



Stormwater Management Program Millis, Massachusetts

EPA NPDES Permit Number: MAR041100

Updated: June 2022



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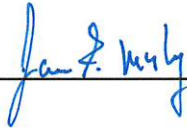
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1 CERTIFICATION

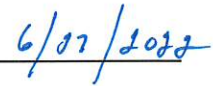
"I certify under the penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information is submitted, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Printed Name:

Signature:

A handwritten signature in blue ink, appearing to read "Jan F. Kelly", is written over a horizontal line.

Date:

A handwritten date "6/07/2022" in blue ink is written over a horizontal line.

2 BACKGROUND

2.1 STORMWATER REGULATION

The Stormwater Phase II Final Rule was promulgated in 1999 and was the next step after the 1987 Phase I Rule in EPA's effort to preserve, protect, and improve the Nation's water resources from polluted stormwater runoff. The Phase II program expands the Phase I program by requiring additional operators of MS4s in urbanized areas and operators of small construction sites, through the use of NPDES permits, to implement programs and practices to control polluted stormwater runoff. Phase II is intended to further reduce adverse impacts to water quality and aquatic habitat by instituting the use of controls on the unregulated sources of stormwater discharges that have the greatest likelihood of causing continued environmental degradation. Under the Phase II rule all MS4s with stormwater discharges from Census designated Urbanized Area are required to seek NPDES permit coverage for those stormwater discharges.

2.2 PERMIT PROGRAM BACKGROUND

On May 1, 2003, EPA Region 1 issued its Final General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (2003 small MS4 permit) consistent with the Phase II rule. The 2003 small MS4 permit covered "traditional" (i.e., cities and towns) and "non-traditional" (i.e., Federal and state agencies) MS4 Operators located in the states of Massachusetts and New Hampshire. This permit expired on May 1, 2008 but remained in effect until operators were authorized under the 2016 MS4 General Permit (2016 Permit), which became effective on July 1, 2018.

The Town of Millis submitted their Notice of Intent (NOI) for compliance with the 2016 Permit on September 12, 2018, and it can be found at the following link:

<https://www3.epa.gov/region1/npdes/stormwater/ma/tms4noi/millis.pdf>

Authorization to Discharge was granted by the EPA on December 14, 2018, and the Authorization Letter can be found here: <https://www3.epa.gov/region1/npdes/stormwater/ma/tms4noi/millis-auth.pdf>

2.3 STORMWATER MANAGEMENT PROGRAM (SWMP)

The SWMP describes and details the activities and measures that will be implemented to meet the terms and conditions of the permit. The SWMP accurately describes the permittees plans and activities. The document should be updated and/or modified during the permit term as the permittee's activities are modified, changed or updated to meet permit conditions during the permit term. The main elements of the stormwater management program include the six Minimum Control Measures (MCM) and then additional requirements to waterbodies that are either impaired or contain a TMDL.

The six MCM requirements are:

- (1) a public education program in order to affect behavior causing stormwater pollution;
- (2) an opportunity for the public to participate and comment on the stormwater program;
- (3) a program to effectively find and eliminate illicit discharges within the MS4;
- (4) a program to effectively control construction site stormwater discharges to the MS4;
- (5) a program to ensure that stormwater from development projects entering the MS4 is adequately controlled by the construction of stormwater controls; and
- (6) a good housekeeping program to ensure that stormwater pollution sources on municipal properties and from municipal operations are minimized.

The water quality limited waters and TMDL requirements include:

- (7) enhanced BMPs to address impairments of bacteria/pathogens, chloride, nitrogen, phosphorus, and solids/oil/grease/metals;
- (8) enhanced BMPs and programs for both in state and out of state TMDLs, mainly for phosphorus, bacteria/pathogens, or nitrogen.

