

TMDL: Upper Mahoning River Watershed, Ohio

Effective Date:

Decision Document for Approval of the Upper Mahoning River Watershed, OH TMDL Report

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. Part 130 describe the statutory and regulatory requirements for approvable TMDLs. Additional information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable. These TMDL review guidelines are not themselves regulations. They are an attempt to summarize and provide guidance regarding currently effective statutory and regulatory requirements relating to TMDLs. Any differences between these guidelines and EPA's TMDL regulations should be resolved in favor of the regulations themselves.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal should identify the waterbody as it appears on the State's/Tribe's 303(d) list. The waterbody should be identified/georeferenced using the National Hydrography Dataset (NHD), and the TMDL should clearly identify the pollutant for which the TMDL is being established. In addition, the TMDL should identify the priority ranking of the waterbody and specify the link between the pollutant of concern and the water quality standard (see section 2 below).

The TMDL submittal should include an identification of the point and non-point sources of the pollutant of concern, including location of the source(s) and the quantity of the loading, e.g., lbs/per day. The TMDL should provide the identification numbers of the NPDES permits within the waterbody. Where it is possible to separate natural background from non-point sources, the TMDL should include a description of the natural background. This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

- (1) the spatial extent of the watershed in which the impaired waterbody is located;
- (2) the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);
- (3) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;
- (4) present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and

(5) an explanation and analytical basis for expressing the TMDL through *surrogate measures*, if applicable. *Surrogate measures* are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

Comment:

Summary: The Ohio Environmental Protection Agency (OEPA) submitted TMDLs for *E. coli*, phosphorus, and sediment to address the impairment causes of nutrients, siltation, low dissolved oxygen (DO), bacteria, flow alteration, and habitat alteration in several subwatersheds of the Upper Mahoning River Watershed. EPA is approving the TMDLs for these three pollutants contained in the subwatersheds, for a total of 47 TMDLs (Table 1, attached).

Location Description: The Upper Mahoning River Watershed is located in northeastern Ohio, in portions of Columbiana, Stark, Mahoning, Trumbull, Portage, and Geauga Counties (Section 2 of the TMDL). The Upper Mahoning extends from the headwaters in Columbiana County to just below the Leavittsburg dam, a distance of approximately 45 miles. The river flows north and northeast until it turns southeast and eventually into the Ohio River. For purposes of this TMDL, Ohio divided the Upper Mahoning River Watershed into four subwatersheds, based upon 10-digit hydrological unit codes (HUC-10). In turn, each of the HUC-10 subwatersheds is further subdivided into multiple 12-digit HUC subwatersheds (HUC-12). The Upper Mahoning River watershed covers approximately 350,000 acres (541 square miles) (Section 2 of the TMDL).

Several large reservoirs are present in the watershed. These were formed when portions of the Upper Mahoning River and larger tributaries were dammed. OEPA developed TMDLs for phosphorus for the headwaters of the Upper Mahoning River, for two reservoirs (Dale Walborn and Well Creek; treated as one unit) and the Eagle River subwatershed.

Topography and Land Use: The land use in the Upper Mahoning River Watershed is a mixture of forest, row crop agricultural, and pasture. The northern subbasins are more forested, with about 45% forest coverage and 30% cropland and pasture, while the southern subbasins are 25-35% forest and about 50% cropland/pasture (Section 2.1.2 of the TMDL). Developed lands account for between 10-20% of the land use. The City of Alliance is the largest in the watershed, with a population of 23,000. Several smaller cities are present in the watershed. The watershed is part of the Erie-Ontario Lake Plains (EOLP) Ecoregion, which consists of gently rolling plains of glacial material (Section 2.1 of the TMDL).

Pollutant of concern: OEPA has identified the Upper Mahoning River Watershed on Ohio's 2010 303(d) list as impaired due to nutrients, siltation, DO, bacteria, flow alteration, and habitat alteration (Section 1 of the TMDL). OEPA conducted a detailed assessment of the watershed in 2006 (Section 1 of the TMDL). The study supported the decision to list the watershed as impaired. To address these impairments, OEPA has determined that *E. coli*, phosphorus, and sediment are the pollutants that need to be reduced. As discussed in greater detail in Section 2 below, OEPA uses biotic standards to determine the Aquatic Life Use (ALU). OEPA has generated data showing that high levels of phosphorus and sediment often result in impairments of the biotic community (Section 2.2.2 of the TMDL). OEPA has found that the biotic community is impacted by poor habitat and siltation as a result of an excessive amount of sediments in the

streams, which is often due to channelization and surface erosion (Section 3.1 of the TMDL). The watershed is also impaired for Primary Contact Recreational (PCR) use due to high levels of *E. coli*.

Pollutant point sources: OEPA has identified 74 individual point sources in the Upper Mahoning River Watershed that are regulated by National Pollutant Discharge Elimination System (NPDES) permits (Section 5 below). No concentrated animal feeding operations (CAFOs) were identified in the watershed. OEPA noted that the three municipal separate storm sewer systems (MS4) permittees in the watershed do not discharge to impaired portions of the watershed (2.1.4 of the TMDL).

Pollutant nonpoint sources (E. coli): The Nonpoint Sources Section (Section 3.2) of the TMDL discusses the potential nonpoint sources of *E. coli*. The primary source of *E. coli* identified by OEPA is failing/improperly operating septic systems. OEPA also noted that runoff from agricultural lands or pasture contributes a significant amount of *E. coli*. Manure applied as fertilizer can runoff during storm events. This can be exacerbated by agricultural tiling, which allows shorter retention times and more direct drainage to the waterbodies. Wastewater collection (combined sewer overflows from the City of Newton Falls and inadequately treated wastewater from small plants) is also a source of *E. coli* to the waterbodies.

Pollutant nonpoint sources (phosphorus and sediment): The Nonpoint Sources Section (Section 3.2) of the TMDL discusses the potential nonpoint sources of phosphorus and sediment, which impact the aquatic life use in the watershed. OEPA determined that run-off from row crops in which sediment erodes off the cultivated soils contributes significantly to the sediment and phosphorus loads. The sediment may contain particulate phosphorus (attached to the sediment). The runoff may also contain dissolved phosphorus from the application of chemical fertilizers. The runoff of both sediment and phosphorus may be exacerbated by drainage tiles.

OEPA also determined that hydromodification is a potential cause of the aquatic life use impairment. Several of the smaller streams (particularly the headwaters streams) have been channelized to increase drainage in the watershed. This can result in higher stream flows and resulting channel erosion, which can add sediment to the stream. The channelization can also remove riparian vegetation, which increases sediment erosion. Several low head dams are present on the Upper Mahoning River and tributaries, which alters the flow regimes in the rivers and the movement of sediment and nutrients downstream. Failing septic system effluent can reach the waterbodies (i.e., via ponding, etc.) and contribute phosphorus to the waters, although OEPA has determined this is likely a minor source of phosphorus. Small livestock operations, not regulated by CAFO regulations, may be a source of phosphorus due to manure runoff near the waterbodies.

Population and growth trends: As noted in Section 2.1 of the TMDL, few portions of the watershed are experiencing significant development at this time. OEPA noted that the load duration curve process uses existing flow data, which includes actual flow results from the wastewater treatment facilities in the watershed. These flows are usually below the permitted maximum flows. OEPA accounted for future growth by adding in the difference between the actual facility flows and the permitted maximum flows.

Priority ranking: OEPA gave the watersheds a priority ranking of 4-8 (out of a maximum of 13). This prioritization is based upon the type of use that is impaired (recreational, aquatic life, fish consumption and public drinking water) and the severity of the impairment in each category. As stated in OEPA's current listing methodology, the TMDL development schedule corresponds with OEPA's basin-rotation water quality monitoring schedule in order to take advantage of all available resources for TMDL development. The basin-rotation schedule will be used unless there is a significant reason to deviate from it. Priority may be upgraded or downgraded depending on designated uses, magnitude of impairment, implementation practices by other interested parties, or availability of new guidance.

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this first element.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy (40 C.F.R. §130.7(c)(1)). EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

The TMDL submittal must identify a numeric water quality target(s) – a quantitative value used to measure whether or not the applicable water quality standard is attained. Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. The TMDL expresses the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target. Occasionally, the pollutant of concern is different from the pollutant that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as Dissolved Oxygen (DO) criteria). In such cases, the TMDL submittal should explain the linkage between the pollutant of concern and the chosen numeric water quality target.

Comment:

The Water Quality Standards and Designated Uses Section (Section 3) of the TMDL describes designated uses and numeric criteria applicable to this watershed.

E. coli:

Use Designation and Numeric Standards: These waterbodies are designated for Primary Contact Recreation (PCR) (OAC 3745-1-22), and have been determined to be impaired due to *E. coli* (Section 3.2 of the TMDL). Ohio has numeric criteria for *E. coli*, applicable from May 1 through October 31 (OAC 3745-1-07). The numeric target depends upon the subcategory of recreational use. Class A waters are the highest protected and reflects the greatest use of the waterbody for recreation; Class B and C reflect progressively less frequent recreation use. In the Upper

Mahoning Watershed, there are 106 miles designated as Class A, 255 stream miles designated as Class B and 1.9 miles are designated Secondary Contact (Figure 2-6 of the TMDL).

Table 2

Recreation use	<i>E. coli</i> (colony counts per 100 ml)	
	Seasonal geometric mean	Single sample maximum
Bathing water	126	235
Class A primary contact recreation	126	298
Class B primary contact recreation	161	523
Class C primary contact recreation	206	940
Secondary contact	1030	1030

In Ohio, bacteriological criteria apply outside the mixing zone of permitted discharges and during the defined recreation season (May 1st through October 30th). The concentration values of *E. coli* are based on the geometric mean of at least two samples collected at a single site within the same recreational season. If only one sample is available, the single sample maximum concentration can be used to determine if water quality standards are met, otherwise when more than one sample is available attainment is exclusively predicated on the geometric mean value.

Target: For all waterbodies included in the TMDL the target is the same as the applicable PCR standard and Class as per Table 2 above.

Phosphorus and Sediment:

Use Designation: All waters in Ohio have a designation for aquatic life use (OAC 3745-1-07). The Upper Mahoning River Watershed waterbodies determined to be impaired have been designated by OEPA as warmwater habitat (WWH) (Section 2.2.2 and Table 2.5 of the TMDL). OEPA has determined that the waterbodies are impaired by nutrients, siltation, low DO, bacteria, flow alteration, and habitat alteration (Section 2 of the TMDL). Waters in Ohio are also subject to OAC 3745-1-04, which states in part that all waters will be:

(A) Free from suspended solids or other substances that enter the waters as a result of human activity and that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life;

and;

(E) Free from nutrients entering the waters as a result of human activity in concentrations that create nuisance growths of aquatic weeds and algae.

Numeric Standards: OEPA also uses biocriteria to determine the health of a waterbody (OAC 3745-1-07, Table 7-15). Each use designation has a numerical criterion associated with it. The biocriteria consist of biological measures of fish health (Index of Biotic Integrity and Modified Indices of Well Being) and measures of macroinvertebrate health (Invertebrate Community Index). Together, these 3 numeric indices indicate the health of the in-stream biological community. The indices were developed using a large data base of reference sites.

Targets: OEPA has determined that reducing sediment and phosphorus levels will improve the biotic community and ensure the ALU is met (Section 3.2 of the TMDL). The TMDL explains

that siltation can negatively affect aquatic life by: smothering bottom dwelling organisms; choking the habitat; reducing the waterbody's assimilative capacity for nutrients; or contributing to the waterbody's DO sags (Sections 3.4 and 4.1 of the TMDL). The sediments also increase the amount of total suspended solids in the waterbody, which decreases the ability of the fish to forage, reduces the sunlight reaching the bottom of the waterbody and thereby reduces the beneficial rooted vegetation, and increases water temperature by absorbing more sunlight (Sections 3.4 and 4.1 of the TMDL). Finally, phosphorus can enter the waterbodies via attachment to sediment. Phosphorus can contribute additional stress on the biotic community by depleting oxygen levels, as the nutrients can stimulate the growth of algae during the day, which die at night, depleting the dissolved oxygen. Reducing nutrient loads will reduce the swings in DO which can affect biotic communities as well.

