to the same engineering standards as newer impoundments and, consequently, the probability of fluids leaching to the ground water was greater. Current siting and engineering requirements have improved this situation. Twenty-five surface impoundments are known to be contaminating ground water based on information obtained from Ohio EPA's ground water impacts database, the majority being from regulated and unregulated hazardous waste facilities.

Mining and Mine Drainage: The bedrock (Pennsylvanian Units) that underlies eastern Ohio includes significant coal resources. The disruption of the stratigraphic units and oxidation of sulfides associated with coal mining produces ground water contamination by acid mine waters. Acid mine waters are considered a significant threat to ground water in mined areas.

Spills and Leaks: Leaks and spills of hazardous substances from underground tanks, surface impoundments, bulk storage facilities, transmission lines and accidents are major ground water pollution threats. More than a thousand leaks and spills are reported each year. This release of chemicals on to the surface and into near surface environments is certainly one of the greatest threats to ground water quality. The development of shale gas and associated hydrofracturing activity in eastern Ohio has raised concerns about potential for aquifer impacts. Historically, the surface management of brines has been the greatest cause of ground water contamination associated with oil production and hydro fracking activities (*State Oil and Gas Agency Groundwater Investigations and Their Role in Advancing Regulatory Reforms*, GWPC, August 2011). Revised regulations address the management and disposal of oil and gas production brines with the preferred mode of disposal as injection into Class II injection wells.

The major sources of ground water contamination listed include point and nonpoint sources in roughly equal proportions. In strict terms, a point source is a discharge from a discernable, confined and discrete conveyance, but in practical terms, the distribution or spatial scale of a contaminant controls the designation of a source as point or nonpoint. For example, salt applied for de-icing along roads exhibits nonpoint source behavior, while salt stockpiles behave more like point sources, with the potential for continual release of concentrated brine that may affect ground water quality. This dichotomy is typical of many agricultural contaminants, manure spreading versus storage, fertilizer application versus storage or mixing sites. In Ohio, we generally have better documentation of ground water contamination associated with point source contamination than nonpoint source contamination due to the extensive ground water monitoring programs at regulated facilities.

Rapid runoff in glacial till areas overlying much of Ohio and drainage tiling have protected many of Ohio's aquifers from traditional nonpoint source pollution sources such as nitrate, chloride, pesticides or bacteria. In sensitive settings (for example, sand and gravel aquifers, shallow bedrock aquifers), indicators of nonpoint source pollution are more clearly identified in Ohio's Ambient Ground Water Quality Monitoring program and the public water system compliance monitoring data. However, these monitoring programs do not focus on shallow aquifers, which have a higher likelihood of being influenced by nonpoint source pollution such as agricultural practices.

Table M-3 — Major sources of potential ground water contamination.

Contaminant Source	Highest-Priority Sources	Factors Considered in Selecting a Contaminant Source	Contaminants
Agriculture Activities			
Agricultural chemical facilities			
Animal feedlots	×	4, 5, 6, 8	E, J, K, L
Drainage wells			
Fertilizer applications (manure application)	✓	1, 2, 3, 4, 5, 8	E, J, K, L
Irrigation practices			
Pesticide applications			
On-farm agricultural mixing and loading			
Land application of manure			
Storage and Treatment Activities			
Land application			
Material stockpiles			
Storage tanks (above/below ground)	✓	1, 2, 3, 4, 5, 6, 7	C, D, H, M, N
Surface impoundments	×	6	G, H, M
Waste piles			
Waste tailings			
Disposal Activities			
Deep injection wells			
Landfills	✓	1, 2, 3, 4, 5, 6	A, B, C, D, H, M, N
Septic systems	✓	1, 2, 3, 4, 5, 6	E, H, J, K, L
Shallow injection wells	✓	1, 2, 3, 4, 5, 6, 8	C, D, G, H, M
Other			
Fire training areas	✓	1,3	N
Hazardous waste generators			
Hazardous waste sites	✓	1, 2, 3, 4, 5, 6, 7	A, B, C, D, H, I, M, N
Large industrial facilities			
Material transfer operations			
Mining and mine drainage	×	6, 8	G, H
Pipelines and sewer lines	✓		D, E, J, K, L
Salt storage and road salting	✓	6	G
Spills	×	6	C, D, H, M
Transportation of materials			
Urban runoff (storm water management, storm drains)	✓	2, 4	A, B, C, D, G, H, J
Small-scale manufacturing and repair shops	✓	4, 6	C, D, H, M, N

Notes: (✓) Highest Priority (×) Potentially High Priority
Factor and Contaminant codes on next page.

Factors	Contaminants
1. Human health and/or environmental risk (toxicity)	A. Inorganic pesticides
2. Size of the population at risk	B. Organic pesticides
3. Location of the sources relative to drinking water sources	C. Halogenated solvents
4. Number and/or size of contaminant sources	D. Petroleum compounds
5. Hydrogeologic sensitivity	E. Nitrate
6. State findings, other findings	F. Fluoride
7. Documented from mandatory reporting	G. Salt/Salinity/brine
8. Geographic distribution/occurrence	H. Metals
	I. Radionuclides
	J. Bacteria
	K. Protozoa
	L. Viruses
	M. Other (VOCs)
	N. PFOS/PFOA

M6. Summary of Ground Water Quality by Aquifer

Table M-4 and Table M-5 (Table 5-4, U.S. EPA 305(b) Guidelines, 1997) summarize water quality compliance data from Ohio public water systems and raw water data from the AGWQMP, respectively. The compliance data for public water systems in Ohio (Table M-4) documents water quality for treated water (post processing) and some raw (untreated) water quality (new well samples). Parameters generally unaffected by standard treatment, such as nitrate, may be used to characterize Ohio's ground water quality because post treatment values are similar to ground water values. DDAGW created the AGWQMP program (Table M-5) to monitor raw (untreated) ground water. This program's goal is the collection, maintenance and analysis of raw ground water quality data to measure long-term changes in the water quality of the Ohio's major aquifer systems.

Ohio does not have statewide ground water quality standards, so data for the major aquifers are compared to primary maximum contaminant levels (MCLs), secondary maximum contaminant levels (SCMLs), health advisory levels (HALs), action levels (copper and lead), and drinking water advisory levels (sodium and sulfate). Primary MCLs are the highest level of a contaminant that is allowed in public drinking water and are set as close to MCL goals (a health-based standard) as feasible using the best available treatment technology and economic considerations. Primary MCLs are enforceable standards. Secondary MCLs are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor or color) in drinking water. HALs are levels in drinking water below which there are no adverse health effects over different time periods, such as one day, 10-day, long-term or lifetime. Action levels for lead and copper are set such that if more than 10 percent of tap water samples are above the action level, requirements may be triggered including: water quality parameter monitoring; corrosion control treatment; source water monitoring/treatment; public education; and/or lead service line replacement. Drinking water advisory levels for sodium and sulfate provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. The sodium drinking water advisory level applies only to adults on a low-salt diet.

Primary and secondary MCLs, HALs, action levels and drinking water advisory levels are used as practical benchmarks for water quality characterization in Table M-4 and Table M-5. For primary and secondary MCLs, 50 to 100 percent of the benchmark is used as the range for the watch list determination. The public water systems or wells identified in this category may warrant additional monitoring to identify increasing trends. Benchmark exceedances are used as the criteria for the impaired category for each of the five benchmarks: primary and secondary MCLs, HALs, action levels and drinking water advisory levels. Table

M-4 and Table M-5 were generated using the last 10 years of data (1/1/2007-8/17/2017). Mean concentrations of a parameter are used to decide if a public water system or well is included in the watch list (50 to 100 percent of the benchmark) or impaired category (> benchmark). Maximum concentrations of nitrate and nitrite are reported in these tables instead of averages, due to the acute nature of their health concerns.

Public Water System Compliance Data

Mean values were calculated from public water system compliance data for 2007-2017 to determine the number of public water systems on the watch list and in the impaired category. A 10-year period of record was used to increase the statistical significance of the determination due to the infrequent sampling requirements (once per three-year period). **Public water systems included in the impaired category may not match Safe Drinking Water Act regulatory determinations of a violation due to the method of calculation.** A benchmark exceedance for compliance is generally an annual average, so the **decadal average presented in Table M-4 is not a compliance number**, but rather a comparison to set values, as a benchmark to identify public water systems in the watch list and impaired categories.

