



Loading Analysis Plan and Supporting Data Acquisition Needed for the Tiffin River Watershed

Total Maximum Daily Load Development



Ohio EPA Technical Report AMS/2012-TIFFI-3

Division of Surface Water
Assessment and Modeling Section

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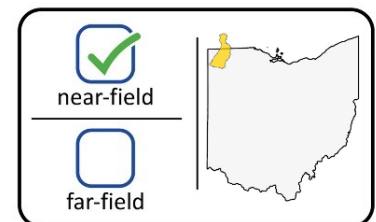


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Introduction

This document provides an overview of the information considered in proposing the strategy to address water quality impairments in the Tiffin River watershed. These recommendations are based on data collected as part of a biological and water quality study in 2012-2014. A description of the project area, sites, data types and methods can be found in the Biological and Water Quality Survey of the Tiffin River and Selected Tributaries study plan document (Ohio EPA, 2013). A summary of the study results can be found in the biological and water quality report (Ohio EPA, 2015)

Sites in the Tiffin River watershed were assessed for aquatic life use and recreation use. The attainment of aquatic life and recreation use is based on specific criteria. This document examines those criteria and lays out proposals for addressing each impairment. Where appropriate, methods and targets are outlined to develop total maximum daily loads (TMDL) for specific pollutants.

There are no impairments of the public drinking water supply use in this study area (Ohio EPA, 2022), and this use is therefore not further considered in this report.

The federal Clean Water Act (CWA) requires that states identify waters not meeting water quality goals and then prioritize them for action to restore their beneficial uses. The resulting list of prioritized impaired waters is known as the 303(d) list. The process of listing involves assigning a condition status (a category) for each of four beneficial uses (aquatic life, human health, recreation, and public water supply) for each assessment unit. For more information on impaired water listings and categories, please see Ohio's Integrated Water Quality Monitoring and Assessment Report (Ohio EPA, 2022).

Aquatic Life Use

Evaluation of Biocriteria

Aquatic Life Use (ALU) attainment details are documented in the biological and water quality report (Ohio EPA, 2015). The attainment status for each site is shown in Figure 1. Table 1 lists assessment sites not meeting their ALU designation. This table also contains the cause(s) and source(s) of impairment for each site.

Assessment for ALU was completed in 22 streams in the Tiffin watershed located in Defiance, Fulton, Williams, and Henry counties. Of the 52 sites sampled for ALU, 33 locations (63.5%) were in full attainment, 10 locations were in partial attainment (21.4%) and 9 locations (17.3%) were in non-attainment.



Figure 1 — Map summarizing ALU attainment status in the Tiffin River watershed from 2012-2014.

Table 1 – Aquatic life use attainment information for impaired sampling locations in the Tiffin River watershed, 2012-2014.

| Station | Location | Ecoregion/ALU | River Mile ^a | Drain. Area (mi ²) | QHEI | Attain. Status | Causes | Sources |
|--|---|---------------|-------------------------|--------------------------------|-------|----------------|----------------------|--------------------------------------|
| Deer Creek -Bean Creek - 04100006 02 02 | | | | | | | | |
| P07W24 | Deer Creek Dst. Fayette @ County Rd. 23 | ECBP/WWH | 4.56 | 9.9 ^H | 61 | PARTIAL | Nutrient Enrichment | Row Crop Agriculture |
| Mill Creek - 04100006 02 04 | | | | | | | | |
| P07W26 | Mill Creek Southeast of Alvordton @ County Rd. P | ECBP/WWH | 11.9 | 23.4 ^W | 61 | PARTIAL | Organic Enrichment | Unsewered Areas |
| | | | | | | | Fish Passage Barrier | Downstream Impoundment |
| P07S32 | Mill Creek Southeast of Alvordton @ County Rd. 28 | ECBP/WWH | 7.92 | 32.8 ^W | 58.5 | NON | Nutrient Enrichment | Row Crop Agriculture |
| | | | | | | | Fish Passage Barrier | Downstream Impoundment |
| Bates Creek - Tiffin River - 04100006 03 01 | | | | | | | | |
| P07K30 | Bates Creek East of West Unity @ County Rd. 25-2 | ECBP/WWH | 1.65 | 11.8 ^H | 51.25 | NON | Siltation | Channelization, Row Crop Agriculture |
| Leatherwood Creek - 04100006 03 02 | | | | | | | | |
| P07K27 | Leatherwood Creek North of Stryker @ County Rd. H | ECBP/WWH | 1.15 | 9.8 ^H | 57.5 | NON | Siltation | Channelization, Row Crop Agriculture |
| Flat Run - Tiffin River - 04100006 03 03 | | | | | | | | |
| P07K28 | Flat Run Northeast of Stryker @ County Rd. 22-75 | ECBP/WWH | 0.4 | 10.2 ^H | 40 | NON | Siltation | Channelization, Row Crop Agriculture |
| Upper Lick Creek - 04100006 04 01 | | | | | | | | |
| P07W20 | Lick Creek Northwest of Bryan @ County Rd. 13 | ECBP/WWH | 21.77 | 6.2 ^H | 61.5 | PARTIAL | Nutrient Enrichment | Row Crop Agriculture |
| Middle Lick Creek - 04100006 04 02 | | | | | | | | |
| P07W22 | Lick Creek Northwest of Ney @ Behnfeltd Rd. | ECBP/WWH | 4.97 | 7.5 ^H | 50.5 | PARTIAL | Nutrient Enrichment | Row Crop Agriculture |

