

Maine Impervious Cover TMDL for Impaired Streams Addendum

January 31, 2024

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Prepared for: USEPA New England, Region 1



MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

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INTRODUCTION

This is an addendum to the *Maine Statewide Impervious Cover Total Maximum Daily Load (IC TMDL)*, which was prepared by the Maine Department of Environmental Protection (MDEP) and approved by the U.S. Environmental Protection Agency (USEPA) in 2012. The IC TMDL and all appendices are available on the MDEP webpage (<https://www.maine.gov/dep/water/monitoring/tmdl/tmdl2.html>). As stated in Section 2.4 Future TMDL Applicability of the 2012 TMDL, DEP may submit additional TMDLs to EPA for specific waterbodies to be added for IC TMDL coverage without resubmitting the approved core document. This addendum contains the information to develop TMDLs for one additional impaired stream (Table 1).

This report:

- Contains the watershed-specific information necessary to add this IC TMDL to the existing 2012 TMDL Report.
- References the basic background information and required TMDL elements from the 2012 TMDL Report.

Table 1. Summary information for impaired streams included in this addendum (from Maine DEP 2018/2020/2022 Integrated Water Quality Monitoring and Assessment Report Appendices).

Streams	Town	Segment ID	Class	Listing Causes
Penjajawoc Stream and Meadow Brook	Bangor	ME0102000513_226R03	B	Benthic Macroinvertebrate Bioassessments, Dissolved Oxygen, Habitat Assessment, Periphyton (Aufwuchs) Indicator Bioassessments

This stream is listed on Maine’s 303(d) list of impaired waters in Maine DEP’s *2018/2020/2022 Integrated Water Quality Monitoring and Assessment Report* (MDEP, 2022). It has been assessed by DEP as not meeting Maine’s water quality standards for aquatic life use based on the results of various assessment criteria for aquatic life use in freshwater streams, including dissolved oxygen, benthic-macroinvertebrate bioassessment, periphyton indicator bioassessment, and habitat assessment. TMDLs are required under the U.S. Clean Water Act for all impaired waters on the 303(d) list, and this TMDL will be added to the existing 2012 IC TMDL.

The IC TMDL provides a framework for addressing aquatic life and habitat impairments in streams. Developed areas and associated impervious cover result in increased stormwater volume and pollutant loads to receiving waterbodies. A combination of pollutants found in stormwater, including sediment and nutrients, contribute to aquatic life impairments in streams, along with habitat loss and unstable stream banks caused by excessive amounts of runoff. Increasing the percentage of total impervious cover (% IC) in a watershed is linked to decreasing stream health (CWP, 2003). Because aquatic life impairment associated with stormwater is not always caused by a single pollutant, % IC has been selected and applied as a representative measure of the mix of pollutants and other impacts associated with excessive stormwater runoff and urban development. The IC TMDL estimates the effective % IC target for the watershed of each impaired surface water addressed by the TMDL. The ultimate achievement of the TMDL will be assessed by the waterbody meeting water quality standards. The Load Allocation & Waste Load Allocation (WLA & LA) target is intended to guide the development of a Watershed-Based

Management Plan (WBP) that will apply appropriate Best Management Practices (BMPs) and Low Impact Development (LID) techniques to achieve water quality standards.

Table 2. Elements of a TMDL

TMDL Element	Definitions	Stream Goals
Goal (End Point)	Achieve water quality consistent with Maine’s Class A, B or C standards	A biological community consistent with Maine’s Class A, B or C standards
TMDL Target (Loading Capacity)	Maximum loading of pollutants that attains the goal	Analysis of Maine’s biomonitoring data indicate that a watershed with characteristics of X% IC would achieve the goal
Margin of Safety (MOS)	The MOS accounts for uncertainty in target-setting and adds a safety factor to increase the likelihood of attainment	A 1% or 2% IC reduction is reserved from the target as a MOS
Load Allocation (LA) & Waste Load Allocation (WLA) Target	Maximum allowable pollutant load that can be allocated to various watershed sources and still achieve the water quality target and goal	X% IC Target - MOS, which represents an approximate % reduction in stormwater runoff volume and associated pollutants when compared to existing pollutant loads
Future Actions or Watershed Management Plan	Actions or engineered BMPs that are designed to achieve water quality standards	A Watershed-Based Management Plan and/or BMP implementation plan may be developed to determine the relative contributions and the best approach to solutions

Under Maine’s Water Classification Program, the State of Maine has four tiers of water quality classifications for freshwater rivers and streams (AA, A, B, C), each with varying designated uses and water quality criteria providing different levels of protection. A guidance document developed by MDEP in 2011 outlines the methods used to determine the % IC values adequate to support aquatic life use in Maine’s waterbodies. The % IC guidelines are based on analyses of data collected in Maine streams at 148 sample locations across the state, representing the full range of impervious cover expected in Maine. Based on the combined information obtained in the study, the % IC guideline ranges specified in Table 3 represent the % IC values found sufficient to support water quality classes in Maine (MDEP, 2011).

Table 3. Percent impervious cover (% IC) guidance for expected attainment of Maine’s designated aquatic life uses (DEP, 2011).

	Class AA/A	Class B	Class C
IC TMDL TARGETS*	≤5%	≤9%	≤16%

* A 1% Margin of Safety (MOS) is applied to Class AA, A, and B waters; a 2% MOS is applied to Class C waters. The MOS for Penjajawoc Stream and Meadow Brook is 1%.

Impervious Cover Used for this Addendum

The waterbody-specific % IC target for this TMDL was determined based on the Class B value provided in Table 3. To calculate the current Penjajawoc watershed % IC, Maine DEP staff used the City of Bangor's impervious cover layer. The City of Bangor created this detailed impervious surface GIS data layer from high resolution aerial photography (City of Bangor, 2014).¹ This layer was determined to be the best available impervious cover dataset for the portion of the watershed located within the City of Bangor, which is the majority of the watershed. The very small portion of the watershed in Orono was determined to have no impervious cover. For the portion of the watershed in Veazie, the impervious cover dataset created by the State of Maine and Sanborn (Sanborn and State of Maine, 2007) was used as a base product. This layer was created from 2007 data, and therefore did not contain any impervious additions between 2007 and present. Additional impervious area was added to the Veazie dataset by DEP staff, using 2021 NAIP (National Agriculture Imagery Program) imagery with 1 meter resolution.

PUBLIC PARTICIPATION

Maine DEP staff have been in communication with the City of Bangor during the development of this addendum and the development of the Penjajawoc Stream Watershed-Based Management Plan.

This draft introduction and stream summary appendix was made available for public review and comment for thirty days beginning on October 23, 2023, on MDEP's 'Opportunity for Comment' webpage, <https://www.maine.gov/dep/comment/index.html>. Email notification was sent to a list of compiled stakeholders, along with any others who expressed interest, as well as to digital subscribers of the comment webpage.

A virtual informational meeting on the addition of Penjajawoc Stream and Meadow Brook to the Statewide IC TMDL was held on November 8, 2023 at 2:00pm via Zoom. Notification of the meeting was included with notification of public review and comment of the TMDL addendum both on MDEP's website and via email.