Table M-4 lists all parameters with MCLs, SMCLs, HALs, action levels and drinking water advisory levels and summarizes the number of public water systems in the watch list (MCLs and SMCLs only) and impaired category for both raw and treated water quality data (all five benchmarks). The results for each parameter are further divided into major aquifer type categories. The total number of public water systems with data used in these determinations is presented to allow comparison of the total number of public water systems to those that exhibit elevated levels. Data from active and inactive systems is included in Table M-4. For parameters with non-MCL benchmarks, treated water data is limited or absent because compliance data is generally not required for aesthetic water quality issues.

Except for a new well analysis, there are no requirements for collecting and reporting raw water data, so the number of public water systems with raw water data is less than the number with treated water data. The public water system data were linked to geologic settings using the DDAGW Source Water Assessment data, which allowed the breakout of the data by major aquifer. In this analysis, any detection in raw water data was used to generate public water system averages. For treated water data, public water system averages were generated only if there were at least two detections of a parameter. The inorganic parameters that place numerous public water systems in the watch list and impaired category warrant additional analysis.

The number of public water systems in the watch list and the impaired categories of Table M-4 for treated water are generally low; however, several parameters do exhibit higher numbers of public water systems in these groups. Fortunately, most of these occurrences are for secondary MCLs, not primary MCLs, HALs, action levels or drinking water advisories. That is, the water quality impacts documented are mostly aesthetic issues and are not health-based. Groups of parameters are discussed individually.

Table M-4 — Counts of public water systems where 2007-2017 decadal mean values of compliance data occur in the Watch List and Impaired Category.

					Public Water Systems					
					Raw Water			Treated Water		
Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard
Inorganics	Aluminum	SMCL	200 µg/L	Sand and Gravel						
				Sandstone						
				Carbonate						
	Ammonia	Lifetime HAL	30 mg/L	Sand and Gravel	9					
				Sandstone	11					
				Carbonate	26					
	Antimony	MCL	6 µg/L	Sand and Gravel	284	2	1	702	6	
				Sandstone	286	5	1	712	9	1
				Carbonate	260	4		447	5	1
	Arsenic	MCL	10 µg/L	Sand & Gravel	367	60	68	705	87	44
				Sandstone	318	20	20	719	48	11
				Carbonate	316	53	51	447	65	36
	Asbestos	MCL	7x106 fibers/L	Sand and Gravel	35			169		
				Sandstone	10			50		
				Carbonate	12			62		
	Barium	MCL	2000 µg/L	Sand and Gravel	295	4		703	5	
				Sandstone	301	6	1	714	2	
				Carbonate	261	1	1	446	1	
	Barium	1/10 Day HAL	700 µg/L	Sand and Gravel	295		9	702		10
				Sandstone	301		9	714		5
				Carbonate	261		3	445		2
	Beryllium	MCL	4 µg/L	Sand and Gravel	284	2		702		1
				Sandstone	287			713		
				Carbonate	257			446		
	Cadmium	MCL	5 µg/L	Sand and Gravel	288		1	702	1	
				Sandstone	287		1	713	2	
				Carbonate	257			446		
	Cadmium	Lifetime HAL	5 µg/L	Sand and Gravel	288		1	701		
				Sandstone	287		1	713		
				Carbonate	257			445		

					Public Water Systems					
					Raw Water			Treated Water		
Chemical Group	**Chemical**	**Std. Type**	**Standard**	**Major Aquifer**	**Total # public water systems**	**Watch List > 50% to 100% Standard**	**Impaired > Standard**	**Total # public water systems**	**Watch List > 50% to 100% Standard**	**Impaired > Standard**
Inorganics	Cadmium	1/10 Day HAL	40 µg/L	Sand and Gravel	288			701		
				Sandstone	287			713		
				Carbonate	257			445		
	Chloride	SMCL	250 mg/L	Sand and Gravel	259	5	1			
				Sandstone	293	15	10			
				Carbonate	249	3	2			
	Chromium	MCL	100 µg/L	Sand and Gravel	286			702		
				Sandstone	285	1	1	713	1	
				Carbonate	259			446		
	Chromium	1/10 Day HAL	1000 µg/L	Sand and gravel	286			701		
				Sandstone	285			713		
				Carbonate	259			445		
	Copper	Action Level	1300 µg/L	Sand and Gravel	309			603		
				Sandstone	333			624		
				Carbonate	262			356		
	Cyanide	MCL	0.2 mg/L	Sand and Gravel	275			702	1	
				Sandstone	285			713		
				Carbonate	255			446		
	Fluoride	MCL	4 mg/L	Sand and Gravel	304	1		702	6	
				Sandstone	298	1		713	1	
				Carbonate	269	21		446	20	
	Fluoride		2 mg/L	Sand and Gravel	304	1		702	6	
		SMCL		Sandstone	298	1		713	1	
				Carbonate	269	21		446	20	
	Iron	SMCL	300 µg/L	Sand and Gravel	295	14	162			
				Sandstone	295	37	144	1		
				Carbonate	278	22	140	1		1
	Lead	Action Level	15 µg/L	Sand and Gravel						
				Sandstone						
				Carbonate						
	Manganese	SMCL	50 µg/L	Sand and Gravel	264	40	106			
				Sandstone	295	32	146	1		
				Carbonate	251	42	45	1		1

Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Public Water Systems – Raw Water – Total # public water systems	Public Water Systems – Raw Water – Watch List > 50% to 100% Standard	Public Water Systems – Raw Water – Impaired > Standard	Public Water Systems – Treated Water – Total # public water systems	Public Water Systems – Treated Water – Watch List > 50% to 100% Standard	Public Water Systems – Treated Water – Impaired > Standard
Inorganics	Manganese	Lifetime HAL	300 µg/L	Sand and Gravel	264		26			
				Sandstone	295		36	1		
				Carbonate	251		3	1		
	Manganese	1/10 Day HAL	1000 µg/L	Sand and Gravel	264		5			
				Sandstone	295		5	1		
				Carbonate	251		2	1		
	Mercury	MCL	2 µg/L	Sand and Gravel	281		1	702		
				Sandstone	287	1		713		1
				Carbonate	257	1		446		
	Nickel	Lifetime HAL	100 µg/L	Sand and Gravel	287			701		2
				Sandstone	288		1	713		2
				Carbonate	260		1	445		
	Nickel	1/10 Day HAL	1000 µg/L	Sand and Gravel	287			701		
				Sandstone	288			713		
				Carbonate	260		1	445		
	Nitrate * (Max Value)	MCL	10 mg/L	Sand and Gravel	349	16	9	1603	57	17
				Sandstone	331	6	4	2053	31	5
				Carbonate	286	6	7	1397	34	2
	Nitrate* (Max Value)	1/10 Day HAL	100 mg/L	Sand and Gravel	349			1601		1
				Sandstone	331			2053		
				Carbonate	286			1393		
	Nitrite * (Max Value)	MCL	1 mg/L	Sand and Gravel	326			1611	1	2
				Sandstone	311	1		2062	3	3
				Carbonate	269			1407	1	
	pH	SMCL	6.5-8.5 SU	Sand and Gravel						
				Sandstone						
				Carbonate						
	Selenium	MCL	50 µg/L	Sand and Gravel	284			702		
				Sandstone	288			713		
				Carbonate	258	2		446		
	Selenium	Lifetime HAL	50 µg/L	Sand and Gravel	284			701		
				Sandstone	288			713		
				Carbonate	288			445		

Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Public Water Systems					
					Raw Water			Treated Water		
					Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard
Inorganics	Silver	SMCL	100 µg/L	Sand and Gravel	248		1			
				Sandstone	274			1		
				Carbonate	241		1			
	Sodium**	DW Advisory	20 mg/L	Sand and Gravel	246		94			
				Sandstone	280		141	1		
				Carbonate	241		117			
	Strontium	Lifetime HAL	4000 µg/L	Sand and Gravel	3		1			
				Sandstone	3					
				Carbonate	1		1			
	Strontium	1/10 Day HAL	25000 µg/L	Sand and Gravel	3					
				Sandstone	3					
				Carbonate	1					
	Sulfates	SMCL	250 mg/L	Sand and Gravel	291	17	15			
				Sandstone	299	12	17			
				Carbonate	270	30	83	1		
	Sulfates	DW Advisory	500 mg/L	Sand and Gravel	291		9			
				Sandstone	299		7			
				Carbonate	270		54	1		
	Thallium	MCL	2 µg/L	Sand and Gravel	282	2	1	702	3	
				Sandstone	286		1	713	2	1
				Carbonate	257	1		446		1
	Total Dissolved Solids	SMCL	500 mg/L	Sand and Gravel	119	50	30			
				Sandstone	167	71	32			
				Carbonate	144	23	79			
	Zinc	SMCL	5000 µg/L	Sand and Gravel	155					
				Sandstone	145			1		
				Carbonate	137					
	Zinc	Lifetime HAL	2000 µg/L	Sand and Gravel	155					
				Sandstone	145			1		
				Carbonate	137		1			
	Zinc	1/10 Day HAL	6000 µg/L	Sand and Gravel	155					
				Sandstone	145			1		
				Carbonate	137					

