State of Ohio's DRAFT

Domestic Action Plan 1.0

In accordance with the Great Lakes Water Quality Agreement

Ohio Lake Erie Commission

Ohio Department of Agriculture

Ohio Environmental Protection Agency

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Introduction

Ohio's Domestic Action Plan (DAP) will advance efforts toward the proposed 40% nutrient reduction target put forth in the Great Lakes Water Quality Agreement of 2012 (GLWQA). On June 13, 2015, the governors of Ohio and Michigan, and the premier of Ontario committed to a goal of reducing phosphorus loadings to Lake Erie by 40 percent through the signing of the Western Basin of Lake Erie Collaborative Agreement (Collaborative). The Collaborative was intended to serve as the precursor to Ohio's DAP. Ohio's DAP will expand on the Collaborative implementation initiatives and will also include the Central Basin as well as the Western Basin of Lake Erie.

The DAP is not a static document. It is intended to be a plan that is subject to change and revisions following the Adaptive Management philosophy. As defined by the U.S. Department of the Interior "An adaptive approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions."[1]

Goals of the Ohio Domestic Action Plan

- Achieve a 40 percent total spring load reduction in the amount of total and dissolved reactive phosphorus entering Lake Erie's western basin by the year 2025 with an aspirational goal of a 20 percent reduction by 2020[2]. This goal applies to priority tributary watersheds to the Western Basin of Lake Erie in Ohio as identified by the Objectives and Targets Task Team of the Annex 4 Subcommittee under the GLWQA, which include the Maumee, Toussaint, and Portage Rivers. Ohio is also including spring targets for the Sandusky River to protect water quality in Sandusky Bay. Ohio EPA will continue to develop a process to identify and recommend additional priorities within these watersheds at the HUC 12 level, with a focus on the Maumee River watershed.
- Achieve a 40 percent total annual load reduction in the amount of total phosphorus entering Lake Erie's central basin by the year 2025 with an aspirational goal of a 20 percent reduction by 2020. This goal applies to priority tributary watersheds to the Central Basins of Lake Erie in Ohio as identified by the Objectives and Targets Task Team of the Annex 4 Subcommittee under the GLWQA, which include the Sandusky, Huron, Vermilion, Cuyahoga, and Grand Rivers[3].

The Domestic Action Plan is based on the following guiding principles:

- **Implementation** of point and nonpoint nutrient reduction practices.
- **Verification** of targeted practice implementation and effectiveness.
- **Documentation** of water quality changes resulting through the implementation of nutrient reduction practices.

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[1] See http://www.doi.gov/ppa/upload/Chapter1.pdf.

[2] Achieving a spring (March – July) Flow-Weighted Mean Concentration (FWMC) of .23 mg/l TP and .05 mg/l DRP and a target of 860 MT total phosphorus and 189 MT Dissolved Reactive Phosphorus in the Maumee River will achieve a 40 percent reduction from the base year of 2008.

[3] The spring load targets for the Maumee, Toussaint, and Portage Rivers will also serve to reduce phosphorus to the Central Basin of Lake Erie.

- **Adaptability** to allow for the modification of programs, practices and policy as new information is obtained and changes occur.
- **Accountability** to ensure compliance with rules and laws, establish clear areas of responsibilities, and that the commitment is made and kept toward achieving the goals.

The Domestic Action Plan was developed with input through meetings and conversations with various stakeholder groups and state agencies. The initial draft was then made available for additional interest group and public comment.

As previously stated, central to the implementation of the Domestic Action Plan is the adaptive management process. This means the Domestic Action Plan is intended to convey an understanding that there will be changes in data, programs, and policy that will need to be reflected in the Domestic Action Plan going forward.

While the focus the Domestic Action Plan is to achieve nutrient reductions from the base year of 2008, at the same time we need to consider the potential impact of new sources of phosphorus coming into in the watershed, and the increased frequency and severity of rainfall events, and how these changes pose challenges to the over-all net reduction of nutrients as we work towards the established goals.

How does the Domestic Action Plan fit in the context of Ohio's over-all efforts to address Harmful Algal Blooms in Lake Erie?

Ohio's long history of problems and solutions for nutrient enrichment and nuisance and/or harmful algal blooms in Lake Erie is laid out extensively in the Ohio Lake Erie Phosphorus Task Force I and II reports. To summarize, after a lengthy but successful fight to reduce previously high nutrient levels in Lake Erie, algal blooms had abated in the 1980s. However, in the mid-1990s, toxin-producing blue-green algal blooms began to appear in the western basin of Lake Erie. A particularly massive bloom occurred in 2003, and blooms of varying intensity have recurred most years since then.

The State of Ohio has been in the forefront of developing a response to the problems impacting Lake Erie. The Ohio Lake Erie Phosphorus Task Force I convened in January, 2007, in response to the increased harmful algal blooms in the early 2000s. Led by the Ohio Environmental Protection Agency (Ohio EPA), Ohio Department of Agriculture (ODA), Ohio Lake Erie Commission (OLEC) and Ohio Department of Natural Resources (ODNR), the Task Force included representatives from state and federal agencies, Lake Erie researchers, soil scientists, agricultural program representatives and wastewater treatment plant personnel and drew on the expertise of many other experts in a variety of disciplines.

The Task Force developed a variety of recommendations to address nutrient reductions, particularly to the western basin of Lake Erie. Recommendations were made for all the sources examined with a major focus on upland measures that influence agricultural practices. The report included a research agenda, which has served as a basis for directing millions of dollars of state and federal research funds.

In response to the findings of the Task Force, the State of Ohio directors of ODA, ODNR and Ohio EPA convened the Directors' Agricultural Nutrients and Water Quality Working Group on Aug. 25, 2011. The purpose of this group was to identify and implement, at the state level, those agricultural practice initiatives which would ultimately result in the reduction of harmful algal blooms developing in Ohio's inland lakes and Lake Erie, while at the same time continuing to assure that the region's agricultural base was not impaired by unintended consequences. As a guiding principle, the final report encouraged farmers to adopt nutrient application guidelines known as 4R Nutrient Stewardship (4R). The 4R concept promotes using the right fertilizer source, at the right rate, at the right time, with the right placement. It

was believed that this approach would be in part effective in reducing phosphorus and nitrogen from impacting waterways across the state.

Starting in 2012, Ohio EPA, coordinating with ODA and ODNR, developed Ohio's Nutrient Reduction Strategy. This comprehensive framework to manage point and nonpoint sources of nutrients and reduce their impact on Ohio's surface waters was an outgrowth of Ohio's participation on the Mississippi River/Gulf of Mexico Watershed Nutrient (Hypoxia) Task Force. The strategy recommends regulatory initiatives and voluntary practices that can reduce point and nonpoint sources of nutrients throughout the state.

The Point Source and Urban Runoff work group of the Hypoxia Task Force recommended that Ohio develop a statewide nutrient mass balance that examines both point and nonpoint sources of nutrients to Ohio's watersheds. This is necessary to determine appropriate reductions for all sources and to enable cost-benefit assessments to determine the most environmentally effective and economically feasible mechanism for the state to reduce nutrient loading to watersheds. The first round of this study was completed in December, 2016 and is included in the source discussion below.

Simultaneously with those efforts, Ohio EPA, OLEC, ODA and ODNR reconvened the Ohio Lake Erie Phosphorus Task Force as a Phase II effort. The Task Force II final report (2013) includes a detailed review of state and federal efforts, including research results from some of the initial studies recommended by the Task Force I. After hearing from numerous experts at several meetings, the Task Force II worked to develop a phosphorus target for Lake Erie's Western Basin.

Based on a comparison of discharge, total phosphorus loads and dissolved reactive phosphorus loads for the Maumee River for water year and spring (March-June) totals for 2000 through 2012, the Task Force II recommended an annual loading reduction of approximately 40 percent to significantly reduce or eliminate HABs in the Western Basin. The Task Force II also recommended an adaptive management approach that would allow annual reviews of progress and evaluation/modification of loading targets.

As the Task Force II was completing its final report, the GLWQA Nutrients Annex Subcommittee was beginning the process of revising the prior GLWQA nutrient loading goal for Lake Erie. Modeling showed that spring loading of phosphorus from the Maumee River is the determining factor. The Subcommittee determined that there should be a reduction of 40 percent in spring loads of both total and dissolved phosphorus from the Maumee River. A 40 percent reduction to the Maumee equates to a target spring load of 860 metric tons per year of total phosphorus and 186 metric tons per year of soluble reactive phosphorus under high spring discharge conditions. This goal is intended to limit the formation of harmful algal blooms in nine years out of 10, which allows for an occasional very wet year in which the goal would not be achievable. The proposed goal, drafted in February 2015, has been finalized with the development of state and province Domestic Action Plans due by 2018.

This recommended loading goal tracked very closely to the recommended value from the Task Force II. Therefore, the state decided to move forward with accepting the proposed goal in the Domestic Action Plan.

Major Sources of Phosphorus in Ohio

In 2016, the State of Ohio, Environmental Protection Agency conducted a nutrient mass balance study [4] to evaluate major sources of phosphorus in select watersheds across the state, including the most

[4] The following source discussion is extracted in part from the Nutrient Mass Balance Study. For more details and a complete set of figures, see document at http://epa.ohio.gov/Portals/35/documents/Final%20Nutrient%20Mass%20Balance%20Report_12_30_16pdf.pdf.

significant four of the Annex 4 priority watersheds in Ohio (Maumee, Portage, Sandusky, and Cuyahoga).

The next edition of this study, required by state law to be completed by the end of 2018, will add the Huron watershed, which is also an Annex 4 priority watershed. The two remaining Annex 4 priority watersheds are the Vermilion River and the Grand River. These two tributaries have very small contributing loads (an order of magnitude less than the Maumee River load) and need further study to determine whether significant load reductions are feasible.

Sources of Phosphorus in the Maumee River Watershed

The Maumee River drains 6,568 sq. mi. in northwestern Ohio, southeastern Michigan and northeastern Indiana. Agricultural production dominates the watershed, which includes the fertile drained lands of the Great Black Swamp. There is a notable shift in land use as the river enters the Toledo metropolitan area downstream of Waterville. Downstream of this point, the proportion of agricultural production reduces from 79 percent to 49 percent whereas both high/low intensity development and natural lands increase in proportion.

Total P loads from the Maumee River were 2,295 metric tons per year (mta) in water year 2013 (October-September) and 2,062 mta for water year 2014. See Figure below for source breakdown by percentage. For more details and data for water year 2014, see the Nutrient Mass Balance Study document.

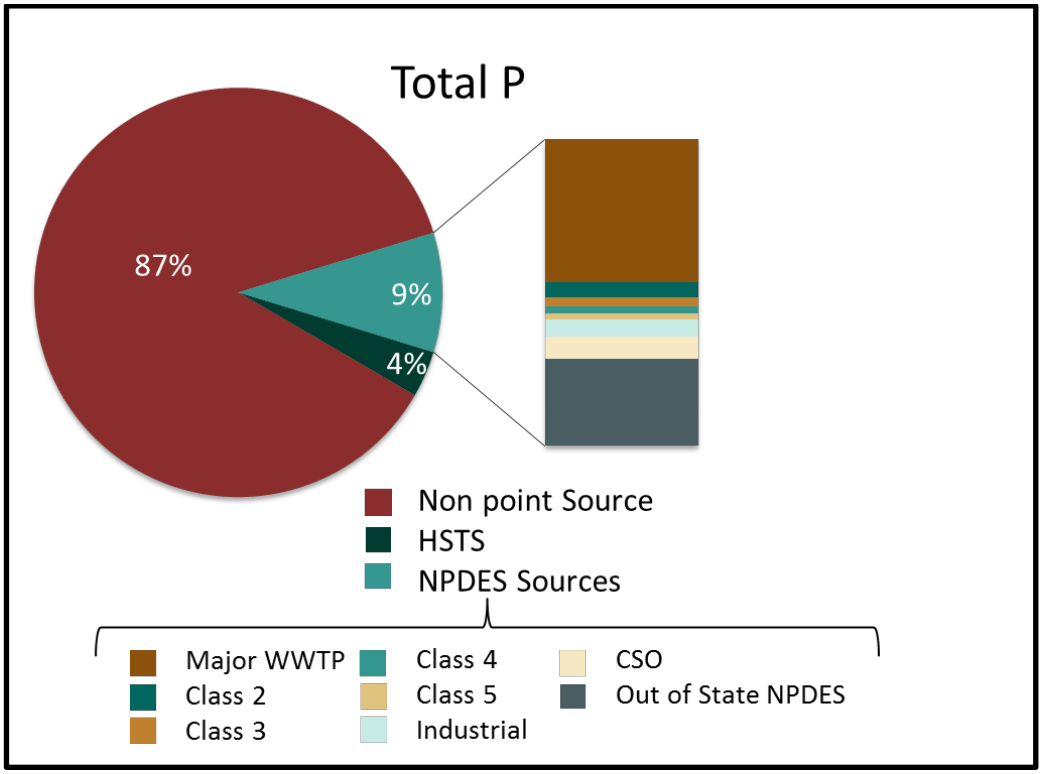

Figure 1: Total phosphorus source breakdown for Maumee River, water year 2013. From Nutrient Mass Balance Study 2016. See report for more details.

The nonpoint source is the largest proportion of the load in the Maumee River at 87 percent for total P. The permitted point sources (NPDES) comprised 9 percent of the total P. These sources are further broken down into source categories corresponding to plant type and size. The majority of the NPDES

load (total P – 47 percent) is from major WWTPs. The second largest NPDES contribution is from out of state sources at 28 percent of the NPDES total P load. Home sewage treatment systems are the remaining 4 percent of the annual total phosphorus load.

Sources of Phosphorus in the Portage River Watershed

The Portage River drains 585 sq. mi. in northwest Ohio. Agricultural production dominates the landscape, with 81 percent of the total land area being dedicated to agricultural production. Natural areas and low intensity development were similar to each other at 8.4 percent and 8.7 percent respectively.

Total P loads from the Portage River were 168 metric tons per year (mta) in water year 2013 and 219 mta for water year 2014.

The nonpoint source is the largest proportion of the load in the Portage River at 84 percent for total P. The permitted point sources (NPDES) comprised 11 percent of the total P. The single largest permitted point source load contributor is major WWTPs (total P – 34 percent). CSOs and class 2 WWTPs (0.5 – 1.0 mgd) are also large total P load contributors contributing 22 and 27 percent of the total NPDES loads, respectively. Home sewage treatment systems are the remaining 6 percent of the annual total P load.

Sources of Phosphorus in the Sandusky River Watershed

The Sandusky River drains 1,420 sq. mi. in north central Ohio. Agricultural production dominates, with 80 percent of the total land area. Natural areas are the second leading land use at 11 percent and the remainder are developed lands. The watershed is home to 220,000 people (120 people per square mile), making it the least densely populated of Ohio's major watersheds.

Total P loads from the Sandusky River were 711 metric tons per year (mta) in wy13 and 615 mta for wy14. The nonpoint source is the largest proportion of the load in the Sandusky River at 94 percent for total P. The NPDES sources comprised 4 percent of the total P loads. The single largest NPDES load contributor is from CSOs for total P, comprising 42 percent of the NPDES total P load. The major WWTPs contributed a similar amount of total P as the Class 2 facilities (0.5 – 1.0 mgd) for total P at 28 and 23 percent, respectively. Discharge limits for phosphorus are the reason that the major WWTPs are not the leading NPDES source. HSTS are the remaining 2 percent of the annual total P load.

Sources of Phosphorus in the Cuyahoga River Watershed

The Cuyahoga River drains 808 sq. mi. in northeast Ohio. Natural areas and low intensity development dominate the land use of the Cuyahoga watershed at 38 percent and 36 percent, respectively. Closer to the lake shore, there is a notable shift in land use with a reduction of natural and agricultural areas to largely low and high intensity development, 56 percent and 36 percent, respectively.

Total P loads from the Cuyahoga River were 327 metric tons per year (mta) in wy13 and 402 mta for wy14. The nonpoint source is the largest proportion of the total P load in the Cuyahoga River at 60 percent. The NPDES sources comprised 29 percent of the total P load. The single largest NPDES load contributor is from major WWTPs for total P comprising 56 percent of the total P load. CSOs were the second leading NPDES contributor at 40 percent of the NPDES total P load. HSTS are the remaining 11 percent of the annual total P load.