The OEPA does not have statewide numeric criteria for phosphorus. To determine the appropriate targets for the TMDL, OEPA uses a technical report entitled *Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams* (OEPA, 1999). This document provides the results of a study analyzing the effects of nutrients on the aquatic assemblages of Ohio streams and rivers. The study reaches a number of conclusions and stresses the importance and impact of habitat and other factors, which are separate from instream nutrient concentrations, on the health of biological communities. Table 3 below shows the phosphorus targets for the impaired subwatersheds.

Table 3 Phosphorus Targets

Use designation	Watershed Size	Phosphorus Target (mg/l)
WWH	Headwaters	0.08
	Wadeable	0.10
	Small River	0.17

For the Walborn/Deer Creek Reservoir, OEPA used the proposed lake criteria recently released for public review. For impoundments in the EOLP ecoregion, the resulting target for phosphorus is 32 µg/L (Table 4-5 of the TMDL).

As discussed in Attachment 1 of this document, OEPA is using the Qualitative Habitat Evaluation Index (QHEI) scores as a surrogate numerical target for sediment to assess the impacts of sedimentation and habitat alteration in the Upper Mahoning River watershed. To more closely focus efforts on the impairments due to sediment, OEPA is using a specific set of matrices that track sediment deposition in the waterbodies (Section 4.3.2 of the TMDL). The substrate, riparian characteristics, and channel matrices will be used to determine siltation effects (Table 4 below; Section 4.3.2 of the final TMDL; *Qualitative Habitat Evaluation Index Evaluation Sheet*, OEPA, 2006). OEPA has determined that attaining these targets will result in attainment of the WWH use designation.

Table 4 TMDL Targets for sediment

Sediment TMDL =	Substrate +	Channel Morphology +	Riparian Zone/ Bank Erosion	= Total
For WWH	≥13 +	≥14 +	≥5 =	≥ 32

This combination of scores allows OEPA to determine the general source, degree, and extent of siltation. The substrate matrix evaluates the type and quality of the bottom deposits, as well as the amount of finer materials (i.e., silt) that are filling in the coarser bottom materials. Filling in of the interstitial spaces between the coarser materials reduces food supplies and impacts reproduction of fish and invertebrate species. The channel matrix evaluates the stability and degree of channelization that have occurred in the waterbody and, thus, rate of in-stream erosion. The riparian category evaluates the type of bank erosion and the sediment storage capacity of riparian land directly adjacent to the waterbody (*Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI)*; OEPA, June 2006).

The EPA finds that the QHEI scores are an acceptable alternative to calculating a mass load for sediments and comply with EPA's *Protocol for Developing Sediment TMDLs* (USEPA, October 1999) and with 40 CFR 130.2(i), which states that "TMDLs can be expressed in terms of either mass per unit time, toxicity, or other appropriate measure."

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this second element.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

A TMDL must identify the loading capacity of a waterbody for the applicable pollutant. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). If the TMDL is expressed in terms other than a daily load, e.g., an annual load, the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen. The TMDL submittal should describe the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

The TMDL submittal should contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling. EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

TMDLs must take into account *critical conditions* for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. (40 C.F.R. §130.7(c) (1)). TMDLs should define applicable *critical conditions* and describe their approach to estimating both point and non-point source loadings under such *critical conditions*. In particular, the TMDL should discuss the approach used to compute and allocate non-point source loadings, e.g., meteorological conditions and land use distribution.

Comment:

E. coli: The loading capacities for *E. coli* (Tables 5-23 below) for the Upper Mahoning River watershed were determined by OEPA using the load duration curve method (LDC) (Section 4.4 and Appendix D of the TMDL). Pollutant concentrations were measured at water quality monitoring stations in the watershed (Appendix A of the TMDL). A very simplified explanation is provided below.

1. Flow data - First, continuous flow data are required, and are provided by two U.S. Geological Survey (USGS) gages, 03086500 located on the Mahoning River near Alliance, Ohio, and 03093000 located on Eagle Creek at Phalanx Station (Section Appendix D of the TMDL). The data reflect a range of natural occurrences from extremely high flows to extremely low flows over 50 years.
2. Water Quality data - This dataset is the monitored *E. coli* data as noted in Appendix A of the TMDL.
3. Load Duration Curves (Appendix D of the TMDL) - The plots are derived from the flow data and water quality data described above. Existing monitored water pollutant loads, represented by the square-shaped points on the plot, are compared to target loads, the water quality standard line. If the existing sampling results are below (less than) the target line, no reduction needs to occur. Conversely, if the existing sampling results are above (greater than) the target load, a reduction is necessary to reach the target.
4. Analysis - The final step is to link the geographic locations of load reductions needed to the flow conditions under which the exceedences occur. Specific flow regimes contributing to pollutant loads, represented by the graph, are identified to determine under what flow conditions the pollutant exceedences are occurring. The LDCs in Appendix D of the TMDL show that the exceedences occur under varied flow conditions, depending on the site. By knowing the flow conditions under which exceedences are occurring, OEPA can focus implementation activities on those sources most likely to contribute loads.

The plots show under what flow conditions the water quality exceedences occur. Those exceedences at the right side of the graph occur during low flow conditions; exceedences on the left side of the graphs occur during higher flow events, such as storm runoff. OEPA provided analysis for each LDC, to determine the flow conditions for which exceedences (or the most severe exceedences) occurred (Section 5 of the TMDL).

Using the load duration curve approach allows OEPA to determine which implementation practices are most effective for reducing pollutant loads based on flow magnitude. For example, if loads are significant during storm events, implementation efforts can target those best management practices (BMPs) that will most effectively reduce runoff. This allows for a more efficient implementation effort. These TMDLs are concentration-based, and tie directly into Ohio's water quality standard for the pollutants. The target for these TMDLs is the water quality standard, and therefore meeting this loading capacity should result in attainment of water quality standards. The load duration curve is a cost-effective TMDL approach, to address the reductions necessary to meet WQS for these pollutants.

Weaknesses of the TMDL analysis are that non-point source (NPS) load allocations were not assigned to specific sources within the watershed, and the identified sources of the pollutants were assumed based on the data collected in the watershed, rather than determined by detailed monitoring and sampling efforts. Moreover, specific source reductions were not quantified. However, EPA believes the strengths of the State's proposed TMDL approach outweigh the weaknesses and that this methodology is appropriate based upon the information available. In the event that the pollutant levels do not meet WQSs in response to implementation efforts described in the TMDL submittal, the TMDL implementation strategy may be amended as new information on the watershed is developed, to better account for contributing sources of the impairment and to determine where reductions in the Upper Mahoning River watershed are most appropriate. Natural background was not determined.

Phosphorus:

The phosphorus loading capacities for the two riverine subwatersheds are found in Section 5 of the TMDL (Tables 24-28 below). OEPA used the Generalized Watershed Loading Function (GWLF) model to determine the loading capacity for phosphorus in the Upper Mahoning River watershed (Section 4.1 of the TMDL).

The GWLF model is a mid-range model that provides monthly outputs of nutrient concentrations by simulating run-off, groundwater recharge, and streamflow using a water-balance method. The model uses land use, soil characteristics, daily precipitation and average temperature data (Section 4.1 of the TMDL). Run-off is predicted based upon precipitation events, soil characteristics, plant growth, and soil moisture levels. Groundwater recharge is determined by tracking daily water balances in both the saturated and unsaturated soil zones. Streamflow is computed as a result of the first two flows. OEPA used two gages in the Upper Mahoning River watershed to determine stream levels (Figure 4.1 of the TMDL). Ten years of precipitation data were used in the model. Several calibration runs were performed for both hydrology and nutrients to improve the fit of the model (Figure 4.2 and Appendix D of the TMDL). OEPA discussed the strengths and weaknesses of the modeling approach, and compared predicted modeling results to those observed by sampling in Appendix D of the TMDL. Results show the model appropriately represents the system. Further information is in Appendix D of the TMDL.

For the Wellborn/Deer Creek Reservoirs, OEPA used the GWLF model in conjunction with the BATHTUB model (Section 4.2 of the TMDL). The GWLF model discussed above was used to determine the nutrient load entering the reservoir from the watershed. To determine in-lake water quality, OEPA used the BATHTUB. The BATHTUB model applies a series of empirical equations derived from assessments of lake data and performs steady state water and nutrient calculations based on lake morphometry and tributary inputs. The BATHTUB model requires fairly simple inputs to predict phosphorus loadings and concentrations. The model accounts for pollutant transport, sedimentation, and nutrient cycling.

Sediment: As discussed previously in Section 2 above, OEPA is using a subset of habitat scores to determine impairments due to sediments. The QHEI components assess the impacts of sediments on a habitat. Tables 29-32 below show the component scores for numerous locations in the subwatersheds. As explained above, by reducing sediment into the waterbodies, the habitat

will improve, thereby allowing the biologic community to meet its designated use. The sediment loading capacities are the sediment targets in Table 4 above.

Although OEPA analyzed both the sediment subscores and the overall QHEI scores, EPA believes the sediment scores are the primary measure of the sediment impacts on the water quality and biota. Therefore, only those locations where the sediment TMDL targets were exceeded are considered by the EPA to be TMDLs (Tables 29-32, below).

As discussed above in Section 2, the QHEI subset of scores are an acceptable alternative to calculating a mass load for sediments and comply with EPA's *Protocol for Developing Sediment TMDLs* (USEPA, October 1999) and with 40 CFR 130.2(i), which states that "TMDLs can be expressed in terms of either mass per unit time, toxicity, or other appropriate measure." These scores apply on a daily basis, and therefore are considered "daily loads".

Critical condition:

E. coli: OEPA determined that the critical condition for pathogens is the summer dry period, when the flows are the lowest and dilution is limited (Section 4.4.5 of the TMDL). This is also the time period when recreational use occurs. The TMDLs were developed specifically to address the summer recreational season.

Phosphorus: OEPA determined that the critical condition for nutrients in both rivers and lakes is the summer dry period, when the flows are the lowest and dilution is limited (Sections 4.2 and 4.3 of the TMDL). Temperatures are higher, and sunlight is greater, allowing more algal growth. The lower flows allow filamentous and/or other types of algae to grow. In lakes, detention time is greater, allowing increased time for algal growth. The TMDLs were developed specifically to address the summer recreational season

Sediment: OEPA determined that the critical condition for sediment is the summer low flow season, when stress on the biotic community is greatest (Section 4.3 of the TMDL). The presence of high-quality habitat features, such as deep pools and unembedded substrate, is an essential niche to provide refuge for aquatic life. The sediment scores and overall QHEI quantifies these critical habitat features. The sediment scores are assessed during the summer field season and are therefore reflective of the critical condition.

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this third element.

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity attributed to existing and future non-point sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, load allocations should be described separately for natural background and non-point sources.

Comments:

The LAs for *E. coli* for the Upper Mahoning River Watershed are in Tables 5-23 below (Section 5 of the TMDL). OEPA did not calculate a natural background load.

The LAs for phosphorus are found in Tables 24-28 below (Section 5 of the TMDL). OEPA determined LAs for various source loads (urban, pasture, cropland, etc.) and determined reductions needed to achieve water quality standards. The reductions are for spring and summer, when load reductions are needed.

The LAs for sediment are found in Tables 29-32 below. For sediment, the LA can be considered the same as the loading capacity; that is, the sediment target scores. As discussed in Attachment 1, the EPA finds that the QHEI sediment scores are an acceptable alternative to calculating a mass load for sediments and comply with EPA's *Protocol for Developing Sediment TMDLs* (USEPA, October 1999) and with 40 CFR 130.2(i), which states that "TMDLs can be expressed in terms of either mass per unit time, toxicity, or other appropriate measure." These scores apply on a daily basis, and therefore are considered "daily loads".

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this fourth element.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit.

The individual WLAs may take the form of uniform percentage reductions or individual mass based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. These individual WLAs may be adjusted during the NPDES permitting process. If the WLAs are adjusted, the individual effluent limits for each permit issued to a discharger on the impaired water must be consistent with the assumptions and requirements of the adjusted WLAs in the TMDL. If the WLAs are not adjusted, effluent limits contained in the permit must be consistent with the individual WLAs specified in the TMDL. If a draft permit provides for a higher load for a discharger than the corresponding individual WLA in the TMDL, the State/Tribe must demonstrate that the total WLA in the TMDL will be achieved through reductions in the remaining individual WLAs and that localized impairments will not result. All permittees should be notified of any deviations from the initial individual WLAs contained in the TMDL. EPA does not require the establishment of a new TMDL to reflect these revised allocations as long as the total WLA, as expressed in the TMDL, remains the same or decreases, and there is no reallocation between the total WLA and the total LA.