					Public Water Systems					
					Raw Water			Treated Water		
Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard
Volatile Organic Chemicals	1,2-Dichloroethane	MCL	5 µg/L	Sand and Gravel	326	1		706		
				Sandstone	321			719		1
				Carbonate	277			451		1
	1,1-Dichloroethylene	MCL	7 µg/L	Sand and Gravel	327	1		707		
				Sandstone	321		1	719		1
				Carbonate	277			451		
	1,2-Dichloropropane	MCL	5 µg/L	Sand and Gravel	328		1	707		1
				Sandstone	322			719		
				Carbonate	277			451	1	
	1,1,1-Trichloroethane	MCL	200 µg/L	Sand and Gravel	328			707		
				Sandstone	322			719		
				Carbonate	277			451		
	1,1,2-Trichloroethane	MCL	5 µg/L	Sand and Gravel	328			707		
				Sandstone	322			719		
				Carbonate	277			451		
	1,2,4-Trichlorobenzene	MCL	70 µg/L	Sand and Gravel	328			707		
				Sandstone	321			719		
				Carbonate	277			451		
	Benzene	MCL	5 µg/L	Sand and Gravel	327		3	707		
				Sandstone	322			719		
				Carbonate	275			451		
	Carbon Tetrachloride	MCL	5 µg/L	Sand and Gravel	328	1		707		1
				Sandstone	322	1	1	719		
				Carbonate	277			451		
	Chlorobenzene	MCL	100 µg/L	Sand and Gravel	328					
				Sandstone	321					
				Carbonate	277					
	Cis-1,2-Dichloroethylene	MCL	70 µg/L	Sand and Gravel	328			707		
				Sandstone	321			719		
				Carbonate	277			451		
	Dichloromethane	MCL	5 µg/L	Sand and Gravel	327	2	1	707	2	1
				Sandstone	316	1	1	719		1
				Carbonate	276		1	451	1	1

Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Public Water Systems: Raw Water: Total # public water systems	Raw Water: Watch List > 50% to 100% Standard	Raw Water: Impaired > Standard	Treated Water: Total # public water systems	Treated Water: Watch List > 50% to 100% Standard	Treated Water: Impaired > Standard
Volatile Organic Chemicals	Ethyl benzene	MCL	700 µg/L	Sand and Gravel	328			707		
				Sandstone	322			719		
				Carbonate	277			451		
	o-Dichlorobenzene	MCL	600 µg/L	Sand and Gravel	328			707		
				Sandstone	321			719		
				Carbonate	277			451		
	p-Dichlorobenzene	MCL	75 µg/L	Sand and Gravel	328			707		
				Sandstone	320			719		
				Carbonate	277			451		
	Styrene	MCL	100 µg/L	Sand and Gravel	328			707		
				Sandstone	322			719		
				Carbonate	277	1		451		
	Tetrachloroethylene	MCL	5 µg/L	Sand and Gravel	328	3	3	707	3	
				Sandstone	322	1	2	719	1	1
				Carbonate	277			451	1	
	Toluene	MCL	1000 µg/L	Sand and Gravel	328			707		
				Sandstone	322			719		
				Carbonate	277			451		
Volatile Organics	Trans-1,2-Dichloroethylene	MCL	100 µg/L	Sand and Gravel	328			707		
				Sandstone	322			719		
				Carbonate	277			451		
	Trichloroethylene	MCL	5 µg/L	Sand and Gravel	328	3		707		
				Sandstone	322		1	719	1	
				Carbonate	276	1	1	451	1	
	Vinyl Chloride	MCL	2 µg/L	Sand and Gravel	328	3	2	706		2
				Sandstone	321			719		
				Carbonate	277			451		
	Xylenes, Total	MCL	10 mg/L	Sand and Gravel	327			707		
				Sandstone	318			719		
				Carbonate	276			451		

					Public Water Systems					
					Raw Water			Treated Water		
Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard
Pesticides and Synthetic Organic Chemicals	Alachor (Lasso)	MCL	2 µg/L	Sand and Gravel	270			707		
				Sandstone	281			723		
				Carbonate	241			453		
	Atrazine	MCL	3 µg/L	Sand and Gravel	269			707		
				Sandstone	282			723		
				Carbonate	241			453		
	Benzo(a)Pyrene	MCL	0.2 µg/L	Sand and Gravel	3			94	1	
				Sandstone				47		
				Carbonate	3			19		
	Carbofuran	MCL	40 µg/L	Sand and Gravel	3			98		
				Sandstone	1			44		
				Carbonate	2			20		
	Chlordane	MCL	2 µg/L	Sand and Gravel	4					
				Sandstone						
				Carbonate						
	2,4-D	MCL	70 µg/L	Sand and Gravel	5			97		
				Sandstone	2			44		
				Carbonate	2			20		
	Dalapon	MCL	200 µg/L	Sand and Gravel	5					
				Sandstone						
				Carbonate						
	Dibromochloro-propane (DBCP)	MCL	0.2 µg/L	Sand and Gravel						
				Sandstone						
				Carbonate						
	Di(2-ethylhexyl) adipate	MCL	400 µg/L	Sand and Gravel	4			94		
				Sandstone				47		
				Carbonate	5			19		
	Di(2-ethylhexyl) phthalate	MCL	6 µg/L	Sand and Gravel	4			97		2
				Sandstone				48		
				Carbonate	5	1		21		1
	Dinoseb	MCL	7 µg/L	Sand and Gravel	5					
				Sandstone						
				Carbonate	1					

Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Public Water Systems: Raw Water: Total # public water systems	Raw Water: Watch List > 50% to 100% Standard	Raw Water: Impaired > Standard	Treated Water: Total # public water systems	Treated Water: Watch List > 50% to 100% Standard	Treated Water: Impaired > Standard
Pesticides and Synthetic Organic Chemicals	Diquat	MCL	20 µg/L	Sand and Gravel	3			100		
				Sandstone				46		
				Carbonate	2			18		
	Endothall	MCL	100 µg/L	Sand and Gravel	3			94		
				Sandstone				47		
				Carbonate	2			19		
	Endrin	MCL	2 µg/L	Sand and Gravel	4					
				Sandstone						
				Carbonate						
	Ethylene Dibromide	MCL	0.05 µg/L	Sand and Gravel	6					
				Sandstone						
				Carbonate						
	Glyphosate	MCL	700 µg/L	Sand and Gravel	3			97		
				Sandstone				46		
				Carbonate	2			18		
	Heptachlor	MCL	0.4 µg/L	Sand and Gravel	4					
				Sandstone						
				Carbonate						
	Heptachlor Epoxide	MCL	0.2 µg/L	Sand and Gravel	4					
				Sandstone						
				Carbonate						
	Hexachlorobenzene	MCL	1 µg/L	Sand and Gravel	4					
				Sandstone						
				Carbonate						
	Hexachloro-cyclopentadiene	MCL	50 µg/L	Sand and Gravel	4					
				Sandstone						
				Carbonate						
	Lindane	MCL	0.2 µg/L	Sand and Gravel	4			97		
				Sandstone				46		
				Carbonate	2			18		
	Methoxychlor	MCL	40 µg/L	Sand and Gravel	4			97		
				Sandstone	1			46		
				Carbonate	2			18		

					Public Water Systems					
					Raw Water			Treated Water		
Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard
Pesticides and Synthetic Organic Chemicals	Oxamyl	MCL	200 µg/L	Sand and Gravel	3			98		
				Sandstone	1			44		
				Carbonate	2			20		
	Pentachlorophenol	MCL	1 µg/L	Sand and Gravel						
				Sandstone						
				Carbonate						
	Picloram	MCL	500 µg/L	Sand and Gravel	5			98		
				Sandstone	2			44		
				Carbonate	2			20		
	Simazine	MCL	4 µg/L	Sand and Gravel	269			707		
				Sandstone	282			723		
				Carbonate	241			453		
	Total PCBs	MCL	0.5 µg/L	Sand and Gravel	3			97		
				Sandstone	1			46		
				Carbonate	1			18		
	2,3,7,8-TCDD (Dioxin)	MCL	3×10^{-5} µg/L	Sand and Gravel				24		
				Sandstone				4		
				Carbonate				3		
	2,4,5-TP (Silvex)	MCL	50 µg/L	Sand and Gravel	5					
				Sandstone						
				Carbonate						
	Toxaphene	MCL	3 µg/L	Sand and Gravel	4					
				Sandstone						
				Carbonate						
Organic Disinfection By-Products	Total Haloacetic Acids (HAA5)	MCL	60 µg/L	Sand and Gravel	81	3	1	526	5	2
				Sandstone	51		1	406	6	4
				Carbonate	56	1	1	275	3	1
	Total Trihalomethanes (TTHM)	MCL	80 µg/L	Sand and Gravel	119	6	4	525	40	6
				Sandstone	61	2	1	406	14	2
				Carbonate	62	5	3	275	23	2
Radiological	Gross Alpha (excl & incl)	MCL	15 pCi/L	Sand and Gravel	208	1		421	2	1
				Sandstone	251	4		265	3	1
				Carbonate	176	12	3	190	3	