| Station | Location | Ecoregion/ALU | River Mile ^a | Drain. Area (mi ²) | QHEI | Attain. Status | Causes | Sources |
|---|--|---------------|-------------------------|--------------------------------|-------|----------------|---|---|
| P07S41 | Lick Creek Ust. Ney ust. railroad | HELP/WWH | 0.8 | 23.3 ^W | 57.25 | NON | Organic Enrichment | Manure Application |
| Prairie Creek - 04100006 04 03 | | | | | | | | |
| P07S13 | Prairie Creek Dst. Bryan WWTP adj. County Rd. C | ECBP/WWH | 9.8 | 9.8 ^H | 35.75 | NON | Nutrient enrichment Flocculent Bottom Deposits | Bryan WWTP |
| Beaver Creek - 04100006 05 01 | | | | | | | | |
| P07P17 | Beaver Creek Southwest of West Unity @ County Rd. K | ECBP/WWH | 17.12 | 14.9 ^H | 54.4 | PARTIAL | Siltation | Channelization, Row Crop Agriculture |
| Brush Creek - 04100006 05 02 | | | | | | | | |
| P07S03 | Owl Creek Southwest of Archbold @ County Rd. 25 | HELP/WWH | 0.07 | 10.3 ^H | 26 | PARTIAL | Organic Enrichment Siltation Low Flow | Unrestricted Livestock Access Channelization |
| P07S20 | Brush Creek Dst. Archbold @ County Rd. 24 | HELP/WWH | 13.28 | 34.6 ^W | 47.5 | NON | Organic Enrichment | Archbold WWTP |
| Coon Creek - Tiffin River - 04100006 05 04 | | | | | | | | |
| P07K24 | Coon Creek East of Evansport @ County Rd. 23 | HELP/WWH | 0.62 | 9.3 ^H | 46.25 | PARTIAL | Natural Low Flow | Natural |
| 302201 | Doty Run Southwest of Evansport near mouth @ Evansport Rd. | HELP/WWH | 0.63 | 5.3 ^H | 42.75 | NON | Natural Low Flow | Natural |
| Lost Creek - 04100006 06 01 | | | | | | | | |
| P07W19 | Lost Creek Northeast of Hicksville @ Seevers Rd. | ECBP/WWH | 8.97 | 14.4 ^H | 71.5 | NON | Unknown | Unknown |

| Station | Location | Ecoregion/ALU | River Mile ^a | Drain. Area (mi ²) | QHEI | Attain. Status | Causes | Sources |
|---|---|---------------|-------------------------|--------------------------------|-------|----------------|-----------------------|----------------------|
| Mud Creek - 04100006 06 02 | | | | | | | | |
| 302202 | Dry Creek Southeast of Farmer @ County Rd. 124 (Openlander Rd.) | HELP/WWH | 3.76 | 11 ^H | 36.25 | PARTIAL | Low Flow Siltation | Channelization |
| | | | | | | | Nutrient Enrichment | Row Crop Agriculture |
| | | | | | | | Organic Enrichment | Manure Application |
| Webb Run - 04100006 06 03 | | | | | | | | |
| 302204 | Webb Run Northwest of Defiance @ Flory Rd. | HELP/WWH | 2.99 | 9.3 ^H | 40.75 | PARTIAL | Natural Low Flow | Natural |
| Buckskin Creek - Tiffin River - 04100006 06 04 | | | | | | | | |
| P07K11 | Buckskin Creek Northwest of Brunersburg @ State Route 15 | HELP/WWH | 1.2 | 6.1 ^H | 42 | PARTIAL | Natural Low Flow | Natural |

