Maine Statewide TMDL for Nonpoint Source Pollution Addendum

September 2021

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Modeling and Stream-Specific Summaries by: Great Lakes Environmental Center, Inc
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MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

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TABLE OF CONTENTS

LIST OF TABLES

Introduction

This is an addendum to the *Maine Statewide Total Maximum Daily Load for Nonpoint Source Pollution (NPS TMDL)* (http://www.maine.gov/dep/water/monitoring/tmdl/tmdl2.html), which was prepared by the Maine Department of Environmental Protection (MDEP) and approved by the U.S. Environmental Protection Agency (USEPA) in 2016. This addendum contains the information to develop TMDLs for thirteen streams (Table 1) impaired by nonpoint source pollution (NPS) within their watersheds. Great Lakes Environmental Center, Inc conducted the modeling and drafted the stream-specific summaries for this addendum. This report:

- Contains the watershed-specific information necessary to add NPS TMDLs to the existing 2016 TMDL Report.
- References the basic background information and required TMDL elements from the 2016 TMDL Report.

Table 1. Summary information for impaired streams included in this addendum (from *Maine DEP 2016 Integrated Water Quality Monitoring and Assessment Report Appendices*).

Stream	Town	Segment ID	Class	Listing Cause
Adams Brook	Berwick	ME0106000304_625R01	B	Benthic-Macroinvertebrate Bioassessments
Black Brook	Windham	ME0106000103_607R01	B	Oxygen, Dissolved
Colley Wright Brook	Windham	ME0106000103_607R03	B	Oxygen, Dissolved
Craig Brook	Littleton	ME0101000504_152R02	B	Periphyton Indicator Bioassessments (Proposed)
French Stream	Exeter	ME0102000510_224R03	B	Benthic-Macroinvertebrate Bioassessments; Periphyton Indicator Bioassessments
Halfmoon Stream	Knox, Thorndike, Unity	ME0103000309_326R03 (lower) ME0103000309_326R02 (upper)	B (lower) A (upper)	Periphyton Indicator Bioassessments (lower and upper segments)
Inkhorn Brook	Windham	ME0106000103_607R07	B	Oxygen, Dissolved
Kennedy Brook	Presque Isle	ME0101000412_140R05	B	Periphyton Indicator Bioassessments
Mosher Brook	Gorham	ME0106000103_607R08	B	Oxygen, Dissolved
No Name Brook	Lewiston, Sabattus	ME0104000210_418R02	B	Oxygen, Dissolved
Otter Brook	Windham	ME0106000103_607R09	B	Oxygen, Dissolved
Pleasant River	Windham, Gray	ME0106000103_607R12	B	Oxygen, Dissolved
Stetson Brook	Lewiston, Greene	ME0104000208_413R03	B	Oxygen, Dissolved

These streams are listed on Maine's 303(d) list of impaired waters in Maine DEP's *2016 Integrated Water Quality Monitoring and Assessment Report (MDEP, 2018),* or are proposed to be listed as impaired in the next Integrated Report. TMDLs are required under the US Clean

Water Act for all impaired waters on the 303(d) list and these will be added to the existing 2016 NPS TMDLs.

The purpose of a TMDL is to calculate the amount of pollutant a receiving water can assimilate without exceeding water quality standards for designated uses. The waterbodies in this report, as listed in Table 1, have been assessed as not meeting the criteria for aquatic life use protection contained within Maine's water quality standards. The waterbodies were included on the 2016 list of impaired waters or are proposed to be included on the next list of impaired waters based on the results of various assessment criteria for aquatic life use support in freshwater streams, primarily dissolved oxygen, benthic-macroinvertebrate bioassessments, and/or periphyton indicator bioassessments.

The waterbodies addressed in this document are impaired by NPS pollution as a result of anthropogenic activities within their watersheds. NPS pollution, also known as stormwater runoff, cannot be traced back to a specific source; rather it often comes from a number of diffuse sources within a watershed. One of the major constituents of NPS pollution is sediment, which contains a mixture of nutrients (such as phosphorus and nitrogen), inorganic and organic material that stimulate algal growth. Excess algal growth consumes oxygen during respiration and leads to a decrease in levels of dissolved oxygen (DO) in a stream. Phosphorus and nitrogen are the limiting nutrients for algal growth and sediment-laden runoff carries these nutrients into streams.

The NPS TMDL addresses nutrients (nitrogen and phosphorus) and sediment in NPS pollution, which have been identified as the primary contributors to the observed and measured degradation of aquatic life use in the impaired waterbodies. Because Maine's water quality standards do not contain numeric criteria specifically for phosphorus, nitrogen, or sediment, a regionally calibrated land-use model known as *Model My Watershed* (previously *MapShed*), and a comparative attainment approach were used to establish pollution reduction targets for each of the impaired waterbodies.

