Ohio Environmental Protection Agency

Loading Analysis Plan and Supporting Data Acquisition Needed for the

Little Muskingum River Basin

Total Maximum Daily Load Development

Ohio EPA Technical Report AMS/2015-LMUSK-3

Division of Surface Water
Assessment and Modeling Section
May 2020

Table of Contents

Introduction 3

Aquatic Life Use 3

Evaluation of Biocriteria 3

Proposed Actions 5

Proposed Targets 5

Recreation Use 5

Evaluation of Criteria 5

Proposed Actions 6

Introduction

This document provides an overview of the information considered in proposing the strategy to address water quality impairments in the Little Muskingum river watershed. These recommendations are based on data collected as part of a biological and water quality study in 2015-2016. A description of the project area, sites, data types, and methods can be found in the Little Muskingum River study plan document at (***https://epa.ohio.gov/Portals/35/tmdl/2015_SEORT_StudyPlan.pdf***). A summary of the study results can be found in the biological and water quality report at (***https://epa.ohio.gov/Portals/35/tmdl/TSD/Little%20Muskingum%202015/LittleMuskingum2015_TSD.pdf?ver=2020-04-01-102154-427***).

Sites in the Little Muskingum River watershed were assessed for aquatic life use and recreation use. The public water supply use was not assessed since no surface waters are used as a public water supply in this study area. The attainment of aquatic life and recreation use is based on specific restoration targets. This document examines those targets and lays out proposals for addressing each impairment. Where appropriate, methods are outlined to develop total maximum daily loads (TMDL) for specific pollutants.

Aquatic Life Use

Evaluation of Biocriteria

Attainment of Ohio EPA's biocriteria are based on fish and macroinvertebrate scores, as measured by the Index of Biotic Integrity (IBI), Modified Index of well-being (MIwb) and Invertebrate Community Index (ICI). Further explanations of Ohio EPA's biocriteria can be found in Ohio Administrative Code (OAC) Chapter 3745-1-07 and additionally at ***epa.ohio.gov/dsw/bioassess/BioCriteriaProtAqLife***. Goals for those indices in the Little Muskingum River watershed are shown in Table 1. Figure 1 shows the location of the 72 sites that were sampled for aquatic life use, all of which were in full attainment.

Table 1 – Biological criteria applicable in the Little Muskingum River watershed for aquatic life use designations.

Ecoregion	Biological Index	Assessment Method[2, 3]	Biological Criteria for the Applicable Aquatic Life Use Designations[1]	
			EWH	WWH
Western Allegheny Plateau (WAP)	IBI	Headwater	50	40
		Wading	50	40
		Boat	48	42
	MIwb	Wading	9.4	8.3
		Boat	9.6	8.5
	ICI	All[4]	46	36

[1] Aquatic Life Use (ALU) designations: warmwater habitat (WWH) and exceptional warmwater habitat (EWH).
[2] In general, the assessment method used at a site is determined by its drainage area (DA) according to the following: Headwater: DA ≤ 20 mi^2; wading: DA >20 mi^2 and ≤ 500 mi^2; boat: DA > 500 mi^2.
[3] MIwb not applicable to drainage areas less than 20 mi^2 (headwater sites).
[4] Limited to sites with appropriate conditions for artificial substrate placement.

