Appendix K.

Additional Considerations

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In accordance with House Bill 49 of the 132nd General Assembly and Sections 6111.562(B) and (C) of the Ohio Revised Code (codes.ohio.gov/ohio-revised-code/section-6111.562), additional factors shall be considered and evaluated by Ohio EPA prior to the finalization of a Total Maximum Daily Load (TMDL) report after September 29, 2017. This Appendix serves to document the Agency's considerations and evaluations as required by the statute to the extent possible given that this project began years before the statute revisions took effect.

In addition, Section 6111.561 of the Ohio Revised Code (codes.ohio.gov/ohio-revised-code/section-6111.561) requires Ohio EPA to establish each TMDL at a level necessary to achieve the applicable water quality standards for which the water of the state is impaired that accounts for seasonal variations, a margin of safety, and lack of knowledge concerning the relationship between effluent limitations and water quality (referred to as the margin of safety). This information can be found in Sections 2 and 7 of the TMDL report. Section 6111.563 of the Ohio Revised Code (codes.ohio.gov/ohio-revised-code/section-6111.563) requires the official draft TMDL to include an estimate of the total amount of each pollutant that causes water quality impairment from all sources and an estimate of the total amount of pollutants that may be added to the water of the state while still allowing the water of the state to achieve and maintain applicable water quality standards. This information is located in Appendix H of the report for each individual TMDL calculation.

K-1 The relative contribution of pollutant loading between point sources and nonpoint sources.

The Black River watershed includes both rural, agricultural areas and developed urban areas. See Section 3.4 of the report for additional information on land use and land cover. Point sources and nonpoint sources are present in the watershed and their contribution of total phosphorus (TP), total suspended solids (TSS), *E. coli* and total dissolved solids (TDS) varies from the East Fork and West Fork branches to the mainstem. Identification of point and nonpoint sources is included in Appendix C of the report. The following figures from Section 4 of the report summarize the source loads for the Black River watershed. For more specific information, Appendix E contains source loading modeling outputs at the aquatic life use impaired sites for TP and TSS from the Surface Water Assessment Tool (SWAT) model. The following Figures K-1 and K-2 are examples.

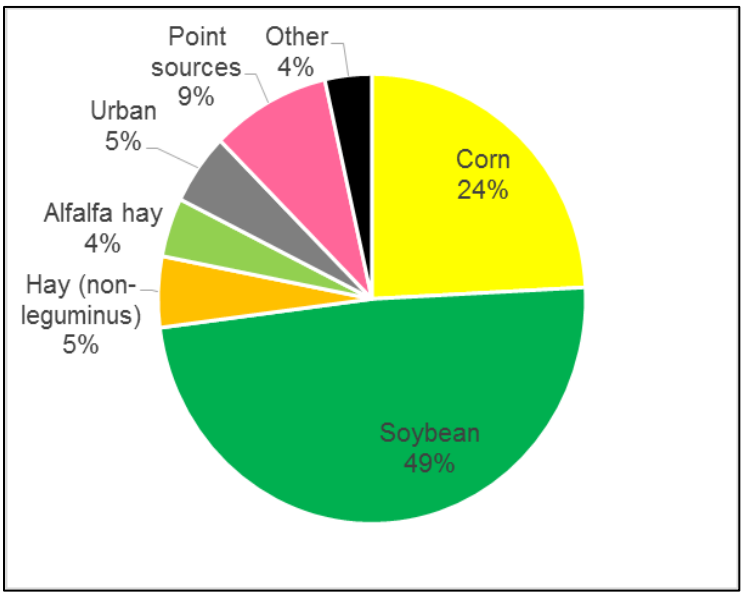

Figure K - 1. Summarized modeled annual TP source loads for the Black River watershed (and excludes the frontal Lake Erie drainages).

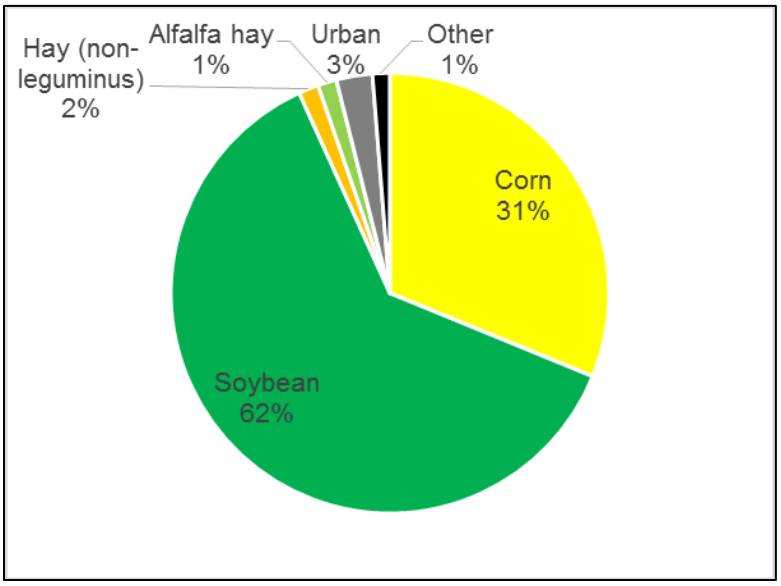

Figure K - 2. Summarized modeled annual TSS source loads for the Black River watershed (and excludes the frontal Lake Erie drainages).