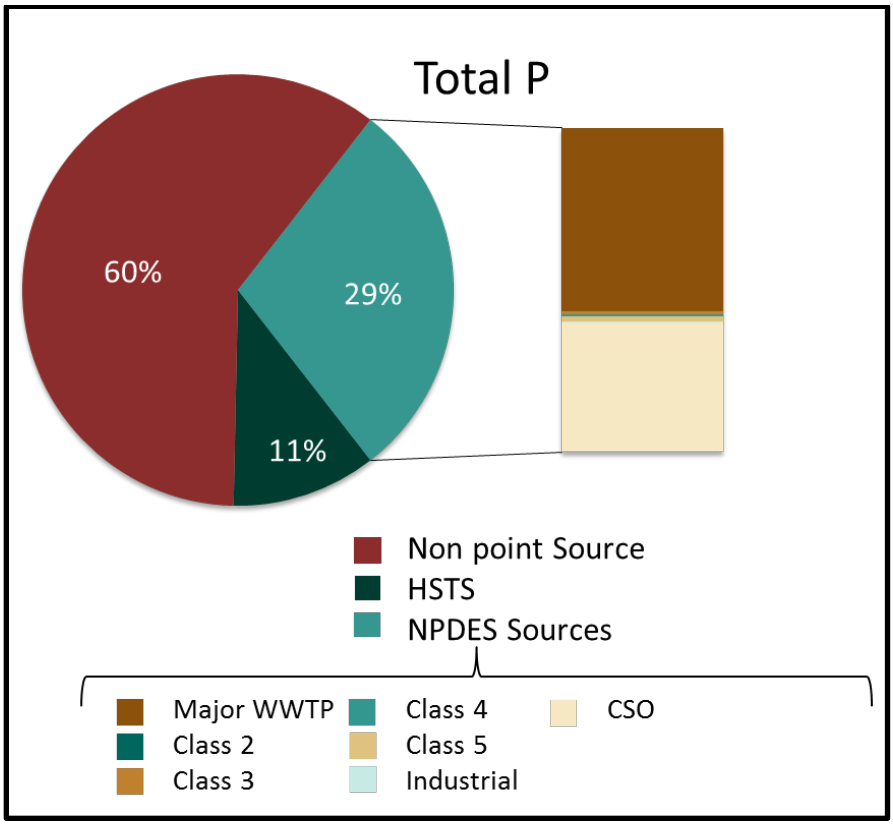

Figure 2: Total phosphorus source breakdown for Cuyahoga River, water year 2013. From Nutrient Mass Balance Study 2016. See report for more details.

State Agencies, Partners, and Related Areas of Responsibility

The Ohio Lake Erie Commission will serve as the coordinating entity working in conjunction with the various state agencies, federal agencies, and other partners to achieve the Domestic Action Plan goals. The Ohio Lake Erie Commission (OLEC) is comprised of the directors for six state agencies most directly involved in implementing this Domestic Action Plan and five public members. Through the Lake Erie Protection and Restoration Strategy, OLEC has identified Nutrient Reduction as a Priority Area for 2017. The Ohio Revised Code 1506.21 which was amended through Senate Bill 2 in 2017 provides the Commission authority to ensure the coordination of state and local policies and programs pertaining to Lake Erie with a priority on those identified in the Lake Erie Protection and Restoration Strategy.

The responsibility and accountability for ensuring implementation of programs and progress toward the agreed to goals will be with the various state agencies. Generally, the Ohio Department of Agriculture (ODA) has responsibility for agricultural nonpoint sources; Ohio EPA (OEPA) has responsibility for point source and water quality monitoring; Ohio Department of Natural Resources (ODNR) has responsibility for Coastal program coordination, habitat, and fisheries, and the Ohio Department of Health (ODH) has responsibility for household and small flow sewage treatment systems. Specific areas of responsibility and involvement are listed below for the primary state agencies and partners engaged in this initiative. This list may not be a total reflection of responsibilities and involvement and they may change over time. The DAP does not establish any new legislation, rule, or enforceable standard. Rather, the actions listed in the DAP propose or describe recommended changes, which would be subject to Ohio's legislative and rulemaking procedures and requirements.

In addition to coordinating agencies listed below, the Commission will coordinate with other parties from time-to-time on specific issues, such as monitoring and research. These parties may include other universities, non-profit organizations, Indiana and Michigan state agencies, and international agencies such as Environment and Climate Change Canada, the Ontario Ministry of the Environment and Climate Change, and Ontario Ministry of Agriculture, Food, and Rural Affairs.

Ohio Department of Agriculture (ODA)

- Agricultural nonpoint program implementation
- Agriculture Fertilizer Applicator Certification Program
- CAFO permitting and regulatory oversight
- Certified Livestock Manager training and inspections
- Manure and Fertilizer Application (SB 1) enforcement
- Fertilizer sales records
- Watershed coordinator program administration
- Agricultural nonpoint BMP technical assistance and oversight
- Agricultural Pollution Abatement Program
- Ohio Runoff Risk Forecast website
- Conservation Reserve Enhancement Program implementation

Ohio Environmental Protection Agency (Ohio EPA)

- National Pollutant Discharge Elimination System (NPDES) permit approval and oversight
- Wastewater treatment technical and feasibility studies
- Storm water management program administration
- Water quality monitoring (watershed and Lake Erie)
- Combined Sewer Overflow permitting and oversight
- Environmental Infrastructure funding (wastewater, drinking water)
- 319 Grant, Surface Water Improvement Fund (SWIF), GLRI Fund administration
- Areas of Concern program administration
- Harmful Algal Bloom program administration
- Nonpoint Source Pollution Control Program administration
- Water Quality Standards Program
- Total Maximum Daily Load (TMDL) studies (See Appendix A for further discussion of TMDLs)
- Administer and enforce a program for the regulation of sewage sludge management

Ohio Department of Health (ODH)

- Establish Home Sewage Treatment System standards and oversight (local health districts)
- Bathing beach advisories and sample results posted on BeachGuard website
- Bathing Beach monitoring for Lake Erie beaches

Ohio Department of Natural Resources (ODNR)

- Coastal resource management
- Private lands wildlife habitat management
- Posting of bathing beach advisories on state park beaches and boat ramps
- Lake Erie fisheries
- Estuarine research
- In-water beneficial reuse of dredge material
- In-water coastal wetland for habitat restoration and nutrient reduction

Ohio Lake Erie Commission (OLEC)

- Domestic Action Plan coordination
- Lake Erie Protection and Restoration Strategy coordination
- Issues grants from the Lake Erie Protection Fund

Natural Resource Conservation Service (NRCS)

- Farm Bill program financial and technical assistance for conservation planning and practice implementation.
- GLRI grants
- Co-Chair the WLEB Partnership with the U.S. Army Corps of Engineers
- Maintain Ohio Field Office Technical Guide conservation practices and standards

Farm Service Agency (FSA)

- Conservation Reserve Program administration
- Conservation Reserve Enhancement Program administration
- Farmable wetlands program administration

U.S. Environmental Protection Agency (U.S. EPA)

- Great Lakes Water Quality Agreement administration
- Total Maximum Daily Load review
- NPDES permit review
- Nine Element Watershed Plan oversight
- 319 funding and GLRI funding administration

US Geological Survey (USGS)

- Stream gauge operation and water quality monitoring

National Ocean and Atmospheric Agency (NOAA)

- Ohio Sea Grant and Old Woman Creek NERR
- Satellite imaging, HAB bulletins and annual forecast

- Coastal Resource Management

Heidelberg University National Center for Water Quality Research (NCWQR)

- Water quality monitoring and data analysis

Ohio Department of Higher Education

- Harmful Algal Bloom Research Initiative

The Ohio State University (OSU – Stone Lab)

- Water quality monitoring
- Data analysis
- Research coordination and summaries

The Ohio State University College of Food, Agriculture and Environmental Sciences

- Research on agricultural and production processes, practices and nutrient best management practices
- Educational programs and producer certification training through OSU Extension

University of Toledo (UT)

- Lake Erie water quality monitoring

Bowling Green State University

- Sandusky Bay water quality monitoring

Great Lakes Commission

- Eriestat
- Great Lakes Sediment and Nutrient Reduction Program
- Erie P Markets nutrient trading

Stakeholder Groups providing input for the Domestic Action Plan

- Ohio Corn Growers
- Ohio Soybean Association
- Ohio Cattleman's Association
- Ohio Dairy Producers Association
- Ohio Pork Producers
- Ohio Agri-business Association
- Ohio Federation of Soil and Water Conservation Districts
- Ohio Association of Soil and Water Conservation District Employees
- Ohio Farm Bureau Federation
- The Nature Conservancy
- National Wildlife Federation

- Environmental Defense Fund
- Ohio Environmental Council
- Black Swamp Land Conservancy
- Alliance for the Great Lakes
- Pheasants Forever
- Ducks Unlimited
- Great Lakes – St. Lawrence Cities Initiative
- Toledo Metropolitan Area Council of Governments
- City of Toledo
- Ohio Charter Boat Captains Association
- County Commissioner Association of Ohio
- Lake Erie Foundation
- Stone Lab/Sea Grant
- The Ohio State University College of Agriculture, Food and Environment
- The Ohio State University – Stone Lab
- Ohio Sea Grant Program

Domestic Action Plan Actions

Action items are broken down into four categories. Agricultural Land Management includes actions to reduce nutrient export from nonpoint sources in lands used for agriculture. Community-Based Nutrient Reduction includes actions to reduce nutrients from urban and rural communities and publicly or privately owned permitted point sources. Restoration and Support of Ecosystem Services includes actions to protect and restore natural lands. Monitoring, Tracking, and Support includes other actions necessary to implement the Domestic Action Plan and track progress toward the GLWQA targets.

The intent is to establish what has been termed "moon-shot" actions like the approach of the Apollo moon program – where there is an all-out, committed focus and direction or re-direction of resources toward the specific goal. Agencies will evaluate these lists of action items to identify and establish a priority order or significance hierarchy of actions as well as implementation timelines in each area. Where possible, anticipated nutrient reductions should be tied to each of these priority actions.

The list of actions is provided in table form in Appendix E. This table includes timelines – an end date if applicable, or 'ongoing' for actions that will need to be maintained (for example, web resources). We have also included milestones – how we expect to determine whether an action is complete, or how to mark interim progress. Anticipated nutrient reductions for each action will be under development, if possible, for a future iteration of the Ohio DAP. At this time these actions are primarily focused on efforts by state agencies, although we intend to develop a supplement to this table of actions in Ohio by non-governmental and private actors.

Additional actions to reduce nutrient loads may have been identified in specific areas served by Total Maximum Daily Load Implementation Plans. For discussion about this, see Appendix A.

Agricultural Land Management

Agriculture is the dominant land use in Ohio's portion of the Lake Erie basin. As described above, runoff from agricultural land is a major nonpoint source of nutrients to Lake Erie. In the Northwest Ohio HUC-8 watersheds (Auglaize, Blanchard, Cedar-Portage, Lower Maumee, Raisin, Sandusky, St. Joseph, St. Marys, Tiffin, Upper Maumee), row crop agriculture accounts for 65-80% of the land use (NASS, 2012). These watersheds were once the Great Black Swamp, and drainage is necessary for agricultural production. The intensity of row crop agriculture decreases from west to east across the northern part of Ohio. In Northeast Ohio, developed and forested land dominate the landscape. Within these watersheds (Ashtabula-Chagrin, Black-Rocky, Chautauqua-Conneaut, Cuyahoga, Grand, and Huron-Vermilion) agriculture only accounts for 11-57% of the land use (NASS, 2012).

Based on the 2012 NASS Agricultural Census there are approximately 20,700 farms within the Lake Erie basin, with over 14,000 located in the Western Lake Erie Basin (WLEB) watershed. Soybeans, corn, wheat and hay are the four dominant crops within the Lake Erie watershed. Soybeans and corn make up approximately 90 percent of the production, with over 50 and 39 percent of the acreage respectively. Wheat acres make up about 8 percent of the WLEB watershed, and hay accounts for another 2 percent (NASS, 2012). Comparatively, corn in the Cedar-Portage, Maumee, and Sandusky watershed counties cover approximately 1.55 million acres of the 1.85 million acres of corn grown in the whole Lake Erie watershed within Ohio.

The Lake Erie basin has some of the most productive farmland in Ohio, and the continued implementation of appropriate conservation practices is imperative due to the amount of intensive agriculture in this region of the state. The Ohio Department of Agriculture has standards outlined in Ohio Administrative Code that specifies the conservation measures necessary to comply with these requirements. The Ohio Department of Agriculture, in cooperation with USDA-NRCS Ohio and Ohio's Soil and Water Conservation Districts, continue to promote and assist Ohio's agriculture industry implement a variety of BMPs that are site specific for the management style and land features of the treatment unit. These BMPs often exceed the minimum standards outlined in Ohio Administrative Code. Continued and expanded implementation of these BMPs will be required to achieve the phosphorus loading reduction goals outlined in this plan. BMPs being promoted in the Lake Erie Basin include but are not limited to the following:

- Soil testing with a frequency based on crop rotation
- Nutrient application rates based on crop removal, soil testing results, and Ohio's nutrient standards
- Subsurface nutrient placement
- Nutrient incorporation combined with the planting of cover crops
- No-till and conservation tillage practices
- Crop rotations that include small grain crops
- Installation of riparian buffers
- Drainage water management with the installation of subsurface drainage systems
- Blind inlets to replace tile risers
- Waste storage structures expanded to improve timing and conditions

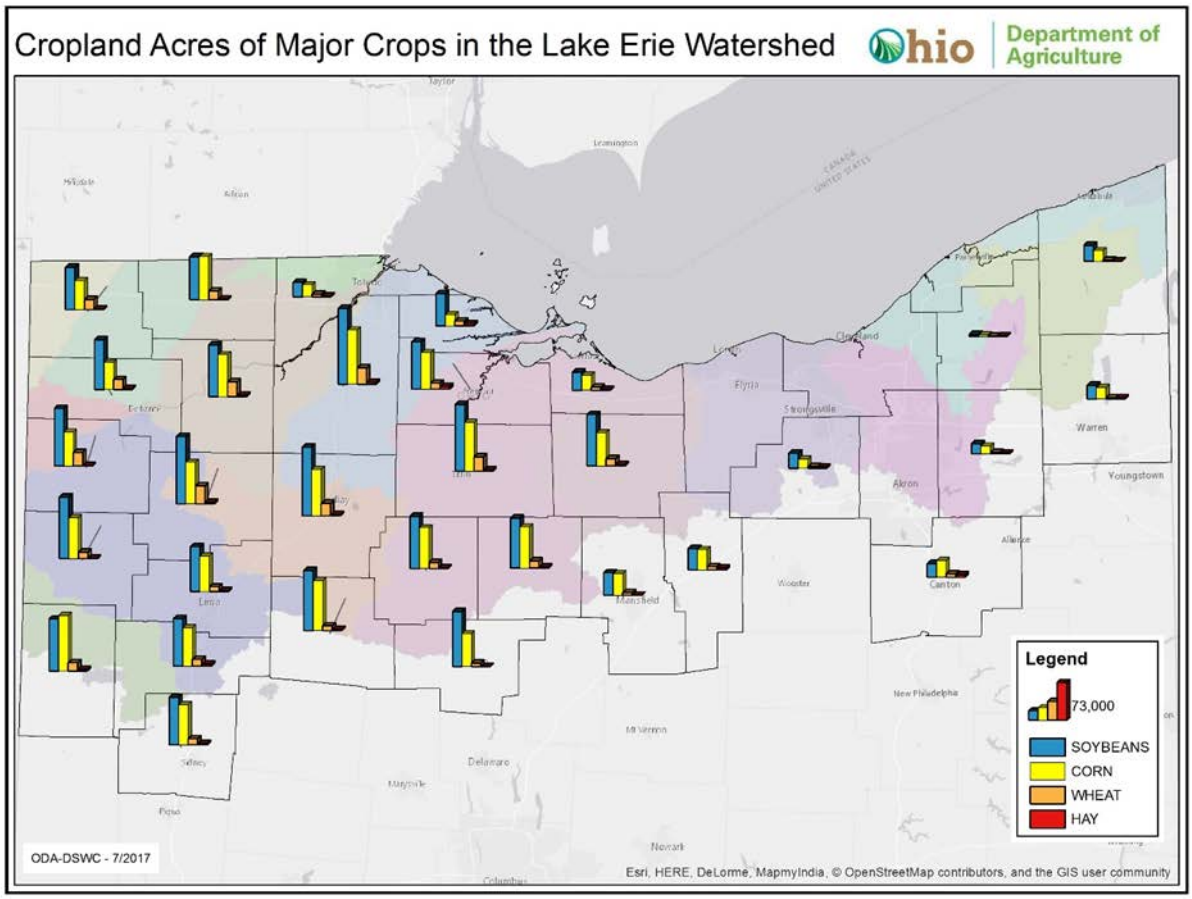

Figure 3: Cropland Acres in the Lake Erie Watershed in Ohio.