					Public Water Systems					
					Raw Water			Treated Water		
Chemical Group	Chemical	Std. Type	Standard	Major Aquifer	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard	Total # public water systems	Watch List > 50% to 100% Standard	Impaired > Standard
Radiological	Gross Beta	MCL	4 mrem/ yr***	Sand and Gravel	162	2	34			
				Sandstone	174	2	48			
				Carbonate	144	2	45			
	Radium 226	MCL	5 pCi/L****	Sand and Gravel	24			1		
				Sandstone	28	2	1	3		
				Carbonate	45	6	2	1		
	Radium 228	MCL	5 pCi/L****	Sand and Gravel	153			418	1	
				Sandstone	159	3	2	265	4	1
				Carbonate	147	2		187	1	
	Uranium	MCL	30 µg/L	Sand and Gravel	3					
				Sandstone	1					
				Carbonate	3					

Note: presented by major aquifer types.
Blank spaces indicate no public water systems exceed the standards (zeros left out to highlight impacted public water systems)
"nda" Indicates no data available
*   Numbers for Nitrate and Nitrite are based on maximum values to reflect the acute nature of the contaminant.
**   Sodium drinking water advisory level is for adults on low-salt diets.
***   If Gross Beta result is less than 50 pCi/L no conversion to mrem/yr is necessary – table used 50 pCi/L as standard.
****   MCL is for combined Radium 226 and Radium 228

Table M-5 —Counts of wells where 2007-2017 decadal mean values of AGWQMP data occur in the Watch List and Impaired Category (maximum values used for nitrate).

Chemical Group	Chemical	Standard Type	Standard	Major Aquifer	Ambient GW Quality Wells Raw Water Total # Wells	Watch List > 50 - 100% Standard	Impaired > Standard
Inorganic Chemicals	Ammonia	Lifetime HAL	30 mg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Antimony	MCL	6 µg/L	Sandstone and Gravel			
				Sandstone	1		
				Carbonate			
	Arsenic	MCL	10 µg/L	Sandstone and Gravel	167	27	24
				Sandstone	49	3	1
				Carbonate	61	5	9
	Alkalinity	SMCL	10,000 mg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Barium	MCL	2,000 µg/L	Sandstone and Gravel	167	2	
				Sandstone	49	2	1
				Carbonate	61		
	Barium	1/10 Day HAL	700 µg/L	Sandstone and Gravel	167		4
				Sandstone	49		5
				Carbonate	61		
	Cadmium	MCL	5 µg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Cadmium	Lifetime HAL	5 µg/L	Sandstone and Gravel	167		
				Sandstone	49		1
				Carbonate	61		1
	Cadmium	1/10 Day HAL	40 µg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Chloride	SMCL	250 mg/L	Sandstone and Gravel	167	5	2
				Sandstone	49	5	2
				Carbonate	61	1	1

Chemical Group	Chemical	Standard Type	Standard	Major Aquifer	Ambient GW Quality Wells		
					Raw Water		
					Total # Wells	Watch List > 50 - 100% Standard	Impaired > Standard
Inorganic Chemicals	Chromium	MCL	100 µg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Chromium	1/10 Day HAL	1,000 µg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Copper	Action Level	1,300 µg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Fluoride	MCL	4 mg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61	6	
	Fluoride	SMCL	2 mg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Iron	SMCL	300 µg/L	Sandstone and Gravel	167	10	121
				Sandstone	49	7	32
				Carbonate	61	8	46
	Lead	Action Level	15 µg/L	Sandstone and Gravel			
				Sandstone			
				Carbonate			
	Manganese	SMCL	50 µg/L	Sandstone and Gravel	167	25	116
				Sandstone	49	4	32
				Carbonate	61	18	8
	Manganese	Lifetime HAL	300 µg/L	Sandstone and Gravel	167		48
				Sandstone	49		13
				Carbonate	61		
	Manganese	1/10 Day HAL	1,000 µg/L	Sandstone and Gravel	167		4
				Sandstone	49		3
				Carbonate	61		
	Nickel	Lifetime HAL	100 µg/L	Sandstone and Gravel	167		1
				Sandstone	49		2
				Carbonate	61		

Chemical Group	Chemical	Standard Type	Standard	Major Aquifer	Ambient GW Quality Wells		
					Raw Water		
					Total # Wells	Watch List > 50 - 100% Standard	Impaired > Standard
Inorganic Chemicals	Nickel	1/10 Day HAL	1,000 µg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Nitrate* (Max Value)	MCL	10 mg/L	Sandstone and Gravel	167	11	4
				Sandstone	49	1	
				Carbonate	61	2	
	Nitrate* (Max Value)	1/10 Day HAL	100 mg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	Nitrite* (Max Value)	MCL	1 mg/L	Sandstone and Gravel	25		
				Sandstone			
				Carbonate			
	Selenium	MCL	50 µg/L	Sandstone and Gravel	167		
				Sandstone	49	1	
				Carbonate	61		
	Selenium	Lifetime HAL	50 µg/L	Sandstone and Gravel	167		
				Sandstone	49		1
				Carbonate	61		
	Sodium	DW Advisory	20 mg/L	Sandstone and Gravel	167		122
				Sandstone	49		36
				Carbonate	61		45
	Strontium	Lifetime HAL	4,000 µg/L	Sandstone and Gravel	167		30
				Sandstone	49		5
				Carbonate	61		54
	Strontium	1/10 Day HAL	25,000 µg/L	Sandstone and Gravel	167		3
				Sandstone	49		
				Carbonate	61		22
	Sulfate	SMCL	250 mg/L	Sandstone and Gravel	167	16	2
				Sandstone	49	2	1
				Carbonate	61	9	26
	Sulfate	1/10 Day HAL	500 mg/L	Sandstone and Gravel	167		1
				Sandstone	49		1
				Carbonate	61		10

Chemical Group	Chemical	Standard Type	Standard	Major Aquifer	Ambient GW Quality Wells Raw Water Total # Wells	Watch List > 50 - 100% Standard	Impaired > Standard
Inorganic Chemicals	Total Dissolve Solids	SMCL	500 mg/L	Sandstone and Gravel	167	111	55
				Sandstone	49	31	12
				Carbonate	61	7	54
	Zinc	DW Advisory	5,000 µg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61	1	
	Zinc	Lifetime HAL	2,000 µg/L	Sandstone and Gravel	167		2
				Sandstone	49		
				Carbonate	61		1
	Zinc	1/10 Day HAL	6,000 µg/L	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
	pH	SMCL	7.0-10.5	Sandstone and Gravel	167		
				Sandstone	49		
				Carbonate	61		
Volatile Organic Chemicals	1,2-Dichloroethane	MCL	5 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	1,1-Dichloroethylene	MCL	7 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	1,2-Dichloropropane	MCL	5 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	1,1,1-Trichloroethane	MCL	200 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	1,1,2-Trichloroethane	MCL	5 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	1,2,4-Trichlorobenzene	MCL	70 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		

Chemical Group	Chemical	Standard Type	Standard	Major Aquifer	Ambient GW Quality Wells Raw Water Total # Wells	Ambient GW Quality Wells Raw Water Watch List > 50 - 100% Standard	Ambient GW Quality Wells Raw Water Impaired > Standard
Volatile Organic Chemicals	Benzene	MCL	5 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Carbon Tetrachloride	MCL	5 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Chlorobenzene	MCL	100 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Cis-1,2-Dichloroethylene	MCL	70 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Dichloromethane	MCL	5 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Ethyl benzene	MCL	700 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	o-Dichlorobenzene	MCL	600 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	p-Dichlorobenzene	MCL	75 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Styrene	MCL	100 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Tetrachloroethylene	MCL	5 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Toluene	MCL	1,000 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		