As explained in Section 6 of the report, the SWAT model does not simulate bacteria therefore source information from the modeling provided for TP and TSS is not available. Instead, a spatial analysis was created depicting impaired sites, land use and degree of exceedance of the *E. coli* geometric mean water quality criterion for the Black River watershed. In addition, *E. coli* sample results are depicted on a map of the watershed during dry and wet conditions. See Figures F-1 to F-3 in Appendix F. This analysis can

be used in a weight of evidence approach to determine whether sources of *E. coli* and more likely to be point or nonpoint sources.

K-2 The flow dynamics, including but not limited to, periodic or seasonal flow variations, runoff, groundwater, and hydrologic or channel modifications.

Section 3.7 of the report contains detailed information on the hydrology of the Black River watershed. Appendix B contains information on the Black River watershed characteristics including land cover, percent of impervious cover, geology and soils, climate, and hydrology. Appendix D has additional information on the Black River watershed hydrology. This information is used in development of the SWAT model, used in determining critical conditions, setting TMDL targets, and implementation of the TMDLs.

K-3 The degree to which point source reductions would influence attainment of applicable water quality standards for which the water of the state is impaired.

The degree to which point source reductions influence attainment of applicable water quality standards for which a water is impaired is discussed site by site in Appendix E of this report for aquatic life use and Appendix F of this report for recreation use. See Table K - 1 for a list of assessment units with point sources listed as sources of aquatic life use impairment and reference to additional information in Appendix E of this report.

Table K - 1. Necessary Pollutant Reductions to Achieve TMDLs (Taken from Table 17 of the Black River Watershed TMDL Report)

WAU (04110001)	Water body	TMDL Pollutant	Pollutant reduction requirements over varying flow regimes	Cause(s) of ALU impairment	Source(s) of ALU impairment	Point Source and Section of Appendix E for Additional Information
East Branch Black River						
04 03	Willow Creek	TP	0% - 63%	Organic enrichment, Nutrient/ eutrophication	On-site treatment system (septic), Municipal point source dischargers	Eaton Homes WWTP Section E-2.3
West Branch Black River						
05 01	Charlemont Creek	TP	35% - 79%	Nutrient/ eutrophication	Municipal point source dischargers	Wellington WWTP Section E-3.1

	UT to Charlemont Creek	TP	78% - 91%	Nutrient/ eutrophication	Municipal point source dischargers	
Black River						
06 02	Black River	TP	0% - 50%	Nutrient/ eutrophication	Municipal point source dischargers	Elyria WWTP Section E-4.2
		TDS	0%	Specific conductance	Municipal point source dischargers	

Regarding recreation use, point sources are not the major source of bacteria loading to the streams, in general, during high flows. Point sources can contribute considerably to the in-stream bacteria loads during low flow conditions. The following point source wastewater treatment plants were identified in Appendix F of this report as contributing significant bacteria loading to the stream: Lodi WWTP, Eaton Homes WWTP, Brentwood Lakes WWTP, Grafton WWTP, Wellington WWTP, LaGrange, French Creek WWTP, Elyria WWTP and Avon Lake WPCF's combined sewer overflows.

K-4 The degree to which nonpoint source reductions would influence attainment of the applicable water quality standards for which the water of the state is impaired.

The degree to which nonpoint source reductions would influence attainment of applicable water quality standards for which a water is impaired is discussed site by site in Appendix E of this report for aquatic life use and Appendix F of this report for recreation use. See Table K - 2 for a list of assessment units with nonpoint sources listed as sources of aquatic life use impairment.