There are sixty-five concentrated animal feeding facilities permitted within the Lake Erie watershed in Ohio. These operations are permitted through the Ohio Department of Agriculture - Division of Livestock Environmental Permitting (DLEP). Similar to the row crop agricultural production, permitted livestock facilities are concentrated in Northwest Ohio. Fifty-six of the concentrated animal feeding operations are in the western basin drainage. These permitted facilities must follow manure management plans and DLEP reviews manure application rates and records.

Because of the predominance of agricultural activity, especially in Ohio's portion of the watershed of the Western Basin of Lake Erie, actions to manage agricultural lands to reduce the export of phosphorus as both total and dissolved forms is of critical importance in meeting the targets set by Annex 4. Since the U.S. Department of Agriculture, through the Natural Resource Conservation Service has primary responsibility for the implementation funding and tracking of Farm Bill Programs including those with nutrient reduction benefits. NRCS should develop, coordinate, and implement the U.S. Domestic Action Plan in partnership with the Ohio Department of Agriculture. Ohio's proposed state actions for management of agricultural land include:

Ohio Department of Agriculture (ODA)

1) ODA will be engaged in the process as USDA Agricultural Research Service, NRCS, and OSU finalize and present results from edge-of-field monitoring and research, and establish next steps in the continuation of this research.

2) ODA will be engaged in the progress as OSU and other state and federal agencies complete revisions to the Tri-State Fertility Guide and the Phosphorus Risk Index. This includes a timeline for making recommendations to adjust the Index, such as variations to the Index pertaining to biosolids, commercial fertilizer and manure.

3) ODA will continue the Ohio Clean Lake Initiative - Impaired Watershed Restoration Program through the Division of Soil and Water Conservation. This program aims to reduce phosphorus loading, including dissolved phosphorus loading, from agricultural landscapes to waters of western Lake Erie, the Maumee River and its tributaries. Specifically, this project will target the most impaired Watershed Assessment Units (WAU) in the Western Lake Erie Basin Watershed. A "systems approach" using a combination of best management practices (e.g. soil testing, cover crops, drainage water management, fertilizer placement technology and manure storage structures and/or roofed feedlots) known to reduce nutrient loading will be promoted within select sub-basins of the Maumee and Sandusky Rivers.

4) ODA will work with NRCS to establish a Western Lake Erie Basin Technical Advisory committee as a subcommittee to the State Technical Committee to provide technical assistance and analysis of economic considerations specific to nutrient management issues and agricultural practices in the basin.

5) ODA will coordinate with the United States Department of Agriculture Commodity Credit Corporation to strengthen and stimulate the Ohio Lake Erie Conservation Reserve Enhancement Program (LE-CREP) to achieve its 2004 goal of voluntarily establishing 67,000 acres of filter strips, riparian buffers, hardwood tree plantings, wildlife habitat and field windbreaks. Incentives will be prioritized based on targeted watersheds and on optimal placement and effectiveness of the riparian practices. Ohio will need to provide USDA a 20% overall match and a 10% cash match for the enrollment costs associated with installing an additional 17,000 acres of conservation buffers to reach the 67,000-acre goal.

6) ODA will collaborate with the USDA – NRCS, the Ohio Federation of Soil and Water Conservation Districts, and other partners to identify a suite of agriculture nonpoint BMPs (e.g. drainage water management, nutrient placement, soil testing and livestock waste management) to be promoted basin-wide but with a priority for placement in targeted watersheds. Additional funds will be sought to provide cost incentives for implementing these BMPs, and BMP implementation will be tracked at the HUC 12 level.

7) ODA will educate producers on the importance of following the fertilizer and manure application restrictions and fertilizer certification requirements in the WLEB. Implementation and enforcement of these restrictions will continue as a top priority for ODA and Ohio's SWCDs.

8) ODA will develop a Farm Stewardship Certification for farmers who protect farmland and natural resources by voluntarily implementing best management practices (BMPs) on their farms. Farmers that fully implement the 4Rs, including nutrient placement or nutrient application onto a living crop, will be eligible to receive this certification. A farm level nutrient management plan (NMP) will provide verification that appropriate BMPs have been implemented and all aspects of the 4Rs are being utilized. Ohio's SWCDs will assist with the review and verification components of the NMP and will recommend farms deserving of the stewardship certification. Acres included in the NMPs and enrolled in the certification program

will be tracked at the HUC 12 level. ODA has established a pilot program in Wood and Henry Counties to evaluate the overall resources required to implement this program statewide.

9) ODA will identify existing programs and consider development of new programs to install practices that reduce or eliminate water quality impacts from agricultural drainage. This will include programs for the installation of drainage control structures and developing incentives for water detention/retention structures in the agricultural landscape.

10) ODA will work with NRCS to encourage the establishment of stream-line processes, sign-up periods, and application requirements for various federal and state funding and technical assistance programs. This may include developing a "carve-out" of Farm Bill programs and processes specific to the multistate Lake Erie basin for a specified period.

11) ODA will work with NRCS and encourage an assessment of the scoring criteria for Farm Bill program eligibility to ensure that those farmers in most need of technical and financial assistance are receiving higher consideration for assistance.

12) ODA has established and will maintain the Ohio Applicator Forecast website[5]. The Forecast is designed to help nutrient applicators identify times when the weather-risk for applying is low. The risk forecast is created by the National Weather Service and takes snow accumulation and melt, soil moisture content, and forecast precipitation and temperatures into account. The chances of surface runoff in the next 24 hours are displayed on the overview map of the state.

Ohio Environmental Protection Agency (Ohio EPA)

1) The Ohio Environmental Protection Agency, Ohio Department of Agriculture, and the Ohio Federation of Soil and Water Conservation Districts are developing a program jointly recognizing individuals and organizations that support sustainable agriculture and environmental stewardship by preventing nutrient loss and protecting water quality through the Stewardship Credit Recognition Program. Organizations could purchase credits from any participating water quality trading program.

2) Ohio EPA will continue to work with the Great Lakes Commission with involvement of agriculture and other stakeholder organizations to determine the feasibility for the establishment of a cross boundary nutrient trading program for portions of the Lake Erie watershed.

3) Ohio EPA will continue work on establishing rules within the water quality standards rule 3745-01-04 that address the public health nuisance associated with the presence of manure in waters of the state.

[5] http://www.agri.ohio.gov/divs/plant/OhioApplicatorForecast/oaf.aspx

Community-Based Nutrient Reduction

There are eight counties along the coast: Lucas, Ottawa, Sandusky, Erie, Lorain, Cuyahoga, Lake, and Ashtabula. According to the U.S. Census Bureau (2016 estimate), the combined population of Ohio's coastal counties (Wood County included) was 2,490,123 people, amounting to nearly one-quarter of the state's total population. There are 332 cities or villages and 403 townships in Ohio's part of the watershed, with four prominent urban areas. From west to east, such populated areas include greater Toledo, the expansive Cleveland metropolitan region, greater Akron, and Youngstown. In addition to these major population centers, there are numerous county seat population centers. For example, in the southwestern portion of the watershed, Norwalk (Huron County), Fremont (Sandusky County), Tiffin (Seneca County) and Findlay (Hancock County).

Community-based sources of phosphorus include major wastewater treatment plants (WWTPs), industrial facilities, or minor publicly-owned treatment works (POTWs). There are a combined total of 913 permitted facility outfalls in the Annex 4 priority watersheds in Ohio, which discharged a combined annual total of 304.8 metric tons for water year 2016 (Oct. 2015-Sept. 2016). The outfalls are distributed as indicated in the following table.

Table: Number of NPDES individual facility permits by Annex 4 Priority Watershed, with water year 2016 total phosphorus annual load from all permitted outfalls. This includes all facilities, public or private, that report discharge of total phosphorus. A detailed list of facilities is presented in Appendix C.

Watershed		Number of Permitted Outfalls	Total Phosphorus Load (MTA)
Annex 4 Priority Watersheds (State of Ohio)	Maumee	342	134.5
	Sandusky	104	11.1
	Portage	97	14.0
	Huron	44	2.65
	Vermillion	24	1.74
	Cuyahoga	200	135.4
	Grand	102	5.47
Annex 4 Priority Total		913	304.8
All others		584	172.0
Total		2410	476.8

In addition, some communities have storm water outfalls that are regulated, which include Combined Sewer Outfalls (CSOs) and individual or general storm water permits. Overflows from combined sewers due to urban storm water are the primary source of untreated sewage discharges to Lake Erie. In the Lake Erie basin, 62 communities have CSOs. Ohio EPA estimates that the six communities with the largest CSO volumes discharged an annual average CSO volume of approximately 10,600 million gallons per year (based on 2014-16 values). Because the amount and timing of storm water discharge varies tremendously from year to year and the phosphorus concentrations also vary, please see the Ohio EPA Nutrient Mass Balance Study, Appendix B for estimates of CSO loadings in selected Lake Erie tributaries for water years 2013 and 2014.

There are numerous communities with storm water permits in the Lake Erie watershed[6]. This includes 125 MS4 Storm Water communities, 2,275 construction storm water permits, and 216 facility based storm water permits.

Estimates of the number, capacity, and failure/discharge rates of home sewage treatment systems were developed for the watersheds in the Nutrient Mass Balance Study.

Every community in Ohio's Lake Erie watershed has a role to play in reducing nutrient loads. These actions outline opportunities for communities to participate in nutrient reduction that will improve conditions in local receiving streams as well as in Lake Erie downstream.

Ohio Environmental Protection Agency (Ohio EPA)

1) Ohio EPA has identified facilities in each of the Annex 4 priority watersheds in Ohio with an NPDES permit that report discharging phosphorus (Appendix C). Ohio EPA will evaluate those facilities that currently do not have a permit limit for total phosphorus to determine options on a facility by facility basis for reducing the phosphorus discharge level.
2) Ohio EPA will evaluate possible legislation that will limit all treatment works discharging waste water containing phosphorus to achieve at least a monthly average effluent concentration of 1 mg/L phosphorus unless alternative limits or conditions are deemed appropriate by the Director. This requirement already exists for major Wastewater Treatment Plants (WWTPs) in the Lake Erie watershed.
3) Ohio EPA has implemented the requirement of SB1 that all facilities discharging more than 1 MGD will include monitoring of both total phosphorus and ortho-phosphorus by Dec. 1, 2016 if this requirement does not currently exist. Data for ortho-phosphorus will be available at the end of water year 2017 (October). Five additional facilities will have new total phosphorus limits in their renewed permits (noted in the tables in Appendix C).
4) Ohio EPA will continue to refine the arrangement with Battelle and possibly other institutes to conduct an evaluation of processes, and product effectiveness for addressing nutrient and/or microcystin management, treatment and control with a focus on drinking and wastewater treatment.[7]
5) Ohio EPA in coordination with ODA has compared the various components of the Biosolid Land Application and Management Plan rules with those of the nutrient and manure management plans to ensure more consistency.[8] Rule development is underway and is expected to be complete around the end of 2017.
6) Ohio EPA and ODA will coordinate with local entities in the development of Watershed Implementation Plans (WIPs)[9] with a focus on priority watersheds that are not already covered by a WIP. The WIP ideally will meet the nine element watershed plan criteria established by U.S. EPA to meet expectations for providing reasonable assurance that nutrient reductions will be

[6]Interactive map of permitted storm water communities is available at http://oepa.maps.arcgis.com/apps/webappviewer/index.html?id=b680bd65d1874023ae6ec2f911acb841

[7] The evaluation procedure is detailed at http://epa.ohio.gov/Portals/35/hab/WQRiskSurvey.pdf.

[8] See
OAC Chapter 3745-40 Sewage Sludge Rules at http://epa.ohio.gov/dsw/rules/3745_40.aspx.

[9] http://www.epa.state.oh.us/dsw/nps/index.aspx#120845160-9-element-nps-is

achieved and maintained and eliminate nutrient impairment for a particular stream. A WIP meeting the nine-element standard will also enable the county and others to apply for 319 grants and other state and federal funding even if an approved TMDL is not in place. If an approved TMDL is in place or if a new TMDL is developed, the intention would be to align the TMDL Implementation Plan and the WIP so that the WIP can also work towards nutrient reduction. Cost share from the state for the WIP will be sought through a re-allocation of existing dollars or new funding.

7) Ohio EPA will continue to focus State Revolving Loan Fund dollars and coordinate with other infrastructure funding programs to direct funding at Division of Surface Water priority CSO separation projects, wastewater treatment plant upgrades, storm water management and home sewage treatment systems.

8) Ohio EPA's stormwater management program working with ODA, local SWCDs and watershed groups will investigate opportunities to utilize storm water management in addressing hydrologic factors that influence nutrient loading into Lake Erie. Revisions to the Rain Water Manual[10] may include increasing upland, channel or storm water storage, floodplain reconnection, and nutrient treatment. Implementation would be in conjunction with landowners and watershed managers on both headwater and larger watersheds basis.

9) Ohio EPA will continue to work with USEPA on establishing a recreational use standard and advisory protocol for microcystin for the open waters of Lake Erie.

10) Ohio EPA will evaluate the existing long term control plans for CSOs and the impacts on nutrient loading.

11) Ohio EPA will track the installation of point source nutrient reduction BMPs since 2008. Tracking will include all major NPDES permits with discharge limits, those required to complete a technical and feasibility study (SB1), CSO outfalls, and state or federal funded storm water management practices.

Ohio Department of Health (ODH)

1) ODH will continue to work with local health districts to ensure implementation of their Operation and Maintenance Tracking programs for sewage treatment systems as required in the Ohio Administrative Code, and provide options and resources for implementing operations and maintenance tracking including identification of failing sewage treatment systems within targeted watersheds[11].

2) Upon identification of a failing system, local health districts will establish specific action plans and timeframes for correction of the nuisance conditions which may include repair, alteration or replacement of the sewage treatment system, or connection to public sewers, where available.

3) Local health districts will continue to work with state and local government agencies and local public sewage treatment providers to facilitate extension of sewers to areas of concentrated failing HSTS.

Restoration and Support of Ecosystem Services

[10] http://epa.ohio.gov/Portals/35/storm/technical_assistance/RLD_11-6-14All.pdf
[11] http://www.odh.ohio.gov/odhprograms/eh/sewage/STSpages/OMTrackingProg.aspx

Ecosystem services are the benefits people obtain from ecosystems. Protection and restoration of the natural ecosystems of the Lake Erie watershed provides low cost mechanisms for nutrient reduction among other benefits. Examples of key ecosystems include inland, stream side, and coastal wetlands.

Wetlands are areas that are wet at a frequency and duration sufficient to support vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas inland, along streams, and along the coast. Wetlands are an integral part of the Great Lakes ecosystem because they store water and act as reservoirs, reducing the risk of flooding. They also help to improve the quality of water by filtering sediment and nutrients.

Wetlands have not always been valued for these functions. The last couple of centuries have brought about a great decrease in the number and acreage of wetlands in Ohio. This loss has been caused by agricultural and urban development, water level fluctuations, shoreline stabilization, and changes in drainage patterns. In the 2006-2007 National Wetland Inventory, there were 47,323 individual wetlands identified in Ohio's Lake Erie watershed, totaling 289,447 acres. For comparison, the total acreage of the Lake Erie watershed is 7,455,360 acres.