Chemical Group	Chemical	Standard Type	Standard	Major Aquifer	Ambient GW Quality Wells Raw Water Total # Wells	Watch List > 50 - 100% Standard	Impaired > Standard
Volatile Organic Chemicals	Trans-1,2-Dichloroethylene	MCL	100 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		
	Trichloroethylene	MCL	5 µg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		1
	Vinyl Chloride	MCL	2 µg/L	Sandstone and Gravel	160	4	
				Sandstone	48		
				Carbonate	59		
	o-Xylene	MCL	10 mg/L	Sandstone and Gravel	160		
				Sandstone	48		
				Carbonate	59		

Blank spaces indicate no public water systems exceed the standards (zeros left out to highlight impacted public water systems)
"nda" Indicates no data available
* Numbers for Nitrate and Nitrite are based on maximum values to reflect the acute nature of the contaminant
** If Gross Beta result is less than 50 pCi/L, no conversion to mrem/yr is necessary – table used 50 p/Ci/L as standard
*** MCL is for combined Radium 226 and Radium 228

Inorganic Parameters

MCL Parameters

Only a few public water systems fall into the watch list or the impaired MCL category based on inorganic parameters. For treated water data, parameters with MCLs and no public water systems in the impaired category (values > MCL) include: **asbestos; barium; cadmium; chromium; cyanide; fluoride; and selenium.** The use of detection limits at or greater than 50 percent of the MCL and using the reporting limit for the non-detect value can result in public water systems placed in the watch list with no detection of the parameter. The data has been reviewed to assure that public water system in the watch list have detected the parameter. Factors limiting the number of public water systems in these categories include limited solubility of the substance in water, low crustal abundance, local geology and possibly treatment. For example, in treated water, no public water systems exceed the fluoride MCL, but 20 public water systems that draw water from carbonate aquifers exceed 50 percent of the MCL. This association is controlled by secondary fluorite mineralization along fractures and voids in limestone in northwest Ohio.

Several parameters including **antimony, beryllium, mercury and thallium** have low numbers of public water systems in the MCL impaired category for treated water. This small number is consistent with the low solubility and scarcity of these metals in Ohio's geology. The use of decadal averages for determining both watch list and impaired categories may overestimate the numbers of public water systems when compared to actual MCL, SMCL or HAL calculations which use annual averages.

The number of public water systems with **arsenic** in raw water and treated water above the MCL (139 and 91, respectively) is consistent with the number of public water systems that DDAGW worked with to reduce arsenic to meet the 2006 revised MCL of 10 μg/L. These systems are associated with reduced ground water and local areas of naturally occurring arsenic. Sand and gravel and carbonate aquifers are more likely than the sandstone aquifers to exhibit arsenic-impaired ground water. The number of public water systems currently exceeding the arsenic MCL is significantly less than what is listed in Table M-4 because numerous public water systems have installed treatment to remove arsenic since 2006. The elevated arsenic results collected from 2007 and beyond (while treatment processes were installed and refined) are included in the 10 years of data used to generate the public water system decadal averages. These elevated values increase the decadal mean calculated for Table M-4 and thus, result in impaired systems on a decadal mean, but these systems are currently serving water below the arsenic MCL. Figure M-4 illustrates the distribution of the public water systems with arsenic in treated and/or raw water greater than the MCL as listed in Table M-4.

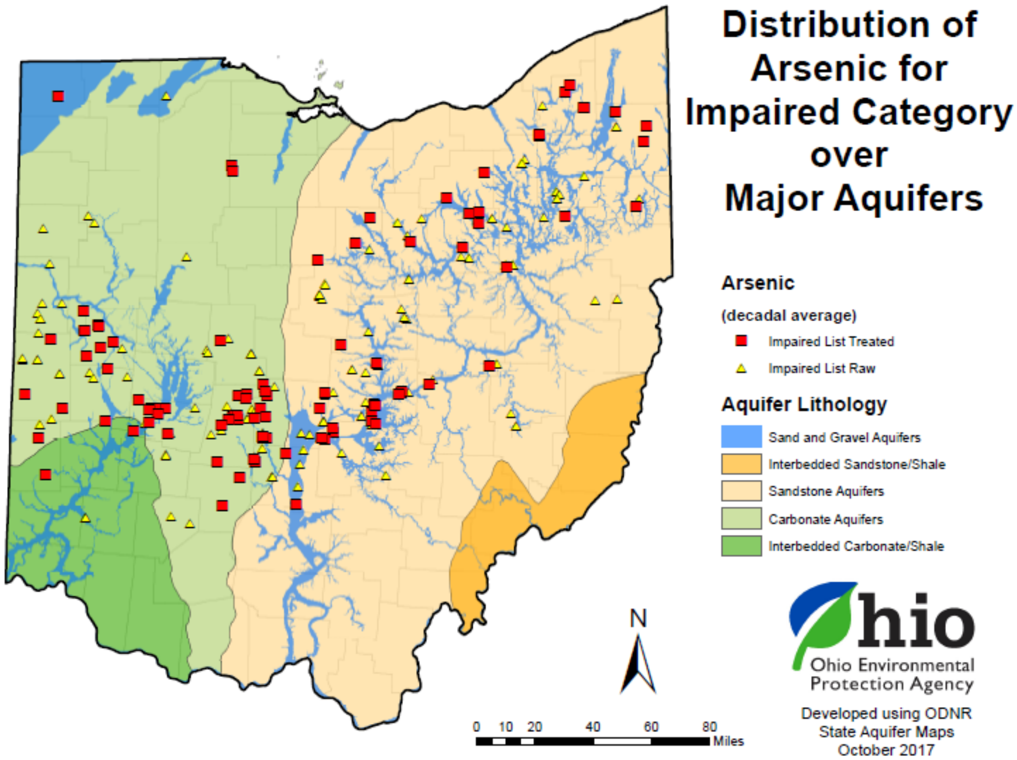


Figure M-4 — Distribution of public water systems on impaired list for arsenic for both treated and raw waters.

SMCL Parameters

Secondary MCL parameters for drinking water are directed at non-health related issues such as taste and odor. Public water systems do not collect compliance data for most parameters with SMCLs. Table M-4 utilized only compliance data and, consequently, it includes little data for treated water for parameters with SMCLs. The raw water data collected through new well samples, however, provides information on the distribution of these parameters.

Multiple public water systems display elevated **chloride**. The largest numbers of public water systems with elevated chloride are associated with the sandstone aquifers followed by sand and gravel aquifers and carbonate aquifers. This may be related to limited natural oil and gas deposits occurring within aquifers, contamination of local aquifers from surface handling of oil and gas production brines, local salt storage facilities overlying sensitive aquifers, road salt application or septic systems. Transportation routes are concentrated in the broad, flat buried valleys and consequently, large salt piles are stored on these broad valleys, which contain sensitive aquifers. Activities to address chloride contamination are discussed in the Major Sources of Ground Water Contamination section.

Iron and manganese have similar oxidation-reduction solubility controls as arsenic and widespread distribution and exhibit elevated numbers of public water systems in the watch list and impaired category of Table M-4 for raw water. Table M-4 utilized only compliance data so little data for treated water is included for iron and manganese. The raw water concentration for Fe and Mn are controlled by the increased solubility of iron and manganese in reduced waters. The deeper wells generally exhibit more reduced conditions (reduced interaction with the atmosphere) and, consequently, elevated iron and manganese. Iron is a common element and is present in all three major aquifers. For manganese, the carbonate aquifer is least likely to exhibit concentrations above the SMCL. Many public water systems remove iron and manganese, so the percentage of public water systems that exhibit impairments in treated water is significantly lower than in raw water.

Sulfate also has an SMCL and only raw water data exists for identifying water quality impacts. A significant number of public water systems exhibit elevated sulfate in the both the watch and impaired categories as illustrated in Figure M-5. Although these sites are distributed in all major aquifers, the carbonate aquifers in NW Ohio exhibit the highest percentage of public water systems on the watch list and in the impaired category (42 percent of carbonate vs. 10-11 percent for sandstone and sand and gravel) due to the presence of evaporates (Gypsum, $CaSO_4 \cdot 2H_2O$) in the Salina Formation in northwest Ohio.