Table K – 2. Necessary Pollutant Reductions to Achieve TMDLs (Taken from Table 17 of the Black River Watershed TMDL Report)

WAU (04110001)	Water body	TMDL Pollutant	Pollutant reduction requirements over varying flow regimes	Cause(s) of ALU impairment	Source(s) of ALU impairment
Headwaters East Branch Black River					
03 01	EFEBBR	TSS	0% - 84%	Sedimentation/siltation	Urban runoff / storm sewers
03 03	EBBR	TSS	0% - 84%	Sedimentation/siltation	Dam or impoundment
East Branch Black River					
04 03	Willow Creek	TP	0% - 63%	Organic enrichment, Nutrient/eutrophication	On-site treatment system (septic), Municipal point source dischargers
		TSS	0% - 74%	Sedimentation/siltation	Agriculture
04 04	EBBR	TSS	3% - 91%	Sedimentation/siltation	Dam or impoundment

West Branch Black River					
05 01	Charlemont Creek	TP	0% - 84%	Nutrient/eutrophication	On-site treatment system (septic)
05 02	WBBR	TSS	0% - 81%	Sedimentation/siltation	Agriculture
05 03	Wellington Creek	TP	0% - 74%	Nutrient/eutrophication	On-site treatment system (septic)
05 04	WBBR	TSS	0% - 70%	Sedimentation/siltation	Agriculture
05 05	Plum Creek	TSS	62% - 83%	Sedimentation/siltation	Urban runoff / storm sewers
05 06	Elk Creek	TP	0% - 73%	Nutrient/eutrophication	Agriculture
	Kelner Ditch	TP	0% - 75%	Nutrient/eutrophication	Agriculture On-site treatment system (septic)
	WBBR	TSS	0% - 82%	Sedimentation/siltation	Agriculture
Black River					
06 01	French Creek	TP	0% - 5%	Nutrient/eutrophication	On-site treatment system (septic)

K-5 Reasonable assurances that reductions can be implemented.

According to U.S. EPA's *Guidelines for Reviewing TMDLs under Existing Regulations issued in 1992* (epa.gov/sites/production/files/2015-10/documents/2002_06_04_tmdl_guidance_final52002.pdf), 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 nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint 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. Section 8 of the Black River Watershed TMDL report contains reasonable assurances.

K-6 The site of the impairment relative to the location of the source.

Figure 3 in the Black River Watershed TMDL report contains the locations of the WAUs and ALU attainment in the project area. Figure 4 in the Black River Watershed TMDL report shows the locations of the WAUs and recreation attainment in the project area. The site of the impairment relative to the location of the source is considered in the distribution of the WLA among NPDES dischargers and in the recommended implementation plan. See Appendix I of this report.

K-7 The degree to which habitat affects impairment and restoration potential.

Habitat quality is factored into the aquatic life use linkage analysis in Appendix E of this report on a site by site basis. Habitat impacts are considered in the cause/source determination for impaired sites, in the TMDL parameter decision making process and in the implementation plan. Ohio EPA uses an adaptive management strategy in TMDL implementation and uses feedback from follow up biological and water

quality monitoring to inform the implementation steps. Implementation plans can be revised, updated, or held steady based upon the monitoring results.

K-8 The feasibility of available demonstrated treatment technology to achieve the degree of pollutant treatment removal necessary to attain the point source reduction recommended in the TMDL wasteload allocation.

Ohio EPA uses an adaptive management approach to implement TMDL WLAs for point sources. In general, the effluent limit reductions are phased in over more than one permit cycles, which is typically five years. Ohio EPA conducts follow up biological and water quality sampling to inform the TMDL implementation phases. In the Black River Watershed TMDL report, WLAs are included for total phosphorus, total suspended solids, total dissolved solids and *E. coli*.

For the purposes of this specific project, the feasibility analysis will focus on the recommended first phase of implementation only since the implementation plan recommends a follow up biological and water quality survey before further action is taken on pollutant reductions. The feasibility analysis will only focus on WLAs for total phosphorus because the WLAs for total suspended solids, total dissolved solids and *E. coli* are based upon best available demonstrated control technology or water quality standards applied as existing effluent limitations in permits.

K-8.1 Total Phosphorus TMDLs

In the first phase of implementation of the Black River watershed TMDL, Ohio EPA is recommending two new total phosphorus effluent limitations of 1.0 mg/L for the Wellington WWTP and Eaton Homes WWTP. See Table I-1 in Appendix I.

States across the nation have established technology based effluent limitations for total phosphorus for publicly owned treatment plants. States that border the Great Lakes have a technology based effluent limit of 1.0 mg/L for total phosphorus. Other states such as Texas, Colorado, and North Carolina also have a technology based effluent limit of 1.0 mg/L for total phosphorus. Ohio has required publicly owned treatment works in the Lake Erie basin with a design flow of 1.0 million gallons per day or more to meet a total phosphorus discharge limit of 1.0 mg/L (Ohio Administrative Code 3745-33-06, epa.ohio.gov/Portals/35/rules/33-06_jun18.pdf) since 2006. A total phosphorus effluent limitation of 1.0 mg/L is technically achievable with current treatment technology.

K-9 Sources of funding available for point and nonpoint sources.

See Appendix J of this report for sources of funding available for point and nonpoint sources of impairment in the Black River watershed.