- a River Mile (RM) represents the Point of Record (POR) for the station and may not be the actual sampling RM.
H Headwater site (draining ≤20 miles²).
W Wading site (non-boat site draining >20 miles²).
B Boat site (large or deep waters, necessitating the use of boat sampling methods)

Aquatic Life Use Proposed Actions

Ohio EPA considers many factors when deciding how to address impairments. For some projects, no TMDL is required. The sites within the watershed may be in attainment or the impairment is being addressed by another program/entity so no further action by the Division of Surface Water is necessary. Additionally, the cause of impairment may be natural (i.e., flow or habitat), in which case no action is required. For those needing a TMDL, the complexity of each impairment—including the primary origin of the pollutant, its delivery mechanisms and the waterbody kinetics involved—will determine the complexity needed in a model. Ohio EPA must also take into consideration ongoing efforts in the watershed, previous TMDL analyses, the questions to be answered by a model and the amount of effort required to complete the model. Depending on the method selected, the Agency may be required to return to the watershed and collect additional data, and it is possible the modeling approach may change. A summary of Ohio EPA's preliminary modeling approaches is presented in Table 2.

Table 2 – Summary of ALU impairments and potential modeling approaches.

| Station | Stream Name | River Mile | Assessment Unit (04100006) | Cause(s) of Impairment | Source(s) of Impairment | IR Cat. ¹ | Action ² | Method ³ | Parameter ⁴ |
|---------|-------------------|------------|----------------------------|------------------------|--------------------------------------|----------------------|---------------------|---------------------|------------------------|
| P07W24 | Deer Creek | 4.56 | 02 02 | Nutrient Enrichment | Row Crop Agriculture | 5 | Other | Follow-up | - |
| P07W26 | Mill Creek | 11.9 | 02 04 | Organic Enrichment | Unsewered Areas | 5 | Other | Follow-up | - |
| | | | | Fish Passage Barrier | Downstream Impoundment | 5 | Other | Follow-up | - |
| P07S32 | Mill Creek | 7.92 | 02 04 | Nutrient Enrichment | Row Crop Agriculture | 5 | Other | Follow-up | - |
| | | | | Fish Passage Barrier | Downstream Impoundment | 5 | Other | Follow-up | - |
| P07K30 | Bates Creek | 1.65 | 03 01 | Siltation | Channelization, Row Crop Agriculture | 5 | TMDL | QHEI-sed | Sediment |
| P07K27 | Leatherwood Creek | 1.15 | 03 02 | Siltation | Channelization, Row Crop Agriculture | 5 | TMDL | QHEI-sed | Sediment |
| P07K28 | Flat Run | 0.4 | 03 03 | Siltation | Channelization, Row Crop Agriculture | 5 | TMDL | QHEI-sed | Sediment |
| P07W20 | Lick Creek | 21.77 | 04 01 | Nutrient Enrichment | Row Crop Agriculture | 5 | Other | Follow-up | - |
| P07W22 | Lick Creek | 4.97 | 04 02 | Nutrient Enrichment | Row Crop Agriculture | 5 | Other | Follow-up | - |