The comparative attainment approach to TMDL development requires identical modeling procedures be applied to impaired watersheds and corresponding watersheds that attain water quality standards for aquatic life and DO. The attainment watersheds share similar characteristics to the impaired watersheds regarding geographic area, climate, soil, topography, watershed size, landscape, development, and land-use patterns. TMDL loading capacity for each of the three surrogate pollutants for each waterbody is calculated by comparing loading results for impaired streams to the appropriate attainment stream values.

Nutrient and Sediment Modeling for this Addendum

The modeling done for the 13 streams and five attainment streams in this NPS TMDL Addendum followed the protocols used in the 2016 NPS TMDL with the following notable differences. All modeling was done using the online *Model My Watershed (v. 1.32.0)*, which replaced the desktop *MapShed* in 2017-2018.

Model My Watershed uses a higher resolution soils layer (gridded SSURGO vs. STATSGO previously in *MapShed*), which often results in seeing higher k-factor (soil erodibility) in some areas of the watershed. This higher k-factor produces higher values for streambank erosion contribution to model sediment load (and to some extent the nitrogen and phosphorus load). *Model My Watershed* has improved subsurface (groundwater) nitrogen estimates resulting in significantly lower total nitrogen per watershed. This version of *Model My Watershed* also uses

the USDA National Agricultural Statistics Service (NASS) 2012 county-based livestock inventory, which was subsequently area-weighted to watershed size, and is more current than what was available through *MapShed* for the 2016 NPS TMDL.

Additional enhancements to this modeling effort include:

- Supplied localized (regional) weather (temperature and precipitation) data for the recent time period (2009-2020 or 12 years of record).
- Employed the most current available land use/cover (NLCD 2016). Since both the sensor age and the algorithm were improved from NLCD 2011, this resulted in considerable differences seen in wooded, wetland, and cropland areas compared to NLCD 2011. The wetland/open water attenuation factor that was applied was based on this newer land use/cover data. The stream buffer in agricultural land (hay/pasture land and cropland) was also based on this newer land use/cover data.
- Reduced estimates of agricultural BMP-use based on available feedback. This was local feedback for Craig Brook and Kennedy Brook, regional feedback from Vermont DEP and high BMP-use feedback from the Chesapeake Bay region. The previous *MapShed* 2012 modeling effort suggested very high percentages of cover cropping, conservation tillage, contour farming, and animal grazing rotation. However, because cropland area per watershed is very small for 11 of the 13 watersheds (except Craig Brook and Kennedy Brook), the reduction in estimates of cropland BMP-use would not significantly alter the model results.

To ensure comparability between the non-impaired (attainment) stream loading values and those of the 13 impaired watersheds, the attainment stream watersheds were also simulated with *Model My Watershed* using the same protocols. Below (Tables 2, 3 and 4) are the loading results for each of the five attainment stream watersheds.

The TMDL is the average of these attainment stream loading values for each pollutant. The difference in loading estimates between the impaired and attainment watersheds represents the percent reduction in nutrient loading required under this TMDL.

Table 2. Total Phosphorus Results and Total Maximum Daily Load Calculations for Attainment Streams.

Total Phosphorus kg/yr					
Sources/Pathways	**Footman Brook**	**Martin Stream**	**Moose Brook**	**Upper Kenduskeag Stream**	**Upper Pleasant River**
Source Loads					
Hay/Pasture	64.7	230.0	114.2	253.8	29.5
Cropland	113.0	37.5	390.7	149.8	0.8
Wooded Areas	10.5	57.6	37.5	60.0	12.0
Wetlands	10.3	51.4	36.7	24.6	10.2
Open Land	0.5	3.3	3.5	2.5	0.7
Barren Areas	0.0	0.3	0.0	0.0	0.5
Low-Density Mixed	0.6	15.8	4.8	7.3	9.5
Medium-Density Mixed	0.0	11.1	0.7	4.6	11.3
High-Density Mixed	0.6	0.8	0.0	1.4	2.3
Low-Density Open Space	4.1	23.4	10.4	25.9	13.0
Farm Animals	20.3	110.8	4.3	65.9	24.0
Septic Systems	0.0	0.0	0.0	0.0	0.0
Source Load Total:	224.6	542.0	602.8	595.8	113.8
Pathway Load					
Stream Bank Erosion	7.0	304.0	82.0	211.0	31.0
Subsurface Flow	59.0	536.7	117.4	266.0	100.1
Total Watershed Mass Load:	290.6	1382.7	802.2	1072.8	244.9
Total Watershed Area (ha):	1,729	10,762	4,460	6,698	1,507
Total Maximum Daily Load:	**0.17 kg/ha/yr**	**0.13 kg/ha/yr**	**0.18 kg/ha/yr**	**0.16 kg/ha/yr**	**0.16 kg/ha/yr**
Average:			**0.16 kg/ha/yr**		

Table 3. Total Nitrogen Results and Total Maximum Daily Load Calculations for Attainment Streams.