Comments:

E. coli: The WLAs for *E. coli* for the Upper Mahoning River Watershed are in Tables 33-36 below. The WLAs are based upon each facility's design flow and NPDES permit limits. OEPA did not identify any MS4 systems discharging to the TMDL areas (Section 2.1.4 of the TMDL).

No WLA was calculated for CAFOs or CSOs in the watershed; therefore the WLA = 0. The WLA for point source home sewage treatment systems (HSTS) is 0.

Phosphorus: The WLAs for phosphorus for the Upper Mahoning River Watershed are in Tables 37-39 below. The WLAs are based upon each facility's design flow and reducing effluent limits to 1 mg/L for larger facilities and 3.0 for minor facilities, unless the limits are already lower. OEPA did not identify any MS4 systems discharging to the TMDL areas (Section 2.1.4 of the TMDL). No WLA was calculated for CAFOs or CSOs in the watershed; therefore the WLA = 0. The WLA for point source HSTS is 0.

Sediment: OEPA did not identify any point sources that discharge sediment. The WLA for sediment is 0.

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this fifth element.

6. Margin of Safety

The statute and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

Comments:

E. coli: For bacteria, the MOS is based upon both an implicit and explicit MOS. The implicit MOS is based upon the assumption of zero die-off of *E. coli* (Section 4.4.3 of the TMDL). OEPA assumed that all pathogen loads that enter the waterbody are passed downstream, when in reality there is some amount of die-off. Many different factors affect the survival of pathogens in water, such as sunlight, temperature, salinity, and nutrient deficiencies (*EPA's Protocol for Developing Pathogen TMDLs*, 1999). Because pathogens have a limited capability of surviving outside of their hosts, a rate of decay would normally be used. Applying a rate of decay, however, could result in a loading that would be greater than the WQS. Therefore, OEPA determined that zero die-off provided a conservative assumption for the MOS. The explicit MOS is 20%, which is based upon the results of recent OEPA studies.

Phosphorus: An explicit MOS of 5% was used by OEPA for the phosphorus TMDLs (Section 4.2 of the TMDL). OEPA believes this is appropriate as the hydrology calibration and water quality calibration are in good agreement, thus fairly representing the system.

Sediment: For the sediment TMDLs, the MOS was implicitly incorporated into the TMDLs by using conservative target values. The target values that have been determined for QHEI and the fish community are based upon relatively unimpacted streams. Attainment, however, can occur at

values lower than those values used for the targets in the TMDL (Section 4.3 of the TMDL); the difference between the values provides implicit MOS.

OEPA relies on biocriteria in determining impairments for waterbodies. By using this approach, OEPA believes that those waters that are truly impaired are listed, even if they are meeting numeric chemical criteria. This reduces the number of “false positives,” or a situation where water meets all numeric chemical criteria, yet the fish community, which OEPA believes is the truest measure of a stream’s health, is impaired. In addition, this biocriteria approach also ensures that a water body is not delisted until the fish community is recovered, thus reducing uncertainty in determining the sediment impacts on the biology.

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this sixth element.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variations. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Comments:

For *E. coli*, the load duration curve process accounts for seasonal variation by using daily flow values over a multi-year period. For phosphorus, the GWLF model uses long-term precipitation values, and OEPA used the output to determine loads based upon the season. For sediment, seasonal variation is accounted for in the development and use of the QHEI subscores. These scores are based upon analysis of years of data and inherently measures seasonal impacts on the habitat and the related biota scores. The implementation measures discussed in Sections 8 and 10 below will affect *E. coli* and sediment loads year-round (Section 5 of the TMDL).

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this seventh element.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by point sources only, the issuance of a National Pollutant Discharge Elimination System (NPDES) permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with “the assumptions and requirements of any available wasteload allocation” in an approved TMDL.

When a TMDL is developed for waters impaired by both point and non-point sources, and the WLA is based on an assumption that non-point source load reductions will occur, EPA’s 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that non-point source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the

load and wasteload allocations, has been established at a level necessary to implement water quality standards.

EPA's August 1997 TMDL Guidance also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by non-point sources. However, EPA cannot disapprove a TMDL for non-point source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

Comments:

Section 6 and Appendix E of the TMDL document the various reasonable assurance mechanisms that are available in the watershed. Appendix E of the TMDL focuses on the various programs that are available to be applied in the watershed, while Section 6 of the TMDL discusses in more detail ongoing activities, and priority areas for pollutant-reduction activities.

In Section 6 of the TMDL, each HUC-12 has been analyzed, and specific locations noted where activities are needed. For example, locations where gullies are a particular problem, where riparian growth has been removed, or where livestock access to the waterbody needs to be controlled are identified. Locations of small subdivisions where bacteria counts or sewage impacts are found are noted, so appropriate action can be taken to deal with failing septic systems. This detailed identification of sources will allow OEPA to more efficiently target funding and activities to reduce sediment, phosphorus, and pathogens.

OEPA also noted the recommended NPDES changes for several permitted systems in the watershed. The city of Newton Falls currently is working with OEPA to implement the Long Term Control Plan to control the Combined Sewer Overflows into the Mahoning River. OEPA believes this will have a very significant effect on bacteria loads and resulting concentrations in the lower portion of the Upper Mahoning River.

EPA finds that the TMDL document submitted by OEPA addresses this eighth element.

9. Monitoring Plan to Track TMDL Effectiveness

EPA's 1991 document, Guidance for Water Quality-Based Decisions: The TMDL Process (EPA 440/4-91-001), recommends a monitoring plan to track the effectiveness of a TMDL, particularly when a TMDL involves both point and non-point sources, and the WLA is based on an assumption that non-point source load reductions will occur. Such a TMDL should provide assurances that non-point source controls will achieve expected load reductions and, such TMDL should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring and leading to attainment of water quality standards.

Comments:

OEPA will continue to conduct long-term monitoring in the watershed to determine the effectiveness of the measures being implemented (Section 6.6 of the TMDL). At a minimum, NPDES permit holders will conduct sampling as required in their permits and OEPA will pursue

adding sampling requirements in the NPDES permits for those facilities without it. Previous sampling efforts were done in 1994, 2003 (for the Ravenna Ammunition plant) and in 2006. OEPA will continue monitoring activities as part of the rotating basin monitoring approach. The next monitoring effort is planned for 2022. Once most of the implementation plan items have been carried out and/or the chemical water quality has shown consistent and stable improvement, OEPA will complete a full scale biological and chemical watershed assessment to evaluate the attainment of designated uses.

EPA finds that the TMDL document submitted by OEPA addresses this ninth element.

10. Implementation

EPA policy encourages Regions to work in partnership with States/Tribes to achieve non-point source load allocations established for 303(d)-listed waters impaired by non-point sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that non-point source LAs established in TMDLs for waters impaired solely or primarily by non-point sources will in fact be achieved. In addition, EPA policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

Comment:

OEPA included discussion in the TMDL report detailing proposed implementation recommendations (Section 6 and Appendix E of the TMDL and Section 8 above). OEPA has noted numerous efforts that are and could be implemented in the watershed to reduce phosphorus, sediment, and *E. coli* loads. Manure application control, failed septic system elimination, stream restoration, low-impact development, and riparian protection are all discussed as options that can reduce loads in the watershed. While this section of the TMDL was reviewed, it did not affect EPA's decision to approve the TMDLs.

EPA finds that the TMDL document submitted by OEPA addresses this tenth element.

11. Public Participation

EPA policy is that there should be full and meaningful public participation in the TMDL development process. The TMDL regulations require that each State/Tribe must subject calculations to establish TMDLs to public review consistent with its own continuing planning process (40 C.F.R. §130.7(c)(1)(ii)). In guidance, EPA has explained that TMDLs submitted to EPA for review and approval should describe the State's/Tribe's public participation process, including a summary of significant comments and the State's/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. §130.7(d)(2)).

Provision of inadequate public participation may be a basis for disapproving a TMDL. If EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

Comments:

The public comment period for this TMDL project began on June 15, 2011 and ended on July 18, 2011. A copy of the public notice, fact sheet, and draft TMDL report was posted on the OEPA website and mailed to local officials, local libraries, and watershed groups. One comment letter was received and OEPA responded appropriately. The comments and OEPA responses are included in Appendix F of the TMDL.

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this eleventh element.

12. Submittal Letter

A submittal letter should be included with the TMDL submittal, and should specify whether the TMDL is being submitted for a technical review or final review and approval. Each final TMDL submitted to EPA should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final review and approval, should contain such identifying information as the name and location of the waterbody, and the pollutant(s) of concern.

Comment:

The transmittal letter from Scott J. Nally, Director, OEPA, to Tinka Hyde, Director, Water Division, Region 5 EPA, was dated August 26, 2011. The letter stated clearly that this was a TMDL submittal under Section 303(d) of the CWA. The letter also contains the name of the watershed as it appears on the Ohio 303(d) list and the causes/pollutants of concern. This decision document addresses the approval of 47 TMDLs submitted by OEPA. These TMDLs are for the subwatersheds listed in Table 1 for the pollutants phosphorus, sediment and *E. coli*.

EPA finds that the TMDL document submitted by OEPA satisfies all requirements of this twelfth element.

13. Conclusion

After a full and complete review, EPA finds that the TMDLs for the Upper Mahoning River Watershed satisfy all of the elements of approvable TMDLs. This approval is for a total of **47** TMDLs. EPA's approval of this TMDL does not extend to those waters that are within Indian Country, as defined in 18 U.S.C. Section 1151. EPA is taking no action to approve or disapprove TMDLs for those waters at this time. EPA or eligible Indian Tribes, as appropriate, will retain responsibilities under the CWA Section 303(d) for those waters.

Table 1 List of watersheds containing approved TMDLs

HUC-10 Watershed	HUC-12 subwatershed	pollutant
Headwaters to Upper Mahoning River 05030101-01	05030101-01 010; N01K26., N01K25, N01K24	<i>E. coli</i> (3 total)
	05030101-01 020; N01K13, N01K14	<i>E. coli</i> (2 total)
	05030101-01 030; N01S12	<i>E. coli</i>
	Mahoning River RM 91.11; RM 85.51	Sediment (2 total)
	Little Beech Creek RM 1.83	Sediment
	Fish Creek RM 2.0	Sediment
	05030101-01 010 and 030(watershed load)	Phosphorus
Deer Creek- Mahoning River 05030101-02	05030101-02 010; 300025, N01K12	<i>E. coli</i> (2 total)
	05030101-02 020; Kale Creek	<i>E. coli</i>
	05030101-02 030; 300061, N01K01	<i>E. coli</i> (2 total)
	05030101-02 040; N01K06	<i>E. coli</i>
	Mill Creek RM 6.28	Sediment
	Island Creek RM 2.65	Sediment
	Garfield Ditch RM 0.66	Sediment
	Trib to Mill Creek at RM 3.67 (RM 1.10)	Sediment
	05030101-02 010 and 020 (watershed load)	phosphorus
West Branch Mahoning River 05030103-03	05030103-03 010; N02W07	<i>E. coli</i>
	05030103-03 020; 300022	<i>E. coli</i>
	05030103-03 030; N02K23	<i>E. coli</i>
	05030103-03 040; N02K20	<i>E. coli</i>
	05030103-03 050; N02P12	<i>E. coli</i>
	05030103-03 060; N02S12	<i>E. coli</i>
	Kale Creek RM 13.08, 11.27	Sediment (2 total)
	Harmon Brook RM 0.49	Sediment
	Trib to West Branch Mahoning River at RM 0.01 (RM 2.10)	Sediment
	Trib to West Branch Mahoning River at RM 8.28 (RM 0.27)	Sediment
	Trib to Kale Creek RM 1.08	Sediment
Eagle Creek – Mahoning River 05030103-04	05030103-04 010; N02S02, N02S03	<i>E. coli</i> (2 total)
	05030103-04 020; N02K06	<i>E. coli</i>
	05030103-04 030; N02K09, N02K10	<i>E. coli</i> (2 total)
	05030103-04 040; N02K02	<i>E. coli</i>
	05030103-04 050; N02P08	<i>E. coli</i>
	05030103-04 060; 602280, N03S64	<i>E. coli</i> (2 total)
	Chocolate Run RM 0.11	Sediment
	Nelson Ditch RM 0.4	Sediment
	Mahoning Creek RM 0.7	Sediment
	05030103-04 010, 030, 040 (watershed load)	phosphorus