Increasing the number and quality of wetlands in Ohio, with particular attention to the type and location, is part of the overall strategy for nutrient reduction and also provides other benefits such as wildlife habitat and beneficial reuse of dredged material.

Ohio Department of Natural Resources (ODNR)

1) ODNR, in cooperation with Ohio EPA and OLEC, will continue to fund and complete engineering and design work for potential in-water coastal wetland restoration projects in the western basin that beneficially use dredged material and can help assimilate in-lake nutrients. Specifically, in-water coastal wetland restoration projects in the mouth of the Maumee River and Phase 1 projects as identified in the Sandusky Bay Initiative (see detailed project listing, timeline, and milestones in Appendix D).
2) ODNR and Ohio EPA will coordinate with the USACE and other Federal agencies to identify opportunities to restore coastal wetlands and natural shorelines that beneficially reuse dredge material along the entire Ohio Lake Erie coastline. This includes the identification of potential local partners and public-private partnerships to leverage state and federal resources.
3) ODNR will continue to coordinate with and assist the USFWS/NOAA Upper Midwest and Great Lakes Landscape Conservation Cooperative (LCC) Coastal Conservation Workgroup to develop and implement tools to identify potentially restorable wetlands for the western basin that incorporates Landscape Conservation Design (LCD) principles and goals, with a focus on restoring and conserving functional coastal wetlands that maximize coastal habitat, water retention, sediment trapping and nutrient processing/reduction benefits.
4) ODNR will administer and implement two coastal wetland pilot demonstration projects recommended for GLRI funding by the LCC Coastal Conservation Workgroup that will reconnect existing degraded tributary and diked wetlands with Sandusky Bay resulting in restored nutrient processing functions and enhancing habitat connectivity with the Bay.
5) ODNR, in cooperation with Ohio Sea Grant, will jointly fund projects to investigate and quantify nutrient processing and reduction benefits of coastal wetlands at Old Woman Creek NERR and as part of the Sandusky Bay Initiative.

6) ODNR through the Division of Wildlife will evaluate opportunities through their Private Lands program and joint state-federal programs to develop projects in the Lake Erie basin that provide a combination of long-term wildlife habitat along with water quality benefits such as riparian buffers and wetlands.

Ohio Lake Erie Commission (OLEC)

1) OLEC, in conjunction with the Department of Taxation, will evaluate the establishment of a pilot Statewide Conservation Land Tax which would serve as an incentive to landowners to place land which would also provide water quality benefits into long-term conservation programs. As part of this initiative, OLEC could fund through the Lake Erie Protection Fund a study to evaluate tax revenue implications to local governments and school districts, possible models such as the State Homestead Exemption program and acceptance by landowners and other stakeholders.
2) OLEC, Ohio EPA, ODA and ODNR will meet with the Maumee Conservancy District to evaluate their role related to the design, construction, funding and management of storm water management including water retention/detention options. More effectively managing surface and subsurface water would help to minimize "flashiness" of streams often resulting in short-term but higher nutrient loads. The conservancy district model may be a structure worth evaluating as a way for implementation and funding large-scale water management issues in the WLEB.

Monitoring, Tracking, and Support

Progress and attainment of the DAP goals will be based on actual water quality monitoring information. Ideally water quality monitoring would be on a continuum which is able to provide data beginning at edge of field, continuing at the sub and major watershed levels, and ultimately the open water of Lake Erie. Ultimately the goal is to establish an allocation at the target tributary pour points and then establish target goals for each of the sub watersheds needed to achieve the over-all loading goal into Lake Erie. It will be imperative to track reduction progress, preferably tied to reduction practices, in specific watersheds through a comprehensive and long-term water quality monitoring program.

Being able to track the expenditure of public and private dollars going toward nutrient reduction is critical to determining the effectiveness and efficiency of those expenditures. Improved coordination of where dollars go and improved accountability for results observed will be a high priority of the DAP.

Achievement of the DAP goals will not be accomplished by just any one level of government or organization. There is a need to improve coordination between state agencies, state and federal agencies, and government and non-government interests. While ultimately the states have responsibility to achieve the state DAP goals, this will only be accomplished through the involvement, input, program implementation, and accountability of a multitude of interests and resources.

Monitoring Water Quality and Tracking Progress

Ohio Environmental Protection Agency (Ohio EPA)

1) Ohio EPA has established a comprehensive water quality monitoring network specific to tracking progress toward meeting the requirements of the Ohio's Domestic Action Plan and Annex 4 (Appendix B). Monitoring locations have been established at key subwatersheds and at the most

practical location near the mouth of the direct primary tributaries to Lake Erie as specified in the Appendix. Ohio will coordinate these monitoring activities with other jurisdictions, particularly for the shared Maumee River watershed with Michigan and Indiana.

2) Ohio EPA, in cooperation with Heidelberg University's National Center for Water Quality Research and USGS, will continue to develop and implement a program to monitor and track water quality improvements resulting from nutrient reduction practices and BMPs. These correlations will be developed at the finest scale practical, whether it is edge of field, HUC12, or HUC10 level.

3) Ohio EPA will publish a Water Quality Target for each Annex 4 priority watershed and major western Lake Erie basin HUC 8 Maumee River subwatershed once the methodology is available. These targets will be used in assessing nutrient reduction progress toward the Domestic Action Plan targets. Work on an appropriate methodology, and the development of numeric spring load targets for the Tiffin River and St. Joseph River HUC 8 sub-basins of the Maumee River, is underway through a grant by USEPA to an outside contractor and is expected to be complete in April, 2018. Once subwatershed targets are established, we could evaluate the feasibility of subdividing loading targets by county.

4) Ohio EPA will take a leadership role with member entities on the Annex 4 Monitoring Work Group (Ohio, Indiana, Michigan, and Ontario) to ensure a consistent sampling and lab testing protocol is in place and being followed. It is recommended that one common platform, such as the Great Lakes Commission's ErieStat program, be used to collect, share, and report on progress toward and verification of achieving the Great Lakes Water Quality Agreement and Domestic Action Plan goals.

5) Ohio EPA along with federal and university-based research partners will establish a western Lake Erie open water monitoring system to monitor the presence and amount of harmful algae and microcystin. This information will be used to track progress towards the Annex 4 Lake Ecosystem Objectives for Lake Erie, including reducing the size and toxicity of algal blooms in the lake to no larger than the 2008 bloom. This open water monitoring system will also provide a science based methodology for assessing use attainment for the open waters of Lake Erie.

6) Ohio EPA in conjunction with ODH will work with researchers to establish a methodology for identifying the potential source of nutrients that may be resulting from manure or human waste through DNA analysis.

7) Ohio EPA will coordinate with local authorities to conduct monitoring of nutrient discharge levels from priority combined sewer overflows. The purpose will be to evaluate the total nutrient load resulting from these periodic discharges to improve estimates for future versions of the Nutrient Mass Balance Study.

Ohio Lake Erie Commission (OLEC)

1) OLEC and member agencies will provide an annual update to the Ohio House and Senate Agriculture, Agriculture and Rural Development, Energy & Natural Resources committee as well as the Lake Erie Caucus on the state of the water quality in the Lake Erie watershed. This report will be presented to Commission members at a regularly scheduled quarterly meeting. These updates and status reports will be made available to the public on the OLEC website.

Tracking Funding and Practices

Ohio Lake Erie Commission (OLEC)

1) OLEC will coordinate with the member agencies and federal partners on the establishment of a nutrient reduction fiscal operations plan. This plan will serve as guide for identifying short-term and long-term funding needs and potential long-term funding sources including re-allocation as well as new local, state, and federal funding opportunities for nutrient reduction. Priority should be given to a consistent and possibly a dedicated funding source for water quality monitoring.
2) Significant dollars and other resources are made available annually from various federal, state, local and private sources to address the issues of Lake Erie. These funds include the Great Lakes Restoration Initiative Funds (GLRI), 319 Grants and other federal funding programs through United States Department of Agriculture (USDA), U.S. EPA, NOAA, United States Army Corps of Engineers (USACE), United States Fish and Wildlife Service (USFWS) and USGS. Several state agencies, ODNR, Ohio EPA, and ODA also have provided significant funding over the years to help address Lake Erie issues. While the combination of funds is significant and it is often easy to point to the resulting projects, there continues to be the need to ensure dollars are being directed to projects and programs that truly address coordinated or stated priority issues. OLEC will seek cooperation, request coordination and may review funding requests made to federal or state agencies from state agencies, government subdivisions, and organizations for funding related to Lake Erie or Lake Erie Basin projects. OLEC does not have the authority to approve or disapprove an application but will evaluate the funding request to confirm if the project is helping to achieve state or federal priorities related to the Lake Erie basin.
3) OLEC will establish methods for tracking the amount of all public funds, and when possible, private sources such as foundations that are expended in Ohio for nutrient reduction. It is recommended that fiscal tracking programs be utilized by all levels of government and by those entities receiving public funds, including Soil and Water Conservation Districts, Sewer and Water Districts, and Watershed Programs that can track dollars received and expended on nutrient reduction and to help document the potential need for funding to achieve the desired program objectives. This would not include identifying the individuals or private business entities receiving cost-share dollars through Farm Bill programs, or other programs where confidentiality of the recipient is protected by law.

Ohio Environmental Protection Agency (Ohio EPA)

1) Ohio EPA will continue to revisit and revise as necessary the Maumee sub-basin watersheds at the HUC 12 level that have been selected for expanded monitoring (Appendix B). The establishment of these sub-watersheds as sentinel sites where monitoring will be focused does not mean that nutrient reduction practices for both point source and non-point should not nor will not continue to be implemented throughout the western Lake Erie basin. Establishing Maumee sub-basin sentinel watersheds at the HUC12 level is intended to indicate those areas where it is believed that the most effective use of resources would result in the quickest reduction in nutrient impacts to water quality and could be verified soonest as a result of targeted water quality monitoring.

Programmatic Support

Ohio Lake Erie Commission (OLEC)

1) OLEC will take the lead to ensure there is annual coordination between state and federal agencies for identifying priority programs, priority areas, and timelines related to Lake Erie and the Lake Erie Basin. Each OLEC members' state agency will coordinate with the OLEC staff to maximize opportunities for the coordination of state and federal priorities.
2) OLEC will establish the DAP Advisory Committee in late 2017 involving similar stakeholders as those involved in the Phosphorus Task Force initiatives which will meet once or twice per year. This Committee would provide input and evaluation to the Commission on the progress of implementation toward achieving the stated nutrient reduction goals.
3) OLEC will coordinate inter-agency engagement and recommendations for the up-coming Farm Bill as they relate to Lake Erie in addition to coordinating state recommendations to be submitted to the Great Lakes Commission for the development Farm Bill recommendation with a Great Lakes basin focus.
4) OLEC with its member agencies will coordinate the development of an Adaptive Management Process "trigger mechanism" which would cause a change of program, practice or policy if the goals are not reached or if no measurable progress is observed toward achieving the goals. Any trigger will be based on the best available science and engagement of interested parties and state agencies.

Major Benchmarks

Major benchmarks are the loading and concentration targets pinned to specific times and places. Benchmarks for Ohio apply to selected Western Basin tributaries to address Harmful Algal Blooms, and to those tributaries plus additional Central Basin tributaries to address Hypoxia. Ohio will use the same springtime benchmark for the Sandusky River to control HABs occurring in Sandusky Bay.

Targets to Address HABs

Priority Tributary	Spring (March 1-July 31) Values				
	2008 Baseline			Targets under 40% Reduction by 2025	
	Discharge (km^3)	Load metric tons	FWMC mg/L	Load Metric tons	FWMC mg/L
Maumee River	3.76	1,414 TP 302 DRP	0.38 TP 0.08 DRP	860 TP 186 DRP	0.23 TP 0.05 DRP
Portage River	NA	NA	NA	TBD	TBD
Sandusky River	0.963	367 TP 69.1 DRP	0.38 TP 0.07 DRP	230 TP 43 DRP	0.23 TP 0.05 DRP

Baseline data are not available for the Portage River in 2008 due to gaps in the data set. The development of a spring loading and concentration target for the Portage River will be completed once the methodology to develop the Maumee River HUC 8 sub-basin targets is completed.

Targets to Address Hypoxia (Metric Tons Annually, MTA)

Priority Tributary	**2008 Annual Load***	**40% Reduction Amount**	**Target Load by 2025**
Maumee River	3,812	1,525	2,287
Portage River	359	144	215
Sandusky River	1,100	440	660
Cuyahoga River	452	181	271

*Annual load estimates based on Maccoux, 2016 values.

The remaining three Annex 4 Priority Watersheds, the Toussaint, Vermilion, and Grand Rivers, are not included in this table because of their relatively small annual load totals (less than 150 MTA each). This represents less than 100 MTA of total reduction. Hence these watersheds, while important, are a lower priority for Ohio and will be considered for specific actions and load reductions at a later date.

How Progress Will Be Measured

It is the goal of the overall water quality monitoring strategy in Ohio to include monitoring data from edge of field, sub-watershed, Annex 4 priority watersheds, and Lake Erie in order to provide a total picture of nutrient sources and the nutrient delivery system. The primary indicator of progress will be water quality monitoring and associated load calculations at the key downstream station on each of the Annex 4 priority watersheds in Ohio.

To track progress in the Maumee River, loading data from the Maumee River near Waterville, United States Geologic Survey (USGS) gage station (04193490) will be used. Water quality monitoring is conducted at the Maumee River near Waterville USGS gage station on a regular basis by the National Center for Water Quality Research (NCWQR) at Heidelberg University. Springtime total and dissolved phosphorus loading at the monitoring stations are presented on Figure B1 and B2, respectively. The target loads for 2020 and 2025 are also noted on these figures.

The Sandusky River is monitored near Fremont, OH (USGS 04198000) with water quality monitoring conducted by NCWQR as well. Springtime loads for total and dissolved phosphorus, both with target loads, are presented for the Sandusky River in Figure B3 and B4, respectively. All figures include springtime stream discharge because there is a strong correlation between total load and streamflow.

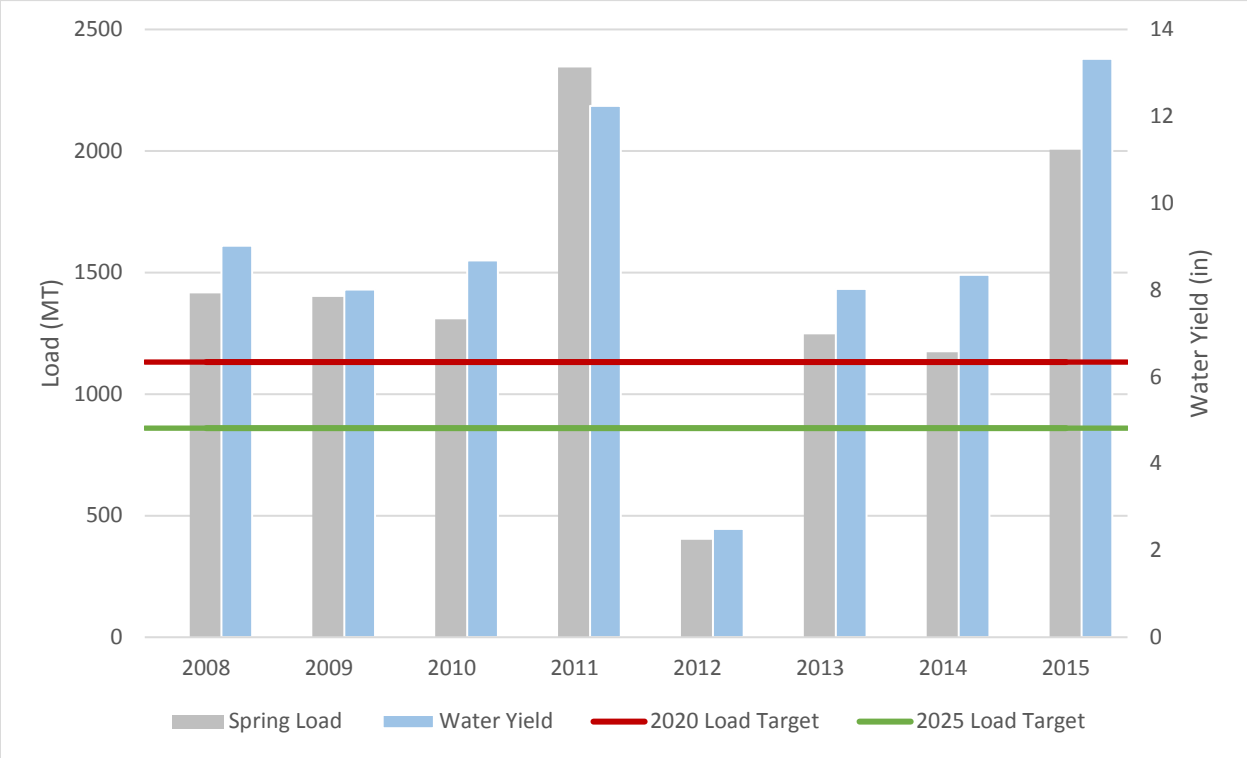

Figure 4: Springtime total phosphorus loading and water yield for the Maumee River from 2008 - 2015. Benchmarks of 20 percent reduction by 2020 and 40 percent by 2025 are included. Water yield is the total streamflow normalized by watershed area, this yield represents the amount of precipitation in inches that resulted in stream discharge.