Total Nitrogen kg/yr					
Sources/Pathways	**Footman Brook**	**Martin Stream**	**Moose Brook**	**Upper Kenduskeag Stream**	**Upper Pleasant River**
Source Loads					
Hay/Pasture	185.4	558.7	223.5	740.7	101.0
Cropland	631.5	195.4	1763.3	916.1	5.3
Wooded Areas	200.0	1120.4	767.5	1120.3	230.4
Wetlands	207.5	1033.4	761.1	480.1	202.4
Open Land	14.3	112.6	104.4	63.2	20.7
Barren Areas	0.0	8.8	0.0	0.8	17.1
Low-Density Mixed	6.2	158.6	50.0	69.9	94.0
Medium-Density Mixed	0.0	117.3	8.2	47.0	118.3
High-Density Mixed	5.9	8.7	0.0	14.1	23.7
Low-Density Open Space	40.4	234.4	107.7	249.0	128.4
Farm Animals	108.1	605.6	18.1	354.3	104.4
Septic Systems	0.0	92.5	6.1	35.2	86.8
Source Load Total:	1399.3	4246.4	3809.9	4090.7	1132.5
Pathway Load					
Stream Bank Erosion	26.0	776.0	204.0	1054.0	125.0
Subsurface Flow	1569.6	27085.1	3086.1	6348.9	5161.5
Total Watershed Mass Load:	2994.9	32107.5	7100.0	11493.6	6419.0
Total Watershed Area (ha):	1,729	10,762	4,460	6,698	1,507
Total Maximum Daily Load:	**1.73 kg/ha/yr**	**2.98 kg/ha/yr**	**1.59 kg/ha/yr**	**1.72 kg/ha/yr**	**4.26 kg/ha/yr**
Average:			**2.46 kg/ha/yr**		

Table 4. Total Sediment Results and Total Maximum Daily Load Calculations for Attainment Streams.

Total Sediment 1000 kg/yr					
Sources/Pathways	**Footman Brook**	**Martin Stream**	**Moose Brook**	**Upper Kenduskeag Stream**	**Upper Pleasant River**
Source Loads					
Hay/Pasture	2.0	11.9	3.9	10.8	7.6
Cropland	40.8	4.7	70.7	48.7	0.3
Wooded Areas	0.5	1.6	0.6	3.6	0.7
Wetlands	0.1	0.6	0.4	0.4	0.2
Open Land	0.1	0.6	0.7	1.0	0.2
Barren Areas	0.0	0.0	0.0	0.0	0.0
Low-Density Mixed	0.2	4.4	1.2	2.5	2.8
Medium-Density Mixed	0.0	4.5	0.3	1.9	4.4
High-Density Mixed	0.1	0.3	0.0	0.6	0.9
Low-Density Open Space	1.3	6.5	2.5	8.9	3.8
Farm Animals	0.0	0.0	0.0	0.0	0.0
Septic Systems	0.0	0.0	0.0	0.0	0.0
Source Load Total:	45.2	35.1	80.3	78.3	21.1
Pathway Load					
Stream Bank Erosion	15.7	587.7	136.0	594.9	109.4
Subsurface Flow	0.0	0.0	0.0	0.0	0.0
Total Watershed Mass Load:	60.9	622.7	216.3	673.1	130.4
Total Watershed Area (ha):	1,729	10,762	4,460	6,698	1,507
Total Maximum Daily Load:	**35.2 kg/ha/yr**	**57.9 kg/ha/yr**	**48.5 kg/ha/yr**	**100.5 kg/ha/yr**	**86.5 kg/ha/yr**
Average:			**65.7 kg/ha/yr**		

Public Participation

A virtual informational meeting on the plan to add thirteen (originally fourteen) freshwater streams to the Statewide NPS TMDL was held on January 20, 2021 via Microsoft Teams. Notification of the meeting was sent via email on December 18, 2020 to potential stakeholders including, municipalities, Soil and Water Conservation Districts, Natural Resource Conservation Service regional representatives, Maine Department of Agriculture, Conservation, and Forestry, USEPA, and other interested parties. Nineteen stakeholders attended the meeting live, and the recording of the meeting and copy of the presentation was made available to others who could not attend. The meeting agenda consisted of: Welcome and Introductions; Purpose, Background and Uses of TMDLs; Overview of Maine's Statewide NPS TMDL and Current Update; Statewide NPS TMDL Stream Summary Example; Previous Stakeholder Concerns; Update Process and Project Timeline; Questions and Answers; Wrap-up and Next Steps.