2.4 MILLIS MS4 BACKGROUND

The Town of Millis was permitted under the 2003 Small MS4 Permit. During that permit term, the Town created an initial SWMP Plan, initiated storm system mapping, and submitted Annual Reports to the EPA. The Town identified the Department of Public Works Director as the point of coordination for Millis's stormwater management. There has been active coordination between the Department of Public Works (DPW), the Conservation Commission, the Board of Health (BOH), the Building Department, and the Town Administrator, to fulfill permit requirements. This coordination continues under the 2016 Permit term.

The Town initially identified and began to prioritize actions that would help them comply with the new Permit. Some of these actions included a more comprehensive mapping effort, improvements to maintenance and operations protocols, development of new ordinances and regulations to allow for better management of existing systems, revisions to existing ordinances to increase the Town's ability to implement effective and long-term measures for stormwater control, and identification of resource, staff, and equipment needs to meet the existing and forthcoming regulatory requirements. While first steps at system mapping were undertaken as a

part of the 2003 Permit, Millis recently revised its GIS mapping inventory of the stormwater system in 2018 for improved spatial accuracy and inventory completeness. This effort included the consolidation of mapping elements from multiple sources, field verifications, and desktop analysis. Millis developed a Stormwater Utility in 2018, which is used to fund their stormwater management program.

2.5 ANNUAL UPDATES AND REPORTING

The Town of Millis submitted Annual Reports to the US EPA beginning in the 2003 Permit term. This yearly reporting requirement continues, and as described in Section 6, the public will have an opportunity to review and comment on the Town's progress every year. In addition, this SWMP is not meant to be a static document, and as the Town's efforts progress and evolve, so too will this plan. The SWMP will be updated periodically and the most up to date version of this plan will be available to the public on the Town's website.

3 STORMWATER MANAGEMENT PROGRAM TEAM

3.1 STORMWATER MANAGEMENT PROGRAM TEAM

3.1.1 SWMP Team Responsibilities

The SWMP Team is multidisciplinary and includes members with a multitude of roles. As a team, the Town is responsible for fully adhering to the 2016 MS4 permit and this SWMP. Team actions include reviewing and updating appropriate bylaws, legal enforcement and disciplinary actions, maintaining records, town wide system mapping, and outfall screening and sampling. The DPW is responsible for many of the Permit requirements, and a full overview of the team is included in Table 3-1.

Table 3-1: Responsible Parties in Program Team

Department / Agency	Title	Person
DPW	DPW Director	James McKay
Conservation Commission	Chairman	Dr. James Lederer
Planning Board	Chairman	Richard Nichols
Building Inspection	Building Commissioner	Michael Giampietro
Board of Health	Director of Public Health	John McVeigh
Town Administrator	Administrator	Michael Guzinski
Town Clerk	Town Clerk	Lisa Jane Hardin

3.1.2 SWMP Team Coordinator

The individual with overall responsibility for implementation of the Town's MS4 program is James McKay, Department of Public Works Director.

3.2 RECEIVING WATERS

Table 3-2: Waterbodies in the Town of includes all receiving waters within the Town, associated impairments, and the number of known outfalls discharging to each water body segment. The waterbody impairments are based on the [*Massachusetts Year 2016 Integrated List of Waters*](#).

Table 3-2: Waterbodies in the Town of Millis

Waterbody Segment that receives flow from the MS4	Number of MS4 Outfalls discharging to receiving water segment	DO/ DO Saturation	Phosphorus	Solids/TSS/ Turbidity	Other Pollutants Causing Impairments
Bogastow Brook (MA72-16)	65				Fecal Coliform / E. Coli
Charles River (MA72-05)	29	X	X	X	Non-Native Aquatic Plants, Algae, Benthic Macroinvertebrate, Chlordane in Fish Tissue, DDT in Fish Tissue, Mercury in Fish Tissue, Nutrient/ Eutrophication Biological Indicators
Great Black Swamp	22				
Maple Swamp	24				
Mccarthy Pond	9				
Richardsons Pond	5				
Walker Pond (MA72-126)	5				

According to the [Massachusetts Year 2016 Integrated List of Waters](#), which was approved by the EPA in 2020, there are two (2) waterbodies in Millis that have an approved Total Maximum Daily Load (TMDL) associated with them. These waterbodies and the causes of the impairments are included in Table 3-3.