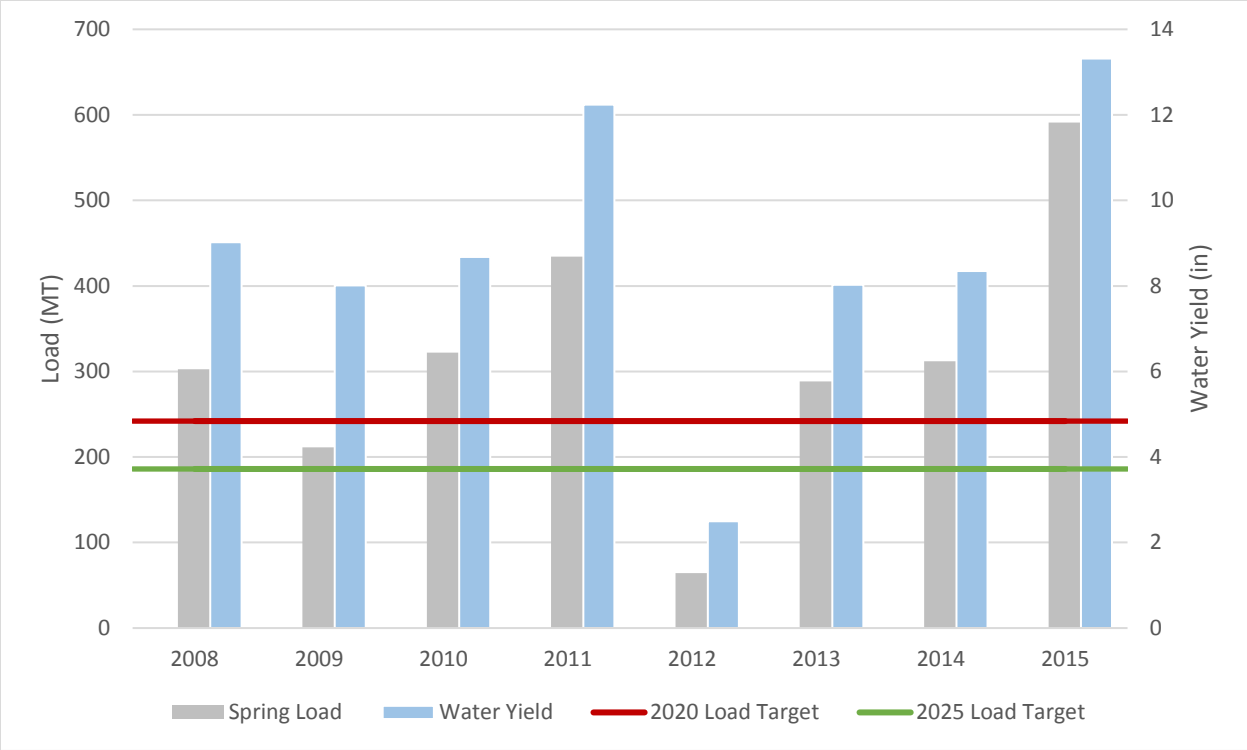

Figure 5: Springtime dissolved reactive phosphorus loading and water yield for the Maumee River from 2008 - 2015. Benchmarks of 20 percent reduction by 2020 and 40 percent by 2025 are included. Water yield is the total streamflow normalized by watershed area, this yield represents the amount of precipitation in inches that resulted in stream discharge.

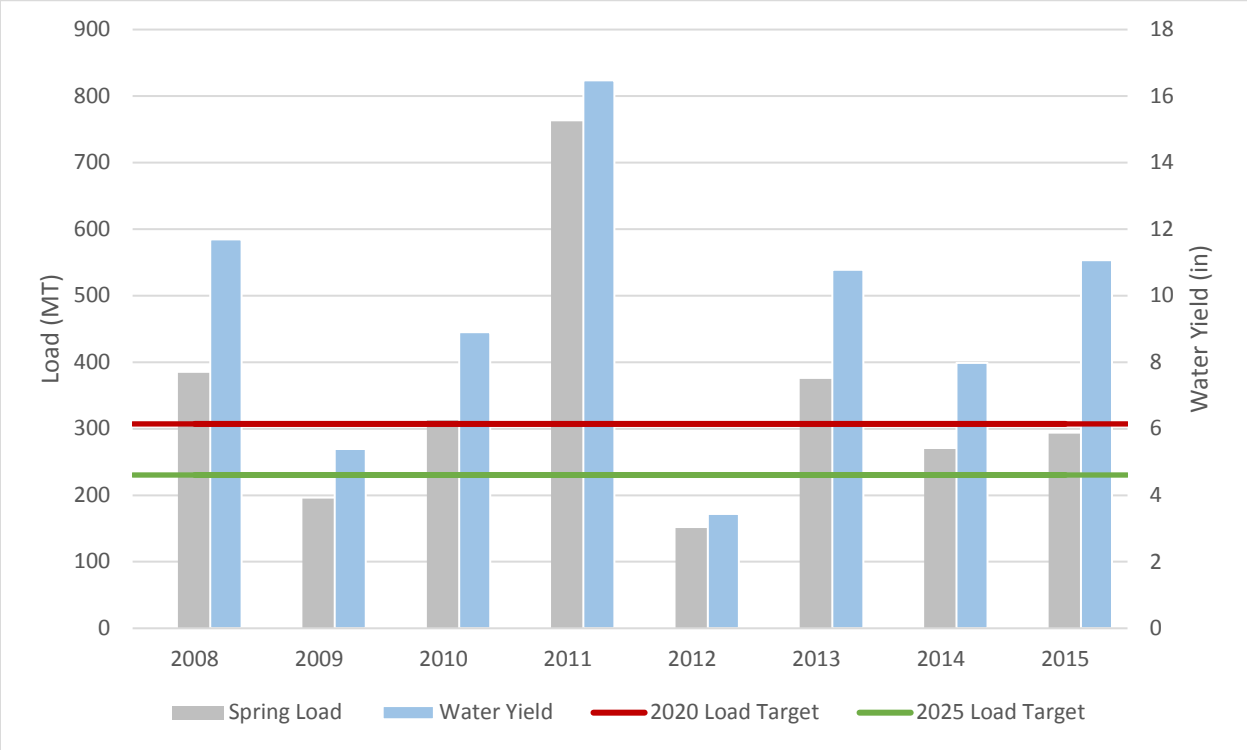

Figure 6: Springtime total phosphorus loading and water yield for the Sandusky River from 2008 - 2015. Benchmarks of 20 percent reduction by 2020 and 40 percent by 2025 are included. Water yield is the total streamflow normalized by watershed area, this yield represents the amount of precipitation in inches that resulted in stream discharge.

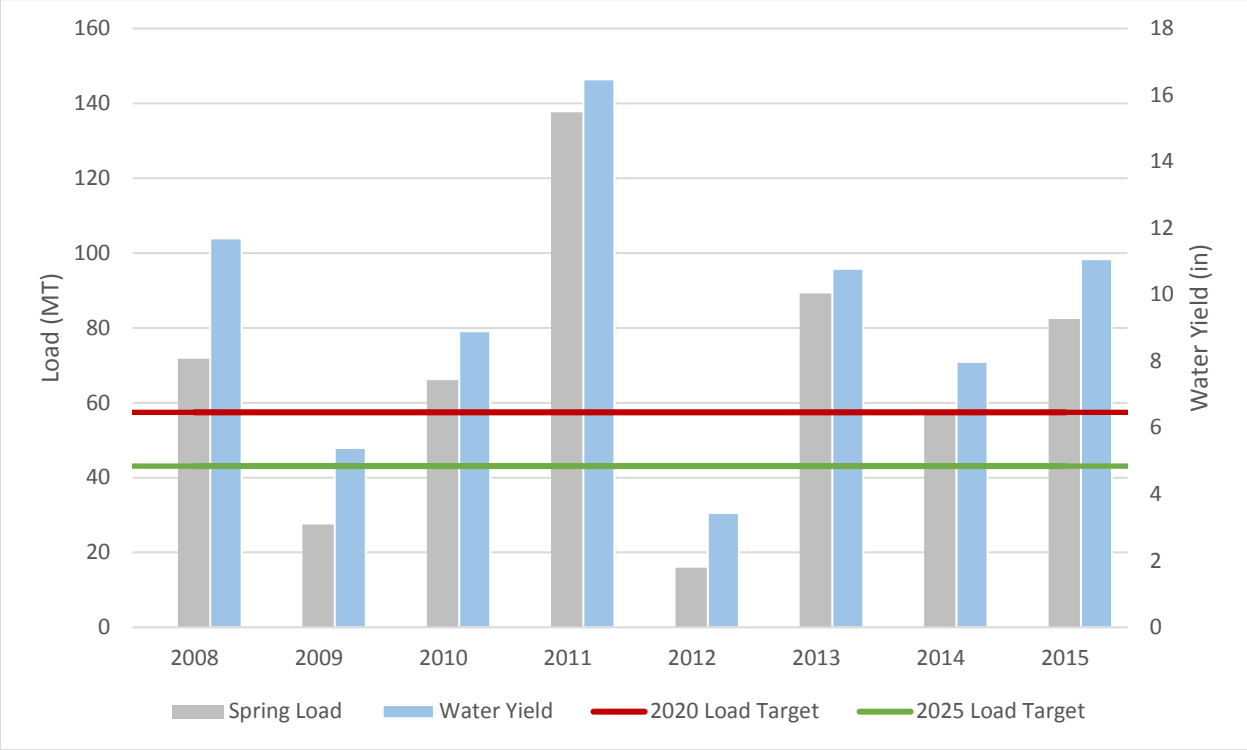

Figure 7: Springtime dissolved reactive phosphorus loading and water yield for the Sandusky River from 2008 - 2015. Benchmarks of 20 percent reduction by 2020 and 40 percent by 2025 are included. Water yield is the total streamflow normalized by watershed area, this yield represents the amount of precipitation in inches that resulted in stream discharge.

The State of Ohio is committed to working with the Annex 4 Subcommittee's Objectives and Targets Task Team as they develop further the Lake Erie Tributary Monitoring Strategy that will inform progress on the GLWQA Annex 4 targets. Ohio will be establishing specific "sentinel watersheds" which should be targeted for nutrient reduction practices by federal, state and private partners in order to document resulting water quality improvement.

Ohio is committed to working with USEPA to coordinate at the federal and state level to provide progress tracking information in a consistent, timely manner. That may include participation in the ErieStat online platform, annual webinars or other public forums, further publications of Ohio's Water Monitoring Fact Sheets, or other mutually agreed upon mechanisms.

Appendix A
The Role of Maumee River Subwatershed TMDLs in meeting the Goals of the Domestic Action Plan

The Total Maximum Daily Load (TMDL) program, established under Section 303(d) of the Clean Water Act, focuses on identifying and restoring polluted rivers, streams, lakes and other surface waterbodies. TMDLs are prepared for waters identified as impaired on the 303(d) list in the Integrated Report which is provided by Ohio EPA to the U.S. EPA as a requirement of the Clean Water Act.

A TMDL is a written, quantitative assessment of water quality problems in a waterbody and contributing sources of pollution. It specifies the amount a pollutant needs to be reduced to meet water quality standards, allocates pollutant load reductions, and provides the basis for taking actions needed to restore a waterbody. Each TMDL report includes an implementation plan that lists these actions.

Watersheds are assessed on a rotating basis. The current schedule for reassessing each subwatershed of the Maumee is given in the most recent Integrated Report (also see table). The oldest assessment and approved TMDL is the one for the Upper Auglaize River, which was completed in 2004. This subwatershed is scheduled for an updated assessment in 2018.

There are six completed TMDLs for subwatersheds of the Maumee River and three in preparation. All the TMDLs contain phosphorus load allocations for some or all parts of the respective subwatershed, based on local impairments due to nutrient loading. As of the current publication of the Domestic Action Plan, these TMDLs have not factored in phosphorus load allocations based on proposed phosphorus targets for Lake Erie. However, the actions recommended to address local nutrient impairments will also aid in reducing the loading to the lake.

Ohio EPA is working with USEPA, their contractor (Tetratech), Indiana and Michigan in the development of a methodology which describes the protocols for developing total phosphorus (TP) and soluble reactive phosphorus (SRP) load and concentration targets which meet the criteria and goals of Annex 4 lake targets for the St. Joseph and Tiffin river watersheds. The protocols described in the methodology will be flexible so that the methodology can be replicated in other subwatersheds of the Maumee River basin. After finalizing the methodology, the contractor is expected to use the procedures to calculate TP and SRP load and concentration targets for the St. Joseph and Tiffin river watersheds that do address the far field targets for Lake Erie.

In addition to actions recommended in the Domestic Action Plan, we incorporate the implementation plans from each TMDL for the Maumee, Portage, Toussaint, and Sandusky Rivers by reference (see list).

List of Maumee Basin TMDL documents

Total Maximum Daily Loads for the Upper Auglaize River Watershed Final Report. Ohio EPA Division of Surface Water. August 16, 2004.

Total Maximum Daily Loads for the Blanchard River Watershed Final Report. Ohio EPA Division of Surface Water. May 22, 2009.

Total Maximum Daily Loads for the Maumee River (lower) Tributaries and Lake Erie Tributaries Watershed Final Report. July 5, 2012. Tetra Tech Inc.

Total Maximum Daily Loads for the Ottawa River (Lima Area) Watershed Final Report. Ohio EPA Division of Surface Water. November 6, 2013.

Total Maximum Daily Loads for the Powell Creek Watershed Final Report. Ohio EPA Division of Surface Water. April 7, 2009.

Total Maximum Daily Loads for the Swan Creek Watershed Final Report. Ohio EPA Division of Surface Water. October 9, 2009.

Appendix B

Monitoring Strategy and Priority Implementation Areas

Introduction

This appendix describes the monitoring strategy for the Western Lake Erie Basin (WLEB) and information that was used to develop the strategy. Water quality monitoring in the basin has been a focus for decades. Two principal pour points, on the Maumee and Sandusky rivers, have near continuous nutrient loading records dating to the early 1970's. These stations were pivotal in documenting loading trends and identifying loading targets for nutrients following the resurgence of algal blooms in the WLEB. Recent efforts have focused on refining the monitoring to get data at secondary and tertiary locations particularly in the Maumee Watershed. The refined monitoring considers the recommendations made in a 2015 report from the Northeast-Midwest Institute completed in conjunction with USGS (Betanzo, 2015).

The Maumee River watershed in Ohio is more than four million acres of diverse landscape superimposed by one dominant land use: row crop production. Producers use a variety of management practices to ensure the productivity of their crops while preventing the loss of soil and nutrients from their fields. In the previous effort for the Collaborative Framework, watershed resources were analyzed considering the available data in the watershed. These data sources included water quality monitoring data, water quality modeling results from a comprehensive SWAT modeling effort, geographic soil distributions, analysis of soil slope, land use data and livestock inventories. A comprehensive summary of these data sources and how they were used is detailed later in this appendix.