Table 5. TMDL Summary for *E. coli* for HUC 05030101-01 010:

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N01K26 - Mahoning River (RM 97.69; Drainage area = 19.14 square miles)					
Samples Collected		2	2		
Sample Median Load		310	466		
NPDES Point Source Existing Load	0.15	0.15	0.15	0.15	0.15
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	103.7	7.1	2.5	1.2	0.9
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	88.5%	97.3%	No Data	No Data
LA (Non-Point Allocation)	518.33	35.48	12.38	5.87	4.36
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	25.92	1.78	0.63	0.30	0.23
WLA (NPDES Point/MS4 permits)	0.15	0.15	0.15	0.15	0.15
TMDL minus (MOS + Future Growth)	518.48	35.64	12.53	6.02	4.51
N01K25 - Tributary to Mahoning River at RM 97.11 (RM 1.15; Drainage area = 4.30 square miles)					
Samples Collected		2	2		
Sample Median Load		89	14		
NPDES Point Source Existing Load	0.12	0.12	0.12	0.12	0.12
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	28.8	2.0	0.7	0.3	0.3
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	88.9%	75.0%	No Data	No Data
LA (Non-Point Allocation)	143.76	9.77	3.38	1.55	1.14
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	7.19	0.49	0.17	0.08	0.06
WLA (NPDES Point/MS4 permits)	0.12	0.12	0.12	0.12	0.12
TMDL minus (MOS + Future Growth)	143.88	9.89	3.50	1.67	1.26
N01K24 - Beaver Run (RM 1.19; Drainage area = 4.80 square miles)					
Samples Collected		2	2		
Sample Median Load		50	29		
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	32.1	2.2	0.8	0.4	0.3
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	77.7%	86.6%	No Data	No Data
LA (Non-Point Allocation)	160.62	11.06	3.88	1.89	1.42
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	8.03	0.55	0.19	0.09	0.07
WLA (NPDES Point/MS4 permits)	0.00	0.00	0.00	0.00	0.00
TMDL minus (MOS + Future Growth)	160.62	11.06	3.88	1.89	1.42

Table 6 TMDL Summary for *E. coli* for HUC 05030101-01 020:

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N01K13 - Little Beech Cr. (RM 1.83; Drainage area = 9.00 square miles)					
Samples Collected		2	2		
Sample Median Load		140	64		
Point Source Load	0.21	0.21	0.21	0.21	0.21
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	47.1	3.2	1.1	0.5	0.4
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	88.4%	91.1%	No Data	No Data
LA (Non-Point Allocation)	235.48	15.99	5.48	2.52	1.83
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	11.78	0.81	0.28	0.14	0.10
WLA (NPDES Point/MS4 permits)	0.21	0.21	0.22	0.22	0.22
TMDL minus (MOS + Future Growth)	235.69	16.20	5.70	2.74	2.05
N01K14 - Beech Cr. (RM 3.54; Drainage area = 17.40 square miles)					
Samples Collected		2	2		
Sample Median Load		310	69		
Point Source Load	0.14	0.14	0.14	0.14	0.14
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	91.1	6.3	2.2	1.1	0.8
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	89.9%	84.1%	No Data	No Data
LA (Non-Point Allocation)	455.50	31.18	10.85	5.13	3.83
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	22.78	1.57	0.55	0.26	0.20
WLA (NPDES Point/MS4 permits)	0.14	0.14	0.14	0.14	0.14
TMDL minus (MOS + Future Growth)	455.65	31.32	11.00	5.28	3.97

Table 7 TMDL Summary for *E. coli* for HUC 05030101-01 030:

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N01S12 - Mahoning River (RM 84.99; Drainage area = 90.00 square miles)					
Samples Collected		3	2		
Sample Median Load		634	77		
NPDES Point Source Existing Load	8.57	8.57	8.57	8.57	8.57
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	471.3	32.4	11.4	5.5	4.1
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	74.5%	26.0%	No Data	No Data
LA (Non-Point Allocation)	2,348.11	153.41	48.30	18.73	11.90
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	117.83	8.10	2.84	1.37	1.02
WLA (NPDES Point/MS4 permits)	8.57	8.57	8.57	8.57	8.57
TMDL minus (MOS + Future Growth)	2356.68	161.98	56.87	27.30	20.47

Table 8 TMDL Summary for *E. coli* for HUC 05030101-02 010:

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
300025 - Deer Cr. (RM 2.90; Drainage area = 33.84 square miles)					
Samples Collected	1	3	5	1	
Sample Median Load	2,819	3,085	42	25.4	
NPDES Point Source Existing Load	1.11	1.11	1.11	1.11	1.11
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	157.6	10.8	3.8	1.8	1.4
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	72.0%	98.2%	54.2%	63.9%	No Data
LA (Non-Point Allocation)	787.07	53.07	17.93	8.04	5.75
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	39.41	2.71	0.95	0.46	0.34
WLA (NPDES Point/MS4 permits)	1.11	1.11	1.11	1.11	1.11
TMDL minus (MOS + Future Growth)	788.18	54.18	19.04	9.15	6.86
N01K12 - Deer Cr. (RM 10.87; Drainage area = 3.50 square miles)					
Samples Collected		1	2	1	
Sample Median Load		120	54	7.4	
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	18.3	1.3	0.4	0.2	0.2
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	94.7%	95.9%	85.4%	No Data
LA (Non-Point Allocation)	91.67	6.31	2.22	1.09	0.81
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	4.58	0.32	0.11	0.05	0.04
WLA (NPDES Point/MS4 permits)	0.00	0.00	0.00	0.00	0.00
TMDL minus (MOS + Future Growth)	91.67	6.31	2.22	1.09	0.81

Table 9 TMDL Summary for *E. coli* for HUC 05030101-02 020:

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
300062 - Kale Cr. (RM 3.38; Drainage area = 7.20 square miles)					
Samples Collected	1	5	5	2	
Sample Median Load	4,551	975	27	28.6	
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	37.7	2.6	0.9	0.4	0.3
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	95.9%	98.7%	82.9%	92.3%	No Data
LA (Non-Point Allocation)	188.54	12.97	4.56	2.19	1.65
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	9.43	0.65	0.23	0.11	0.08
WLA (NPDES Point/MS4 permits)	-	-	-	-	-
TMDL minus (MOS + Future Growth)	188.54	12.97	4.56	2.19	1.65

Table 10 TMDL Summary for *E. coli* for HUC 05030101-02 030:

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
300061 - Mill Cr. (RM 3.38; Drainage area = 19.10 square miles)					
Samples Collected	1	3	6	1	
Sample Median Load	35,775	18,385	88	84.3	
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	100.0	6.9	2.4	1.2	0.9
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	98.6%	99.8%	86.2%	93.1%	No Data
LA (Non-Point Allocation)	500.16	34.38	12.08	5.80	4.37
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	25.01	1.72	0.60	0.29	0.22
WLA (NPDES Point/MS4 permits)	-	-	-	-	-
TMDL minus (MOS + Future Growth)	500.16	34.38	12.08	5.80	4.37
N01K01 - Turkey Broth Cr. (RM 3.36; Drainage area = 4.90 square miles)					
Samples Collected		1	3	1	
Sample Median Load		1,218	571	7.7	
NPDES Point Source Existing Load	0.15	0.15	0.15	0.15	0.15
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	32.8	2.3	0.8	0.4	0.3
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	99.1%	99.3%	74.9%	No Data
LA (Non-Point Allocation)	163.81	11.13	3.82	1.78	1.30
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	8.20	0.56	0.20	0.10	0.07
WLA (NPDES Point/MS4 permits)	0.15	0.15	0.15	0.15	0.15
TMDL minus (MOS + Future Growth)	163.96	11.28	3.97	1.92	1.45

Table 11 TMDL Summary for *E. coli* for HUC 05030101-02 040:

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N01K06 - Island Cr. (RM 2.65; Drainage area = 4.20 square miles)					
Samples Collected		1	2	1	
Sample Median Load		181	346	0.2	
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	22.0	1.5	0.5	0.3	0.2
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	95.8%	99.2%	None	No Data
LA (Non-Point Allocation)	109.99	7.57	2.66	1.28	0.96
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	5.50	0.38	0.13	0.06	0.05
WLA (NPDES Point/MS4 permits)	-	-	-	-	-
TMDL minus (MOS + Future Growth)	109.99	7.57	2.66	1.28	0.96

Table 12 TMDL Summary for *E. coli* for HUC 05030101-03 010:

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Rec Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02W07 - Island Cr. (RM 2.65; Drainage area = 21.90 square miles)					
Samples Collected	1	3	5	1	
Sample Median Load	38,456	501	24	32.9	
NPDES Point Source Existing Load	0.01	0.01	0.01	0.01	0.01
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	114.7	7.9	2.8	1.3	1.0
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	98.5%	92.1%	42.1%	79.8%	No Data
LA (Non-Point Allocation)	573.47	39.42	13.82	6.65	4.97
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	28.67	1.97	0.69	0.33	0.25
WLA (NPDES Point/MS4 permits)	0.01	0.01	0.01	0.01	0.01
TMDL minus (MOS + Future Growth)	573.48	39.43	13.84	6.66	4.98

Table 13 TMDL Summary for *E. coli* for HUC 05030101-03 020

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
300022 - Headwaters West Branch Mahoning River (RM 20.94; Drainage area = 21.80 square miles)					
Samples Collected	2	2	5	1	
Sample Median Load	14,017	1,818	36	51.6	
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	114.2	7.8	2.8	1.3	1.0
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	95.9%	97.8%	62.2%	87.2%	No Data
LA (Non-Point Allocation)	570.84	39.24	13.79	6.63	4.98
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	28.54	1.96	0.69	0.33	0.25
WLA (NPDES Point/MS4 permits)	-	-	-	-	-
TMDL minus (MOS + Future Growth)	570.84	39.24	13.79	6.63	4.98

Table 14 TMDL Summary for *E. coli* for HUC 05030101-03 030

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02K23 - Barrel Run (RM 3.65; Drainage area = 10.20 square miles)					
Samples Collected	1	1	1	1	
Sample Median Load	1,833	96	126	65.2	
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	68.3	4.7	1.7	0.8	0.6
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	81.4%	75.5%	93.5%	93.9%	No Data
LA (Non-Point Allocation)	341.31	23.48	8.26	3.97	2.99
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	17.07	1.17	0.41	0.20	0.15
WLA (NPDES Point/MS4 permits)	-	-	-	-	-
TMDL minus (MOS + Future Growth)	341.31	23.48	8.26	3.97	2.99

Table 15 TMDL Summary for *E. coli* for HUC 05030101-03 040

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02K20 - Silver Cr. (RM 1.83; Drainage area = 9.30 square miles)					
Samples Collected	1	1	1	1	
Sample Median Load	3,232	74	20	62.9	
NPDES Point Source Existing Load	0.39	0.39	0.39	0.39	0.39
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	48.7	3.3	1.2	0.6	0.4
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	92.5%	77.5%	70.5%	95.5%	No Data
LA (Non-Point Allocation)	243.14	16.36	5.51	2.45	1.73
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	12.18	0.84	0.29	0.14	0.11
WLA (NPDES Point/MS4 permits)	0.39	0.39	0.39	0.39	0.39
TMDL minus (MOS + Future Growth)	243.53	16.75	5.89	2.84	2.12