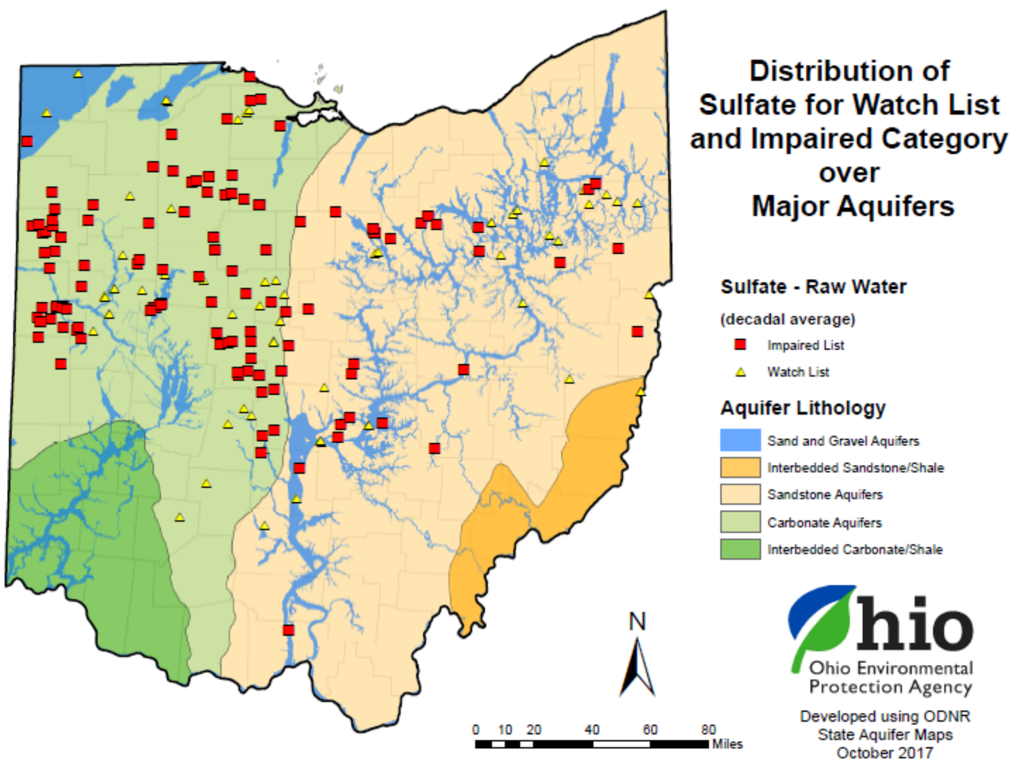


Figure M-5 — Distribution of public water systems in impaired category and on the watch list for sulfate in raw water.

For **Fluoride** results, no public water systems show up in the impaired category for raw or treated water, however, a number of public water systems exhibit watch list concentrations in treated and raw water. Fluoride is unusual in that it has a primary and secondary MCL and the SMCL is 50 percent of the MCL. Thus, all the systems on the watch list for the MCL exceed the SMCL. The distribution of the fluoride watch list systems for both raw and treated water are plotted in Figure M-6. The *Fluoride Technical Report* (2012) describes how fluorite, which was deposited as a secondary mineral in fractures in the carbonate aquifers, controls the distribution of elevated fluoride.

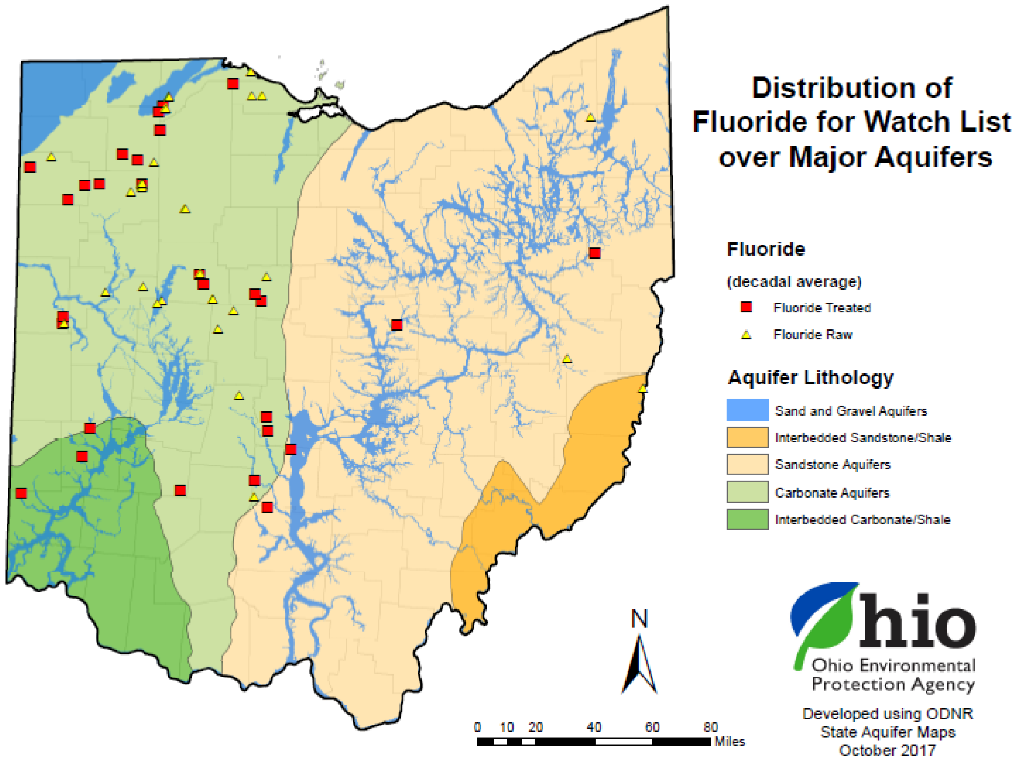


Figure M-6 — Distribution of public water systems on fluoride MCL watch list for treated and raw water.

For **nitrate and nitrite,** maximum values were used rather than average values to reflect the acute nature of the nitrogen MCLs. As a parameter that is stable in oxidized environments, nitrate is more likely to be present in shallower wells. Approximately 2.5 percent (122 of 5,053) of public water systems in Table M-4 (treated water) have maximum nitrate greater than 50 percent of the MCL. Approximately 50 percent of these public water systems are in sand and gravel aquifer settings. A public water system that exceeds 50 percent of the nitrate MCL is required to sample for nitrate on a quarterly basis. Thus, over the last decade, at least 146 public water systems have been required to increase nitrate sampling to at least quarterly. For nitrate in treated water and raw water, 24 and 20 public water systems fall into the impaired category, respectively. Public water systems with maximum results greater than the MCL do not necessarily indicate an MCL exceedance, which is an annual average.

Public water systems with elevated nitrate tend to be associated with more sensitive aquifers such as buried valleys and areas of thin glacial drift over bedrock. Stable nitrate (where decadal averages are relatively high) tend to be found in systems that combine a shallow aquifer with rapid pathways between surface and ground water and stable oxic or sub-oxic ground water. The number of public water systems with maximum nitrates in treated water in the watch list or impaired categories has decreased since 2010 based on the 2010 (243 public water systems), 2012 (227 public water systems), 2014 (181 public water systems), 2016 (149 public water systems) and 2018 (146 public water systems) integrated reports. This is encouraging, but probably reflects improved treatment or use of alternative sources, rather than reduction in nitrate loading. Figure M-7 illustrates the distribution of the public water systems with maximum nitrate above the MCL for both raw and treated water. The public water systems in Figure M-7 tend to cluster along buried valley aquifers, but some occur in bedrock aquifers below thin till or overburden.