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

REFERENCES

City of Bangor, 2014. Impervious GIS layer. James Sewall Company 2009. Updated by KAPPA 2014.

Maine Department of Environmental Protection (MDEP), 2011. Impervious Cover Targets for Stream Restoration and Watershed Management. Thomas J. Danielson, Leonidas Tsomides, Doug Suitor.

¹ Bangor impervious data developed by James Sewall Company from ½ inch resolution aerial photography in November 2009. Data was updated in known changed areas in April 2014 by KAPPA mapping based on ¼ inch resolution photography provided by the Maine Geolibrary Board.

Maine Department of Environmental Protection (MDEP), 2012. Maine Impervious Cover Total Maximum Daily Load (TMDL) for Impaired Streams. DEPLW-1239.

https://www.maine.gov/dep/water/monitoring/tmdl/2012/IC%20TMDL_Sept_2012.pdf

Maine Department of Environmental Protection (MDEP), 2012. Maine Impervious Cover Total Maximum Daily Load (TMDL) for Impaired Streams. DEPLW-1239. Appendix 3: Public Comments, Frequently Asked Questions and DEP Responses to Public Comments.

https://www.maine.gov/dep/water/monitoring/tmdl/2012/ICPublicComments&FAQs_Appendix3.pdf

Maine Department of Environmental Protection (MDEP), 2022. 2018/2020/2022 Integrated Water Quality Monitoring and Assessment Report. Bureau Water Quality, Augusta, ME.

<https://www.maine.gov/dep/water/monitoring/305b/>

Sanborn and State of Maine. 2007. Imperviousness change 2003-2007. Raster digital data.

APPENDIX A: PUBLIC COMMENT AND RESPONSES

This draft introduction and stream summary appendix was made available for public review and comment for thirty days beginning on October 23, 2023, on MDEP's 'Opportunity for Comment' webpage, <https://www.maine.gov/dep/comment/index.html>. Email notification was sent to a list of compiled stakeholders, along with any others who expressed interest, as well as to digital subscribers of the comment webpage.

One comment was received and responded to:

DEP Response to Andrew Hamilton/Landowner Comments

SENT VIA EMAIL

January 24, 2024

P. Andrew Hamilton
Eaton Peabody Attorneys at Law
80 Exchange Street, P.O. Box 1210
Bangor, Maine 04402-1210

Re: Maine Impervious Cover TMDL for Impaired Streams Addendum (10/23/2023) -
PENJAJAWOC STREAM & MEADOW BROOK, BANGOR, MAINE/ LANDOWNER
COMMENTS

Dear Andrew Hamilton,

Thank you for your engagement with Maine DEP and the Maine Impervious Cover TMDL Addendum for Penjajawoc Stream and Meadow Brook. The original comments submitted on the 10/23/23 draft TMDL Addendum are included in italics, followed by Maine DEP's responses. The original numbering scheme has been retained for cross-reference to the comment letter.

Questions and Comments:

- 1. Will the Addendum acknowledge that further impervious cover reduction is not needed if the Penjajawoc Stream ever attains Class B Water Quality classification? If there is a need for effective IC% targets to be used as aspirational goals, consider how the IC TMDL being applied to these asserted Urban Impaired Streams help achieve that attainment goal? Please consider the comments of the City on the TMDL report filed on May and July 2011 with the MDEP (detailed further below). It would be helpful for the Addendum to discuss the metrics for the loadings (either by footnote or by attaching a Basis Statement for adding the Penjajawoc and the Meadow Brook to the IC TMDL) and specifically reference these specific tools to implement the TMDL: (1) the Bangor Stormwater Utility, (2) the upcoming Watershed Management Plan, (3) the MS4 permits of the City and MDOT; and (4) the use of Chapters 500 and 502, as may be amended, in development reviews for stormwater associated with any new development.*

The Addendum states “Ultimate success of the TMDL will result in Penjajawoc Stream and Meadow Brook’s compliance with Maine’s water quality criteria for aquatic life, dissolved oxygen, and habitat.” As currently written, the Addendum does not call for impervious cover reduction for success of the TMDL, success will be assessed by meeting water quality standards. The mechanisms to achieve water quality standards are not dictated by the TMDL. The Next Steps section of the Addendum on page 6 has been edited to reference the Stormwater Utility, the Watershed-Based Management Plan, the MS4 permit, and State Stormwater Rules.

2. *Will the Addendum be amended to acknowledge that the IC TMDL may be too broad an indicator to provide the necessary specific guidance in determining what specific measures are needed to improve water quality in a given stream? In the Addendum for these specific waters, it would be helpful to add a specific reference to the fact that "The MDEP will place greater emphasis on the upcoming Watershed Management Plan and a focus there on efforts to manage runoff of any primary pollutants of concern (including, by way of example, chlorides).*

The following text has been added to the Next Steps section of the Addendum on page 6, “The development and implementation of the WBP is the primary strategy for implementing water quality improvements in Penjajawoc Stream. The strategy of WBPs includes locating and identifying specific stressors to the aquatic community in the watershed and addressing them where they occur. This can include implementing appropriate Best Management Practices (BMPs) and Low Impact Development (LID) techniques to address the identified stressors.”

3. *Will the MDEP in the Addendum continue to give focus on the 2011 and 2012 Comments of the City on the IC TMDL Report? As the City of Bangor earlier commented on the IC TMDL in 2011 and 2012, with the MDEP advising it would adopt the comment in its August 14, 2012 response: The focus of the TMDL, and we submit this Addendum, should be on effective impervious cover IF the IC TMDL is to be applied to these asserted Urban Impaired Streams at all and NOT simply on absolute levels of impervious cover.*

The following text has been added to the Impervious Cover Analysis section of the Addendum on page 3, “There are two general ways to quantify impervious cover: total impervious cover and effective impervious cover. Total IC is all the impervious area in a watershed. Effective IC is only the impervious cover in a watershed that is directly connected to a stream via hard surfaces or stormwater conveyances, without treatment or detention. Effective IC presents the greatest pollution risks to streams, and efforts at improving water quality are generally aimed at disconnecting and preventing the addition of connected IC rather than the literal removal or prevention of impervious cover in a watershed. The % IC calculations in this TMDL are the total IC because the level of effort that would be required to determine effective IC is beyond the scope of the TMDL analysis.”

4. *Will MDEP in the Addendum reference the financial tool that the City set up to address implementation of the Stormwater TMDL? Since 2012, the City has adopted and assessed Bangor taxpayers a Stormwater Utility Fee. Under focused watershed management plans (WMPs), the City may have resources available within the Stormwater Utility fund, in part, to address primary contaminants of concern in the implementation of the WMPs. The MDEP may wish to consider referencing in the Addendum to the unique and*

constructive tool that the City of Bangor has put in place, in part, to address Stormwater Management concerns.

The following text has been added to the Next Steps section of the Addendum on page 6, “In 2012, the City of Bangor passed an ordinance creating a stormwater utility. The goal of the utility is to provide funding to deal with stormwater and the problems it creates. This stormwater utility, and the funding source it creates, can help implement the WBP and address water quality impairments due to stormwater and impervious cover.”