Table 3-3: Impaired Waters in the Town of Millis

Water Bodies with Approved TMDLs (Appendix F of MS4 Permit)	
River Name	Impairment Cause
Charles River ¹	Phosphorus
Bogastow Brook	Pathogens
¹ Charles River also water quality limited for DO and Turbidity, but associated BMPs covered under Phosphorus and Pathogens TMDL requirements	

3.3 ELIGIBILITY

The results of both the Endangered Species and Historic Properties screenings are summarized below. The Town of Millis also recognizes that construction projects not under the Construction General Permit require separate screenings and are not covered by the certifications here.

3.3.1 Endangered Species

During the NOI submission process, the Town referenced the U.S. Fish and Wildlife IPaC system and MA GIS database and determined that the Town of Millis's MS4 operational area contains the Northern Long-eared Bat. Using the ESA Eligibility criteria as referenced in Appendix C of the MA Small MS4 General Permit, the Town ultimately certified eligibility according to the USFWS Criterion C. Under Criterion C, the Town affirmed that there are no discharge-related activities involving the habitat of this species of bat and therefore the Town's MS4 system does not affect any federally threatened or endangered listed species. The results of this screening are included in the NOI in Appendix A.

3.3.2 Historic Properties

The Town of Millis was covered under the 2003 Permit and completed a consultation with the State Historic Preservation Officer at that time. Therefore, the Town meets Criterion A of Appendix D of the Small MS4 General Permit. The Town is not aware of planned projects which would impact historic properties. The results of this screening are included in the NOI in Appendix A.

4 MINIMUM CONTROL MEASURES

This section reviews the requirements for each of the six MCMs outlined in the 2016 Permit. Each MCM is organized into the following sections:

1. Permit Summary
2. Existing and Updated Programs

3. Implementation Deadlines and Program Assessment

The main objective of this section is to outline all the required BMPs that the Town of Millis is responsible for under the 2016 Permit, and outline responsible parties, measurable goals, implementation years, and implementation deadlines to maintain compliance.

4.1 MCM 1: PUBLIC EDUCATION AND OUTREACH

Objective: The permittee shall implement an education program that includes educational goals based on stormwater issues of significance within the MS4 area. The ultimate objective of a public education program is to increase knowledge and change behavior of the public so that the pollutants in stormwater are reduced.

4.1.1 Permit Summary

Part 2.3.2. of the MS4 Permit requires the Town to develop and implement an ongoing Public Education and Outreach Program, with the main goals to increase the public's knowledge about stormwater related issues and to alter public behavior. The Public Education and Outreach Program includes focused educational messages targeted at four (4) audiences:

- Residents,
- Businesses, institutions (churches, hospitals), and commercial facilities,
- Developers (construction),
- Industrial facilities.

Educational messages can be printed materials, electronic materials, mass media, social media, targeted workshops, events, or public area displays. These messages will consider stormwater pollution and prevention topics that are relevant to the Town. The Permit dictates the baseline messaging frequency to each of the above audiences, as well as outreach strategies regarding pollutants of concern. Additionally, the program will educate the public on the proper management and disposal of pollutants of concern, which are listed in the [Massachusetts Year 2016 Integrated List of Waters](#). The Town will focus on actions the public can take to reduce these pollutants at the source. Table 4-1 describes these pollutants, their potential impacts to Millis' waterbodies, and the behaviors that can reduce those impacts.