Table 16 TMDL Summary for *E. coli* for HUC 05030101-03 050

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02P12 - West Branch Mahoning River (RM 0.36; Drainage area = 103.00 square miles)					
Samples Collected	2	2	5	1	
Sample Median Load	100,923	2,183	101	96.8	
NPDES Point Source Existing Load	1.57	1.57	1.57	1.57	1.57
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	539.4	37.1	13.0	6.2	4.7
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	97.3%	91.5%	35.4%	67.7%	No Data
LA (Non-Point Allocation)	2,695.51	183.81	63.51	29.67	21.86
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	134.85	9.27	3.25	1.56	1.17
WLA (NPDES Point/MS4 permits)	1.57	1.57	1.57	1.57	1.57
TMDL minus (MOS + Future Growth)	2697.08	185.38	65.08	31.25	23.43

Table 17 TMDL Summary for *E. coli* for HUC 05030101-03 060

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02S12 - Mahoning River (RM 56.53; Drainage area = 307.00 square miles)					
Samples Collected	1	1	1	1	
Sample Median Load	34,210	2,370	340	323.2	
NPDES Point Source Existing Load	58.62	58.62	58.62	58.62	58.62
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	1607.8	110.5	38.8	18.6	14.0
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	76.5%	76.7%	43.0%	71.2%	No Data
LA (Non-Point Allocation)	7,980.23	493.89	135.31	34.47	11.19
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	401.94	27.63	9.70	4.65	3.49
WLA (NPDES Point/MS4 permits)	58.62	58.62	58.62	58.62	58.62
TMDL minus (MOS + Future Growth)	8038.85	552.52	193.94	93.10	69.82

Table 18 TMDL Summary for *E. coli* for HUC 05030101-04 010

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02S02 - South Fork Eagle Cr. (RM 2.3; Drainage area = 5.20 square miles)					
Samples Collected	1		3		
Sample Median Load	213		7		
NPDES Point Source Existing Load	0.06	0.06	0.06	0.06	0.06
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	34.8	2.4	0.8	0.4	0.3
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	18.2%	No Data	40.5%	No Data	No Data
LA (Non-Point Allocation)	173.94	11.91	4.16	1.95	1.45
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	8.70	0.60	0.21	0.10	0.08
WLA (NPDES Point/MS4 permits)	0.06	0.06	0.06	0.06	0.06
TMDL minus (MOS + Future Growth)	174.01	11.97	4.22	2.02	1.51
N02S03 - Silver Cr. (RM 0.79; Drainage area = 11.20 square miles)					
Samples Collected	1		3		
Sample Median Load	849		20		
NPDES Point Source Existing Load	1.22	1.22	1.22	1.22	1.22
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	74.9	5.2	1.8	0.9	0.7
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	55.9%	No Data	54.2%	No Data	No Data
LA (Non-Point Allocation)	373.52	24.56	7.83	3.13	2.06
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	18.74	1.29	0.45	0.22	0.16
WLA (NPDES Point/MS4 permits)	1.22	1.22	1.22	1.22	1.22
TMDL minus (MOS + Future Growth)	374.74	25.78	9.04	4.35	3.28

Table 19 TMDL Summary for *E. coli* for HUC 05030101-04 020

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02K06 - South Fork Eagle Cr. (RM 2.3; Drainage area = 23.50 square miles)					
Samples Collected	1		3		
Sample Median Load	1,470		69		
NPDES Point Source Existing Load	2.74	2.74	2.74	2.74	2.74
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	157.3	10.8	3.8	1.8	1.4
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	46.5%	No Data	72.4%	No Data	No Data
LA (Non-Point Allocation)	783.54	51.30	16.23	6.36	4.10
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	39.31	2.70	0.95	0.46	0.34
WLA (NPDES Point/MS4 permits)	2.74	2.74	2.74	2.74	2.74
TMDL minus (MOS + Future Growth)	786.28	54.04	18.97	9.11	6.84

Table 20 TMDL Summary for *E. coli* for HUC 05030101-04 030

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02K09 - Mahoning Cr. (RM 0.7; Drainage area = 3.70 square miles)					
Samples Collected	1		3		
Sample Median Load	490		14		
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	24.8	1.7	0.6	0.3	0.2
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	74.7%	No Data	78.7%	No Data	No Data
LA (Non-Point Allocation)	123.81	8.54	2.99	1.45	1.10
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	6.19	0.43	0.15	0.07	0.06
WLA (NPDES Point/MS4 permits)	-	-	-	-	-
TMDL minus (MOS + Future Growth)	123.81	8.54	2.99	1.45	1.10
N02K10 - Eagle Cr. (RM 15.04; Drainage area = 36.00 square miles)					
Samples Collected	1		3		
Sample Median Load	3,682		80		
NPDES Point Source Existing Load	4.84	4.84	4.84	4.84	4.84
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	240.9	16.6	5.8	2.8	2.1
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	67.3%	No Data	63.5%	No Data	No Data
LA (Non-Point Allocation)	1,199.70	77.97	24.25	9.12	5.62
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	60.23	4.14	1.45	0.70	0.52
WLA (NPDES Point/MS4 permits)	4.84	4.84	4.84	4.84	4.84
TMDL minus (MOS + Future Growth)	1204.54	82.81	29.09	13.96	10.46

Table 21 TMDL Summary for *E. coli* for HUC 05030101-04 040

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02K02 - Tinker Cr. (RM 2.5; Drainage area = 11.20 square miles)					
Samples Collected	1		3		
Sample Median Load	485		210		
NPDES Point Source Existing Load	0.00	0.00	0.00	0.00	0.00
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	74.9	5.2	1.8	0.9	0.7
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	22.8%	No Data	95.7%	No Data	No Data
LA (Non-Point Allocation)	374.74	25.78	9.04	4.35	3.28
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	18.74	1.29	0.45	0.22	0.16
WLA (NPDES Point/MS4 permits)	-	-	-	-	-
TMDL minus (MOS + Future Growth)	374.74	25.78	9.04	4.35	3.28

Table 22 TMDL Summary for *E. coli* for HUC 05030101-04 050

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
N02P08 - Eagle Cr. (RM 5.6; Drainage area = 97.80 square miles)					
Samples Collected	2	1	7		
Sample Median Load	89,391	4,644	137		
NPDES Point Source Existing Load	7.58	7.58	7.58	7.58	7.58
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	511.1	35.1	12.3	5.9	4.4
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	97.1%	96.2%	54.8%	No Data	No Data
LA (Non-Point Allocation)	2,548.09	168.08	54.07	22.01	14.61
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	127.78	8.78	3.08	1.48	1.11
WLA (NPDES Point/MS4 permits)	7.58	7.58	7.58	7.58	7.58
TMDL minus (MOS + Future Growth)	2555.67	175.66	61.65	29.59	22.20

Table 23 TMDL Summary for *E. coli* for HUC 05030101-04 060

<i>E. coli</i> TMDL Allocation (billion/day)	Higher Flows	Wet Weather	Mid-Range Summer	Dry Weather	Low
Recreation Season Interval	0-5%	5-40%	40-80%	80-95%	95-100%
602280 - Mahoning River (RM 5.6; Drainage area = 575.00 square miles)					
Samples Collected					
Sample Median Load					
NPDES Point Source Existing Load	67.86	67.86	67.86	67.86	67.86
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	3011.3	207.0	72.6	34.9	26.2
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	No Data	No Data	No Data	No Data	No Data
LA (Non-Point Allocation)	14,989	967	295	106	63
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	752.82	51.74	18.16	8.72	6.54
WLA (NPDES Point/MS4 permits)	67.86	67.86	67.86	67.86	67.86
TMDL minus (MOS + Future Growth)	15056.48	1034.85	363.24	174.36	130.78
N03S64 - Mahoning River (RM 45.73; Drainage area = 542.00 square miles)					
Samples Collected	1		3		
Sample Median Load	41,086		4,239		
NPDES Point Source Existing Load	67.86	67.86	67.86	67.86	67.86
Margin of Safety (%)	20%	20%	20%	20%	20%
Margin of Safety (Load)	2838.5	195.1	68.5	32.9	24.7
Included Upstream TMDL Allocation	0	0	0	0	0
Subwatershed % Reduction Required	65.5%	No Data	91.9%	No Data	No Data
LA (Non-Point Allocation)	14,125	908	275	96	55
Allowance for Future Growth (%)	4%	4%	4%	4%	4%
Allowance for Future Growth	709.62	48.77	17.12	8.22	6.16
WLA (NPDES Point/MS4 permits)	67.86	67.86	67.86	67.86	67.86
TMDL minus (MOS + Future Growth)	14192.36	975.46	342.40	164.34	123.26

Table 24 Total phosphorus TMDL summary for HUC 05030101-01 010 and 030

Season	Median Existing Daily Load (kg/d)	Median TMDL (kg/day)	TMDL MOS (%)	Total Reduction	
				(kg/d)	Percent
Spring	6,541	3,681	5%	2,860	44%
Summer	500	21	5%	479	96%
Autumn	6,625	6,009	0%	-	0%
Winter	10,867	10,033	0%	-	0%

Table 25 Total Phosphorus Seasonal Loads for HUC 05030101-01 010 and 030

Source	Spring Load					Summer Load				
	Total P (kg/d)	Allocation (kg/d)	MOS (%)	Reduction (%)	Total Reduction (kg/d)	Total P (kg/d)	Allocation (kg/d)	MOS (%)	Reduction (%)	Total Reduction (kg/d)
Water	14.5	14.5	0%	0%	-	0.9	0.9	0%	0%	-
Urban	88.2	50.0	5%	46%	40.7	5.3	0	5%	100%	5.2
Other_Urban	11.4	6.5	5%	46%	5.3	0.7	0	5%	100%	0.7
Forest	22.4	22.4	0%	0%	-	1.3	1.3	0%	0%	-
Pasture	30.1	17.1	5%	46%	13.9	1.8	0	5%	100%	1.8
Cropland	6,249.9	3,543.9	5%	46%	2,883.2	373.3	0.1	5%	100%	373.2
Wetland	8.2	8.2	0%	0%	-	0.5	0.5	0%	0%	-
Groundwater	-	-	0%	0%	-	0	-	0%	0%	-
Point Source	21.4	18.5	5%	18%	2.9	21.4	18.5	5%	18%	2.8
Septic Systems	95.0	-	5%	100%	95.0	95.0	-	5%	100%	95.0
TOTAL	6,541	3,681		44%	3041	500	21.4		95.7%	478.8

Table 26 Total phosphorus TMDL summary for HUC 05030101-02 010 and 020

Table 5-20. Modeled Total Phosphorus Existing Load and TMDL Point and Non-Point Source Loads (kg/day) during Growing Season (May-September).

Reservoir		Water	Urban	Forest	Pasture	Cropland	Wetland	Home Sewage Treatment Systems	Point Sources	5% Margin of Safety	Total Maximum Daily Load
Deer Creek and Dale Walborn Reservoirs	Existing	2.16	0.68	0.52	0.72	148.23	25.51	0.61	2.46	---	181
	Allocation	2.16	0.09	0.52	0.1	20.04	25.51	0	1.61	2.78	53
	% Reduction	0.00%	86.10%	0.00%	86.10%	86.10%	0.00%	100.00%	57.90%	---	70.80%

Table 27 Total phosphorus TMDL summary for HUC 05030101-04 010, 030, and 040

Table 5-20. Modeled Total Phosphorus Existing Load and TMDL Point and Non-Point Source Loads (kg/day) during Growing Season (May-September).

Reservoir		Water	Urban	Forest	Pasture	Cropland	Wetland	Home Sewage Treatment Systems	Point Sources	5% Margin of Safety	Total Maximum Daily Load
Deer Creek and Dale Walborn Reservoirs	Existing	2.16	0.68	0.52	0.72	148.23	25.51	0.61	2.46	---	181
	Allocation	2.16	0.09	0.52	0.1	20.04	25.51	0	1.61	2.78	53
	% Reduction	0.00%	86.10%	0.00%	86.10%	86.10%	0.00%	100.00%	57.90%	---	70.80%

Table 28 Total Phosphorus Seasonal Loads for HUC 05030101-01 010, 030, and 040

Table 5-46. Allocations and percent reductions for total phosphorus by source within the GWLF modeled area that employs the Phalanx Station gage on Eagle Creek (12-digit HUCs 01 through 05).