5. *It would be helpful to have more information about how the goal of 9% Impervious Cover will be applied. For example:*
 - a. *Existing development on properties in the watershed of the Penjajawoc Stream where IC currently exceeds the goal. We have been advised by the City and MDEP that property owners will not have to rip up or remove IC and that the % IC is only a preliminary goal, with the details to be worked out in the Watershed Management Plan. It would be helpful to have the Addendum specifically state that understanding.*
 - b. *Future Development on properties in the watershed of the Penjajawoc Stream as an urban impaired stream. As noted, we were advised that the 9% (and with a 1% Margin of Safety, 8%) but again that was a goal and that plans for best practices would be placed in the Watershed Management Plan currently being drafted for the Penjajawoc Stream by Stillwater Environmental Associates for the City; please consider the inclusion of Bangor Landowner representatives on the Advisory Committee to the WMP similar to prior efforts.*
 - c. *Please confirm whether the future development will be governed by MDEP review of Chapter 500 and 502 stormwater management permit filings.*

The following text has been added to the Next Steps section of the Addendum on page 6, “This TMDL does not mandate the removal of existing impervious cover or prevent future development. All future development will be governed by existing federal, state, and local regulations, including Maine Stormwater Rules.” Representation on the Advisory Committee to the Watershed Based Plan is determined by the plan lead, the City of Bangor.

6. *Please consider having the Addendum use the detailed terminology reflected in the prior comments of the City and the August 2012 response of the MDEP. As compared with the Chapter 500 and 502 development reviews, the IC TMDL (And the Addendum for the Penjajawoc and Meadow Brook waters) would, instead of discussing just absolute IC% goals and existing impervious areas (see pages 3-5 of the Addendum including an overreliance on "actual impervious cover" for such areas as the Middle Watershed of the Penjajawoc Stream), also benefit from instead focusing on effective impervious cover and the disconnection of the stormwater from the effective impervious cover from runoff to the streams and focus on BMPS and reductions in the primary pollutants of concern.*

The following text has been added to the Impervious Cover Analysis section of the Addendum on page 3, “There are two general ways to quantify impervious cover: total impervious cover and effective

impervious cover. Total IC is all the impervious area in a watershed. Effective IC is only the impervious cover in a watershed that is directly connected to a stream via hard surfaces or stormwater conveyances, without treatment or detention. Effective IC presents the greatest pollution risks to streams, and efforts at improving water quality are generally aimed at disconnecting and preventing the addition of connected IC rather than the literal removal or prevention of impervious cover in a watershed. The % IC calculations in this TMDL are the total IC because the level of effort that would be required to determine effective IC is beyond the scope of the TMDL analysis.”

7. *The Addendum would benefit from having a focus on BMPs and other approaches to address chlorides, as noted in the reasoning expressed by the MDEP in not accepting the City's prior draft Watershed Management Plan for the Penjajawoc Stream and Meadow Brook. Consider a specific focus on the use of Stormwater Utility funds and efforts to have both the Watershed Management Plan and the MS-4 permit focus on the reduction of chlorides in the Stream and Meadow Brook. Again, this is a constructive focus that could be referenced in the Addendum.*

The following text has been added to the Next Steps section of the Addendum on page 6, “The development and implementation of the WBP is the primary strategy for implementing water quality improvements in Penjajawoc Stream. The strategy of WBPs includes locating and identifying specific stressors to the aquatic community in the watershed and addressing them where they occur. This can include implementing appropriate Best Management Practices (BMPs) and Low Impact Development (LID) techniques to address the identified stressors.”

8. *As the City has commented in recent discussions with MDEP, there is the opportunity to focus on BMPs (including the use of practices to reduce the plowing and the salting of larger parking areas when not needed or used).*

The determination of the use of specific BMPs is beyond the scope of the TMDL Addendum. The discussion of BMPs, including any reductions in plowing and salting can be included in the Watershed-Based Management Plan or other stormwater plans carried out by the City. However, the following text has been added to the Next Steps section of the Addendum on page 6, “The development and implementation of the WBP is the primary strategy for implementing water quality improvements in Penjajawoc Stream. The strategy of WBPs includes locating and identifying specific stressors to the aquatic community in the watershed and addressing them where they occur. This can include implementing appropriate Best Management Practices (BMPs) and Low Impact Development (LID) techniques to address the identified stressors.”

Questions and Comments Related to the City’s 2011 and 2012 Comments:

We continue to support the City's 2011 and 2012 Comments in these respects:

1. *Specify that watershed management plans should focus on pollutants of primary concern. The presentations on the Appendix by MDEP and the City in 2023 have focused on the watershed management plan as the primary vehicle of focus, and we support this focus. We understand that MDEP did not accept the City's prior watershed management plan report because it did not focus sufficiently on chlorides. With the City having adopted a Stormwater Utility and having assessed Bangor taxpayers a stormwater fee to fund*

improvements, we hope the MDEP will help the City focus the recently collected funds on pollutants of primary concern.

Part of the development of a Watershed-Based Management Plan includes the identification of stressors within the watershed. It is in the purview of that plan to identify which specific pollutants or structural issues (flow volumes, habitat, etc.) may be the largest stressor at different locations in the watershed and to prioritize these stressors for implementation actions. The following text has been added to the Next Steps section of the Addendum on page 6, “The development and implementation of the WBP is the primary strategy for implementing water quality improvements in Penjajawoc Stream. The strategy of WBPs includes locating and identifying specific stressors to the aquatic community in the watershed and addressing them where they occur. This can include implementing appropriate Best Management Practices (BMPs) and Low Impact Development (LID) techniques to address the identified stressors.”

2. *Clarify that reducing effective impervious cover, not the absolute amount of impervious cover. This comment of the City was focused on the Statewide TMDL, and that same comment would seem to apply to the proposed October 23, 2023 Addendum for the Penjajawoc Stream and Meadow Brook. At pages 3-5 of the Appendix, the MDEP draft of October 23, 2023 speaks only of IC and % IC without use of the City's proposed 2012 edit that the August 14, 2012 letter response of MDEP advised would be used: “Editorial recommendations were incorporated as suggested...” The specific edit recommended in the City's comments was to revise the text of the TMDL as follows: "This TMDL report established the effective % impervious cover ... and outlines the measures which may be needed to reduce the impacts from impervious cover and meet water quality standards."*

The TMDL Addendum is not editing the original Statewide IC TMDL document, so edits to the text of that document cannot be made at this time. The IC TMDL does state for the TMDL target that the goal is “a watershed with **characteristics** of X% IC”, indicating an effective IC, rather than absolute. In addition, the following text has been added to the Impervious Cover Analysis section of the Addendum on page 3, “There are two general ways to quantify impervious cover: total impervious cover and effective impervious cover. Total IC is all the impervious area in a watershed. Effective IC is only the impervious cover in a watershed that is directly connected to a stream via hard surfaces or stormwater conveyances, without treatment or detention. Effective IC presents the greatest pollution risks to streams, and efforts at improving water quality are generally aimed at disconnecting and preventing the addition of connected IC rather than the literal removal or prevention of impervious cover in a watershed. The % IC calculations in this TMDL are the total IC because the level of effort that would be required to determine effective IC is beyond the scope of the TMDL analysis.”