Until recently there were 16 sites within the WLEB and Sandusky River watersheds that had sufficient water quality and flow data for nutrient load calculations. These sites are maintained by both the National Center for Water Quality Research (NCWQR) at Heidelberg University and the USGS. Funds for the load monitoring stations are from federal, state and local governments as well as private enterprises. These stations were chosen to better understand the impact of loading from different regions within the WLEB and provide data for nutrient loading trends. However, many of these stations have been added since 2007 – yielding a relatively brief dataset for trends analysis. Ensuring funding for these stations for the long term is critical to measuring the success of nutrient reduction efforts.

Most of the stations in the WLEB and Sandusky River watershed that were operational in 2014 were at sites representing large watershed areas. While these are useful in understanding nutrient loadings of these areas, at this scale it is difficult to understand the impact that management practices have on watershed loading. Therefore, in late 2014 Ohio EPA was awarded a Great Lakes Restoration Initiative (GLRI) grant to conduct enhanced water quality monitoring at smaller watersheds throughout the WLEB and Sandusky River watershed. Two of these stations are included in the group of 16 sites where loading calculations could be completed because the sampling was done at sufficient frequency by USGS.

As part of the Collaborative Framework development, Ohio EPA proposed eliminating six of the 2014 GLRI grant funded stations to consolidate resources that would result in better quality data at fewer sites. Two of the remaining stations were proposed to move to new locations based on the supporting data detailed at the end of this appendix. A detailed discussion of each sampling location and its purpose within the sampling strategy follows the supporting data discussion. Ohio EPA received

additional funding at the end of 2016 to move/install monitoring sites and provide funding for sampling approximately two more years on the St. Joseph River, St. Marys River and Upper Auglaize River. In addition, Ohio EPA collaborated with the Ohio State University Sea Grant College Program to provide funding to increase monitoring at five sites (West Creek, S. Turkeyfoot Creek, Wolf Creek, Rock Creek, and the Huron River) where USGS will operate flow gages and NCWQR will begin conducting water quality sampling in late 2017.

The resulting network is presented in Tables B1, Table B2 and Figure B1. Two new large watershed water quality sites have been installed, one on each the St. Joseph and St. Marys Rivers. These two stations are critical for the State of Ohio to monitor progress toward the goals of the DAP in cooperation with Michigan and Indiana, who share jurisdiction in these watersheds. In addition, new gages and water quality sampling sites have been installed by USGS near the mouth of Platter Creek, and in the upper Auglaize River near Spencerville.

The monitoring network is a good starting point for supporting prioritized watershed funds if available. The amount of time needed to detect changes in water quality decreases with watershed size (Betanzo, 2015). Therefore, one strategy for funding prioritization would be to focus funds on area's where monitoring exists at scales smaller than 50 mi^2. Seven of the sites in table B1 fit into the <50mi^2 category. Identifying these small monitored watersheds as priority funding areas is an evolution from the Collaborative Framework and these watersheds will be called "sentinel" watersheds.

Watershed modeling efforts have shown that implementation levels will have to increase basin wide to achieve the 40% load reduction target from Annex 4. The NRCS CEAP report identified that 95% of cropland acres would have to be affected by a suite of BMPs to achieve a 43% reduction in total phosphorus (USDS NRCS, 2016). The Michigan Water Center coordinated an effort combining the results from six watershed models that showed an increase of 50% implementation of a suite of practices would be required to meet the 40% reduction target; and the increased implementation rate would have to be targeted to the highest dissolved reactive phosphorus (DRP) yielding acres in the watershed to achieve the targets for that constituent (Scavia, 2016). These modeling efforts clearly show that every farm throughout the watershed has a role to play in achieving the load reduction targets. The reason for prioritization at sentinel watersheds in the basin is to understand more quickly if targets are being achieved and provide feedback to what actions are most effective.

Table B1: List of existing load monitoring stations in the Western Lake Erie basin within Ohio.

Geographic location	Monitoring Program Name	Sampling Agency	Timeframe
Maumee River near Waterville, OH	Heidelberg Tributary Loading Program	NCWQR	1/10/1975-9/30/1978; 10/13/1981-current
Maumee River near Waterville, OH	GLRI	USGS	continuous 2011 to current -- misc WQ to 1967
Sandusky River near Fremont	Heidelberg Tributary Loading Program	NCWQR	10/2/1974-current
Portage River at Woodville	Heidelberg Tributary Loading Program	NCWQR	8/30/2010-current
Blanchard River near Findlay	Heidelberg Tributary Loading Program	NCWQR	7/9/2007-current
Tiffin River at Stryker	Heidelberg Tributary Loading Program	NCWQR	7/9/2007-current
Honey Creek at Melmore	Heidelberg Tributary Loading Program	NCWQR	1/28/1976-current
Maumee River at Antwerp OH	WLEB OH DNR and WLEB OH EPA (continuous probes)	USGS	2013 to current -- misc WQ back to 1952
Tiffin River near Evansport OH	WLEB OH DNR	USGS	2013 to current
Blanchard River near Dupont OH	WLEB OH DNR	USGS	2013 to current -- Misc WQ back to 1966
Ottawa River near Kalida OH	WLEB OH DNR	USGS	2013 to current -- Misc WQ back to 1966
Auglaize River near Defiance OH	WLEB OH DNR	USGS	2013 to current -- Misc WQ back to 1952
Maumee River near Defiance OH	WLEB OH DNR	USGS	2013 to current -- Misc WQ back to 1952
Auglaize River near Fort Jennings OH	WLEB OH DNR	USGS	2013 to current -- Misc WQ back to 1965
Little Auglaize River at Melrose, OH	WLEB OH EPA	USGS	2015 to current
Auglaize River near Spencerville	WLEB OH EPA	USGS	March 2017 to current
St. Marys River near Willshire	WLEB OH EPA	USGS	March 2017 to current
St. Joseph River near Newville	WLEB OH EPA	USGS	March 2017 to current
Sentinel watershed monitoring stations (draining areas less than 50 square miles)			
Unnamed Tributary to Lost Creek near Farmer	Heidelberg Tributary Loading Program	NCWQR	10/1/1981-9/30/1993; 10/1/2007-current
Little Flatrock near Junction	WLEB OH EPA	USGS	March 2017 to current
Platter Creek near Sherwood	WLEB OH EPA	USGS	March 2017 to current
Wolf Creek near Toledo at Holland	Expanded Heidelberg Tributary Loading Program	NCWQR	Begin October 2017
S. Turkeyfoot Creek near Shunk	Expanded Heidelberg Tributary Loading Program	NCWQR	Begin October 2017
Rock Creek near Republic	Expanded Heidelberg Tributary Loading Program	NCWQR	Begin October 2017
West Creek near Hamler	Expanded Heidelberg Tributary Loading Program	NCWQR	Begin October 2017

Table B2: List of existing load monitoring stations in the Central Lake Erie basin within Ohio.

Geographic location	Monitoring Program Name	Sampling Agency	Timeframe
Sites in the Central Basin			
Huron River at Milan	GLRI/Expanded Heidelberg Tributary Loading Program	USGS/ NCWQR	2014 to Current / Begin October 2017
Vermillion River near mouth	GLRI	USGS	2011 to current
Cuyahoga River at Independence	Expanded Heidelberg Tributary Loading Program	NCWQR	1981 to current
Grand River near Painesville	GLRI	USGS	Begin 2017

Lake Erie Western Basin Drainage in Ohio: USGS Flow Gages and Nutrient Monitoring Stations 2017

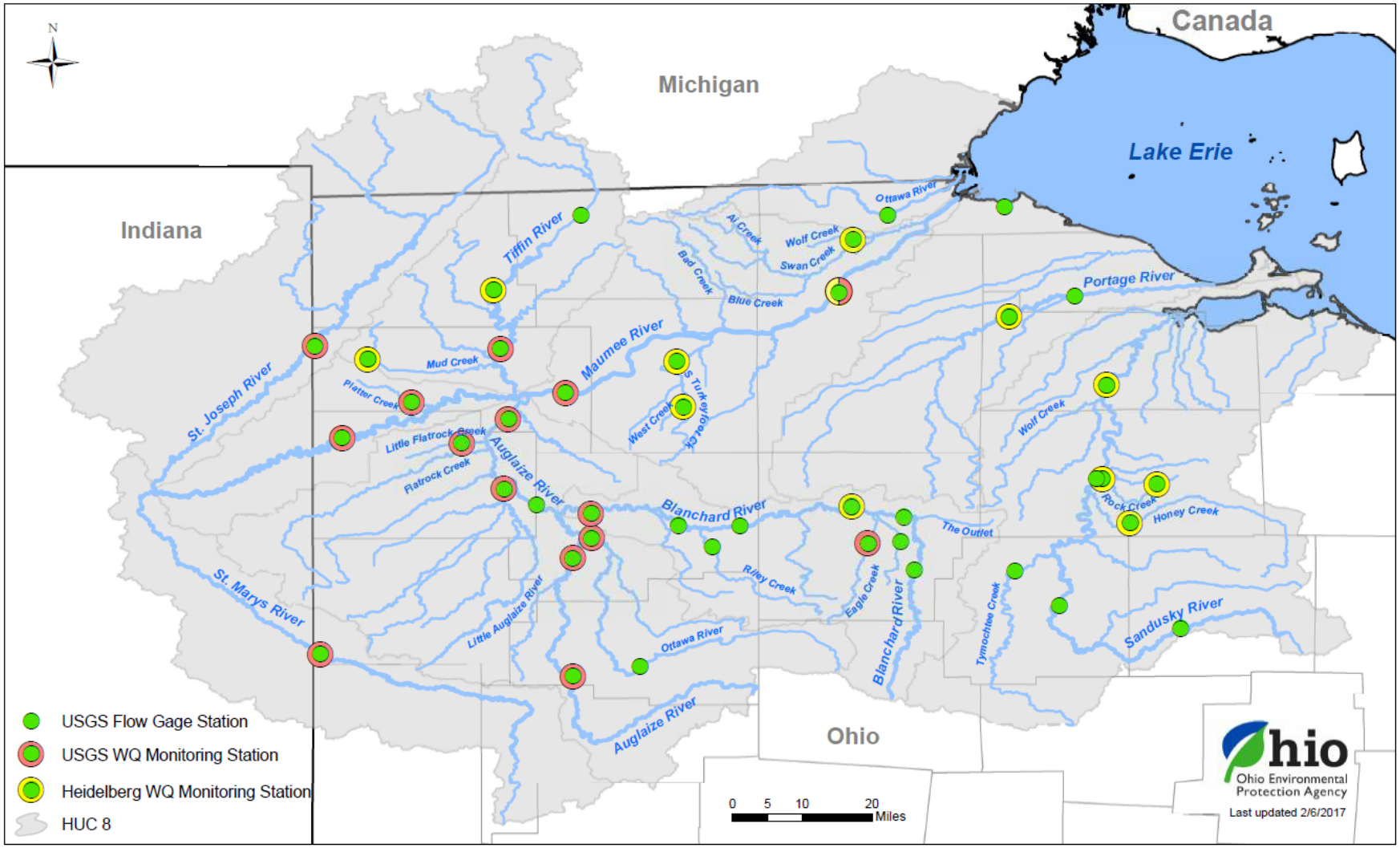

Figure B1: Existing and proposed load monitoring stations in the WLEB. All but four sites (West Creek, S. Turkeyfoot, Wolf Creek and Rock Creek) are operational as of August 2017.

Supporting Data

Starting in 2014, Ohio EPA secured funding to install monitoring stations at 11, HUC10/HUC12 scale, subwatersheds in the Maumee and Sandusky river basins. This included 2 stations that had a sampling strategy to support load estimation by USGS, 4 stations with some enhanced storm monitoring by Ohio EPA staff and the remaining stations were sampled monthly by Ohio EPA staff. In 2016 after Ohio EPA staff reviewed the program it was decided to revamp the program and collect enough data to calculate loads at all the sites being sampled. The below information was used to refine the small monitoring strategy within the Maumee River Basin.

Informing Lake Erie Agriculture Nutrient Management via Scenario Evaluation (Scavia *et al.* 2016)

The Scavia *et al.* 2016 report has directly examined the issue of nutrient export in the Maumee River watershed[12]. This report considers the results from modeling analyses carried out by its coauthors, a wide range of resource experts from University of Michigan, Ohio State University, United States Agricultural Research Service, LimnoTech (a consultancy), Heidelberg University, United State Geological Survey, The Nature Conservancy and Texas A&M. Five Soil and Water Assessment Tool (SWAT) models and one SPAtially Referenced Regressions on Watershed attributes (SPARROW) model are examined and aggregated. One product of this report is the identification of potential critical source areas (referred to in the report as "hotspots"). These critical source areas are determined by agreement among the various models that a subwatershed is in the top 20 percent of nutrient export (Figure B2).

It is important to understand that all pollutant modeling has limitations of resolution. These start with the inputs and are carried through modeling computations into the outputs. One limitation with regards to the SWAT models examined in Scavia et al. 2016 is that existing row crop agricultural practices (for example, planting, tilling and fertilizing) and pollutant reduction BMPs are not input with geographic detail at the HUC 12 level. This monitoring and priority implementation area document recognizes those limitations when using critical source areas to inform actions in the watershed.

[12] This work is being continued during 2017 under the lead of Jay Martin at OSU under a grant from ODHE - HABRI. Once an update of this work is completed in 2018, we will revisit this prioritization to determine if changes are needed or desired. The existing analysis in this Appendix is updated from the Ohio Collaborative Framework.

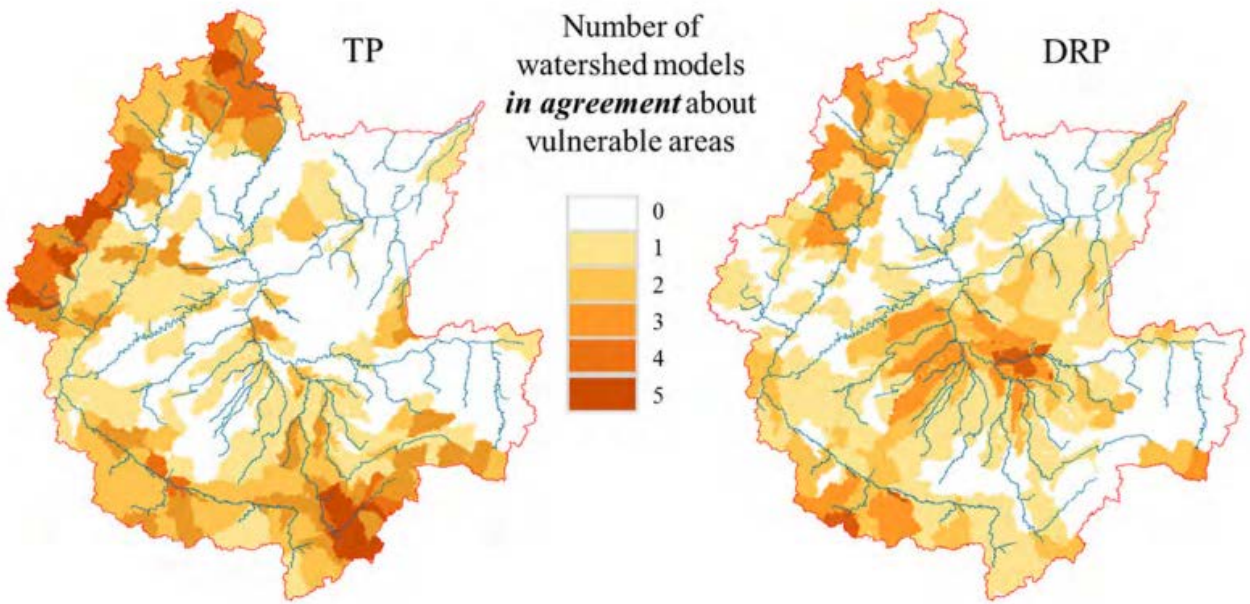

Figure B2: Potential critical source areas for nutrient export to Western Lake Erie Basin in the Maumee River watershed identified by comparing multiple models. Scale is 0 to 5 based on models in agreement. There were six models used in the total phosphorus (TP) map, however all six models did not agree on any area. Only five models are used in the dissolved reactive phosphorus (DRP) map. Figure source: Scavia et al. 2016.