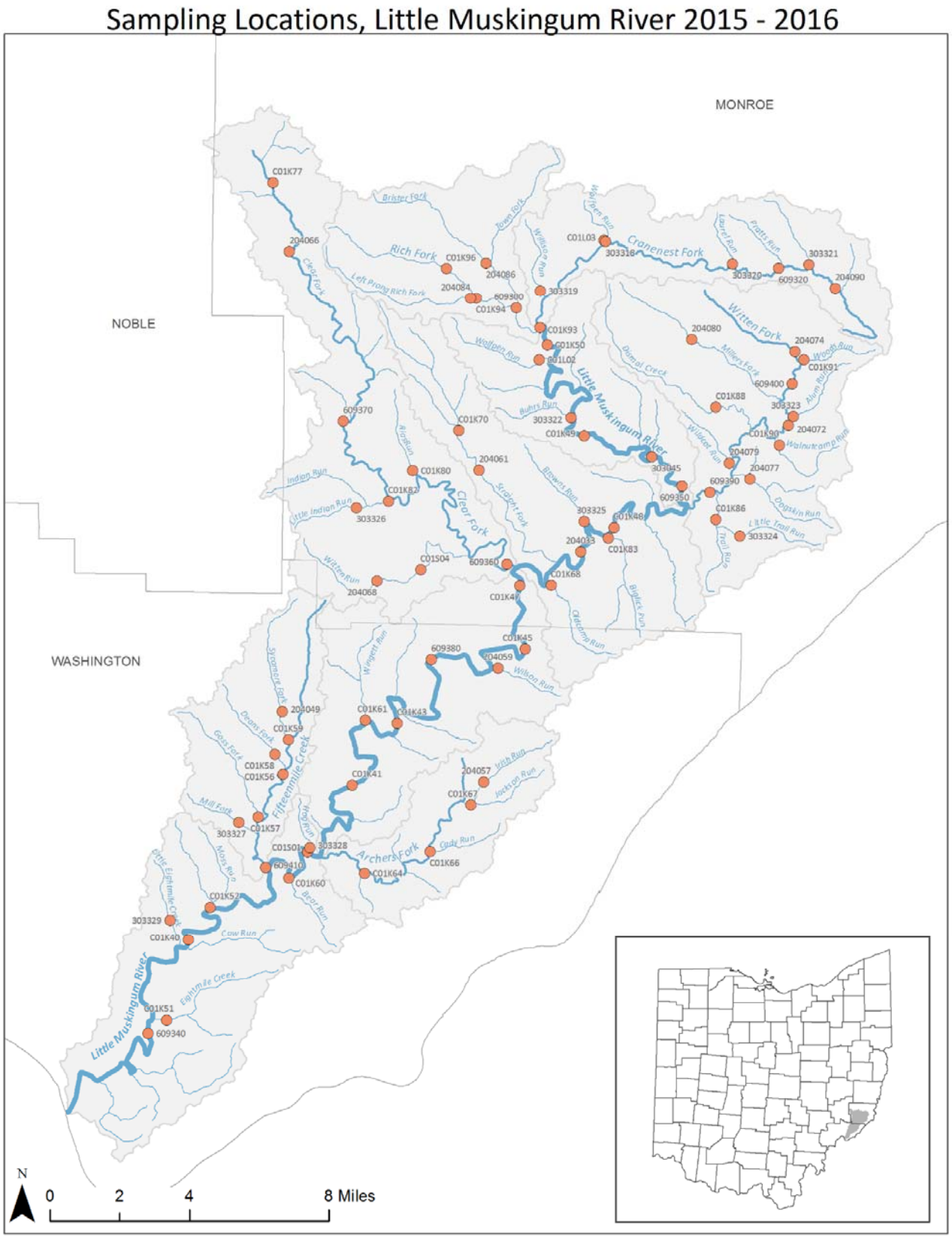

Figure 1 — Map showing sampling locations in the Little Muskingum River watershed in 2015-2016.

Proposed Actions

There are no proposed actions for this watershed, as all sites were attaining applicable aquatic life criteria.

Proposed Targets

There are no proposed targets for this watershed, as all sites were attaining applicable aquatic life criteria.

Recreation Use

Evaluation of Criteria

Attainment of recreation use goals is based on numeric criteria for *Escherichia coli* (*E. coli*) as an indicator bacterium. These criteria, shown in Table 2, are also the targets used for TMDLs. Table 3 lists attainment of recreation use based on criteria at the time of assessment, which were different than the current standards. However, any TMDLs created for those assessment units will use the updated values in Table 2.

Table 2 – Water quality criteria for recreation use

Recreation Use	*Escherichia coli* (colony forming units per 100 mL)	
	90-day geometric mean	Statistical threshold value[1]
Bathing water	126	410[a]
Primary contact recreation	126	410
Secondary contact recreation	1030	1030

[1] These criteria shall not be exceeded in more than 10 percent of the samples taken during any ninety-day period.

[a] A beach action value of 235 E. coli colony counts per 100 mL shall be used for the purpose of issuing beach and bathing water advisories.