3. *Attainment of water quality standards should eliminate the need for further effective IC reductions.*

The Addendum states “Ultimate success of the TMDL will result in Penjajawoc Stream and Meadow Brook’s compliance with Maine’s water quality criteria for aquatic life, dissolved oxygen, and habitat.” As currently written, the Addendum does not call for impervious cover reduction for success of the TMDL, success will be assessed by meeting water quality standards. The mechanisms to achieve water quality standards are not dictated by the TMDL. It should be noted that Federal regulations (40 CFR

130.7(c)(1)) state that “TMDLs shall be established at levels necessary to attain **and maintain** the applicable narrative and numerical WQS.” Once the stream attains water quality standards, ongoing watershed management, informed in large part by the WBP, will be needed to ensure that the stream continues to meet standards.

4. *As the City commented in 2012 as to the IC TMDL overall, the Addendum should acknowledge in specific text and allow for natural conditions. On page 14 of the State's draft IC TMDL in 2012, the TMDL document noted that impairment may be due at least in part to natural conditions (including impermeable soil group or naturally low dissolved oxygen levels) and that includes elevated temperatures in the Bog section of the Penjajawoc Stream. Furthermore, it should be acknowledged that some streams (or reaches within that stream) are not naturally capable of supporting their current stream classification. With an overreliance on pages 3-5 in the Addendum on IC% cover from aerial photography, it would be well to demonstrate the scientific and specific bases for non-attainment due to some of the natural conditions in the Upper Watershed and include those references from the historical record and place those reference in the discussion on pages 3-5 of the Addendum so that the document is technically balanced.*

A study of Penjajawoc Marsh would likely provide greater insight into natural conditions and into its effect on Penjajawoc Stream. All watersheds have unique and varied conditions that necessarily have downstream effects. That being said, many watersheds include wetlands and neither the wetland nor the downstream stream are assessed as impaired. It is clear in the Penjajawoc watershed there are many non-natural conditions that contribute to the stream's impairment and could be addressed to improve the health of the stream.

5. *Clarify that assessment summaries on pages 3-5 of the Addendum are estimates only. The amount of impervious cover is not clearly and consistently referenced as an estimate. The fact that the City used high resolution aerial photography is helpful but two key concepts are needed and should be liberally applied in the text of the Addendum (particularly at pages 3-5) or built out as a new and additional section of the Addendum: (1) again the focus should be on effective impervious cover; and (2) the focus should be on estimated% IC only. In the MDEP August 14, 2012 response to the City's comments, the MDEP stated: "... estimation is inferred when interpreting orthophotos in GIS." It would be helpful, given the heavy reliance on estimating all watershed reaches of the Stream, to have the fact that the current IC % is estimated made explicit.*

The text on pages 3 and 4 has been updated to specify that the % IC values are estimates. The impervious cover map on page 5 does not contain any % IC values and has not been edited.

6. *It would be helpful to have the Addendum include specific reference to the array of tools available to prevent degradation of stream and habitat quality including those detailed at the outset of these comments. As MDOT commented at the November 8 stakeholder review of the Draft Addendum to the IC TMDL, the language of the Addendum should also focus on the use of the MS4 permits linked to Chapter 502 reviews.*

The mechanisms to achieve water quality standards are not dictated by the TMDL. However, the Next Steps section of the Addendum on page 6 has been edited to reference the Stormwater Utility, the Watershed-Based Management Plan, the MS4 permit, and State Stormwater Rules.

7. *Consider having the Addendum repeat the assurance and credit for the City of Bangor making progress by including the following somewhere in the text of the Addendum: "as an MS4 community that is working to put in place a Watershed Management Plan for the Penjajawoc Stream as a stream of primary concern as identified in its MS4 stormwater management plan, and which has a funding source in place which will allow the municipality to make substantial progress on completing the tasks to be outlined in the watershed management plan, the City of Bangor is considered to be making adequate progress under the IC TMDL."*

The Addendum is not assessing the extent to which the City is meeting the IC TMDL, rather it is establishing that TDML. The Next Steps section of the Addendum on page 6 has been edited to reference the City's work on the Stormwater Utility, the Watershed-Based Management Plan, and the MS4 permit.

Sincerely,



Tracy Krueger
TMDL Coordinator, Maine DEP

SENT VIA EMAIL ONLY

November 21, 2023

Tracy Krueger, Stormwater TMDL Coordinator
Maine DEP
17 State House Station
Augusta, Maine 04333

Re: **Maine Impervious Cover TMDL for Impaired Streams Addendum (10/23/2023)--
PENJAJAWOC STREAM & MEADOW BROOK, BANGOR, MAINE/ LANDOWNER
COMMENTS**

Dear Tracy:

As you know, I represent certain of the landowners along the Penjajawoc Stream including those copied on this Comments letter (the "Bangor Landowners") and am submitting the following comments on their behalf with respect to the October 23, 2023 DRAFT Addendum to the Maine Impervious Cover (IC) TMDL for Urban Impaired Streams. We appreciate the cooperative nature of this process, MDEP's thoughtful work on this matter, and as a follow-up respectfully submit the following questions and comments for your consideration:

1. Will the Addendum acknowledge that further impervious cover reduction is not needed if the Penjajawoc Stream ever attains Class B Water Quality classification? If there is a need for effective IC % targets to be used as aspirational goals, consider how the IC TMDL being applied to these asserted Urban Impaired Streams help achieve that attainment goal? Please consider the comments of the City on the TMDL report filed on May and July 2011 with the MDEP (detailed further below). It would be helpful for the Addendum to discuss the metrics for the loadings (either by footnote or by attaching a Basis Statement for adding the Penjajawoc and the Meadow Brook to the IC TMDL) and specifically reference these specific tools to implement the TMDL: (1) the Bangor Stormwater Utility, (2) the upcoming Watershed Management Plan, (3) the MS4 permits of the City and MDOT; and (4) the use of Chapters 500 and 502, as may be amended, in development reviews for stormwater associated with any new development.
2. Will the Addendum be amended to acknowledge that the IC TMDL may be too broad an indicator to provide the necessary specific guidance in determining what specific measures are needed to improve water quality in a given stream? In the Addendum for these specific waters, it would be helpful to add a specific reference to the fact that

“The MDEP will place greater emphasis on the upcoming Watershed Management Plan and a focus there on efforts to manage runoff of any primary pollutants of concern (including, by way of example, chlorides).