SOURCE	Spring Load					Summer Load				
	Total P (kg/d)	TMDL (kg/d)	MOS (%)	Reduction (%)	Total Reduction (kg/d)	Total P (kg/d)	TMDL (kg/d)	MOS (%)	Reduction (%)	Total Reduction (kg/d)
Water	74.3	74.3	0%	0%	-	46.6	46.6	0%	0%	-
Urban	272.7	48.4	5%	83%	226.7	171	61.8	5%	66%	112.3
Other Urban	187.7	33.3	5%	83%	156.1	117.7	42.6	5%	66%	77.3
Forest	312	312	0%	0%	-	195.6	195.6	0%	0%	-
Pasture	98.4	17.5	5%	83%	81.8	61.7	22.3	5%	66%	40.5
Cropland	25,406.1	4,507.2	5%	83%	21,124.3	15929.9	5,755.87	5%	66%	10,461.82
Wetland	413.2	413.2	0%	0%	-	259.1	259.1	0%	0%	-
Groundwater	-	-	0%	0%	-	0	-	0%	0%	-
Point Source	10.5	9.1	5%	17%	1.7	10.5	9.1	5%	17%	5.1
Septic Systems	103.3	-	5%	100%	103.3	103.3	-	5%	100%	103.3
TOTAL	26,878.10	5,414.70		79.90%	21694	16895	6,393.30		62.20%	10,800.32

Table 29 TMDLs for sediment in HUC 05030101-01

Waterbody	River mile	Substrate Score	Channel Score	Riparian Score	Total Score	Target/TMDL
Mahoning River	91.1	1	5	4	10	≥ 32
	85.51	6.5	14	8.5	29	≥ 32
Little Beach Creek	1.83	11	6	1.5	18.5	≥ 32
Fish Creek	2.00	5.5	12	7	24.5	≥ 32

Table 30 TMDLs for sediment in HUC 05030101-02

Waterbody	River mile	Substrate Score	Channel Score	Riparian Score	Total Score	Target/TMDL
Mill Creek	6.28	9.5	12.5	4.5	26.5	≥ 32
Island Creek	2.65	1	13	5.5	19.5	≥ 32
Garfield Ditch	0.66	Poor*	Poor*	Poor*		≥ 32
Trib to Mill Creek at RM 3.67	1.10	14	8	3.5	25.5	≥ 32

* - OEPA did not provide current scores, but noted that significant sediment was present as well as poor riparian growth due to recent channelization

Table 31 TMDLs for sediment in HUC 05030101-03

Waterbody	River mile	Substrate Score	Channel Score	Riparian Score	Total Score	Target/TMDL
Kale Creek	13.08	4.5	12	7.5	24	≥ 32
	11.27	8.5	11.5	5	25	≥ 32
Harmon Brook	0.49	14	15.5	6.5	36*	≥ 32
Trib to West Branch Mahoning River at RM 0.01	2.10	9	14	7.5	30.5	≥ 32
Trib to West Branch Mahoning River at RM 8.28	0.27	7	8	5.5	20.5	≥ 32
Trib to Kale Creek	1.08	10	14	6.5	30.5	≥ 32

* - OEPA noted that although this site is meeting the sediment targets, the invertebrate scores are poor, and there were visual signs of increasing substrate problems.

Table 32 TMDLs for sediment in HUC 05030101-04

Waterbody	River mile	Substrate Score	Channel Score	Riparian Score	Total Score	Target/TMDL
Chocolate Run	0.11	9	9.5	5	23.5	≥ 32
Nelson Ditch	0.4	5.5	6	5.5	17	≥ 32
Mahoning Creek	0.7	0	14	3	23	≥ 32

Table 33* WLAs for HUC 05030101-01

Table 5-2. *E. coli* wasteload allocations for the 05030103-01-01 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
Timashamie Family Campground	3PR00305	0.0039	0.0250	161.0	0.15
Paradise Lake Park Campground	3PR00325	0.02	0.02	161	0.12

Table 5-4. *E. coli* wasteload allocations for the 05030103-01-02 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Dgn Flow Avg MGD	Conc Limit cfu/100mL	WLA billion/day
Stark County Village Green Allot STP	3PG00087	0.0275	0.0200	126.0	0.10
Trilogy Alliance	3IN00347	0.0180	0.0000	0.0	0.00
Washington Elementary School	3PT00101	0.0050	0.0080	161.0	0.05
Marlington Local Schools	3PT00045	0.0213	0.0450	126.0	0.21

Table 5-6. *E. coli* wasteload allocations for the 05030103-01-03 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit cfu/100mL	WLA billion/day
Paradise Lake Park Campground	3PR00325	0.0200	0.0200	161.0	0.12
Timashamie Family Campground	3PR00305	0.0039	0.0250	161.0	0.15
Knox Elementary School - West Branch	3PT00123	0.0019	0.0070	126.0	0.03
Sebring WTP	3IV00182	0.0487	0.0500	0.0	0.00
West Branch Nursing Home LLC	3PR00458	0.0118	0.0118	126.0	0.06
Damascus WWTP	3PA00037	0.0547	0.0080	126.0	0.04
Country Squire Estates Ltd	3PV00130	0.0300	0.0100	126.0	0.05
Beloit WWTP	3PB00005	0.0689	0.1900	126.0	0.91
Tecumseh Village MHP	3PV00023	0.0019	0.0125	126.0	0.06
Sebring Landfill Facility	3IN00351	0.0180	0.0000	0.0	0.00
BP Amoco Oil Corp Bulk Plant Alliance	3IN00287	0.0009	0.0000	0.0	0.00
Sebring WWTP	3PC00011	0.7469	1.5000	126.0	7.15
Central Waste Inc	3IN00313	0.0045	0.0000	0.0	0.00
Alliance Tubular Products Co	3ID00043	1.7000	0.0694	0.0	0.00

* Note: For Tables 33-36, the concentration limit units are cfu/100 mL and the WLA units are billion of colonies per day.

Table 34* WLAs for HUC 05030101-02

Table 5-13. *E. coli* wasteload allocations for the 05030103-02-01 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
Pelican Grove Campground	3PR00373	0.0006	0.0008	126	0.004
Buckeye Packaging Co Inc	3PR00259	0.0013	0.0035	161	0.021
Custom Poly Bag Inc	3PR00389	0.0016	0.0015	161	0.009
Atwater WWTP	3PH00033	0.1074	0.2000	126	0.954
Waterloo K-12 Campus	3PT00079	0.0058	0.0200	161	0.122
Evrol LLC Atwater Terminal	3IG00025	0.0001	0.0001	0	0

Table 5-16. *E. coli* wasteload allocations for the 05030103-02-03 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
Western Reserve High School	3PT00143	0.0019	0	161.000	0.146268

Table 35* WLAs for HUC 05030101-03

Table 5-23. *E. coli* wasteload allocations for the 05030103-03-01 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
Nemenz Little Village Shoppe Inc	3PR00190	0	0.003	126	0.012067

Table 5-27. *E. coli* wasteload allocations for the 05030103-03-04 12-digit HUC.

Regulated point source requirements	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
ODOT Rest Area 04-35 WWTP	3PP00033	0.0037	0.0200	126	0.095
Southeast High School	3PT00016	0.0153	0.0500	126	0.238
The Diamond Lodge	3PR00505	0.0100	0.0100	126	0.048
Gionino's Pizza	3PR00390	0.0002	0.0015	126	0.007

Table 5-29. *E. coli* wasteload allocations for the 05030103-03-05 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
ODOT Rest Area 04-35 WWTP	3PP00033	0.0037	0.020	126	0.095
Southeast High School	3PT00016	0.0153	0.050	126	0.238
The Diamond Lodge	3PR00505	0.0100	0.010	126	0.048
Gionino's Pizza	3PR00390	0.0002	0.002	126	0.007
Maple Del Manor MHP	3PV00034	0.0267	0.040	126	0.191
Crest Rubber Co	3IR00015	0.1082	0.001	0	0
Countryside Estates	3PG00120	0.0263	0.035	126	0.167
Country Acres Campground 1	3PR00234	0.0027	0.010	126	0.048
Leisure Lake Park	3PR00265	0.8174	0.038	126	0.179
ODNR Beach Area W Branch SP	3PP00010	0.0039	0.100	126	0.477
Amies West Branch Steak House	3PR00174	0.0008	0.003	126	0.016
Jolly Time MHP	3PV00085	0.0005	0.002	126	0.011
KMV III Ltd DBA Hamlet MHP	3PV00041	0.0164	0.020	126	0.095

Table 5-31. *E. coli* wasteload allocations for the 05030103-03-06 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
Alliance WWTP	3PD00000	5.2550	7.5000	126	35.77
Newton Falls STP	3PD00015	1.1084	1.5000	126	7.15
Sebring WWTP	3PC00011	0.7469	1.5000	126	7.15
Craig Beach WWTP	3PH00030	0.5271	1.0000	126	4.77
Atwater WWTP	3PH00033	0.1074	0.2000	126	0.95
Beloit WWTP	3PB00005	0.0689	0.1900	126	0.91
Alliance Tubular Products Co	3ID00043	1.7000	0.0694	0	0.00
Modern Management Solutions DBA All Seasons MHP	3PV00047	0.0353	0.0550	126	0.26
Sebring WTP	3IV00182	0.0487	0.0500	0	0.00
Marlington Local Schools	3PT00045	0.0213	0.0450	126	0.21
US Corp of Engineers Mill Creek R	3PN00000	0.0205	0.0300	126	0.14
Timashamie Family Campground	3PR00305	0.0039	0.0250	161	0.15
Western Reserve High School	3PT00143	0.0019	0.0240	161	0.15
Stark County Village Green Allot STP	3PG00087	0.0275	0.0200	126	0.10
Paradise Lake Park Campground STU	3PR00325	0.0200	0.0200	161	0.12
Waterloo K-12 Campus	3PT00079	0.0058	0.0200	161	0.12
Stark County Village Green Allot STP	3PG00087	0.0275	0.0200	126	0.10
North East Ohio Church of God Campground	3PR00437	0.0140	0.0140	126	0.07
Tecumseh Village MHP	3PV00023	0.0019	0.0125	126	0.06
West Branch Nursing Home LLC	3PR00458	0.0118	0.0118	126	0.06
Country Squire Estates Ltd	3PV00130	0.0300	0.0100	126	0.05
Washington Elementary School	3PT00101	0.0050	0.0080	161	0.05

Damascus WWTP	3PA00037	0.0547	0.0080	126	0.04
Washington Elementary School	3PT00101	0.0050	0.0080	161	0.05
Knox Elementary School - West Branch	3PT00123	0.0019	0.0070	126	0.03
Green Acres Campground	3PR00221	0.0027	0.0050	126	0.02
Grace Community Church of Alliance	3PR00451	0.0050	0.0050	126	0.02
Circle Restaurant Inc	3PR00120	0.0014	0.0044	126	0.02
Ben's Restaurant and Bar	3PR00491	0.0037	0.0037	126	0.02
RC Sports Lounge	3PR00323	0.0005	0.0035	126	0.02
Buckeye Packaging Co Inc	3PR00259	0.0013	0.0035	161	0.02
Nemenz Little Village Shoppe Inc	3PR00190	0.0007	0.0025	126	0.01
Nemenz Food Mart	3PR00210	0.0008	0.0015	126	0.01
Custom Poly Bag Inc	3PR00389	0.0016	0.0015	161	0.01
Pelican Grove Campground	3PR00348	0.0006	0.0008	126	0.00
Pelican Grove Campground	3PR00373	0.0006	0.0008	126	0.00
Evrol LLC Atwater Terminal	3IG00025	0.0001	0.0001	0	0.00
Industrial Mining - City Stone	3IJ00067	0.3500	0.0000	0	0.00
Trilogy Alliance	3IN00347	0.0180	0.0000	0	0.00
Sebring Landfill Facility	3IN00351	0.0180	0.0000	0	0.00
BP Amoco Oil Corp Bulk Plant Alliance	3IN00287	0.0009	0.0000	0	0.00
Central Waste Inc	3IN00313	0.0045	0.0000	0	0.00
Trilogy Alliance	3IN00347	0.0180	0.0000	0	0.00
Alliance WWTP	3PD00000	5.2550	7.5000	126	35.77
Newton Falls STP	3PD00015	1.1084	1.5000	126	7.15
Sebring WWTP	3PC00011	0.7469	1.5000	126	7.15

Table 36* WLAs for *E. coli* for HUC 05030101-04

Table 5-34. *E. coli* wasteload allocations for the 05030103-04-01 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
Camp Asbury Central	3PR00220	0.0013	0.009	161	0.055
Custom Poly Bag Inc	3PR00389	0.0016	0	161	0.009
Hiram WWTP	3PB00020	0.1160	0	161	1.219

Table 5-36. *E. coli* wasteload allocations for the 05030103-04-02 12-digit HUC.