| Station | Stream Name | River Mile | Assessment Unit (04100006) | Cause(s) of Impairment | Source(s) of Impairment | IR Cat. ¹ | Action ² | Method ³ | Parameter ⁴ |
|---------|----------------|------------|----------------------------|----------------------------|--------------------------------------|----------------------|---------------------|---------------------|------------------------|
| P07S41 | Lick Creek | 0.8 | 04 02 | Organic Enrichment | Manure Application | 5 | Other | Follow-up | - |
| P07S13 | Prairie Creek | 9.8 | 04 03 | Nutrient enrichment | Bryan WWTP | 5 | Other | Follow-up | - |
| | | | | Flocculent Bottom Deposits | | 5 | Other | Follow-up | - |
| P07P17 | Beaver Creek | 17.12 | 05 01 | Siltation | Channelization, Row Crop Agriculture | 5 | TMDL | QHEI-sed | Sediment |
| P07S03 | Owl Creek | 0.07 | 05 02 | Organic Enrichment | Unrestricted Livestock Access | 5 | Other | Follow-up | - |
| | | | | Siltation | Channelization | 5 | TMDL | QHEI-sed | Sediment |
| | | | | Low Flow | | 4C | N/A | - | - |
| P07S20 | Brush Creek | 13.28 | 05 02 | Organic Enrichment | Archbold WWTP | 5 | Other | Follow-up | - |
| P07K24 | Coon Creek | 0.62 | 05 04 | Natural Low Flow | Low Flow | 4C | N/A | - | - |
| 302201 | Doty Run | 0.63 | 05 04 | Natural Low Flow | Natural | 4C | N/A | - | - |
| P07W19 | Lost Creek | 8.97 | 06 01 | Unknown | Unknown | 5 | Other | Follow-up | - |
| | | | | Low Flow | Channelization | 4C | N/A | - | - |
| | | | | Siltation | | 5 | TMDL | QHEI-sed | Sediment |
| 302202 | Dry Creek | 3.76 | 06 02 | Nutrient Enrichment | Row Crop Agriculture | 5 | Other | Follow-up | - |
| | | | | Organic Enrichment | Manure Application | 5 | Other | Follow-up | - |
| 302204 | Webb Run | 2.99 | 06 03 | Natural Low Flow | Natural | 4C | N/A | - | - |
| P07K11 | Buckskin Creek | 1.2 | 06 03 | Natural Low Flow | Natural | 4C | N/A | - | - |

¹ IR Cat. (Integrated Report Category)

| Category | Definition/interpretation |
|----------|---|
| 4C | Water body is impaired for this parameter, but the parameter is not considered a pollutant and therefore a TMDL is not required |
| 5 | Water body is impaired for this parameter, and it needs to be addressed by additional actions |

² Action

| Abbreviation | Definition/interpretation |
|--------------|---|
| N/A | Not applicable, no action needed |
| Other | Action will be taken outside of a new TMDL |
| TMDL | A Total Maximum Daily Load (TMDL) will be developed |

³ Method

| Abbreviation | Definition/interpretation |
|------------------|---|
| Follow-up | Follow-up sampling is required to determine if the attainment status has changed after ongoing implementation has occurred or to clarify/verify the listed cause of impairment. |
| QHEI-sed | Sub-metrics of the QHEI (Qualitative habitat evaluation index) will be used to address sedimentation and embeddedness. |
| Restoration Plan | A restoration plan will be developed to address a 4C impairment outside of the TMDL process. |

⁴ Parameter – For TMDL or Other actions, the parameter listed in this field will be the pollutant or non-pollutant stressor used to address impairment. This parameter will match a heading in the Proposed Targets section.

The following subsections are organized to explain the various methods being used to address the proposed actions outlined in Table 2.

No action required due to natural causes of impairment: IR Cat: 4C - Action: N/A

For several sites outlined in Table 2, the source of impairment is classified as natural, such as an inherent low flow. Impairments due to natural sources are exempt from TMDL requirements. For these sites, where no other sources of impairment have been documented, no further action is required to address these impairments.

No action required due to cause of impairment not considered a pollutant: IR Cat: 4C - Action: N/A

Owl Creek RM 0.07 and Dry Creek 3.76 have an impairment caused by low flow. The source of this impairment is identified at channelization. Low flow is not considered a pollutant and no further action is required to address these impairments.

Follow-up monitoring is recommended prior to TMDL development to address some causes: IR Cat: 5 - Action: Other

Several causes of impairment outlined in Table 2 for Tiffin River watershed are from impacts that may not persist. Since the most recent assessment performed in 2012 through 2014, several actions in the watershed may have ameliorated these causes.