Ohio EPA Monitoring Data

The bulk of Ohio EPA samples are collected in the summer field sampling season when biological indices are assessed (March through September). The result is a purposeful bias of low-flow sources representing a critical condition for stream biology. Using these data alone to prioritize nutrient export and/or monitoring, that is as it relates to Lake Erie loading targets, without hydrologic considerations (for example, weightings) is not appropriate. Rather these data are used to flag watersheds with relatively high TP concentrations and are currently most useful in understanding low-flow sources of nutrients, such as point source discharges.

The enhanced (non-low flow biased) sampling program at four of the Ohio EPA monitoring stations in 2014 and 2015 was helpful in identifying that all stations received elevated total and DRP concentrations during storms. This supports the need for widespread implementation throughout the basin. This monitoring additionally found consistently elevated total and DRP concentrations at one of those four stations; the Little Flatrock Creek station.

Miscellaneous Data Sources

Additional supporting information was also used to justify the siting of other gaging stations within the Maumee Basin. These include the following:

1) Land use
2) CAFO information
3) Soils information
4) Previous implementation efforts

Secondary and Tertiary Monitoring Stations for load calculations in the WLEB

St. Marys River

The St. Marys River is an inter-jurisdictional watershed with Ohio and Indiana. Monitoring at this location, near the Ohio/Indiana state line, is important to understand the effectiveness of the two states approaches to reaching water quality reduction targets. Further the modeling efforts identify several HUC12 scale subwatersheds in the St. Marys Basin in Ohio as being critical source areas (Scavia, 2016). The modeling results also suggest that greater reductions in total loads when higher yielding areas predicted by the model were subject to BMP implantation. Validating the model results identification of the St. Marys River as a critical source of phosphorus loads will be able to help refine BMP targeting strategies in the future.

St. Josephs River

The St. Josephs River is also an inter-jurisdictional watershed with Michigan, Ohio and Indiana. Monitoring at this location is important to understand the effectiveness of the three states approaches to reaching water quality reduction targets.

Upper Auglaize River

The modeling efforts identify several HUC12 scale subwatersheds in the St. Upper Auglaize River as being critical source areas (Scavia, 2016). The modeling results also suggest that greater reductions in total loads when higher yielding areas predicted by the model were subject to BMP implantation. Validating the model results identification of the St. Marys River as a critical source of phosphorus loads will be able to help refine BMP targeting strategies in the future.

Little Auglaize River

This HUC10 sized subwatershed of the Maumee lies within the geologic central lake plain and therefore has very high proportions of drainage class D soils. These soils are subject to different farming practices than better drained soils that respond more effectively to tile drainage. The land use in the watershed is amongst the highest at the HUC10 scale for row crop agriculture. These factors separate the Little Auglaize River from the rest of the Auglaize Basin as an appropriate location to refine our knowledge about regional phosphorus loadings.

Little Flatrock Creek

The modeling results identified Little Flatrock Creek as a critical source area for DRP. The influence of intense drainage practices and a high proportion of the land use dedicated to row crop agriculture were identified as the driving factors elevating DRP loading. Additionally, enhanced monitoring by Ohio EPA identified nutrient concentrations in Little Flatrock Creek that were consistently elevated above the three other sites monitored in the same program. Further, the size of Little Flatrock Creek (it drains 15 square miles at the monitoring location) makes it an ideal candidate for priority funding to assess watershed scale BMP implementation efforts on phosphorus loading.

Platter Creek

Manure management is often identified as an important component of phosphorus loading in the WLEB. Managing manure efficiently involves different challenges from using inorganic nutrients for row crop production. This can affect both the rate and timing of applications. Also, there is little watershed scale data that can be used to understand loadings in areas with higher portions of the land area being influenced by manure applications. Platter Creek has several large CAFOs and is a good area to understand the influence of manure management on watershed loading. Further, the size of Platter Creek (it drains 19.5 square miles at the monitoring location) makes it an ideal candidate for priority funding to assess watershed scale BMP implementation efforts on phosphorus loading.

South Turkeyfoot Creek/West Creek

These two watersheds have been a part of the Regional Conservation Partnership Program (RCPP) administered by NRCS. They also are representative of an area that has a very high portion of the land use dedicated to row crop agriculture. The soils are highly productive and generally respond well to tile drainage. Prior monitoring in the basin and its representativeness of a large segment of the agriculture in the basin are reasons for continuing the monitoring effort at these sites. The West Creek sampling station is nested within the South Turkeyfoot Creek Watershed. The understanding of scale and nutrient routing through the basin was a deciding factor in deciding to nest this gaging station. Further, the size of West Creek (it drains 15.5 square miles at the monitoring location) makes is an ideal candidate for priority funding to assess watershed scale BMP implementation efforts of phosphorus loading.

Wolf Creek

Wolf Creek differs from most of the focused monitoring areas because the land use is dominated by suburban development. While row crop agriculture dominates the greater basin, and bears the largest share of the nutrient load it is important to understand the role of the urban and suburban community. This subwatershed was also part of NRCS's RCPP and continued monitoring will serve to understand the influence of a different subset of BMPs on phosphorus loading in the Maumee Basin.

Rock Creek

The Rock Creek monitoring station was the only station that was added within the Sandusky River Basin. Like the West Creek monitoring station, the Rock Creek station is nested within a downstream monitoring station also on Rock Creek. This again serves to understand the influence of scale on interpreting nutrient loads. Further, due to the size the upper Rock Creek monitoring station (it drains 15 square miles here) it makes it an ideal candidate for priority funding to assess watershed scale BMP implementation efforts on phosphorus loading.

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Appendix C

Appendix C: Point Source Facilities in Ohio's Annex 4 Priority Watersheds

Watershed		Number of Permitted Outfalls	Total Annual Phosphorus Load	MTA
Within River Priority Watersheds (State of Ohio)	Maumee	342	134513	134.513
	Sandusky	104	11076	11.076
	Portage	97	13976	13.976
	Huron	44	2645	2.645
	Vermillion	24	1742	1.742
	Cuyahoga	200	135377	135.377
	Grand	102	5465	5.465
All others		584	172037	172.037
Total		1497	476831	476.831

Watershed		Number of Permitted Outfalls	Total Phosphorus Load (MTA)
Within River Priority Watersheds (State of Ohio)	Maumee	342	134.5
	Sandusky	104	11.1
	Portage	97	14.0
	Huron	44	2.65
	Vermillion	24	1.74
	Cuyahoga	200	135.4
	Grand	102	5.47
Annex 4 Priority Total		913	304.79
All others		584	172.0
Total		2410	476.8

Appendix D

Potential Beneficial Use and Restoration Projects - geographic list west to east

	Project Title	Type of Project	Implementer/Local Partner*	Status	Funding	Match	Other	Timing	USACE 204	AOC	Comments
	Western Basin Projects										
1	**Woodtick Peninsula Michigan**	Wetland Restoration	MI and OH Coastal Programs					Long			
2	**Cullen Park Wetland**	Wetland Restoration	City of Toledo	E&D	HLEF			Active		Maumee	E&D Contract Issued
3	**Riverside**	Agricultural Field Placement	Port of Toledo	Ongoing	HLEF			Complete		Maumee	Constructed/Operational
4	**Facility 3 Wetland**	Wetland Restoration	City of Oregon	E&D	HLEF			Active		Maumee	E&D Contract Issued
5	**Little Cedar Point Wetland**	Wetland Restoration	Port of Toledo					Mid		Maumee	
6	**Magee Marsh Wetland**	Wetland Restoration	ODNR/Wildlife					Mid		Maumee	
	Sandusky Bay Projects										
7	**Green and Muddy Creek Bay**	Wetland Restoration/Enhancement	City of Sandusky/ODNR, Wildlife	Phase 2	HLEF/GLRI			Mid			
8	**Western Sandusky Bay**	Coastal Marsh and/or Marsh Terrace	City of Sandusky/ODNR, Wildlife	Phase 2	HLEF/GLRI			Mid			
9	**Western Sandusky Bay**	Marsh Island Creation	City of Sandusky/ODNR, Wildlife	Phase 2	HLEF/GLRI			MId			
10	**Willow Point/Pickerel Creek Wildlife Preserves**	Nearshore Enhancement - Additional Restoration	City of Sandusky/ODNR, Wildlife	Phase 2	HLEF/GLRI			Mid			
11	**Standing Rush Wetland**	Wetland Restoration/Reconnection	Erie Soil Conserv Dist/Standing Rush	GLRI Funding	LCC		Pub/ Priv	Pending			Awaiting GLRI Award Notification
12	**Central Bay - Edison Bridge Region**	Marsh Creation and Shoreline Enhancement	City of Sandusky/ODNR, Wildlife	Phase 2	HLEF/GLRI			Mid			
1	**1. Eastern Sandusky Bay**	Nearshore Marsh Creation	City of Sandusky	E&D	HLEF			Active			E&D Contract Issued
1	**Bay Point Wetland Restoration**	Wetland Restoration/Bay Point	City of Sandusky	Phase 2	HLEF/GL			Mid			
15	**Pipe Creek Outlet to East Sandusky Bay**	Restoration/Shoreline Enhancements	Erie Soil Conserv Dist/Cedar Fair LP	GLRI Funding	LCC		Pub/ Priv	Pending			Awaiting GLRI Award Notification
16	**2. Cedar Point Causeway and Inland Areas**	Living Shoreline, Wetland Enhancement	City of Sandusky/Cedar Fair LP	E&D	HLEF		Pub/ Priv	Active			E&D Contract Issued
17	**3. East Sandusky Bay**	Marsh Restoration/Recreation	City of Sandusky	E&D	HLEF			Active			E&D Contract Issued
18	**4. Sheldon Marsh Wetland**	Beach Nourishment/Nature Based Shoreline	City of Sandusky/ODNR	E&D	HLEF?			Active			Awaiting RFQ

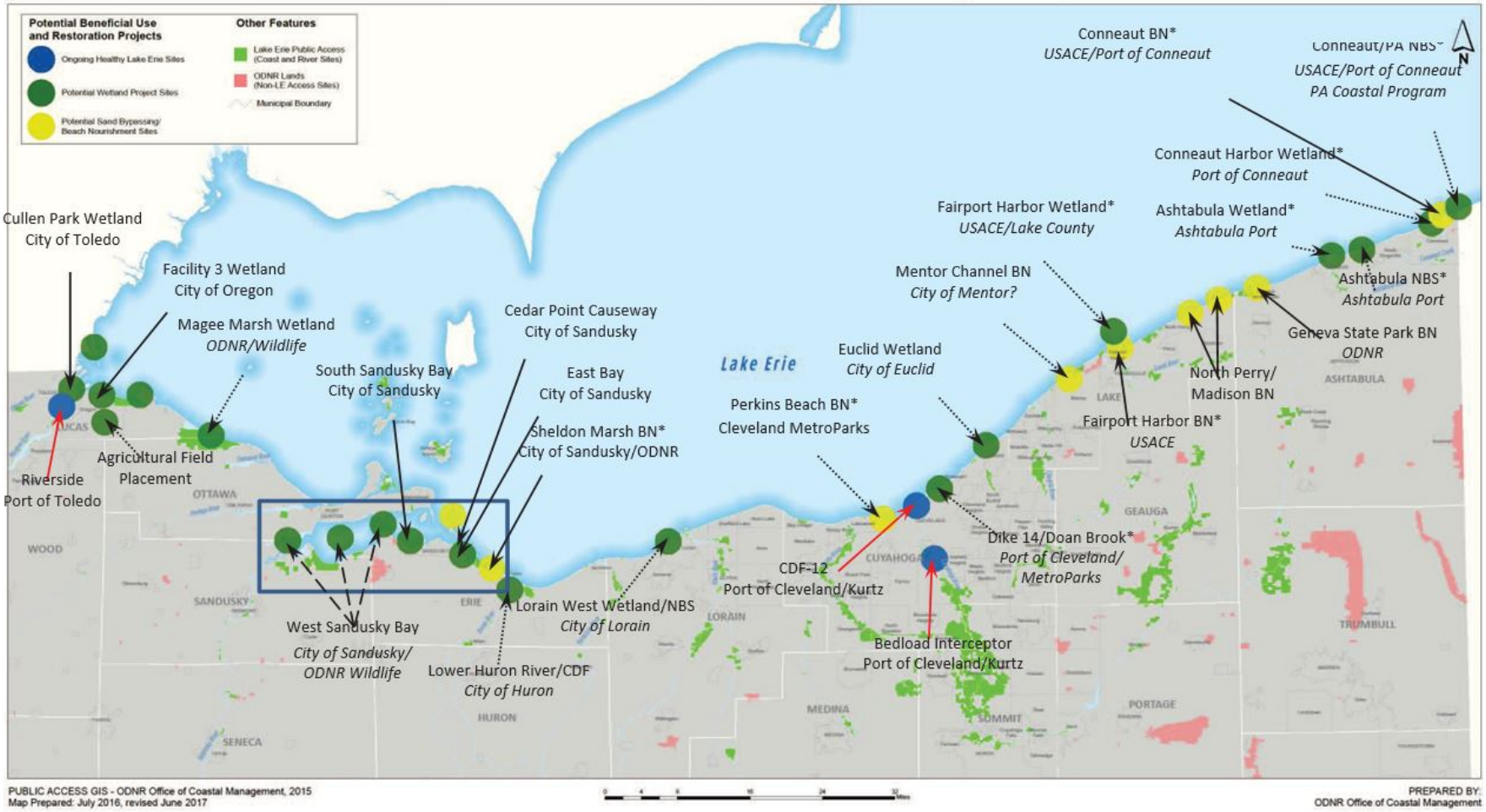
	Central Basin Projects										
19	**Huron CDF Wetland**	Wetland Restoration/Enhancement	USACE/City of Huron		USACE	City of Huron		Pending	204		LOI Executed
2	**Lower Huron River Wetland**	Wetland Enhancement	City of Huron					Mid-Long			
2	**Lorain West Wetland/NBS**	Wetland Enhancement/Nature Based	City of Lorain					Mid-Long		Black	
2	**Perkins Beach BN**	Beach Nourishment	Cleveland MetroParks					Long			
2	**CDF-10b**	Beneficial Reuse - Sediment Processing	USACE		USACE			Active			RFP Issued
2	**CDF-12**	Beneficial Reuse - Sediment Processing	Port of Cleveland/Kurtz	Ongoing	HLEF		Pub/	Complete			Constructed/Operational
2	**Bedload Interceptor**	Beneficial Reuse - Sediment	Port of Cleveland/Kurtz	Ongoing	HLEF		Pub/	Complete			Constructed/Operational
2	**Cleveland Harbor Breakwater**	Wetland Creation	USACE/Port of Cleveland	E&D				Mid-Long		Cuyahoga	
27	**Dike 14/Doan Brook**	Wetland Restoration	Port of Cleveland/MetroParks				WRDA?	Mid		Cuyahoga	
2	**Euclid Wetland**	Wetland Restoration	City of Euclid					Mid-Long			
2	**Mentor Channel BN**	Beach Nourishment	City of Mentor	Ongoing	Mentor			Active			
3	**Fairport Harbor BN**	Beach Nourishment	USACE	Ongoing	USACE			Active			
3	**Fairport Harbor Wetland**	Wetland Restoration	USACE/Lake County			Lake		Pending	204		LOI Executed
32	**North Perry BN**	Beach Nourishment	North Perry	Ongoing	North Perry			Active			
3	**Madison BN**	Beach Nourishment	Madison Township	Ongoing	Madison			Active			
3	**Geneva Stake Park BN**	Beach Nourishment	ODNR	Ongoing	ODNR			Active			
35	**Ashtabula Wetland**	Wetland Restoration	USACE/Ashtabula Port		USACE	OLEC		Active	204	Ashtabula	LOI Executed
3	**Ashtabula NBS**	Nature Based Shoreline	Ashtabula Port					Mid-Long			
3	**Conneaut Harbor Wetland**	Wetland Restoration	USACE/Port of Conneaut					Mid-Long			
38	**Conneaut BN**	Beach Nourishment	USACE/Port of Conneaut, PA Coastal	Ongoing	Conneaut			Active			
39	**Conneaut/PA NBS**	Nature Based Shoreline	USACE/Port of Conneaut, PA Coastal					Mid			