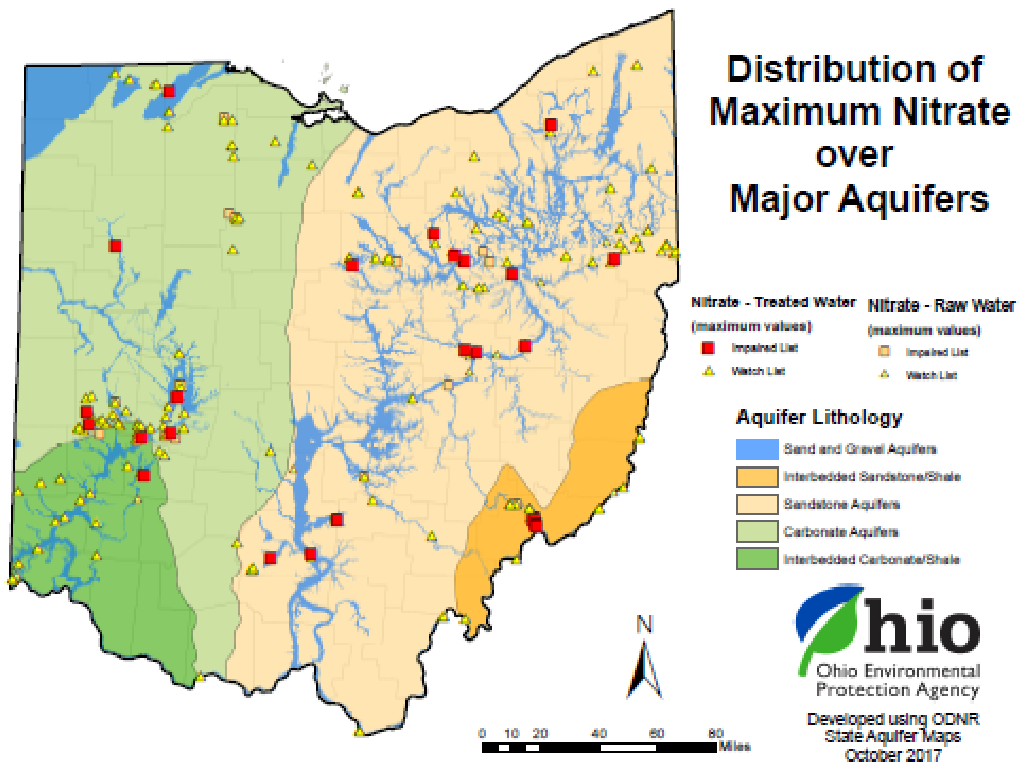


Figure M-7 — Distribution of public water systems with maximum nitrate in treated and raw water greater than the MCL.

HAL Parameters

HALs are constituent levels below which there are no adverse health effects over different time periods, such as one day, 10-day, long-term or lifetime. For HAL parameters, only an exceedance of the HAL (impaired status) was calculated in Table M-4. For raw water, a percentage of public water systems are included in the impaired category for **barium** (two percent) and **manganese** (8.5 percent). Barium and manganese exceedances are spread evenly between sand and gravel and sandstone aquifers. For treated water supplies, a very small percentage (<1 percent) of barium and **nickel** public water systems exceed their respective HAL. Two public water system wells, one in carbonate and one in sand and gravel, exceed the lifetime HAL for strontium.

Drinking Water Advisory Parameters

Exceedances of drinking water advisory levels for **sodium** and **sulfate** can cause human health effects. The sodium drinking water advisory level applies only to adults on a low-salt diet. Only an exceedance of the drinking water advisory (impaired status) was calculated in Table M-4. For raw water, a percentage of public water systems are included in the impaired category for **sodium** (41.3 percent) and **sulfate** (7.6 percent). Sodium exceedances are found most often in sandstone, then carbonate aquifers. The large percentage of public water systems with sodium exceedances may be due to oil and gas production brines, salt storage facilities or road salt applications. Sulfate exceeds the drinking water advisory level most commonly in the carbonate aquifers again due to the presence of evaporates.

Organic Parameters

Only seven organic parameters' mean concentrations for treated water samples place public water systems in the impaired category: 1,2-dichloroethane; 1,1-dichlorethylene; 1, 2-dichloropropane; carbon tetrachloride; dichloromethane; tetrachloroethylene; and vinyl chloride. Two of these parameters are common solvents and the third is a compound used to make plastic. Dichloromethane (methylene chloride) is a known lab contaminant, but it is also possible that it can leach to ground water before it volatilizes, so it is included in Table M-4. In addition to the public water systems identified above, there are about 15 public water systems that are not using a production well or are using air strippers to remove VOC contamination from ground water prior to use. The raw water data may include some of these systems, but if these ground water-based public water systems were not removing VOC contaminants, additional constituents would be identified as impaired.

Pesticides and Synthetic Organics

One pesticide and synthetic constituent is identified as impaired, **di(2-ethylhexyl) phthalate.** These data confirm that although we see impact from pesticides and other organic compounds migrating to major aquifers, the protection that the till cover and tile drainage provide to protect Ohio ground water is significant.

Radiological Parameters

For treated water, several public water systems are included on the watch list and the impaired category for **gross alpha** and **radium 228**. The limited number of public water systems in the watch list and impaired category is consistent with the Ohio's geologic setting having few natural sources of radionuclides. The exceptions are uranium associated with reduced geologic settings like glacial tills, the Ohio Shale and coal deposits, but these settings are generally not utilized as aquifers. Gross beta compliance monitoring focuses on anthropogenic sources of radiation. The distribution of radionuclides is discussed in the DDAGW technical report *Radionuclides in Ohio's Ground Water* (July 2015).

Ambient Ground Water Quality Monitoring Data

Mean values were calculated from the AGWQMP data (raw water) for each well over the past 10 years (2007 through 2017) to determine the number of wells in the watch list and impaired categories for each constituent. These numbers are listed in Table M-5 by parameter and major aquifer. The number of wells used in the determinations is also presented to provide the relative number of wells that exhibit ground water quality with elevated concentrations of MCL, SMCL, HAL and drinking water advisory parameters. A limited number of AGWMP wells are listed in the watch list and impaired category, as was the case for the public water system compliance data. The results for groups of parameters are discussed below.

Inorganic Parameters

The AGWQMP does not collect data for **antimony (except for one sandstone well), asbestos, beryllium, cyanide, mercury, nitrite, silver and thallium**, so no comparison can be made to the public water system data. These parameters are not analyzed due to their historically low concentrations in Ohio ground water. No well waters are impaired (have decadal averages that exceed the MCL or SMCL) for **alkalinity, cadmium, chromium, copper, fluoride, nickel, nitrate, selenium or zinc.** Very few wells exceed the lifetime HAL for cadmium (0.07 percent), nickel (0.1 percent), selenium (0.3 percent) and zinc (0.1 percent). Six wells exceed 50 percent of the fluoride MCL. These wells produce water from the carbonate aquifer, as was seen with public water systems in Table M-4 and Figure M-6. A few well means are greater than 50 percent of the **barium** MCL, with one MCL and nine HAL impairments identified. Averages for **chloride** exceed the SMCL in five cases. Thirteen wells have chloride above 50 percent of the SMCL. The source of contamination is likely associated with improper storage of salt for road deicing, oil and gas drilling brine disposal, brines in bedrock aquifers with a history of oil production, or road deicing.

For **nitrate**, well maximums were used rather than averages to reflect the acute nature of the nitrate MCL. This approach makes it difficult to compare the nitrate numbers to numbers for other parameters in Table M-4. Nitrate is stable in oxidized environments and, thus, is more likely to be detected in shallower wells that have rapid exchange pathways with the atmosphere and surface water. In the AGWQMP, the sand and gravel wells are generally the shallowest and consequently, would be expected to exhibit the largest number of wells with elevated nitrate concentrations. This is the case with about seven percent of the sand and gravel wells exceeding 50 percent of the MCL. Three percent of the carbonate wells exceed 50 percent of the MCL, probably associated with sensitive karst settings and only two percent of the sandstone wells are on the watch list for (maximum) nitrate. The AGWQMP tends to collect samples from higher production wells located deeper in aquifers; consequently, it is not the best program to evaluate ground water quality in shallow (25 to 50 feet), sensitive aquifer settings.

Arsenic, iron, manganese, total dissolved solids (TDS) and sulfate mean concentrations result in significant numbers of wells on the watch list and in the impaired category. These are the same parameters identified in the public water system compliance data, with the addition of TDS. TDS is not required or collected for public water systems compliance data. Except for arsenic, all parameters have SMCLs and treatment is generally not required. Many public water systems remove iron, with the additional benefit of manganese and arsenic removal, since arsenic and iron solubility are controlled by similar redox controls. Sulfate in the AGWQMP is elevated in carbonate aquifers due primarily to the presence of evaporates in the Salina Formation, in the upper portion of the Silurian carbonate aquifer. For the carbonate aquifers, 57 percent of the ambient sites exceed 50 percent of the SMCL for sulfate, which is significantly higher than the percentage of sandstone and sand and gravel aquifers (six percent and 11 percent respectively). The elevated TDS in raw water results from the relative solubility of aquifer material and the residence time for ground water in all of Ohio's major aquifers. The carbonate aquifers generally have higher mean TDS, but all three main aquifers exhibit high percentages of ambient sites with TDS exceeding 97 percent of the SMCL.

HAL exceedances for **strontium** occur most commonly in carbonates followed by unconsolidated aquifers resulting most likely from the presence of the naturally-occurring mineral celestite ($SrSO_4$). Twenty-five ambient wells have strontium values greater than the one- and 10-day HAL of 25,000 μg/L (nine percent) while 86 wells (30 percent) exceeded the life-time HAL of 4,000 μg/L.