Organic enrichment is listed as a cause of impairment for Mill Creek RM 11.9. This organic enrichment was caused by the unsewered community of Alvordton. On August 8, 2015, a Director's Final Findings and Orders was issued stating that the villages of Alvordton and Kunkle contained inadequate or failing onsite home sewage treatment systems that discharge to tributaries of Mill Creek. Since then, a wastewater treatment plant has been built in Kunkle. Sanitary sewer system upgrades are ongoing in Alvordton. When the upgrades are completed, then the Alvordton wastewater will be treated at the new Kunkle WWTP.

Nutrient/eutrophication biological indicator and/or low dissolved oxygen are listed as a cause of impairment for Deer Creek RM 4.56, Mill Creek 7.92, Lick Creek RM 21.77, Lick Creek RM 4.97, and Dry Creek 3.76. The source of the nutrients at these sites is identified as agriculture. Organic enrichment is listed as a cause of impairment for Lick Creek RM 0.8, Owl Creek RM 0.07, and Dry Creek RM 3.76. This source of this organic enrichment is identified as manure application or unrestricted livestock access. Several efforts are ongoing to increase conservation practices on agricultural land and reduce nutrient losses. The United States Department of Agriculture Natural Resources Conservations Service (USDA-NRCS) has continually funded conservation practices in the Tiffin River watershed through the Environmental Quality Incentives Program and the Conservation Stewardship Program. Practices funded in the watershed include cover crops and nutrient management. In addition, Ohio's H2Ohio program has been active in this area since 2020. This program has provided financial incentives to reduce phosphorus runoff from farms through the use of proven, science-based nutrient management best practices and the creation of phosphorus-filtering wetlands.

Mill Creek RM 11.9 and Mill Creek RM 7.92 are impaired by a fish passage barrier due to a downstream impoundment. Since this impoundment is for a state park lake, dam removal is not being considered. However, continued nonpoint source pollutant reductions throughout the Tiffin River watershed may have reduced more minor stresses to these sites' fish community since the time of the last assessment.

Prairie Creek RM 9.8 is impaired by nutrient enrichment and flocculent bottom deposits attributed to the Bryan WWTP. Since the end of the survey in 2014, the Bryan WWTP has performed several improvements, including a switch to ultraviolet disinfection and the rehabilitation of sludge digestors. These enhancements could reduce impacts downstream.

Brush Creek RM 13.28 is impaired by organic enrichment attributed to Archbold WWTP. Since the stream assessment, this facility has installed additional aeration to their treatment system. This type of secondary treatment reduces the amount of oxygen demanding materials in a wastewater treatment plant's effluent. This load reduction is expected to decrease the stress caused by organic enrichment to Brush Creek.

The cause and source of the water quality impairment observed at Lost Creek RM 8.97 could not be determined and are listed as unknown. Follow-up monitoring is recommended to fully determine the impact(s) limiting the aquatic life use.

Because of these factors, follow-up monitoring is recommended prior to TMDL development for the assessment sites discussed above. When this follow-up monitoring occurs another study plan, water quality results, and Loading Analysis Plan will be published prior to any new TMDL development. All three of those future documents will include public comment periods before they are considered final.

[TMDL to address sediment impairments required: IR Cat: 5 - Action: TMDL](#)

The cause of impairment for several sites outlined in Table 2 for Tiffin River watershed was due to impacts from sedimentation and/or siltation.

Sedimentation is seen widely throughout the watershed and is listed as the cause of impairment for six of the nineteen impaired sites. The sedimentation is largely due to channelization and agriculture. A sediment TMDL calculated using QHEI sub-metrics will appropriately address this cause of impairment. Sediment impairments for this watershed will be developed in a separate report that will include several other watersheds. Updates to this separate sediment TMDL report will be posted to [Ohio EPA's multi-watershed TMDL webpage](#).

Aquatic Life Use Proposed Targets

[Sediment](#)

Numeric targets for sediment are based on three sub-metrics of the QHEI. Although the QHEI evaluates the overall quality of stream habitat, some of its component sub-metrics consider particular aspects of stream habitat that are closely related to and/or impacted by the sediment delivery and transport processes occurring in the system. The QHEI sub-metrics used in the sediment TMDL are the substrate, channel morphology, and bank erosion/riparian zone. Table 3 lists targets for each of these metrics.