Table 3 – Recreation use attainment information for impaired sampling locations in the Little Muskingum River watershed, 2015-2016.

Station	Stream Name	River Mile	# Samples	Geometric Mean	Maximum Value	Attainment Status	Potential Source(s) [1]
HUC 05030201-06-01 – Rich Fork							
C01K93	Rich Fork	0.10	8	214	2,500	Non	AG, HSTS
HUC 05030201-06-02 – Cranenest Fork							
C01L03	Cranenest Fork	4.00	7	265	2,800	Non	HSTS
HUC 05030201-06-03 – Wolfpen Run-Little Muskingum River							
C01K50	Little Muskingum River	57.80	8	294	4,200	Non	HSTS
C01K49	Little Muskingum River	51.80	11	122	4,700	Non	HSTS, AG
303045	Little Muskingum River	48.83	10	345	5,500	Non	HSTS
HUC 05030201-06-04 – Witten Fork							
609390	Witten Fork	1.10	11	282	4,000	Non	HSTS, AG
HUC 05030201-06-05 – Straight Fork-Little Muskingum River							
C01K48	Little Muskingum River	42.50	7	270	7,500	Non	HSTS, AG
204033	Little Muskingum River	40.90	10	158	10,000	Non	HSTS
HUC 05030201-07-02 – Archers Fork							
C01K64	Archers Fork	1.83	12	263	970	Non	AG
HUC 05030201-07-03 – Wingett Run-Little Muskingum River							
C01K47	Little Muskingum River	37.50	11	221	10,000	Non	HSTS
C01K45	Little Muskingum River	34.60	12	172	8,400	Non	HSTS
609380	Little Muskingum River	30.20	13	111	1,700	Non	HSTS
C01K43	Little Muskingum River	25.80	13	179	1,300	Non	HSTS
C01K41	Little Muskingum River	22.20	13	101	2,400	Non	AG
HUC 05030201-07-04 – Fifteen Mile Creek							
609410	Fifteen Mile Creek	0.10	13	349	1,200	Non	HSTS, AG
HUC 05030201-07-05 – Eightmile Creek-Little Muskingum River							
C01S01	Little Muskingum River	17.20	13	100	2,000	Non	HSTS, AG
C01K40	Little Muskingum River	9.50	13	112	770	Non	HSTS, AG
609340	Little Muskingum River	5.43	13	151	2,000	Non	AG

[1] Potential Sources: AG = agriculture; CAFO = concentrated animal feeding operation; HSTS = home sewage treatment system; WWTP = wastewater treatment plant; CSO = combined sewer overflows; SSO = sanitary sewer overflows; Urban = urban runoff.

Proposed Actions

Concentrations of *E. coli* exceeding the water quality standard are due to both pervasive and direct sources. Two predominant pathways exist for pathogen delivery to water bodies. The first pathway is pathogen-rich discharge, including material such as poorly treated or untreated effluent from wastewater treatment plants, combined sewer overflows, sanitary sewer overflows, household sewage treatment systems and livestock access to streams. This is delivered to the stream by direct discharge. The second pathway is pathogen-rich runoff/drainage from nonpoint sources. The associated delivery mechanism is precipitation-driven wash-off. This type of transport involves the delivery of pathogen-rich material by overland flow during precipitation and runoff events (e.g., summer storms, snowmelt, etc.).

Due to these mechanisms of delivery, the sources of pathogens in surface waters can be determined to a certain extent via the level of stream flow observed. Therefore, Ohio EPA proposes using the load duration curve (LDC) framework for recreation use TMDLs. LDCs are an empirical method of determining TMDL pollutant loading and needed reductions. The main advantage of the use of LDCs is in this method's ability to differentiate loads from various types of sources based on stream flow regime. While this is a fairly basic modeling method, relationships

between bacteria source contributions and flow regimes are straight forward. In-stream processes and interactions between pathogen sources are assumed conservative (i.e., not occurring) in this method. *Figure 2* shows an example LDC with corresponding TMDL calculations represented in Table 4.