3. Will the MDEP in the Addendum continue to give focus on the 2011 and 2012 Comments of the City on the IC TMDL Report? As the City of Bangor earlier commented on the IC TMDL in 2011 and 2012, with the MDEP advising it would adopt the comment in its August 14, 2012 response: The focus of the TMDL, and we submit this Addendum, should be on *effective* impervious cover IF the IC TMDL is to be applied to these asserted Urban Impaired Streams at all and NOT simply on absolute levels of impervious cover.
4. Will MDEP in the Addendum reference the financial tool that the City set up to address implementation of the Stormwater TMDL? Since 2012, the City has adopted and assessed Bangor taxpayers a Stormwater Utility Fee. Under focused watershed management plans (WMPs), the City may have resources available within the Stormwater Utility fund, in part, to address primary contaminants of concern in the implementation of the WMPs. The MDEP may wish to consider referencing in the Addendum to the unique and constructive tool that the City of Bangor has put in place, in part, to address Stormwater Management concerns.
5. It would be helpful to have more information about how the goal of 9% Impervious Cover will be applied. For example:
 - a. Existing development on properties in the watershed of the Penjajawoc Stream where IC currently exceeds the goal. We have been advised by the City and MDEP that property owners will not have to rip up or remove IC and that the % IC is only a preliminary goal, with the details to be worked out in the Watershed Management Plan. It would be helpful to have the Addendum specifically state that understanding.
 - b. Future Development on properties in the watershed of the Penjajawoc Stream as an urban impaired stream. As noted, we were advised that the 9% (and with a 1% Margin of Safety, 8%) but again that was a goal and that plans for best practices would be placed in the Watershed Management Plan currently being drafted for the Penjajawoc Stream by Stillwater Environmental Associates for the City; please consider the inclusion of Bangor Landowner representatives on the Advisory Committee to the WMP similar to prior efforts.
 - c. Please confirm whether the future development will be governed by MDEP review of Chapter 500 and 502 stormwater management permit filings.
6. Please consider having the Addendum use the detailed terminology reflected in the prior comments of the City and the August 2012 response of the MDEP. As compared with the Chapter 500 and 502 development reviews, the IC TMDL (And the Addendum for the Penjajawoc and Meadow Brook waters) would, instead of discussing just absolute IC % goals and existing impervious areas (see pages 3-5 of the

Addendum including an overreliance on “actual impervious cover” for such areas as the Middle Watershed of the Penjajawoc Stream), also benefit from instead focusing on *effective* impervious cover and the disconnection of the stormwater from the effective impervious cover from runoff to the streams and focus on BMPS and reductions in the primary pollutants of concern.

7. The Addendum would benefit from having a focus on BMPs and other approaches to address chlorides, as noted in the reasoning expressed by the MDEP in not accepting the City’s prior draft Watershed Management Plan for the Penjajawoc Stream and Meadow Brook. Consider a specific focus on the use of Stormwater Utility funds and efforts to have both the Watershed Management Plan and the MS-4 permit focus on the reduction of chlorides in the Stream and Meadow Brook. Again, this is a constructive focus that could be referenced in the Addendum.
8. As the City has commented in recent discussions with MDEP, there is the opportunity to focus on BMPs (including the use of practices to reduce the plowing and the salting of larger parking areas when not needed or used).

The comments filed by the City of Bangor in its comments of May 27, 2011, and July 2012 (to which the MDEP responded in its August 14, 2012 letter response), continue to be relevant and helpful to this discussion, viz.:

- While impervious cover is useful as a predictive model, it does not indicate what pollutants are causing stream impairment and does not therefore serve the purposes of a TMDL.
- No single mechanism for directly measuring effective IC was ever earlier provided or is now proposed in the Addendum, leaving uncertainty as to how those who are subject to the IC TMDL are to implement it or measure their progress. Specifically, as the City noted, “While stream-specific appendices mention a reduction in runoff volume and associated pollutants [NOTE: in 2022 and 2023, it is apparently “chlorides”], there is no basis given for determining that reduction in runoff volume and associated pollutants bears a linear [or even some] relationship to reduction in effects of IC.”
- No case studies are provided showing how an impaired waterbody has met its water quality classification under the IC TMDL approach. The technical and financial feasibility of the IC TMDL approach has not been established, yet no opportunity for reevaluation of this approach is contemplated in the TMDL document [or, for that matter, in the Addendum to the TMDL].

These comments continue to inform this discussion. We continue to support the City’s 2011 and 2012 Comments in these respects:

1. Specify that watershed management plans should focus on pollutants of primary concern. The presentations on the Appendix by MDEP and the City in 2023 have focused on the watershed management plan as the primary vehicle of focus, and we support this focus. We understand that MDEP did not accept the City’s prior watershed management plan

report because it did not focus sufficiently on chlorides. With the City having adopted a Stormwater Utility and having assessed Bangor taxpayers a stormwater fee to fund improvements, we hope the MDEP will help the City focus the recently collected funds on pollutants of primary concern.

2. Clarify that reducing *effective* impervious cover, not the absolute amount of impervious cover. This comment of the City was focused on the Statewide TMDL, and that same comment would seem to apply to the proposed October 23, 2023 Addendum for the Penjajawoc Stream and Meadow Brook. At pages 3-5 of the Appendix, the MDEP draft of October 23, 2023 speaks only of IC and % IC without use of the City's proposed 2012 edit that the August 14, 2012 letter response of MDEP advised would be used: "Editorial recommendations were incorporated as suggested..." The specific edit recommended in the City's comments was to revise the text of the TMDL as follows: "This TMDL report established the effective % impervious cover ... and outlines the measures which may be needed to reduce the impacts from impervious cover and meet water quality standards."
3. Attainment of water quality standards should eliminate the need for further effective IC reductions.
4. As the City commented in 2012 as to the IC TMDL overall, the Addendum should acknowledge in specific text and allow for natural conditions. On page 14 of the State's draft IC TMDL in 2012, the TMDL document noted that impairment may be due at least in part to natural conditions (including impermeable soil group or naturally low dissolved oxygen levels) and that includes elevated temperatures in the Bog section of the Penjajawoc Stream. Furthermore, it should be acknowledged that some streams (or reaches within that stream) are not naturally capable of supporting their current stream classification. With an overreliance on pages 3-5 in the Addendum on IC % cover from aerial photography, it would be well to demonstrate the scientific and specific bases for non-attainment due to some of the natural conditions in the Upper Watershed and include those references from the historical record and place those reference in the discussion on pages 3-5 of the Addendum so that the document is technically balanced.
5. Clarify that assessment summaries on pages 3-5 of the Addendum are estimates only. The amount of impervious cover is not clearly and consistently referenced as an estimate. The fact that the City used high resolution aerial photography is helpful but two key concepts are needed and should be liberally applied in the text of the Addendum (particularly at pages 3-5) or built out as a new and additional section of the Addendum: (1) again the focus should be on *effective* impervious cover; and (2) the focus should be on *estimated % IC only*. In the MDEP August 14, 2012 response to the City's comments, the MDEP stated: "... estimation is inferred when interpreting orthophotos in GIS." It would be helpful, given the heavy reliance on estimating all watershed reaches of the Stream, to have the fact that the current IC %s is estimated made explicit.
6. It would be helpful to have the Addendum include specific reference to the array of tools available to prevent degradation of stream and habitat quality including those detailed at

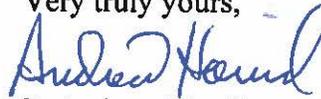
Tracy Krueger, Stormwater TMDL Coordinator
Maine Department of Environmental Protection
November 21, 2023

the outset of these comments. As MDOT commented at the November 8 stakeholder review of the Draft Addendum to the IC TMDL, the language of the Addendum should also focus on the use of the MS4 permits linked to Chapter 502 reviews.