K-10 Alternative approaches and actions for point and nonpoint sources to achieve TMDL-recommended pollutant reductions, agreements between and among point and nonpoint sources to jointly achieve pollutant load reductions, and adaptive management.

See Section 8.5.4 of the Black River Watershed TMDL report for alternative approaches and adaptive management of the recommended TMDL implementation actions. This section will be updated after the comment period on the draft report to include stakeholder feedback.

K-11 The implementation of the recommended wasteload reductions over multiple NPDES permit renewals to achieve compliance with water quality standards, as appropriate, to mitigate potential economic impacts of the TMDL's recommended load reductions on such sources.

See Table I-1 in Appendix I of this TMDL report. The table includes recommendations for incremental or "phasing-in" of NPDES permit effluent limitations for total phosphorus wasteload allocations.

K-12 The estimated economic impact, on a categorical basis, on government subdivisions, point sources, agricultural operations, and nonpoint sources.

There is a cost to restoring water quality in the Black River watershed. This cost will be discussed for point sources and nonpoint sources and is based upon the recommended implementation in Appendices I and J of this report. Overall, the cost analysis of implementing the Black River watershed is highly variable and includes many assumptions since it is prepared without facility/best management practice specific information. Costs will also change as treatment technologies become more common for point sources and as progressive practices are voluntarily adopted to reduce impacts from nonpoint sources.

This analysis can be updated after the stakeholder comment period based upon information received. See Section K-13, below.

K-12.1 Point Sources

K-12.1.1 Total Phosphorus

As a result of the Black River watershed TMDL report, point source wastewater treatment plants (WWTPs) (including publicly owned and privately owned treatment works) receiving TP WLAs will be required to implement reductions in accordance with Table I-1 in Appendix I through the National Pollutant Discharge Elimination System (NPDES) permit program.

K-12.1.1.1 New Total Phosphorus Monitoring Requirement

In the Black River watershed TMDL project, Ohio EPA is recommending 20 facilities receive a new monitoring requirement in their NPDES permit for total phosphorus. See Table K - 3. The frequency of the monitoring requirement will depend on factors such as design flow and wastewater type. The

economic impact to these facilities is the cost of the laboratory analysis for the total phosphorus parameter and the frequency of reporting during the life of the permit (typically five years). The laboratory cost can vary amongst commercial labs. For estimation purposes, the Ohio EPA, Department of Environmental Services Lab cost for total phosphorus analysis is $12.00 per sample. Sampling frequencies can be estimated from Ohio EPA guidance for sanitary wastewater (epa.ohio.gov/portals/35/guidance/npdes_permit_guidance%201.pdf) and for industrial wastewater (epa.ohio.gov/portals/35/guidance/permit2.pdf).

The cost of time for sample collection and reporting should be minimal since these facilities already collect samples and report results on those to the Agency on a monthly basis.

Table K - 3. List of Point Sources with a New Recommendation to Monitor Total Phosphorus under the NPDES Program

NPDES ID	Facility	Design flow (mgd)	WLA		Recommended permit condition
			(mg/L)	(lb/d)	1st phase
2PR00121	Country Stage Campground	0.006	0.21	0.011	Monitor
3IG00085	Town and Country Co-op, Inc.	storm water	0.17	0.0021 - 1.6	Monitor
3IN00059	Buckeye Partners, L.P.	storm water	0.08	0.000003 - 0.09	Monitor
3IN00224	First Energy Generation Corp. – Westwood Ash Facility	storm water	0.08	0.0002 - 0.71	Monitor
3IS00087	Spencer Forge and Manufacturing Company	0.00432	0.20	0.0072	Monitor
3PA00018	Spencer WWTP	0.090	0.21	0.058	Monitor
3PR00185	Elyria Hauling Company	0.007	0.21	0.012	Monitor
3PR00191	Elyria Hotel	0.002	0.21	0.0035	Monitor
3PR00326	D'Tanglez Studio	0.0015	0.21	0.0026	Monitor
3PR00394	Lorain County Resource Recovery Complex	0.008	0.21	0.014	Monitor
3PR00434	Circle K No. 5312	0.0015	0.21	0.0026	Monitor
3PR00487	The Activity Center	0.023	0.21	0.0040	Monitor
3PT00092	Chatham Township Community Center	0.003	0.21	0.0053	Monitor
3PT00099	Litchfield Preschool Daycare Center	0.009	0.21	0.016	Monitor
3PT00103	EMSNET Business Center	0.0066	0.21	0.012	Monitor
3PT00104	Educational Service Center of Lorain County	0.0088	0.21	0.015	Monitor
3PW00027	A-1 Construction Apartments	0.003	0.21	0.0053	Monitor
3PW00033	Butternut Ridge Apartments	0.0015	0.21	0.0026	Monitor
3PW00038	Butternut Terrace Apartments	0.0075	0.21	0.013	Monitor
3PZ00055	Forest Hills Country Club	0.005	0.21	0.0088	Monitor

K-12.1.1.2 New Total Phosphorus limit

In the first phase of the Black River TMDL implementation, Ohio EPA is recommending new total phosphorus permit limitations for two WWTPs. These facilities are listed in Table K- 4 below.