Regulated point source requirements	NPDES OEPA ID	Exist Flow Avg MGD	Dgn Flow Avg MGD	Conc Limit	WLA
Windham WWTP	3PC00019	0.349	0	161	2.74
Harbison Walker Refractories Windham Works	3IE00043	0	0	0	0

Table 5-38. *E. coli* wasteload allocations for the 05030103-04-03 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
Hiram WWTP	3PB00020	0.116	0.200	161.00	1.219
Blackbrook Valley Estates	3PG00093	0.064	0.030	161	0.183
Therm-O-Link Inc	3IQ00059	0	0	0.000	0
Western Reserve WWTP	3PG00121	0.022	0	161.000	0.134
Northern Ohio Multipurpose	3IH00073	0.350	0.350	0.000	0
Garrettsville WWTP	3PB00016	0.281	0.500	161	3.047
Homestead Manor MHP	3PV00103	0.030	0.030	161	0.183
Camp Asbury Central	3PR00220	0.001	0.009	161	0.055
Johnson Farm Recreational Camp	3PR00387	0.003	0.003	161	0.018

Table 5-41. *E. coli* wasteload allocations for the 05030103-04-05 12-digit HUC.

Regulated point source	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA 0.5
Hiram WWTP	3PB00020	0	0.200	161	1.219
Blackbrook Valley Estates	3PG00093	0	0.030	161	0.183
Therm-O-Link Inc	3IQ00059	0	0.000	0	0
Western Reserve WWTP	3PG00121	0	0.022	161	0.134
Northern Ohio Multipurpose	3IH00073	0.350	0.350	0	0
Garrettsville WWTP	3PB00016	0.281	0.500	161	3.047
Homestead Manor MHP	3PV00103	0.030	0.030	161	0.183
Camp Asbury Central	3PR00220	0.001	0.009	161	0.055
Johnson Farm Recreational Camp	3PR00387	0.003	0.003	161	0.018

Table 5-43. *E. coli* wasteload allocations for the 05030103-04-06 12-digit HUC.

Regulated Point Sources	NPDES OEPA ID	Exist Flow Avg MGD	Design Flow Avg MGD	Conc Limit	WLA
ODOT Rest Area 04-35 WWTP	3PP00033	0.004	0.020	126	0.0954
Southeast High School	3PT00016	0.015	0.050	126	0.2385
The Diamond Lodge	3PR00505	0.010	0.010	126	0.0477
Gionino's Pizza	3PR00390	0.000	0.002	126	0.0072
Maple Del Manor MHP	3PV00034	0.027	0.040	126	0.1908
Crest Rubber Co	3IR00015	0.108	0.001	0	0.0000
Countryside Estates	3PG00120	0.026	0.035	126	0.1669
Country Acres Campground 1	3PR00234	0.003	0.010	126	0.0477
Leisure Lake Park	3PR00265	0.817	0.038	126	0.1789
ODNR Beach Area W Branch SP	3PP00010	0.004	0.100	126	0.4770
Amies West Branch Steak House	3PR00174	0.001	0.003	126	0.0159
Jolly Time MHP	3PV00085	0.001	0.002	126	0.0110
KMV III Ltd DBA Hamlet MHP	3PV00041	0.016	0.020	126	0.0954
Newton Falls STP	3PD00015	1.108	1.500	126	7.1544
RC Sports Lounge	3PR00323	0.000	0.004	126	0.0167
Craig Beach WWTP	3PH00030	0.527	1.000	126	4.7696
Industrial Mining - City Stone	3IJ00067	0.350	0.000	0	0.0000
Green Acres Campground	3PR00221	0.003	0.005	126	0.0238
Washington Elementary School	3PT00101	0.005	0.008	161	0.0488
North East Ohio Church of God Campground	3PR00437	0.014	0.014	126	0.0668
Ben's Restaurant and Bar	3PR00491	0.004	0.004	126	0.0174
US Corp of Engineers Mill Creek R	3PN00000	0.020	0.030	126	0.1431
Pelican Grove Campground	3PR00348	0.001	0.001	126	0.0038
Circle Restaurant Inc	3PR00120	0.001	0.004	126	0.0209
Nemenz Food Mart	3PR00210	0.001	0.002	126	0.0072
Modern Management Solutions DBA All Seasons MHP	3PV00047	0.035	0.055	126	0.2623
Alliance WWTP	3PD00000	5.255	7.500	126	35.7722
Grace Community Church of Alliance	3PR00451	0.005	0.005	126	0.0238
Stark County Village Green Allot STP	3PG00087	0.028	0.020	126	0.0954
Trilogy Alliance	3IN00347	0.018	0.000	0	0.0000
Paradise Lake Park Campground STU 1	3PR00325	0.020	0.020	161	0.1219
Timashamie Family Campground	3PR00305	0.004	0.025	161	0.1524
Knox Elementary School - West Branch	3PT00123	0.002	0.007	126	0.0334
Sebring WTP	3IV00182	0.049	0.050	0	0.0000
West Branch Nursing Home LLC	3PR00458	0.012	0.012	126	0.0560
Damascus WWTP	3PA00037	0.055	0.008	126	0.0382
Country Squire Estates Ltd	3PV00130	0.030	0.010	126	0.0477
Beloit WWTP	3PB00005	0.069	0.190	126	0.9062
Tecumseh Village MHP	3PV00023	0.002	0.013	126	0.0596
Sebring Landfill Facility	3IN00351	0.018	0.000	0	0.0000
BP Amoco Oil Corp Bulk Plant Alliance	3IN00287	0.001	0.000	0	0.0000
Sebring WWTP	3PC00011	0.747	1.500	126	7.1544
Central Waste Inc	3IN00313	0.005	0.000	0	0.0000
Alliance Tubular Products Co	3ID00043	1.700	0.069	0	0.0000
Pelican Grove Campground	3PR00373	0.001	0.001	126	0.0038
Buckeye Packaging Co Inc	3PR00259	0.001	0.004	161	0.0213
Custom Poly Bag Inc	3PR00389	0.002	0.002	161	0.0091
Atwater WWTP	3PH00033	0.107	0.200	126	0.9539
Waterloo K-12 Campus	3PT00079	0.006	0.020	161	0.1219

Evrol LLC Atwater Terminal	3IG00025	0.000	0.000	0	0.0000
Nemenz Little Village Shoppe Inc	3PR00190	0.001	0.003	126	0.0121
Stark County Village Green Allot STP	3PG00087	0.028	0.020	126	0.0954
Trilogy Alliance	3IN00347	0.018	0.000	0	0.0000
Washington Elementary School	3PT00101	0.005	0.008	161	0.0488
Marlington Local Schools	3PT00045	0.021	0.045	126	0.2146
Western Reserve High School	3PT00143	0.002	0.024	126	0.1145
Hiram WWTP	3PB00020	0.116	0.200	161	1.2189
Blackbrook Valley Estates	3PG00093	0.064	0.030	161	0.1828
Therm-O-Link Inc	3IQ00059	0.033	0.000	0	0.0000
Western Reserve WWTP	3PG00121	0.022	0.022	161	0.1341
Northern Ohio Multipurpose	3IH00073	0.350	0.350	0	0.0000
Garrettsville WWTP	3PB00016	0.281	0.500	161	3.0473
Homestead Manor MHP	3PV00103	0.030	0.030	161	0.1828
Camp Asbury Central	3PR00220	0.001	0.009	161	0.0549
Johnson Farm Recreational Camp	3PR00367	0.003	0.003	161	0.0183
Windham WWTP	3PC00019	0.349	0.450	161	2.7425
Harbison Walker Refractories Windham Works	3IE00043	0.099	0.065	0	0.0000
Southington Local School Dist	3PT00134	0.002	0.024	126	0.1145
Arhaven Estates MHP	3PV00064	0.013	0.018	126	0.0835
PK Rentals	3GV00030	0.010	0.010	126	0.0477
William C Wilson	3GV00027	0.010	0.010	126	0.0477
Short Stop Truck Plaza	3PR00162	0.007	0.010	126	0.0477
Denman Tire Corp	3IR00002	0.057	0.130	0	0.0000
Warren No 3 WWTP	3PG00106	0.016	0.013	126	0.0596
Full Covenant Tabernacle Church	3GV00035	0.010	0.010	126	0.0477
Top of the Hill Store	3GV00019	0.010	0.010	126	0.0477
Ridge Ranch Campgrounds Sh	3PR00310	0.002	0.003	126	0.0143
Pleasant Park Mobile Court	3PV00067	0.021	0.023	126	0.1073
Delightful Auto Center	3GV00021	0.010	0.010	126	0.0477

Table 37 WLAs for phosphorus for HUC 05030101-01 010 and 030

Table 5-11. Existing and proposed loading information, including wasteload allocations, for NPDES dischargers within the GWLF modeled area that employs the Alliance gage on the Mahoning River (HUCs 01 and 03).

Permit Number	Facility	Design Flow (mgd)	Existing Total Phosphorus Effluent Concentration (mg/l)	Existing Total Phosphorus Load (kg/day)	Proposed Total Phosphorus Effluent Concentration (mg/l)	Proposed Total Phosphorus Load - WLA (kg/day)
3PV00023	Tecumseh Village MHP	0.0125	3*	0.142	3	0.142
3PR00196	Dairy Kool	0.0011	3*	0.012	3	0.012
3PA00037	Damascus WWTP	0.08	3*	0.909	3	0.909
3IN00313	Central Waste Inc***	2.73	0.033	0.341	3	0.341
3PB00005	Beloit WWTP	0.190	3*	2.158	1	0.719
3PC00011	Sebring WWTP	1.50	3*	17.035	1	5.678
3PR00458	West Branch Nursing Home, LLC	0.012	3*	0.133	3	0.133
3PV00112	Arew Mobile Park	0.004	3*	0.045	3	0.045
3PR00305	Timashamie Family Campground	0.025	3*	0.284	3	0.284
3PR00325	Paradise Lake Park Campground STU 1	0.020	3*	0.227	3	0.227
3PT00123	Knox Elementary School - West Branch	0.0070	3*	0.079	3	0.079
TOTAL		4.578	na	21.365	na	8.569

* Estimate for facilities for which no data exists.

*** Average discharge flow from sedimentation basin utilized for loading calculation.

Table 38 WLAs for phosphorus for HUC 05030101-02 010 and 020

Table 5-21. Deer Creek Reservoir Watershed Point Source Discharge Total Phosphorus proposed Limit and Resulting Waste Load.

NPDES Permit Number	Type	Size	Facility Name	County	Total Phosphorus Concentration		Design Flow (mgd)	Total Phosphorus Load	
					Existing (mg/L)	Proposed (mg/L)		Existing (kg/d)	Proposed (kg/d)
3PR00389	Public	Minor	Custom Poly Bag Inc	Stark	3**	3.0	0.0015	0.017	0.017
3PT00079	Public	Minor	Waterloo K-12 Campus	Portage	3**	3.0	0.0200	0.227	0.227
3PH00033	Public	Minor	Atwater WWTP	Portage	2.14	1.0	0.2000	1.620	0.757
3IG00025	Industrial	Minor	Evrol LLC Atwater Terminal*	Portage	3**	3.0	0.0500	0.568	0.568
3PR00259	Public	Minor	Buckeye Packaging Co Inc	Stark	3**	3.0	0.0032	0.036	0.036

* Maximum daily flow in lieu of design flow

** Estimated because lack of historic data

Table 39 WLAs for phosphorus for HUC 05030101-04 010 to 050

Table 5-47. Existing and proposed loading information, including wasteload allocations for NPDES dischargers within the GWLF modeled area that employs the Phalanx Station gage on Eagle Creek (HUCs 01 through 05).