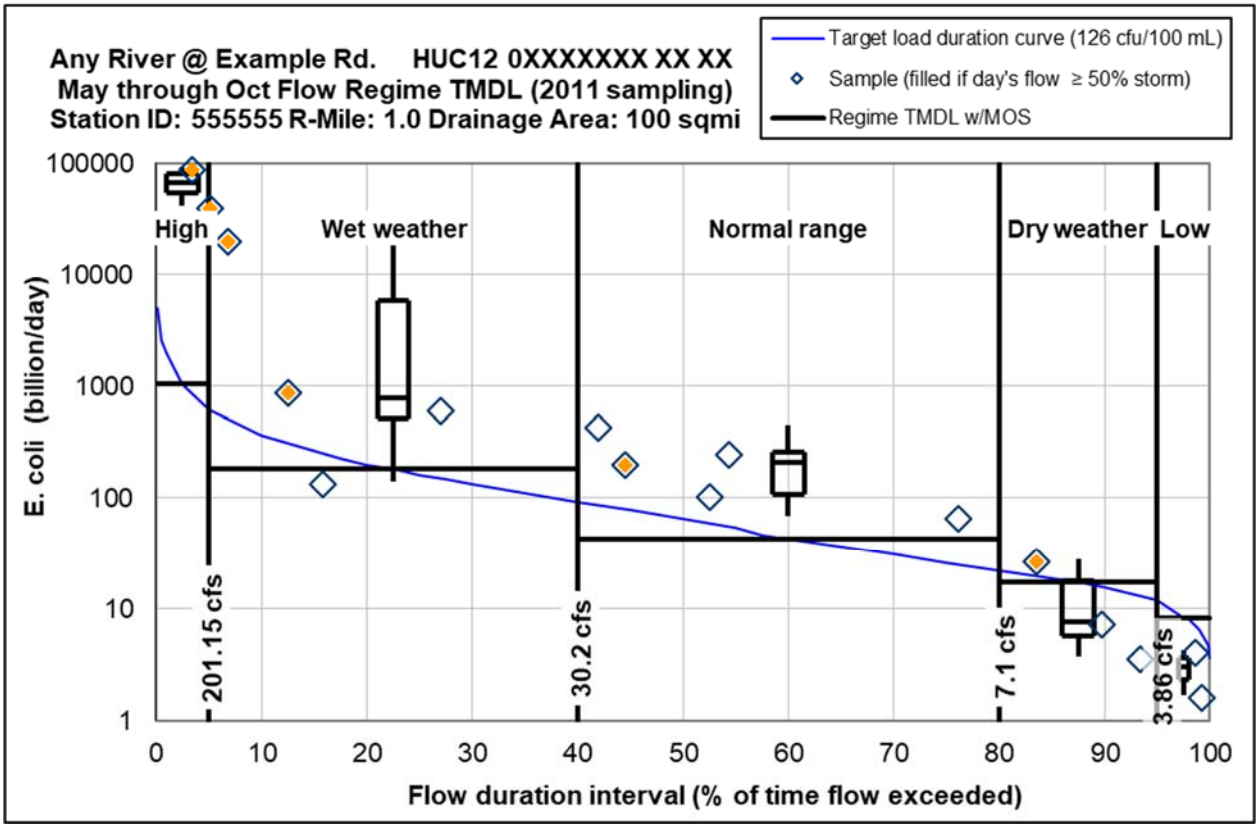

Figure 2 – Example load duration curve.

Table 4 – Example TMDL table calculations (from above load duration curve).

TMDL and duration intervals	High 0-5%	Wet weather 5-40%	Normal range 40-80%	Dry weather 80-95%	Low 95-100%
Samples Per Regime	2	4	5	3	2
Median Sample load	66807	781	209.25	7.72	2.99
Total Load Reduction Required	98.9%	82.8%	84.7%	NA	NA
Total Maximum Daily Load	1036.68	182.09	43.25	17.26	8.35
Margin of Safety: 20%	207.34	36.42	8.65	3.45	1.67
Allowance for Future Growth	62.20	10.93	2.60	1.04	0.50
Load Allocation	740.71	127.29	27.63	8.98	2.58
Wasteload Allocation Total	26.43	7.46	4.37	3.80	3.60
MS4	23.01	4.04	0.96	0.38	0.19
Example Town WWTP XPX00XXX	3.41	3.41	3.41	3.41	3.41