Table 3 – QHEI targets for sediment TMDLs

| Sediment TMDL Targets | | |
|------------------------------|---------------------|------------|
| QHEI Category | WWH/ MWH | EWH |
| Substrate | ≥ 13 | ≥ 15 |
| Channel | ≥ 14 | ≥ 15 |
| Riparian | ≥ 5 | ≥ 5 |
| Sediment TMDL ► | ≥ 32 | ≥ 35 |

The substrate sub-metric evaluates predominant substrate types, the amount and origin of these types and the degree of embeddedness and silt cover. This is a qualitative evaluation of the amount of excess fine material in the system and the ability of the channel to assimilate or sort the sediment load.

The channel morphology sub-metric considers sinuosity, riffle and pool development, channelization, and channel stability. Except for stability, each of these aspects is directly related to channel form, sediment transport, erosion, and deposition within the channel. Stability reflects the degree of channel erosion, which indicates the potential of the stream to be a significant sediment source.

The bank erosion and riparian zone sub-metric also reflects the likely degree of in-stream sediment sources. The evaluation of floodplain quality is included in this sub-metric, which relates to the capacity of the system to assimilate sediment loads.

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 4, are also the targets used for TMDLs. Table 5 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 4.

Table 4 – Water quality criteria for recreation use

| Recreation Use | <i>Escherichia coli</i> (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 90-day period.

^a A beach action value of 235 *E. coli* colony forming units per 100 mL shall be used for the purpose of issuing beach and bathing water advisories.

Table 5 – Recreation use attainment information for impaired sampling locations in the Tiffin River watershed, 2012-2014.

| Station | Stream Name | HUC-12 (04100006) | RM | # Samples | Geo. Mean | Possible Source(s) |
|---------|----------------------|----------------------|-------|-----------|--------------|------------------------------------|
| 500330 | Bean Creek | 02 02 | 7.55 | 5 | 177 | |
| P07W24 | Deer Creek | 02 02 | 4.56 | 5 | 1293 | Fayette CSOs (sewers now separate) |
| P07W26 | Mill Creek | 02 04 | 11.90 | 5 | 363 | Alvordton (Unsewered Community) |
| P07S32 | Mill Creek | 02 04 | 7.92 | 5 | 330 | Kunkle (Unsewered Community) |
| P07S31 | Mill Creek | 02 04 | 1.85 | 5 | 665 | |
| P07S33 | Bean Creek | 02 05 | 2.20 | 5 | 471 | |
| P07K06 | Tiffin River | 03 01 | 47.54 | 5 | 440 | |
| P07K30 | Bates Creek | 03 01 | 1.65 | 5 | 745 | |
| 302205 | Tiffin River | 03 03 | 41.10 | 5 | 283 | West Unity WWTP |
| P07K28 | Flat Run | 03 03 | 0.40 | 5 | 1090 | Failing HSTS, Agricultural run-off |
| P07K17 | Miller Creek | 04 01 | 0.50 | 5 | 304 | |
| P07S41 | Little Lick Creek | 04 02 | 0.80 | 5 | 605 | |
| P07S13 | Prairie Creek | 04 03 | 9.80 | 5 | 790 | |
| P07W12 | Prairie Creek | 04 03 | 3.40 | 5 | 348 | |
| P07S36 | Lick Creek | 04 04 | 10.05 | 5 | 615 | |
| 500310 | Lick Creek | 04 04 | 1.23 | 5 | 559 | |
| P07K25 | Beaver Creek | 05 01 | 12.66 | 5 | 406 | |
| P07P14 | Beaver Creek | 05 01 | 7.52 | 5 | 1413 | Pulaski (Unsewered Community) |
| P07S22 | Brush Creek | 05 02 | 19.06 | 5 | 603 | |
| P07S20 | Brush Creek | 05 02 | 13.28 | 5 | 695 | Archbold WWTP |
| P07W15 | Brush Creek | 05 02 | 1.05 | 5 | 468 | |
| P07K03 | Tiffin River | 05 03 | 35.28 | 5 | 220 | |
| P07S08 | Tiffin River | 05 03 | 30.97 | 5 | 372 | |
| P07S07 | Tiffin River | 05 03 | 26.17 | 5 | 415 | |