7. Consider having the Addendum repeat the assurance and credit for the City of Bangor making progress by including the following somewhere in the text of the Addendum: “as an MS4 community that is working to put in place a Watershed Management Plan for the Penjajawoc Stream as a stream of primary concern as identified in its MS4 stormwater management plan, and which has a funding source in place which will allow the municipality to make substantial progress on completing the tasks to be outlined in the watershed management plan, the City of Bangor is considered to be making adequate progress under the IC TMDL.”

We thank the Department for the opportunity to comment on the October 23 Draft Addendum and respectively submit these commits for consideration. Also, thank you again for the MDEP’s and the City’s outreach to the Bangor Landowners as part of the collaborative efforts contemplated by the TMDL and collaborate water management planning. We welcome any questions you may have.

Very truly yours,



P. Andrew Hamilton

cc: Wendy Garland, MDEP Division of Environmental Assessment
Richard May, City of Bangor Stormwater
William Fletcher, Maine Community College System
Noreen Patient, Darling’s Auto
Bob Quirk, Quirk Auto
Rick Varney, Varney GMC



Penjajawoc Stream & Meadow Brook

Watershed Description

This Total Maximum Daily Load (TMDL) applies to a 5.2-mile section of Penjajawoc Stream, and a 1.5-mile section of Meadow Brook, located in the City of Bangor, Maine. The watershed is made up of four subwatersheds including the Upper Subwatershed, Middle Subwatershed, Meadow Brook Subwatershed, and Mt. Hope Subwatershed. The Upper Subwatershed drains a large 300-acre emergent freshwater marsh known as Penjajawoc Marsh. The Middle and Meadow Brook Subwatersheds drain the Bangor Mall and other intensely developed commercial areas on Stillwater Avenue and Hogan Road (Figure 1). Meadow Brook flows into Penjajawoc Stream just above Mt. Hope Avenue and then Penjajawoc Stream flows southeasterly into the Penobscot River. The Mt. Hope subwatershed drains the eastern portion of the watershed and joins Penjajawoc Stream a small distance before it flows into the Penobscot River. This subwatershed is primarily comprised of older, low-density residential development and a cemetery (Figure 2) (CH2MHILL, 2009; BSA, 2008).

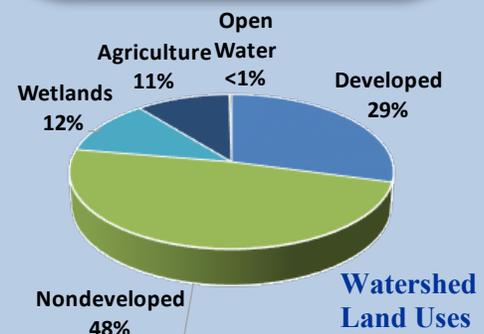
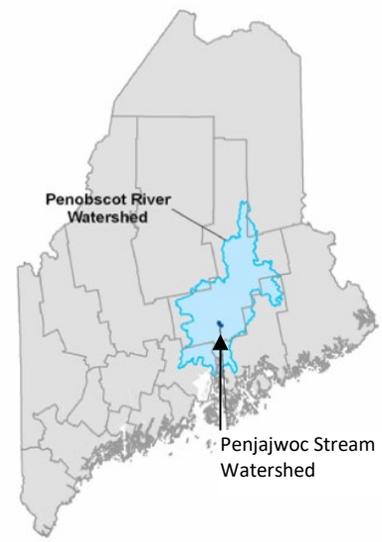
- Stormwater runoff from **impervious cover (IC)** flows quickly off impervious surfaces, carrying sediment, oils, metals, salt, and other pollutants. IC contributes to altered stream stability, in-stream habitat degradation, and impaired stream biological communities.
- The percent IC for the entire Penjajawoc watershed is 11%, but varies greatly among the four subwatersheds:
 - 3% in the Upper Subwatershed
 - 45% in the Middle Subwatershed
 - 25% in the Meadow Brook Subwatershed
 - 8% in the Mt. Hope subwatershed

Definitions

- **TMDL** is an acronym for **Total Maximum Daily Load**, representing the total amount of a pollutant that a water body can receive and still meet water quality standards.
- **Impervious cover (IC)** refers to landscape surfaces (e.g. roads, sidewalks, driveways, parking lots, and rooftops) that no longer absorb rain and may direct large volumes of stormwater runoff into the stream.

Waterbody Facts

- **Segment ID:** ME0102000513_226R03
- **City:** Bangor, ME
- **County:** Penobscot
- **Impaired Segment Length:** 6.76 miles
- **Classification:** Class B
- **Direct Watershed:** 8.8 mi² (~5,600 acres)
- **Watershed Impervious Cover:** 11%
- **Major Drainage Basin:** Penobscot River



Why is a TMDL Assessment Needed?

Penjajawoc Stream and Meadow Brook have been assessed by DEP as not meeting water quality standards for Class B freshwater streams. Penjajawoc Stream violates water quality standards for dissolved oxygen and aquatic life use, causing it to be listed on Maine’s 303(d) list of impaired waters. The Clean Water Act requires that all 303(d)-listed waters undergo a TMDL assessment that describes waterbody impairments and establishes a target to guide the measures needed to restore water quality. The goal is to bring listed waterbodies back into attainment with Maine water quality standards.



Penjajawoc Stream flows through the highly developed Bangor Mall area. (Photo: DEP)

The IC TMDL assessment for Penjajawoc Stream and Meadow Brook addresses water quality impairments for dissolved oxygen and aquatic life use (benthic-macroinvertebrate, periphyton (algae), and stream habitat assessments). These impairments are associated with a variety of pollutants in urban stormwater as well as erosion, habitat loss, and unstable stream banks caused by excessive amounts of runoff.

Sampling Results & Pollutant Sources

Sampling Station	Statutory Class	Sample Result by Sample Date							
		2008	2009	2011	2012	2014	2015	2016	
314	B	C		C/C ^a	NA				
315	B	NA		C/C ^a				NA/NA ^a	
511	B	C	C	C/C ^a				NA	
513	B	C			NA			NA/C ^a	
918	B	C	C						
927	B	C	NA						
1045	B					C			
1079	B							NA	

Maine DEP uses a variety of data types to measure the ability of a stream to adequately support aquatic life, including; dissolved oxygen, benthic macroinvertebrates, and periphyton (algae). For benthic macroinvertebrates, DEP makes aquatic life use determinations using a statistical model that incorporates 30 variables of data collected from rivers and streams, including the richness and abundance of streambed organisms, to determine the probability of a sample meeting Class A, B, or C criteria. Biologists use the model results

Recent DEP biomonitoring results for Penjajawoc Stream.
 NA = Non Attaining. Does not meet Class A, B, or C criteria.
^a = Algae assessment result. All others benthic macroinvertebrate results.

and supporting information to determine if samples comply with the numeric aquatic life criteria of the class assigned to the stream or river (Davies and Tsomides, 2002). Maine DEP uses an analogous model to aid in the assessment of algal communities but makes aquatic life use determinations based on narrative standards. Both benthic macroinvertebrate and algae biomonitoring assessments were conducted at

various sampling stations since 1997, with the most recent assessments in 2016. Data indicate that Class B Penjajawoc Stream did not attain its statutory class at any of the eight sampling locations.