Table K - 4. List of Point Sources with a New Recommended Total Phosphorus Permit Limit

NPDES ID	Facility	Design flow (mgd)	WLA		Recommended permit condition
			(mg/L)	(lb/d)	1st phase
3PC00014	Wellington WWTP	0.750	0.08	0.50	1.0 mg/L
3PH00023	Eaton Homes WWTP	0.200	0.18	0.30	1.0 mg/L

The cost associated with reducing total phosphorus varies on a case-by-case basis for each WWTP. Factors contributing to the variation include total phosphorus concentration of the raw wastewater influent, type of treatment system, design flow of treatment system, layout/location of the treatment system (available space for additional treatment components), etc. Overall, the cost increases with the level of total phosphorus removal required and the cost per gallon of wastewater treated will likely be smaller for the larger WWTPs due to economies of scale. Numerous reports are available seeking to estimate the cost for nutrient reduction by wastewater treatment plants. The following are example reports from U.S. EPA:

- *A Compilation of Cost Data Associated with the Impacts and Control of Nutrient Pollution* - epa.gov/nutrient-policy-data/compilation-cost-data-associated-impacts-and-control-nutrient-pollution
- *Case Studies on Implementing Low-Cost Modifications to Improve Nutrient Reduction at Wastewater Treatment Plants* - epa.gov/nutrient-policy-data/case-studies-implementing-low-cost-modifications-improve-nutrient-reduction
- *Six Municipalities, One Watershed: A Collaborative Approach to Remove Phosphorus in the Assabet River Watershed* - nepis.epa.gov/Exe/ZyPDF.cgi/P100M0UH.PDF?Dockey=P100M0UH.PDF

U.S. EPA is also conducting a national study of nutrient removal and secondary treatment technologies. The goals of the study are to obtain nationwide data on nutrient removal; encourage improved treatment plant performance with less expense; and provide a forum for stakeholders to share best practices. For additional information, see: epa.gov/eg/national-study-nutrient-removal-and-secondary-technologies.

U.S. EPA contracted with TetraTech to update Ohio EPA's 2006 *Analysis of Treatment and Disposal Standards for Phosphorus for Publicly Owned Treatment Works* in 2013. The technical support document *Cost Estimate of Phosphorus Removal at Wastewater Treatment Plants* (epa.ohio.gov/Portals/35/wqs/nutrient_tag/OhioTSDNutrientRemovalCostEstimate_05_06_13.pdf) outlines procedures used to produce cost estimates for nutrient removal at WWTPs, including a breakdown into planning level capital, operations and maintenance and life-cycle cost.

Based upon the information used in the 2013 TetraTech report, the cost associated with the scenario of ugrading a WWTP to 1-point chemical addition using no filters to reach a total phosphorus effluent limit of 1.0 mg/L is presented in Table K - 5.

Table K - 5. Summary of WWTP Cost Information to Reach Total Phosphorus Limit of 1 mg/L

Source	Classification	Technology	Flow Rate (MGD)	Influent (mg/L)	Target (mg/L)	Capital Costs ($/gpd)	Total O&M ($/MG)	Life-cycle costs ($/MG treated)
CAPDETWorks	Chemical	1-point chemical addition, no filter (6mg/L)	1	6	1	$0.35	$70.71	$153.43
CAPDETWorks	Chemical	1-point chemical addition, no filter (7mg/L)	1	7	1	$0.35	$94.86	$177.57
CAPDETWorks	Chemical	1-point chemical addition, no filter (8mg/L)	1	8	1	$0.35	$119.01	$201.72

K-12.1.2 New Total Suspended Solids Limit

In the first phase of the Black River TMDL implementation, Ohio EPA is recommending a new total suspended solids (TSS) permit limitation for one facility, listed in Table K - 6 below.

Table K - 6. List of Point Sources with a New Recommended Total Suspended Solids Permit Limit

NPDES ID	Facility	Design flow (mgd)	WLA		Recommended permit condition
			(mg/L)	(lb/d)	1st phase
3IN00059	Buckeye Partners, L.P.	storm water	25	0.23 - 27	25 mg/L

Buckeye Partners, L.P. currently monitors and reports results for total suspended solids. Upon review of the facility's Discharge Monthly Reports (DMRs), the average of total suspended solids concentration values reported from October 2017 to October 2020 is 22 mg/L. Depending upon the wastewater treatment system and operation, the new effluent limitation may be met by the facility without any additional expense.