Organic Parameters - Detection of organic parameters at and above watch list concentrations is not common in the AGWQMP. Organic parameters, each detected at one public water system above the MCL, include carbon tetrachloride and trichloroethylene. These organic solvents were detected in public water systems raw water samples as listed in Table M-4.

Pesticides – Benzo(a)pyrene, 1,2-dibromo-3-chloropropane (DBCP), di(2-ethylhexyl) phthalate (1), ethylene dibromide (EDB), hexachlorobenzene (1) and pentachlorophenol were pesticides detected in the AGWQMP wells above their respective MCLs. The AGWQMP does not analyze for pesticides on a regular basis, as reflected in the low number of wells listed for pesticides, due to the lack of pesticide detections during several sampling rounds in the late 1990s. This sampling and consultations with the Ohio Department of Agriculture regarding its pesticide sampling results, suggests that further pesticide data collection is not cost-effective for the AGWQMP. Review of available data supports the conclusion that the glacial till provides protection for Ohio's ground waters based on low detections rates and low concentrations detected. Nevertheless, local sensitivity and improper use of pesticides can lead to pesticide impacts. The historic data points to the greatest impacts occurring at the mixing sites or areas of spills.

Radiological Parameters – Radiological parameters are not included in the AGWQMP sampling.

Comparison of public water system and AGWQMP Data

Overall, we see similar trends in the public water system compliance and the AGWQMP data. This confirms that the AGWQMP data are appropriate for identifying long-term trends in the ground water quality of the major aquifers utilized by the public water systems. Thus, the AGWQMP goal of monitoring and characterizing the ground water quality utilized by public water systems in Ohio is validated by these empirical data.

It is interesting that the ground water quality differences documented between the major aquifers in AGWQMP data based on major components are not obvious in Table M-4 and Table M-5. The major elements or components (Ca, Mg, Cl, Na, K, sulfate and alkalinity) are generally the parameters utilized to identify water types. However, Ca, Mg, K and alkalinity do not have MCLs or SMCLs, so MCL and SMCL comparisons are limited in their capacity to delineate geochemical differences among waters from different aquifers. Chloride and sulfate do have SMCLs and exhibit significant differences between the major aquifers as noted above in Table M-4 and Table M-5. Treatment, such as softening, of public water system-distributed water can mask differences in water quality between major aquifers.

The most recognizable geochemical differences between the major aquifers in Ohio relate to the concentrations of calcium, magnesium, bicarbonate and strontium. These differences relate to the higher solubility of carbonate rocks and the long water-rock reaction time of ground water. The carbonate waters are characterized by elevated calcium, manganese, bicarbonate and strontium compared to water in sandstone and sand and gravel aquifers. The higher percentages of public water systems that exhibit watch list and impaired category results for TDS and sulfate in the carbonate aquifers reflects the dissolution of gypsum within the carbonate stratigraphy. Summary data from the AGWQMP provides a description of Ohio's major aquifers and their water quality available in the technical report, *Major Aquifers in Ohio and Associated Water Quality (2015)*.

M7. Conclusions and Future Directions for Ground Water Protection

Ohio is fortunate that ground water is plentiful across the state. With the exceptions of a few areas that exhibit effects of over-pumping, decreasing static water levels have not been documented across extensive areas. Some new, high-yielding agricultural wells are being installed, but the duration of pumping is generally limited, so annual recharge appears to replenish the aquifer. Although the quantity of ground water appears stable, the documentation of water quality impacts in this document illustrate that continued protection of ground water resources is necessary. Ground water contamination can eliminate the potential use of water resources, just like diminished quantities. If other water sources are not available, additional treatment will increase the cost of providing a needed resource.

As documented in the previous sections, numerous sites exhibit ground water contamination from anthropogenic and natural point and nonpoint sources. The alternative to combat natural sources of contamination that cause impairment of drinking water is to develop and install treatment that removes the contamination or to locate another water source. The options for managing anthropogenic sources are more numerous, with the most constructive focusing on prevention of releases that migrate to ground water. Instituting best management practices (especially for the use of fertilizers and salt storage), implementing appropriate siting criteria for new waste storage and disposal sites and improving design for material storage and waste disposal facilities are proactive approaches to prevent releases to ground water. These kinds of proactive practices are critical to the sustainability of Ohio's high-quality ground water resources.

The ongoing implementation of the Source Water Protection Program (SWAP) for Ohio's public water systems helps raise awareness of ground water quality issues and promotes source water protection planning. The SWAP potential contaminant source inventory data was instrumental in identifying and ranking major sources of contamination near public water systems, as listed in Table M-3 in the 2012, 2014, 2016 and 2018 integrated reports. SWAP staff has also had key roles in the development of several guidance documents to help protect ground water in association with the SCCGW.

Generally, awareness and concern about ground water resources is increasing. State agencies are working together to develop appropriate guidance or guidelines for activities that may threaten ground water. This is documented by the development of the *Recommendations for Geothermal Heating and Cooling Systems* (February 2012) and *Recommendations for Salt Storage* (February 2013). A recent guidance is the updated *Regulations and Technical Guidance for Sealing Unused Water Wells and Boreholes*, finalized in March 2015. ODNR, in conjunction with several other agencies, has revised and developed fact sheets and best management practices to provide information on water resource issues associated with shale gas development. These documents are available on the ODNR Division of Oil and Gas Resources web page in the Shale activity section: ***oilandgas.ohiodnr.gov/shale#SHALE***.

To help provide well owners information on water quality, Ohio EPA worked with ODH and OSU Extension on the development of a new web-based water quality interpretation tool for private well owners. In the Know Your Well tool, water sample results from a lab sheet are entered into the tool and with one click, well owners are provided with the standard for the parameter of interest, the natural range in ground water in Ohio for comparison, recommendations on actions, health effects and treatment options if applicable. The tool is part of the website hosted at OSU Extension at: ***ohiowatersheds.osu.edu/know-your-well-water***.

The relational database, GWQCP, has housed water quality data for non-compliance projects in DDAGW. It is being expanded to also house data collected through the RCRA ground water monitoring program, submitted as part of reporting requirements. This data has been housed electronically in DDAGW's Central Office and has not been readily available for use by regulators or the public. Data from more than 400 facilities with collection ranging from 1980s to the present will be available for reports and studies.

Other activities completed over the past two years include:

- Partnership with the Ohio State University Department of Microbiology to investigate bacterial communities in Ohio's ground water.
- Department of Environmental Services installs a new Laboratory Information Management System.
- Phase II of the ground water investigation at Devola, Ohio is completed.

DDAGW staff participated in a two-year project with primary investigator Mike Wilkins, Ph.D., professor in the Ohio State University School of Earth Sciences and Department of Microbiology. The aim of the study was to identify naturally occurring bacteria present in shallow Ohio aquifers using DNA-based techniques. Many of the bacteria present catalyze reactions that impact ground water quality, including the generation of dissolved iron (Fe^{2+}), and the potential resulting mobilization of arsenic. This study is the first effort to track microbial structure and function across representative aquifer systems in southern Ohio where reducing conditions lead to metal mobilization. Knowledge gained from this work will be coupled to extensive complementary geochemical parameters gathered by Ohio EPA, with the intent of enhancing the current conceptual model for metal release in Ohio aquifers. The first paper to come out of this study, *Members of the Candidate Phyla Radiation are functionally differentiated by carbon- and nitrogen-cycling capabilities* was published Sept. 2, 2017 in the journal Microbiome. Citation for this open access publication is: ***Danczak et al. Microbiome (2017) 5:112; DOI 10.1186/s40168-017-0331-1***.

The Division of Environmental Services, Ohio EPA's in-house analytical laboratory, installed a new Laboratory Information Management System (LIMS) to manage all analytical equipment output as well as software to automatically log samples required by AGWQMP field staff. The conversion to the new LIMS allows district staff to coordinate with laboratory personnel quickly and efficiently. Sample Tracking allow users to log and follow samples through the system to help manage data processing. Electronic data transfer allows for the direct flow of data from the instrument to the QA/QC office to the end user. This upgrade will ensure close contact between analysts and district staff.

Phase II of Ohio EPA's 2011 study, Unsafe Water Supply Investigation, Putnam Community Water Association, Devola, Washington County, Ohio was completed through additional ground water sampling in 2016. Conclusions of the original 2011 study were substantially confirmed through results of the 2016 study. The significant conclusion supported by both phases of the investigation is that the unsewered areas of the village of Devola are a significant source of nitrate contamination that is impacting the community's wells, at times driving the public water system's nitrate concentrations above safe drinking water standards. This contamination is determined to be the result of untreated or partially treated sewage from residences in Devola entering the ground water system and flowing to the wells.

Section

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