To improve the accuracy of model results, the Maine DEP made a request to the appropriate municipalities, Soil and Water Conservation Districts, Natural Resource Conservation Service regional representatives, and the Maine Department of Agriculture, Conservation, and Forestry for watershed-specific estimates of agricultural and urban/suburban best management practice use, livestock numbers and significant changes in land use. The request was made to seventeen people via email on March 1, 2021. One response to the municipal information request was received and incorporated, as was agricultural information that was provided for two northern watersheds.

The draft introduction and stream summary appendices were made available for public review and comment for thirty days beginning on August 3, 2021 on DEP's 'Opportunity for Comment' webpage, https://www.maine.gov/dep/comment/index.html. E-mail notification was sent the list of stakeholders, which included those who the informational meeting notification went to along with any others who expressed interest, as well as to digital subscribers of the comment webpage.

All written public comments and responses will be submitted to the USEPA as part of the final TMDL submittal documents and posted on DEP's web page 'TMDL approved by EPA' at http://www.maine.gov/dep/water/monitoring/tmdl/tmdl2.html.

REFERENCES

MDEP, 2018. State of Maine, 2016 Integrated Water Quality Monitoring and Assessment Report. Augusta, ME. Available at: http://www.maine.gov/dep/water/monitoring/305b/index.htm

MDEP, 2016. Maine Statewide Total Maximum Daily Loads (TMDL) for Nonpoint Source Pollution. Augusta, ME. Available at: http://www.maine.gov/dep/water/monitoring/tmdl/tmdl2.html

Stroud Water Research Center (2017) Model My Watershed [Software]. Available from https://wikiwatershed.org/

APPENDIX A: PUBLIC COMMENTS AND RESPONSES

The draft introduction and stream summary appendices were made available for public review and comment for thirty days beginning on August 3, 2021 on DEP's 'Opportunity for Comment' webpage, https://www.maine.gov/dep/comment/index.html. E-mail notification was sent the list of stakeholders, which included those who the informational meeting notification went to along with any others who expressed interest, as well as to digital subscribers of the comment webpage.

One comment was received and responded to:

Sent: Wednesday, September 01, 2021 7:32 AM
Subject: Public Comment on Maine Statewide Nonpoint Source (NPS) Pollution TMDL Addendum

Good morning Ms. Feindel,

I am submitting my public comment on this addendum. As a resident of Alna, Maine, and landowner of 150 acres of conserved land bordering the Sheepscot River, I am concerned that there are another 13 streams and rivers to add to the list in the first place. To me, this is a sign that our State model shoreland zoning ordinance, is not strong enough to prevent this sort of NPS pollution. In addition, Maine's NRPA)or its interpretation/administration) doesn't go far enough to protect our natural resources. To add 13 more streams and rivers to this TMDL report proves our protections are not enough - especially if there are not an equal number of streams/rivers coming OFF the report.

I urge the DEP to evaluate and adopt more preventative measures, such as stricter regulations for the model shoreland zoning ordinance, as well as NRPA application requirements. I also urge the DEP to apply stricter interpretation of the NRPA, with the goal of achieving a net REDUCTION of streams/rivers appearing on the TMDL report over the next 10 years.

Thank you,
Jeff Philbrick
Alna, ME

From: Feindel, Kristin B
Sent: Tuesday, September 07, 2021 1:46 PM
Subject: RE: Public Comment on Maine Statewide Nonpoint Source (NPS) Pollution TMDL Addendum

Dear Mr. Philbrick,

Thank you for your comment on the Maine NPS TMDL Addendum. We appreciate your care and concern for streams and rivers in the State of Maine.

Of the 13 streams added to this TMDL, only one (Craig Brook in Littleton) is a new impairment that will be included in the next Integrated Water Quality Monitoring and Assessment Report (https://www.maine.gov/dep/water/monitoring/305b/index.html). The other 12 streams were already listed as impaired in the 2014 and 2016 (and prior) Integrated Reports. The Integrated Report is where waterbodies are listed as impaired if they do not meet water quality standards, which generally triggers a requirement to develop a TMDL. Adding these streams to the NPS TMDL meets the requirement to have a TMDL and does not indicate new impairments.

There are several efforts to improve water quality of impaired waters, and therefore have them removed from the impaired list in the Integrated Report, including developing and implementing watershed plans, grant funds to install conservation practices, and local efforts and ordinances. It sounds like you are already involved locally, but if you are not and would like to learn about local efforts and contacts, please let me know. I will forward your comments on shoreland zoning and NRPA regulations to relevant staff in the DEP Bureau of Land Resources.

Thank you,
Kristin

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