- Tentative

Lucas County - Western Basin	
Ottawa County - Western Basin + Sandusky Bay	Project constructed & operational
Sandusky County - Sandusky Bay	Project active or planned to start in 2017
Erie County - Sandusky Bay + Central Basin	USACE CAP 204 Project
Lorain County - Central Basin	
Cuyahoga County - Central Basin	
Lake County - Central Basin	
Ashtabula County - Central Basin	

BN= Beach Nourishment
CAP = Continuing Authorities Program
E&D = Engineering and Design
GLRI = Great Lakes Restoration Initiative
HLEF = Healthy Lake Erie Fund
LOI = Letter of Intent
NBS = Nature Based Shoreline
Phase 2 = E&D will be done when funding becomes available
WRDA = Water Resources Development Act

Potential Beneficial Use Restoration Projects



Appendix E

Ohio Domestic Action Plan – Major State Activities and Milestones					
Programs/Projects					
Agricultural Land Management					
Placement of Agricultural BMPs in Targeted Watersheds	Identify a suite of agriculture nonpoint BMPs to be promoted basin-wide but with a priority for placement in targeted watersheds.	Additional funds will be sought to provide cost incentives for implementing these BMPs. ODA is providing incentives payments for fertilizer placement through Healthy Lake Erie funds and Ohio Clean Lake Initiative - Impaired Watershed Restoration Program.	ODA; with USDA-NRCS, OFSWCD, OSU SWAT model team	Initial list by 1/2017 then On-going	ODA will rely on the edge-of-field research to identify the suite of most effective BMPs. Preliminary results indicate that fertilizer incorporation or placement are promising practices that could reduce P loss when compared to broadcast fertilizer application.
Strengthen and stimulate the Ohio Lake Erie Conservation Reserve Enhancement Program	Provide incentives to farmers to voluntarily establish filter strips, riparian buffers, hardwood tree plantings, wildlife habitat, and field windbreaks.	ODA has budgeted for the state incentives.	ODA; with USDA Commodity Credit Corporation	Achieve its 2004 goal of voluntarily establishing 67,000 acres of filter strips, riparian buffers, hardwood tree plantings, wildlife habitat, and field windbreaks.	ODA is working with USDA to amend the CREP agreement. (Total so far: 50,000 acres)
Ohio Clean Lake Initiative - Impaired Watershed Restoration Program	Target four of the most impaired Watershed Assessment Units (WAU) in the Western Lake Erie Basin Watershed to reduce	In 2016, ODA received a GLRI grant to fund $2.6M in BMPs.	ODA - DSWC	Practices should be installed/completed by Spring 2018.	All of these funds have been allocated.

	phosphorus loading, including dissolved phosphorus loading				
Edge of Field Monitoring and Research	Finalize and present results from edge-of-field monitoring and research, establish next steps		ODA; with USDA-ARS, NRCS, OSU	Field work will continue for several years	Dr. Kevin King presented progress report at February 2017 meeting of Concentrated Animal Feeding Facility (CAFF) Advisory Committee.
Revisions to the Tri-State Fertility Guide			ODA; with OSU	Preliminary proposal by 4/2018 Field trials will continue for several years	Dr. Steven Culman presented progress report on research and revisions to Ohio's fertility guidelines at the November 2016 meeting of the CAFF Advisory Committee.
Revisions to Phosphorus Index	Develop timeline to adjust the Index, including changes pertaining to commercial fertilizer and manure		ODA; with OSU	Preliminary proposal by 4/2018 – then Ongoing evaluation	Dr. Libby Dayton presented a progress report on the P-Index at the June 2017 CAFF advisory committee meeting.
Drainage control	Identify existing programs and consider development of new programs to install practices that reduce or eliminate water quality impacts from		ODA	On-going	

	agricultural drainage.				
Fertilizer and manure application restrictions and fertilizer certification requirements	Continue to educate producers. Implementation and enforcement of existing restrictions.		ODA; with local SWCDs	Certifications to be complete by September 30, 2017. Education and outreach will be on-going	-Over 17,400 attended Agricultural Fertilizer Applicator Training course offered by Div. of Plant Health. -Over 15,700 individuals have received Agricultural Fertilizer Applicator Certification. - Div. of Soil and Water resources developed voluntary nutrient management plan template and trained Soil & Water Conservation Districts on its use. - Div. of Livestock Environmental Permitting continues to hold Certified Livestock Managers training days - The Department will make presentations at the annual Manure Science Review in August 2017
Ohio Applicator Forecast Website	The Forecast is designed to help nutrient applicators		ODA	Finalized initial site 10/2017 Ongoing up-dates	ODA released the Ohio Applicator Forecast in May 2017

	identify times when the weather-risk for applying is low.				
Western Lake Erie Basin Technical Advisory committee	Subcommittee to the State Technical Committee to provide technical assistance specific to nutrient management issues		ODA; with NRCS	Establish by 3/2018 On-going	
Farm Stewardship Certification	Farmers that fully implement the 4Rs, including nutrient placement or nutrient application onto a living crop, will be eligible to receive this newly created certification.		ODA; with local SWCDs	ODA will run this pilot through Spring 2018 to collect information to develop a larger program.	The Agricultural Stewardship Verification Program, a small pilot program, has launched within the WLEB.
Pilot Program for Voluntary Tracking of BMPs	Establish a pilot program with Wood and Henry County SWCDs to track voluntary BMPs being implemented in select watersheds.		ODA; with Wood and Henry County SWCDs	On-going	
Streamline Agricultural Technical Assistance Programs	Encourage the establishment of streamlined processes, sign-up periods, and application requirements for various federal and state funding and		ODA; with NRCS	On-going	

	technical assistance programs.				
Assessment of the scoring criteria for Farm Bill program eligibility	Ensure that those farmers in most need of technical and financial assistance are receiving higher consideration for assistance.		ODA; with NRCS	On-going	
Stewardship Credit Program	Finalize a program to prevent nutrient loss and protect water quality through the purchase and retirement of Stewardship Credits.		OEPA; with ODA, OFSWCD	On-going	MOU to be signed in 2017
Rules for Nuisance Manure	Amend water quality standards rule 3745-01-04 to address manure.		OEPA with ODA	Initiated preliminary stakeholder meetings 10/2017 – finalize draft rule by 12/2017	
Community-Based Nutrient Reduction					
Reduce phosphorus discharge from significant minor NPDES facilities without P limits	Evaluate and determine options on a facility by facility basis for reducing the phosphorus discharge level.	Existing permit development resources	OEPA	At a minimum, each facility will be evaluated as its permit is up for renewal	Complete by end of permit cycle
Major NPDES facilities to monitor ortho-P	Implement the requirement of SB1.	Existing permit development resources	OEPA	Completed December 31, 2016	Data to be available water year 2017
Incorporate Nutrient Reduction into Storm Water Management Program	Investigate opportunities to utilize storm water management in	Existing Storm Water Program resources	OEPA	By end of 2018	Rainwater Manual revision due 2018

	addressing hydrologic factors that influence nutrient loading into Lake Erie.				
CSO Loadings	Conduct monitoring of nutrient discharge levels from priority CSOs to evaluate seasonal and annual loads.		OEPA; with NEORSD and other local authorities	Spring 2018	Incorporate into Nutrient Mass Balance Study due at end of 2018
Water Infrastructure Upgrades	Direct funding at priority CSO separation projects, wastewater treatment plant upgrades, storm water management, and home sewage treatment systems.	State Revolving Loan Fund dollars and coordinate with other infrastructure funding programs	OEPA	Ongoing	Prepare annual report
Numeric P Limit in Statute	Propose legislation that will limit all treatment works discharging waste water containing phosphorus to achieve at least a monthly average effluent concentration of 1 mg/L phosphorus.	Existing legislative liaison resources	OEPA	Ongoing	Legislation to be proposed and introduced in 2017
Biosolids/Manure Rules Consistency	Make nutrient/ manure management plans and the Biosolid Land Application and	Existing Rules development resources	OEPA and ODA	Ongoing	Rules process complete in 2017

	Management Plans rules more consistent.				
Watershed Implementation and NPS-IS Plans	Focus development of new plans in watersheds not already covered.	Re-allocation of existing dollars or new funding; GLRI	OEPA; with ODA-DSWC	Determine status of eacjh plan by 2/2018 Ongoing	Funding in hand for 13 plans to be done within the Maumee AOC ag-dominated watersheds.
Point Source Reduction BMPs	Track the installation of point source nutrient reduction BMPs installed since 2008.		OEPA; with local authorities	On-going	Have 2008 – 2016 BMP report by spring of 2018.
Operations and Maintenance of HSTS	Implementation of local Operation and Maintenance Tracking programs.		ODH; with local authorities	Initiated 2017 - On-going	All systems installed or altered under permit are enrolled in the local program. Existing systems are added according to local implementation plans.
Restoration and Support of Ecosystem Services					
Sandusky Bay Initiative	Fund and complete engineering and design work for potential in-water coastal wetland restoration projects (12 planned).	Ohio Clean Lake funds	ODNR; with OEPA and OLEC	Design work is underway for three projects; two projects to be constructed by June 2019	Project construction starting in 2018
Coastal Wetland and Shoreline Projects	Identify opportunities to restore coastal wetlands and nature-based shorelines.		ODNR; with OEPA, USACE, other federal	Six projects tentatively identified for Western Basin, 21 for central basin; three constructed;	Project construction starting in 2018

				two western basin projects in design phase	
Coordinate with USFWS/NOAA Upper Midwest and Great Lakes Landscape Conservation Cooperative (LCC) Coastal Conservation Workgroup	Identify potentially restorable coastal wetlands.		ODNR; with USFWS/NOAA Upper Midwest and Great Lakes Landscape Conservation Cooperative (LCC)	On-going	
Two coastal wetland pilot demonstration projects	Develop and implement tools to identify potentially restorable wetlands for the western basin	GLRI	ODNR; with USFWS/NOAA Upper Midwest and Great Lakes Landscape Conservation Cooperative (LCC)	On-going	
Coastal Wetland Research	Fund projects to investigate and quantify nutrient processing and reduction benefits of coastal wetlands.	CMAG?	ODNR; with Ohio Sea Grant, NOAA, Old Woman Creek NERR	On-going	
Private Lands Program Opportunities	Develop projects that include water quality benefits.			Initiate 2/2018 On-going	Establish program focus with Div of Wildlife
Explore Statewide Conservation Land Tax	Evaluate a pilot Statewide Conservation Land Tax as an incentive to landowners to place land into long-term conservation programs.	Lake Erie Protection Fund	OLEC	Spring of 2018	

Evaluate Conservancy District Model	Meet with the Maumee Conservancy District to evaluate their role related to the design, construction, funding and management of storm water management including water retention/detention options.		OLEC; with Ohio EPA, ODA, ODNR, Maumee Conservancy District	Fall of 2017	To be determined as a result of meeting with Conservancy District
Monitoring, Tracking, and Support					
Monitoring Water Quality and Tracking Progress					
Water Quality Monitoring Network	Tracking progress toward meeting the requirements of the Ohio's Domestic Action Plan and Annex 4	Restructuring of existing resources	OEPA	Changes implemented in 2017 field season; will evaluate initial results each year through 2019 to determine if further adjustments are necessary	Stations have been relocated and resources reallocated; evaluations to occur in winter 2018 and winter 2019
Track Water Quality Improvements (HUC12)	Monitor and track water quality improvements resulting from nutrient reduction practices and BMPs at the HUC 12 level.		Ohio EPA; with Heidelberg University's National Center for Water Quality Research and USGS	Annual report beginning in 2014 - Ongoing	Watershed Monitoring Report will be prepared annually for key priority watersheds
Additional Water Quality Targets	Publish a Water Quality Target for each Annex 4 priority watershed and major western Lake Erie		Ohio EPA; with OLEC and USEPA	Methodology development due April 2018 with targets for Tiffin and St Joseph Rivers;	Methodology finished April 2018; targets for first 2 due April 2018; targets for all to be completed by 2020 or

	basin HUC 8 Maumee River subwatershed.			schedule for other targets dependent on methodology needs	sooner if feasible
Consistent Protocols	Ensure a consistent sampling and lab testing protocol is in place and being followed by all agencies.		Ohio EPA; with member entities on the Annex 4 Monitoring Task Team (Ohio, Indiana, Michigan and Ontario) and USEPA	On-going -evaluate biennially	Established - will re-evaluate annually
Open Water Monitoring System	Establish a western Lake Erie open water monitoring system for the presence and amount of harmful algae and microcystin.	Existing monitoring resources	Ohio EPA; with federal and university-based research partners	Discussions are underway in 2017; changes to existing monitoring activities to begin implementation in 2018 field season	Publish monitoring plan by start of 2018 field season
DNA Analysis of Sources	Establish a DNA analysis methodology for differentiating nutrients from manure and human waste.		OEPA; with ODH	Will meet with professor developing the process 12/2017	
Improve CSO Nutrient Load Estimates	Coordinate with local authorities to evaluate the total nutrient load resulting from combined sewer overflows.		OEPA; with NEORSD and other local authorities	Conduct studies and monitoring during 2018	Improved estimates for next Nutrient Mass Balance Study due December 2018
Water Quality Status Reports	Annual update to the Ohio legislature and general public on nutrient reductions in		OLEC and member agencies; with Heidelberg University's National	Annually each spring once flow data are complete	Publication of report on OLEC website

	Ohio's Lake Erie watershed.		Center for Water Quality Research and USGS		
Tracking Funding and Practices					
Fiscal Operations Plan	Establish a guide for identifying short-term and long-term funding needs and potential funding sources including the re-allocation as well as new local, state and federal funding opportunities.		OLEC; with member agencies, federal partners and the Great Lakes Commission (Blue Accounting)	Will initiate spring of 2018	
Coordination with Funding Sources	Seek cooperation, request coordination, and review funding requests made to federal or state agencies for funding related to Lake Erie watershed projects.		OLEC	Initiate 1/2018 Ongoing	Letter to be sent to various stakeholders and grant applicants fall of 2017 outlining process
Tracking Funding	Establish methods for tracking the amount of all funds expended in Ohio for nutrient reduction to Lake Erie.		OLEC	Initiate 2/2018 On-going	Data for the most part readily available for most point sources- need work on non-point
Tracking Funding for Practices	Institute a tracking program by county showing the total public dollars allocated for nutrient management and/or		Ohio EPA; with OLEC and ODA	Innitiate 1/2018 - On-going	Will begin in spring of 2018

	reduction practices in Annex 4 priority watersheds.				
Maumee Sub-basin HUC12 Priority Watersheds	Continue to develop a process to identify and revisit and revise as necessary the Maumee sub-basin priority watersheds at the HUC 12 level (Appendix C).		OEPA; with university researchers	Research underway, expected to complete in 2018	Map revisions if necessary in later edition of Ohio DAP
Programmatic Support					
Ohio DAP Lead Agency	Ensure there is annual coordination between state and federal agencies for identifying priority programs, priority areas, and timelines related to Lake Erie and the Lake Erie Basin.		OLEC	Ongoing	Initiated through SB 2
DAP Advisory Committee	Establish DAP Advisory Committee to provide further input and evaluation to the Commission on the progress of DAP implementation		OLEC	Early 2018	Periodic meetings
Federal Farm Bill Recommendations	Coordinate inter-agency engagement and recommendations for federal Farm Bill		OLEC; with member agencies and Great Lakes Commission	Initiate state agency discussions in winter 2017	Submit Ohio's recommendations to Great Lakes Commission for combined Great

					Lakes input
Adaptive Management Process "trigger mechanism"	Coordinate the development of an Adaptive Management Process "trigger mechanism" which would cause a change of program, practice or policy if the goals are not reached or if no measurable progress is observed toward achieving the goals.		OLEC; with member agencies	Initiate with DAP Advisory Committee 2/2018 On-going	To be determined by Advisory Committee