Permit Number	Facility	Design Flow (mgd)	Existing Total Phosphorus Effluent Concentration (mg/l)	Existing Total Phosphorus Load (kg/day)	Proposed Total Phosphorus Effluent Concentration (mg/l)	Proposed Total Phosphorus Load - WLA (kg/day)
3PB00020	Hiram WWTP	0.20	3.26	2.468	1	0.757
3PV00103	Homestead Manor MHP	0.03	0.794	0.090	1	0.114
3PR00367	Johnson Farm Recreational Camp	0.0030	3*	0.034	3	0.034
3IH00073	Northern Ohio Multi Purpose	0.35	1**	1.325	1	1.325
3PX00004	Modern Management Solutions DBA PM Estates	0.05	3*	0.568	3	0.568
3PG00093	Blackbrook Estates MHP	0.030	3.51	0.399	3.51	0.399
3PR00220	Camp Asbury WWTP	0.0090	3*	0.102	3	0.102
3PG00121	Western Reserve WWTP	0.0132	3*	0.150	3	0.150
3PC00019	Windham WWTP	0.45	0.745	1.269	1	1.703
3PB00016	Garrettsville WWTP	0.3560	3*	4.043	3	4.043
TOTAL		1.491	na	10.448	na	10.519

* Indicates estimate utilized for TMDL purposes for those facilities in which no data exists.

** Total P concentration is limited by NPDES permit.

Expanded technical analysis

1. OVERVIEW

The purpose of this expanded technical analysis is to describe logic used to identify indicators and targets for the Upper Mahoning River sediment TMDLs. This watershed is impaired for aquatic life use based upon results of fish population sampling. A report developed by the Ohio Environmental Protection Agency (OEPA) suggests, based on a large pool of data, that habitat alteration and sedimentation are contributing to the impairment. To assess the habitat in a waterbody, OEPA uses the Qualitative Habitat Evaluation Index (QHEI), and uses the QHEI score results as well as a subset score to set sediment targets for use in these TMDLs. Results of this technical analysis indicate that these habitat/silt QHEI scores are an appropriate measure to determine targets for sediment in Upper Mahoning River.

Numeric Standards

All waters in Ohio have a designation for aquatic life use (OAC 3745-1-07). OEPA uses biocriteria to determine the health of a waterbody and define the aquatic life use (OAC 3745-1-07, Table 7-15). Each of these use designations has a numerical criteria associated with it, based upon the size of the drainage area of the waterbody.

Attainment of aquatic life uses is determined by directly measuring fish and aquatic macroinvertebrate populations to see if they are comparable to those seen on at least impacted reference sites that are about the same size and located within the same ecoregion in Ohio. Attainment benchmarks from these least impacted areas are established in the WQS in the form of "biocriteria", which are then compared to the measurements obtained from the study area. The biocriteria consist of the Index of Biotic Integrity (IBI), the Modified Index of Well-being (MIWb), and the Invertebrate Community Index (ICI). The IBI and MIWb measure the fish community while the ICI measures the invertebrate community. It is important to note that the biocriteria are a direct measure of the biology. Attaining the aquatic life use is the goal for this TMDL.

Narrative Standards

Waters in Ohio are also subject to OAC 3745-1-04, which states in part that all waters will be:

- (A) Free from suspended solids or other substances that enter the waters as a result of human activity and that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life;

OEPA does not have a numeric WQS for sediment, siltation, or total suspended solids (another common sediment surrogate). However, OEPA has done research on how habitat affects fish communities, and what levels of substances may adversely affect aquatic life (*Association between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams* (OEPA 1999)).

Specific Upper Mahoning River data: The biocriteria applicable in the Upper Mahoning River watershed, which correspond to the Erie-Ontario Lake Plains (EOLP) Ecoregion, are presented in Table 2-5 of the TMDL (copied below). The TMDL report, in Appendix B, contains the overall biological attainment of the various sites in the watershed. Section 3 of the TMDL discusses the actual fish and macroinvertebrate results from the various sampling sites, as well as the QHEI results.

Table 2-5. Biological criteria applicable to rivers and streams throughout Ohio for three aquatic life use designations. Criteria are established based on ecoregion and assessment method.

Ecoregion	Biological Index	Assessment method ^{2,3}	Biological criteria for the applicable aquatic life use designations ¹		
			WWH	EWB	MWH ⁴
Erie-Ontario Lake Plains (EOLP)	IBI	Headwater	40	50	24
		Wading	38	50	24
		Boat	40	48	24 / 30
	MIwb	Wading	7.9	9.4	6.2
		Boat	8.7	9.6	5.8 / 6.6
	ICI	All ⁵	34	46	22

1. Cold water habitats (CWH), limited warmwater habitat (LWH), resource waters (LRW) and seasonal salmonid habitat (SSH) do not have associated biological criteria.
2. The assessment method used at a site is determined by its drainage area (DA) according to the following: Headwater: DA ≤ 20 mi²; Wading: DA >20 mi² and ≤ 500 mi²; Boat: DA > 500 mi²
3. MIwb not applicable to drainage areas less than 20 mi².
4. Bio-criteria depend on type of MWH. MWH-C (due to channelization) is listed first, MWH-I (due to impoundment) is listed second, and MWH-A (mine affected) is listed third (only applicable in the WAP).
5. Limited to sites with appropriate conditions for artificial-substrate placement.

Discussion

OEPA has determined that numerous waterbodies in the state are impaired based upon the aquatic life use scores. During the determination of impairment status, the causes of impairment are reviewed. As part of the assessment process, OEPA determines habitat quality, to determine the role habitat may play in the impairment decision. OEPA has researched the impacts of nutrients and habitat on biology, as documented in *Association between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams* (OEPA, 1999). In this document, OEPA discusses how habitat alteration in conjunction with nutrient loads can reduce biological diversity and lead to impairment of the biotic community.

Sediment can have significant short and long-term impacts on a biological community. High levels of bedload sediments and suspended solids clog fish gills, retard growth rates, decrease resistance to disease, and prevent egg and larval development. High sediment concentrations can also reduce the amount of sunlight available to aquatic organisms and decrease water clarity which in turn impairs the ability of fish to see and catch food, and increases stream temperature. In addition, metals, pathogens and other contaminants can attach to suspended or bedload sediments and become concentrated in the waterways. Such changes in the habitat affect the species composition away from functional assemblages comprised of intolerant species, benthic insectivores, and top carnivores typical of high quality streams towards less desirable assemblages of tolerant species, niche generalists, omnivores, and detritivores typical of degraded streams. Such a shift in community structure lowers the diversity of the system (Section 2 and 3 of the TMDL; *The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application*, OEPA 1989; *Association between Nutrients, Habitat and the Aquatic Biota in Ohio Rivers and Streams* OEPA, 1999).

To assess habitat, OEPA uses the QHEI. The QHEI is a quantitative index that combines the scores given to six physical stream/riparian variables, to assess the physical habitat quality of streams and rivers. This index measures the important components of stream habitat that are essential to sustaining high value aquatic communities. The variables included in the index are: substrate, instream cover, riparian characteristics (riparian width, flood plain quality and bank erosion), channel characteristics, pool/riffle quality, and gradient/drainage area.

OEPA has had extensive experience in using the QHEI, and has used the QHEI since the late 1980's (*The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application*, OEPA 1989). The process allows OEPA to determine not only the quality of habitat, but to document and refine habitat evaluations in a reproducible format. The process has undergone several updates, the latest in 2006 (*Methods for Assessing Habitat in Flowing Waters: Using the Qualitative Habitat Evaluation Index (QHEI)*, OEPA 2006).

Habitat changes can have many forms. The QHEI process reviews a wide range of habitat features, some of which can be related to a pollutant. For this review, those caused by sediment (sedimentation, siltation, etc.) are the focus. To measure the impacts of sediment on the habitat (and thus on the biological community), OEPA uses a subset of the QHEI matrices. The substrate, riparian characteristic, and channel metrics all evaluate stream attributes related to sediment bedload and related flow alteration Section 3 of the TMDL).

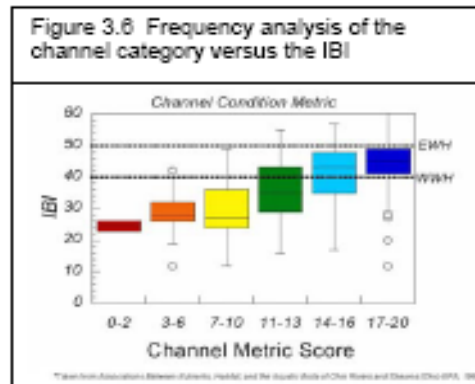
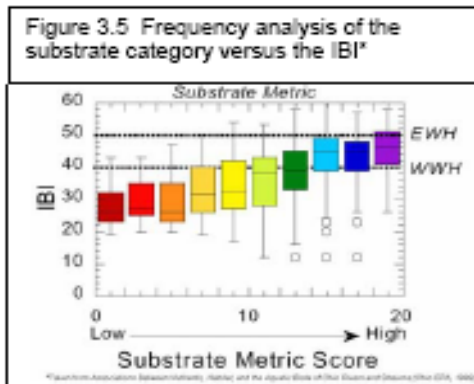
* The substrate metric includes an assessment of streambed sediment quality, quantity, and origin. Substrate refers to the base or bottom of the stream. Higher levels of mud/muck/silt that cover the substrate have significant negative impacts on the fish community, impacting the reproduction, feeding, and overall health of the biotic community.

* The riparian metric evaluates riparian width, quality, and bank erosion. The riparian metric targets the floodplain and the state of the streambanks. Streambank erosion can dump very large amounts of sediment into a stream, particularly during higher flows. In addition, the floodplain can serve as a "bank" for sediment. When flows are high/flooding, the stream will deposit excess sediment on the floodplain. If the floodplain is poor/absent, then this sediment cannot be removed from the system, and will be transported downstream, until flows slow and the sediments deposited in another reach.

* The channel metric describes stream physical morphology including sinuosity and extent of development. Sinuosity refers to the "serpentine" nature of the channel. A stream that has low sinuosity has likely been channelized, and has highly altered erosional features. The channel matrix also looks at how well-developed the pool/riffle structures are. Excessive sediment will fill-in the pools, and cover up the ruffles, resulting in a more uniform, flat stream bed, severely impacting the feeding and reproductive habitat in the stream.

Each of these factors measures the degree to which siltation and related flow alteration affect a

stream, and cumulatively serves as its numeric target. As shown below, results clearly show that biological scores are strongly influenced by the substrate and channel quality. For attainment of EWH and WWH use, Tables 3.5 and 3.6 of the *Associations* document (copied below) indicates the target scores.



Based upon these results, OEPA believes, and EPA agrees, that using the QHEI matrices related to sedimentation will result in a more useful sediment target than the traditional mass per unit time (Section 3 of the TMDL). The sedimentation scores can be thought of as a “concentration”, as they measure the current amount of sediment in the stream. Therefore, the loading capacity, the amount of sediment the stream can assimilate, would be measured by the sediment scores:

Table 4 TMDL Targets for sediment

Sediment TMDL =	Substrate +	Channel Morphology +	Riparian Zone/ Bank Erosion	= Total
<i>For WWH</i>	≥13 +	≥14 +	≥5 =	≥ 32

Since the sediment scores can be considered a concentration, then the load allocations (LAs) and wasteload allocations (WLAs) would be the same as the loading capacity, i.e., a sediment score of 32 (LA = 32, WLA = 32).

Thus, they are consistent with EPA’s *Protocol for Developing Sediment TMDLs* (USEPA, October 1999) and with 40 CFR 130.2(i), which states that “TMDLs can be expressed in terms of either mass per unit time, toxicity, or other appropriate measure.” The scores also comply with the “daily” load requirement, as they are applicable at any time (e.g., any day).

OEPA believes that achieving these targets will result in sediment loading reductions and biotic community improvements that will influence attainment of the water aquatic life use designations. As discussed earlier, OEPA has a clearly-defined process for developing the QHEI scores, with on-going field training for field personnel. A manual and supplemental material has been developed to help ensure habitat assessments are performed consistently.

Conclusion:

Based upon the material submitted by OEPA, and the material reviewed by the EPA, using the sediment scores as defined by OEPA is an appropriate measure of sediment in developing end-point targets for the Upper Mahoning River TMDL.

References:

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