K-12.1.3 New Total Dissolved Solids Monitoring

In the Black River watershed TMDL project, Ohio EPA is recommending two facilities receive a new monitoring requirement in their NPDES permit for total dissolved solids. See Table K - 7. The frequency of the monitoring requirement will depend on factors such as design flow and wastewater type. The economic impact to these facilities is the cost of the laboratory analysis for the total dissolved solids parameter and the frequency of reporting during the life of the permit (typically five years). The laboratory cost can vary amongst commercial labs. For estimation purposes, the Ohio EPA, Department of Environmental Services Lab cost for total dissolved solids analysis is $12.00 per sample. Sampling frequencies can be estimated from Ohio EPA guidance for sanitary wastewater (epa.ohio.gov/portals/35/guidance/npdes_permit_guidance%201.pdf) and for industrial wastewater (epa.ohio.gov/portals/35/guidance/permit2.pdf).

The cost of time for sample collection and reporting should be minimal since these facilities already collect samples and report results on those to the Agency on a monthly basis.

Table K - 7. List of Point Sources with a New Recommendation to Monitor Total Dissolved Solids under the NPDES Program

NPDES ID	Facility	Design flow (mgd)	WLA (tons/day)	WLA (mg/L)	Recommended permit condition for TDS (mg/L)
3IS00079	Kalt Manufacturing Company	0.005	0.031	1,500	Monitor
3PA00024	Westfield Allotment WWTP	0.025	0.016	1,500	Monitor

K-12.1.4 Small Municipal Separate Storm Sewer Systems (MS4s)

Since this is a second version of a TMDL for the Black River watershed, there are Small Municipal Separate Storm Sewer Systems (MS4s) already included in the current TMDL and implementing the TMDL requirements.

Small MS4s are required to comply with requirements contained in the NPDES Small MS4s General Permit. Small MS4s are required by the NPDES permit to develop a Storm Water Management Plan that contains six minimum control measures. Under the current version of the NPDES Small MS4 General Permit (OHQ000003), the small MS4s are required to, where applicable, select BMPs for the storm water minimum control measures that address U.S. EPA approved TMDL recommendations. Small MS4s are also required to include in the BMP selection rationale, how selected BMPs address applicable TMDL recommendations.

The NPDES Small MS4 General Permit (OHQ000003) does not require BMPs above and beyond minimum requirements for MS4s located in TMDL watersheds, it just requires that Small MS4s select BMPs that address TMDL requirements. In short, there is no additional cost. Small MS4s can select the BMPs to implement and are required to implement BMPs whether they are in a TMDL watershed or not.

The NPDES Small MS4 General Permit is currently being renewed. Draft version OHQ000004 contains more specific requirements for small MS4s in TMDL watersheds. The requirements apply to small MS4s identified in Appendix A of the General Permit (the listing includes Small MS4s with wasteload allocations in current, approved TMDL reports). The fact sheet that accompanies the General Permit contains more specific information on the requirements for the identified Small MS4s in TMDL watersheds (epa.ohio.gov/dsw/storm/index).

Due to timing of the NPDES Small MS4 General Permit renewal and the drafting of this TMDL, only small MS4 communities listed in Appendix A of the permit will be required to follow the TMDL related requirements during the term of the renewed general permit. The additional small MS4 communities identified in the draft TMDL report will not be required to implement the additional requirements until the next renewal of the NPDES Small MS4 General Permit (in five years).

The cost will vary for each small MS4 depending upon the number of pollutants causing water quality issues within a watershed, the types of pollutants and size of small MS4 (number of watersheds the MS4 is in), and the current level of BMP implementation. The cost may include the extra time in developing materials, distributing materials, additional construction site inspections of sites in noncompliance, education of contractors on green infrastructure practices, additional street sweeping and catch basin cleanouts, etc. There is one new requirement for post-construction storm water management that will likely be an additional cost to the small MS4 communities with applicable TMDLs. 2

- Retrofit one (1) existing storm water practice that solely provides a peak-discharge function to meet the performance standard for an extended detention post-construction practice; or
- Perform restoration of at least three hundred linear feet of channelized stream where natural channel stability and floodplain restoration will reduce stream erosion; or
- Update ordinance or other regulatory mechanism to require OHC000005 Table 4b practices and/or other green infrastructure practices where feasible.; or
- Install one (1) or more Table 4b practices to treat a minimum of 1 acre of existing impervious area developed prior to 2003.

The cost associated with this requirement will depend upon the option selected by the community. The Urban Runoff BMPs section below contains cost information that may be applicable to this requirement. The Agency is interested in receiving cost information from small MS4s subject to this requirement in the NPDES Small MS4 General Permit renewal for consideration in future TMDL reports.