Impervious Cover Analysis

There are two general ways to quantify impervious cover: total impervious cover and effective impervious cover. Total IC is all the impervious area in a watershed. Effective IC is only the impervious cover in a watershed that is directly connected to a stream via hard surfaces or stormwater conveyances, without treatment or detention. Effective IC presents the greatest pollution risks to streams, and efforts at improving water quality are generally aimed at disconnecting and preventing the addition of connected IC rather than the literal removal or prevention of impervious cover in a watershed. The % IC calculations in this TMDL are the total IC because the level of effort that would be required to determine effective IC is beyond the scope of the TMDL analysis.

To calculate the estimated Penjajawoc Stream watershed percent impervious cover (% IC), Maine DEP staff used the City of Bangor's IC layer. The City of Bangor created this detailed impervious surface GIS data layer from high resolution aerial photography (City of Bangor, 2014).¹ This layer was determined to be the best available IC dataset for the the portion of the watershed located within the City of Bangor, which is the majority of the watershed. The very small portion of the watershed in Orono was determined to have no IC. For the portion of the watershed in Veazie, the IC dataset created by the State of Maine and Sanborn (Sanborn and State of Maine, 2007) was used as a base product. This layer was created from 2007 data, and therefore did not contain any impervious additions between 2007 and present. Additional impervious area was added to the Veazie dataset by DEP staff, using 2021 NAIP (National Agriculture Imagery Program) imagery with 1 meter resolution.

Increasing % IC in a watershed is linked to decreasing stream health (CWP, 2003). Because the impairment in Penjajawoc Stream and Meadow Brook is not caused by a single pollutant, % IC is used for this TMDL to represent the mix of pollutants and other impacts associated with excessive stormwater runoff. The Penjajawoc Stream watershed (including Meadow Brook) has an estimated % IC of **11%** (Figure 1). A TMDL is defined as $TMDL = WLA + LA + MOS$. DEP has found that in order to support Class B aquatic life use, the Penjajawoc Stream watershed needs to have the characteristics of a watershed with 9% IC (DEP, 2012). The IC TMDL has set an explicit Margin of Safety (MOS) for Class B waters at 1% IC, making 8% IC the combined Wasteload (WLA) and Load (LA) Allocation for the Penjajawoc Stream and Meadow Brook watersheds. This TMDL target of 9% is intended to guide the application of Best Management Practices (BMPs) and Low Impact Development (LID) techniques to reduce the *impact* of impervious surfaces, i.e. the effective IC. Ultimate success of the TMDL will result in Penjajawoc Stream and Meadow Brook's compliance with Maine's water quality criteria for aquatic life, dissolved oxygen, and habitat.

It should be noted that while the overall % IC for the Penjajawoc Stream watershed is only slightly higher than the TMDL % IC target for the watershed, the IC in the various subwatersheds within the overall Penjajawoc Stream watershed are not uniform (Figure 1). The Upper Subwatershed of Penjajawoc Stream is comprised largely of wetlands and other undeveloped land – much of it undevelopable or preserved – and has an estimated % IC of 3%. The Mt. Hope subwatershed, which is largely rural and drains the eastern section of the watershed, has an estimated % IC of 8%. However the Middle Subwatershed, where the Bangor Mall and other development along Stillwater Ave. are located, has an estimated % IC of 45%

¹ Bangor impervious data developed by James Sewall Company from ½ inch resolution aerial photography in November 2009. Data was updated in known changed areas in April 2014 by KAPPA mapping based on ¼ inch resolution photography provided by the Maine Geolibrary Board.

and the Meadow Brook subwatershed has an estimated % IC of 25%. Due to this variability, the whole watershed % IC value likely underestimates the effect of the imperviousness on the stream and the % IC values of the Middle and Meadow Brook subwatersheds likely overestimate the effect. It should be noted that while determining the % IC of the watershed and subwatersheds is part of the TMDL process, the path toward achieving water quality criteria will depend on locating and identifying the specific stressors to the aquatic community and addressing them where they occur.

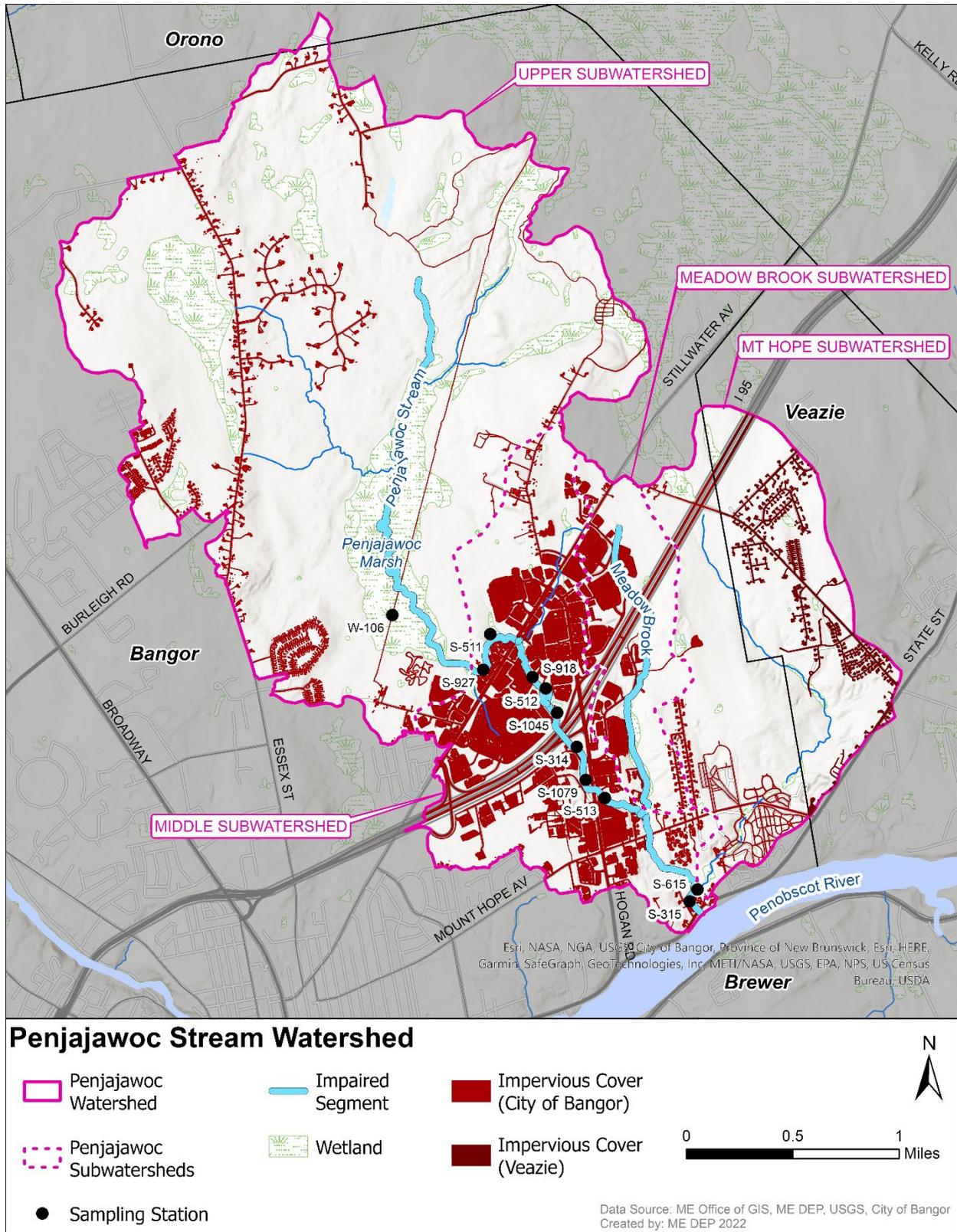


Figure 1: Penjajawoc Stream Watershed Impervious Cover (City of Bangor, 2014 and updated Sanborn and State of Maine, 2007).