| Station | Stream Name | HUC-12 (04100006) | RM | # Samples | Geo. Mean | Possible Source(s) |
|---------|--------------|----------------------|-------|-----------|--------------|---------------------------------------|
| 302206 | Tiffin River | 05 03 | 19.70 | 5 | 322 | |
| P07K24 | Coon Creek | 05 04 | 0.62 | 5 | 531 | |
| P07W18 | Lost Creek | 06 01 | 1.41 | 5 | 778 | Livestock, pasture land, failing HSTS |
| 302202 | Dry Creek | 06 02 | 3.76 | 5 | 346 | |
| P07S04 | Mud Creek | 06 02 | 1.50 | 5 | 432 | |
| 302204 | Webb Run | 06 03 | 2.99 | 5 | 241 | |

| Station | Stream Name | Large River Assessment Unit (4100006) | RM | # Samples | Geo. Mean | Possible Source(s) |
|---------|--------------|--|------|-----------|-----------|-----------------------------------|
| 500300 | Tiffin River | 9001 | 18.7 | 5 | 269 | Failing HSTS / Agriculture Runoff |
| P07K01 | Tiffin River | 9001 | 14.1 | 5 | 254 | Failing HSTS / Agriculture Runoff |
| P07S05 | Tiffin River | 9001 | 7 | 5 | 211 | Failing HSTS / Agriculture Runoff |

Recreation Use 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 6.

Figure 2 – Example load duration curve.

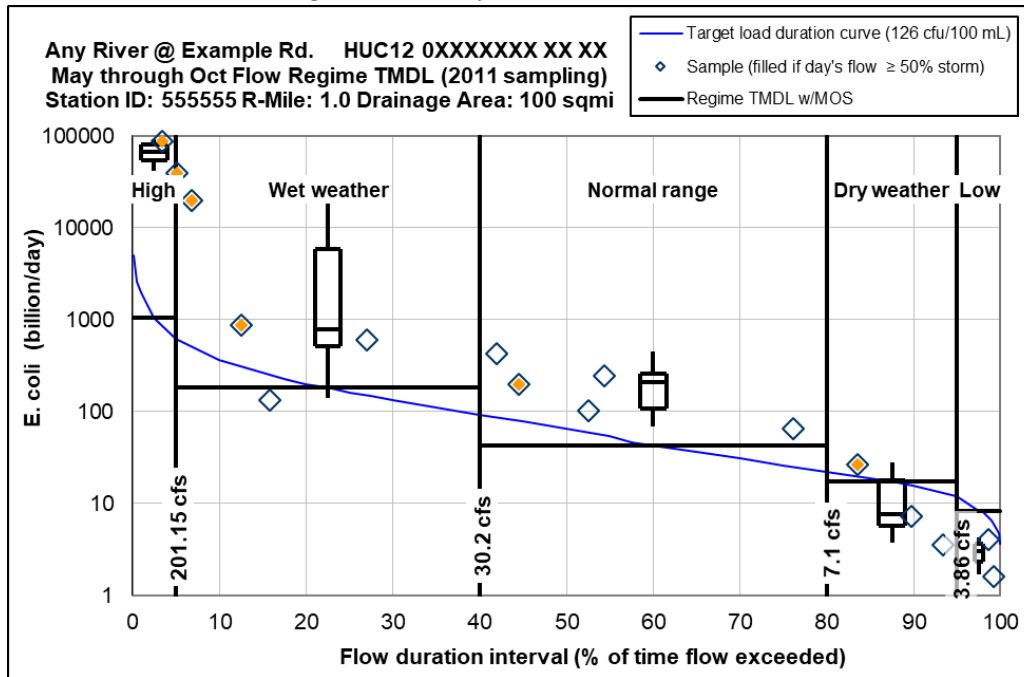


Table 6 – Example TMDL table calculations (from load duration curve).

| 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 |

Recreation Use Proposed Targets

The primary contact recreation geometric mean criterion of 126 colony forming units per 100 mL *E. coli* will be used as the target concentration for the recreation use TMDL. As shown as the blue curve in the example load duration curve of Figure 2, above, this target concentration is converted into a load throughout the calculated flow regime. The black horizontal lines in Figure 2 and the “Total Maximum Daily Load” row in Table 6 show the TMDL values for five flow regime categories. This TMDL is the median of the curve load within each flow regime category.

References

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