The following small MS4s are included in the current Black River TMDL report:

- Carlisle Township
- Elyria City
- Elyria Township
- Grafton Village
- Lorain County
- North Ridgeville City
- Oberlin City

See Table K – 8 for a complete list of small MS4s included in the Black River TMDL report. Small MS4s not included in the first Black River TMDL report will not be required to implement the TMDL specific requirements under the NPDES Small MS4s General Permit (OHQ000004) until the next general permit renewal.

Table K - 8 Summary of Small MS4s included in the Draft Black River TMDL Report

Ohio EPA ID	Permittee	WAU	*E. coli*	TP	TSS	TDS
3GQ10009	North Ridgeville	04 03	X		X	
		04 04				
		06 01	X	X		
		06 02	X	X		X
3GQ00013	Lorain County Metro Parks	06 01	X			
		06 02	X	X		X
		06 03	X			
		06 03	X			
3GQ00015	Grafton (village)	04 03	X	X	X	
		04 04	X		X	
		06 02		X		
3GQ00022	Ohio Turnpike Commission	06 01	X	X		
		06 02	X	X		X
3GQ00056	Sheffield Lake	06 03	X			
3GQ00079	Bay Village	06 03	X			
3GQ00082	Elyria	04 04	X		X	
		05 06	X			
		06 01	X			
		06 02	X	X		X

Ohio EPA ID	Permittee	WAU	*E. coli*	TP	TSS	TDS
3GQ00116	Avon Lake	06 01	X			
		06 03	X			
		06 03	X			
		06 03	X			
3GQ10001	North Olmsted	06 01	X	X		
3GQ10002	Avon	06 01	X	X		
		06 03	X			
		06 03	X			
3GQ10006	Sheffield (village)	06 01	X			
		06 03	X			
3GQ10012	Lorain County Storm Water Management District	04 03	X	X	X	
		04 04	X		X	
		05 04	X		X	
		05 05	X		X	
		05 06	X			
		06 02	X	X		X
3GQ10013	Westlake	06 01	X	X		
		06 03	X			
4GQ00000	Ohio Department of Transportation	04 03	X	X		
		04 04	X		X	
		05 04	X		X	
		05 05	X		X	
		05 06	X			
		06 01	X	X		
		06 02	X	X		X
		06 03	X			

K-12.2 Nonpoint Sources

The Black River TMDL report includes loading allocations for nonpoint sources of pollution. A weight-of-evidence approached was used in the project to determine the likely category of nonpoint source attributing to the non-attainment of the sampling location. This cost analysis will focus on those categories identified for implementation of nonpoint source best management practices (BMPs) in Table J-1 of Appendix J Implementation: Nonpoint Source Strategy. These include agriculture runoff BMPs, urban runoff BMPs, HSTS repair/replacement, stream restoration and dam removal.

K-12.2.1 Agriculture Runoff BMPs

Practice implementation costs of agriculture BMPs may vary widely based upon many factors including: type of BMP, area/volume of water to be treated by the BMP, concentrations of pollutants in the runoff water, landscape attributes such as soil type and slope, etc. In general, the cost of the agriculture runoff BMP includes the cost to design, install, operate and maintain, and can include the cost of taking working land out of production. These costs can be offset by various local, state and federal programs. The main funding programs are identified in Appendix J of this report.

Ohio United States Department of Agriculture, Natural Resources Conservation Service estimates the cost of various conservation practice standard (agriculture runoff BMPs) implementation scenarios. These are available at: nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/?cid=nrcseprd1328257.

This information can be used to estimate the cost of various TMDL implementation items such as development of nutrient management plans, reduced tillage, cover crops, critical area plantings, etc.

In addition, The Nature Conservancy's *Cost Benefit Synthesis of Best Management Practices to Address Sediment and Nutrients in Ohio* (TNC, 2019) presents total life cycle cost information for 10 agricultural runoff BMPs. These practices and costs are included in Table K - 9 below.

Table K - 9 Total Life Cycle Cost of Ten Common Agricultural Runoff BMPs

Best Management Practice	Total Life Cycle Cost Range
Filter strips	$700 to $4,500 per acre
Conservation tillage	$29 to $49 per acre
Cover crops	$45 to $270 per acre
Drainage water management	$30 to $100 per acre
Grassed waterways	$210 to $5,000 per acre
Injection/Incorporation of fertilizer	$31 to $56 per acre
Nutrient management plans	$2 to $9 per acre
Saturated buffers	$2 to $9 per linear foot
Two-stage ditches	$8 to $78 per linear foot
Variable rate application/technology	$3 to $19 per pound/acre

K-12.2.2 Urban Runoff BMPs

The cost of urban runoff BMPs is like agriculture runoff BMPs. The cost is based upon factors such as type of BMP, area/volume of water to be treated by the BMP, concentrations of pollutants in the runoff water, landscape attributes such as soil type and slope, space available to install the BMP (especially in retrofit projects), and more. In general, the cost of an urban runoff BMP includes the cost to design, install, operate and maintain the practice as well as the cost of using developable land. Some BMPs provide savings in terms of conventional drainage infrastructure. BMP costs can be offset by various local, state and federal programs. The main funding programs are identified in Appendix J of this report.