Next Steps

The City of Bangor completed a Watershed-Based Management Plan (WBP) for Penjajawoc Stream, approved by DEP, in 2008. Following the approval of this WBP, six of the highest priority projects were implemented. In 2015, the City of Bangor drafted a WBP as an update to the 2008 plan and submitted it to the Maine DEP in 2017. This WBP was not approved because it did not address high chloride levels during baseflow conditions. The City of Bangor is currently working on updating the WBP. The development and implementation of the WBP is the primary strategy for implementing water quality improvements in Penjajawoc Stream. The strategy of WBPs includes locating and identifying specific stressors in the watershed and addressing them where they occur. This can include implementing appropriate Best Management Practices (BMPs) and Low Impact Development (LID) techniques to address the identified stressors. This TMDL does not mandate the removal of existing impervious cover or prevent future development. All future development will be governed by existing federal, state, and local regulations, including Maine Stormwater Rules.

In 2012, the City of Bangor passed an ordinance creating a stormwater utility. The purpose of the utility is to provide the municipality with funds for stormwater management throughout the City, including, infrastructure maintenance and installations, water quality improvements, and WBP development and implementation.

The City of Bangor is subject to the General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4s). The City anticipates revising and resubmitting the Penjajawoc Stream WBP as part of the 2022-2027 MS4 permit cycle. Following approval the WBP will be implemented. Additionally, the MS4 General Permit contains specific requirements for Urban Impaired Streams, which includes Penjajawoc Stream and tributaries. The MS4 Stormwater Management Plan (SMP) identifies three BMPs that will be implemented to meet the Urban Impaired Stream requirement of the 2022 MS4 General Permit. These BMPs include, an education campaign to raise citizens' awareness of Urban Impaired Streams in Bangor, inspection of publicly owned ditches within the right-of-way in Urban Impaired Stream watersheds, and implementation of structural BMPs in Urban Impaired Stream watersheds.

Future planning projects that will benefit both Penjajawoc Stream and Meadow Brook include:

- Update Watershed-Based Management Plan (including addition of high chloride levels in baseflow and a strategy for addressing this stressor).
- Implement Watershed-Based Management Plan recommendations.
- Implement the requirements of the 2022 MS4 permit and Stormwater Management Plan.

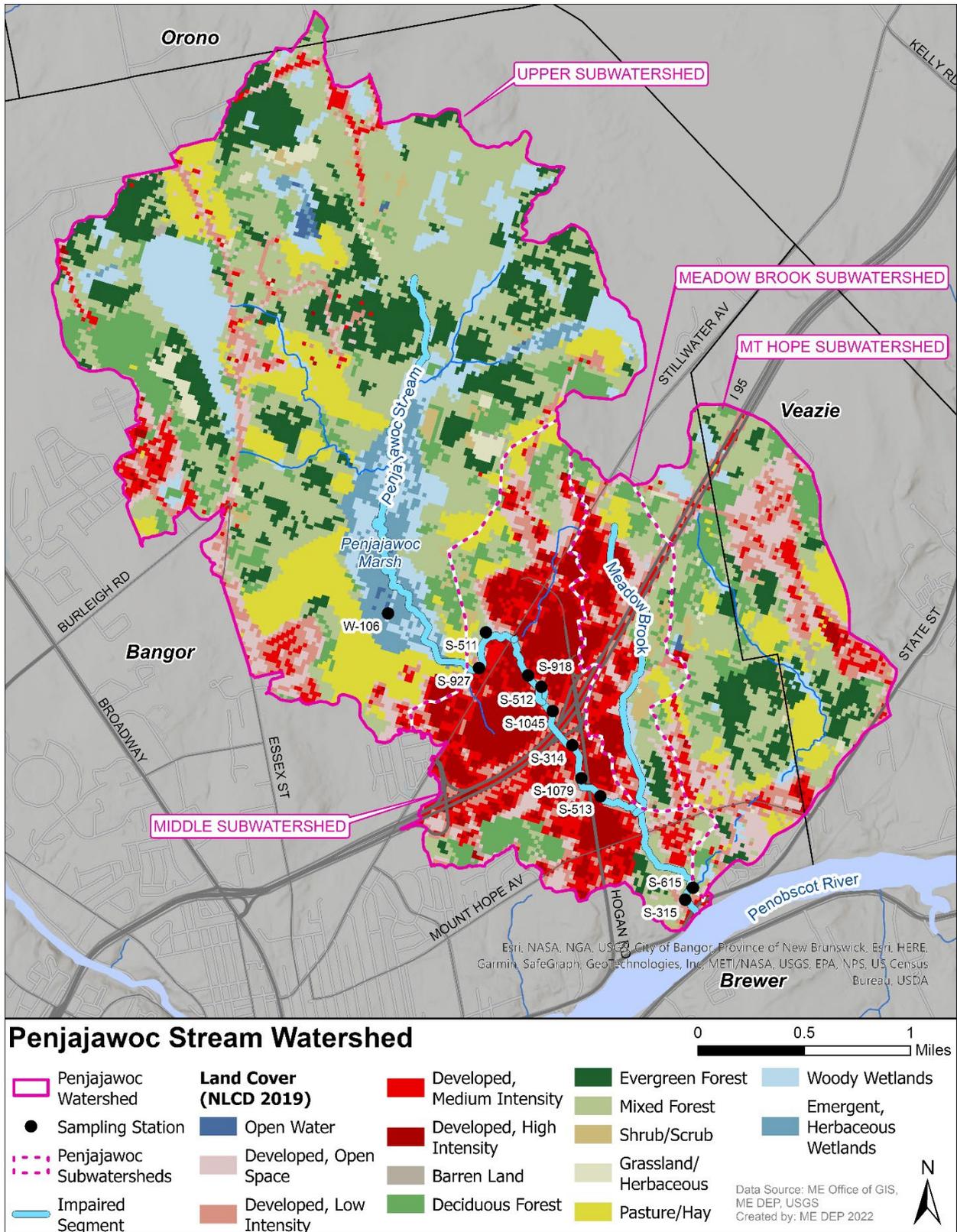


Figure 2. Penjajawoc Stream Watershed National Land Cover Database 2019 Land Cover.

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