Information on the cost associated with urban runoff BMPs in Ohio is more limited and variable than cost of agriculture runoff BMPs. The Nature Conservancy's *Cost Benefit Synthesis of Best Management Practices to Address Sediment and Nutrients in Ohio* (TNC, 2019) presents total life cycle cost information for five urban storm water BMPs, see Table K - 10 below. The total life cycle cost includes construction and maintenance of the practice.

Table K - 10 Total Life Cycle Cost of Five Urban Runoff BMPs

Best Management Practice	Total Life Cycle Cost Range
Bioretention	$9 to $37 per square foot
Dry Detention Ponds	$51,000 to $170,000 per acre-foot
Grassed Swales	$32 to $130 per linear foot
Pervious Pavement	$7 to $18 per square foot
Wet Detention Ponds	$53,000 to $190,000 per acre-foot

K-12.2.3 HSTS Repair/Replacement

The cost to repair a household sewage treatment system depends upon the type of repair needed and the type of system being repaired. The cost to replace a household sewage treatment system depends upon the amount and type of sewage to be treated, available area for a suitable treatment system, type of soils present, whether a soil-based treatment system can be installed verses mechanical system, whether an NPDES permit will be required (for a discharging system), and operation/maintenance costs with the type

of system installed. Drip distribution and mound systems will be more expensive than leach lines and a mechanical system will be more expensive to operate than a soil-based treatment system. The cost of a replacement system can range from approximately $8,500 for a typical system consisting of a septic tank to leach lines to $22,500 for a system consisting of a septic tank to a drip distribution system. These costs can be offset by various local, state and federal programs. The main funding programs are identified in Appendix J of this report and on the Ohio Department of Health's webpage at: odh.ohio.gov/wps/portal/gov/odh/know-our-programs/residential-sewage-treatment-systems/information-for-homeowners/financial-resources-for-the-repair-and-replacement-of-household-sewage-treatment-systems.

K-12.2.4 Stream Restoration

Stream restoration is a broad term that describes work to improve the quality of a stream or river. The improvement could include items like habitat restoration, reconnection to floodplain, channel restoration, removal of barriers to fish passage, etc. The cost associated with stream restoration is also highly variable and depends on the type of restoration to be completed, catchment size and length of stream to be restored, degree of surrounding landscape, and floodplain development. Some examples of cost are included in the list below:

- Two-stage Ditch: total life cycle cost range is $8 to $78 per linear foot (TNC, 2019). This cost is bench height and width specific and catchment specific. Based upon the review of past Ohio Section 319 projects, the cost may be higher (e.g., $90-$125 per linear foot) in larger ditches with wider bench design, or to include riparian plantings
- Natural Channel Design: $200 to $500 per linear foot based upon review of past Ohio Section 319 projects, and is dependent upon contributing watershed size; and degree of restoration work in the floodplain and along stream banks
- Ohio NRCS Ohio United States Department of Agriculture, Natural Resources Conservation Service estimates the cost of various conservation practice standard (agriculture runoff BMPs) implementation scenarios. These are available at: nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/?cid=nrcseprd1328257

K-12.2.5 Dam Removal

Costs associated with dam removal projects are generally very site specific. Contributing variables can include:

- Height, width, and base of the dam
- Access to and from site; and degree of material disposal/re-use
- Complete or partial removal
- Mussel survey (if needed)
- Property ownership and easements
- Permitting
- Dam pool sediment evaluation and removal (if needed)
- Degree of stream, wetland and/or riparian restoration to ensure responsible project completion
- Utilities that may need to be relocated

Based upon review of past Ohio Section 319 projects and dam removal projects in Ohio, projects can range from $25,000 for removal of small low-head dams to $10 million for larger dam removal projects. The cost can increase to $70 million for dam removal projects such as the Gorge Dam on the Cuyahoga River (cuyahogariver.net/interests/dam-removal/gorge-dam/).

K-13 Information submitted by indirect dischargers or other stakeholders relating but not limited to cost, economic impacts, environmental benefit, and technical feasibility.

Any information provided to the Agency will be included here and considered and evaluated by the Director prior to submitting the final TMDL report to U.S. EPA for review and approval.

K-14 References

The Nature Conservancy. 2019. *Cost Benefit Synthesis of Best Management Practices to Address Sediment and Nutrients in Ohio*. Dublin, Ohio.