Table 4-1. Pollutants of Concern

Pollutants of Concern	Waterbodies of Concern	Impact to Waterbodies	Targeted Sources	Desired Behaviors
Bacteria/ Pathogens	Bogastow Brook	Can cause disease and make waters unfit for recreation.	<ul style="list-style-type: none"> • Pet waste • Septic 	<ul style="list-style-type: none"> • Properly dispose of pet waste • Properly operate and maintain septic systems • Properly dispose of septic waste
Phosphorous	Charles River	Excessive amounts of phosphorous can cause harmful algae blooms and create low oxygen conditions that harm aquatic life.	<ul style="list-style-type: none"> • Pet waste • Grass clippings • Lawn fertilizer • Leaf litter 	<ul style="list-style-type: none"> • Properly dispose of pet waste • Use fertilizer sparingly and never before storms • Properly dispose of leaves and grass clippings
Turbidity	Charles River	Reduce the penetration of light in the water and limit the growth of aquatic plants.	<ul style="list-style-type: none"> • Leaf litter • Soil and sediment erosion 	<ul style="list-style-type: none"> • Properly dispose of leaves and grass clippings • Adequate soil erosion and sediment controls
Dissolved Oxygen	Charles River	Insufficient amounts of dissolved oxygen for fish and other aquatic life	<ul style="list-style-type: none"> • Pet waste • Grass clippings • Lawn fertilizer • Leaf litter 	<ul style="list-style-type: none"> • Properly dispose of pet waste • Use fertilizer sparingly (and not before storms) • Properly dispose of leaves and grass clippings

4.1.2 Existing and Updated Program

In the 2003 Permit Term, the Town of Millis developed and implemented education and outreach requirements required by the Permit. Through the development of the NOI for the 2016 Permit, the DPW evaluated and determined multiple types of stormwater messaging that will be effective for meeting the requirements of this MCM. The Town is determined to continue to better inform residents on stormwater issues through engagement with public interest groups, leveraging existing educational materials, and maintaining a focus on reaching a diverse audience.

There are multiple education and outreach programs that currently seek to raise the public's awareness to environmental and stormwater-specific issues. New programs and resources are continuously considered and implemented to lay the foundation for the Public Education and Outreach Program for the SWMP. The Town uses various strategies and outreach media, including:

- Department websites, social media, and special programming
- Cooperative efforts with local organizations and environmental advocates, including the Charles River Watershed Association, Scouts, and elementary schools
- Informational materials (on leaf litter, grass clippings, pet waste management, etc.)
- Stewardship and volunteerism
- Signage
- Workshops, trainings, presentations, and other events

Table 4-2 details Millis's Public Education and Outreach Program and implementation plan under the current Permit term. Each Best Management Practice (BMP) includes a lead responsible department. The individuals responsible for implementation are presented in Table 3-1.

During the current Permit term, the success of each BMP will be measured and evaluated against the metrics provided in the "Measurable Goal" category in Table 4-3 below. Data collected for each BMP will be recorded, and the efficacy of each BMP towards reaching the public education goals and will be presented in each years' Annual Report.

Table 4-2: Implementation Program for MCM 1

BMP #	BMP Description	Outreach Media Category	Purpose of message	Targeted Audience	Responsible Department/P arties	Beginning Year of BMP Implementation	Status¹
1-1	Post stormwater information for residents on Stormwater Web Page	Web Page	General	Residents	DPW Operations	2018	Complete
1-2	Post stormwater information for business on Stormwater Web Page	Web Page	General	Businesses, Institutions and Commercial Facilities	DPW Operations	2018	Complete
1-3	Add stormwater brochure / flyer to developer packet through Plan review	Brochures/ Pamphlets	General	Developers (Construction)	DPW Operations	2018	Complete
1-4	Distribute mailers to targeted audience	Brochures/ Pamphlets	General	Industrial Facilities	DPW Operations	2018	Complete
1-5	Mail stormwater information with Annual Water Quality Report	Brochures/ Pamphlets	General	Residents	DPW Operations	2021	Ongoing
1-6	Distribute mailers to targeted audience	Brochures/ Pamphlets	General	Businesses, Institutions and Commercial Facilities	DPW Operations	2021	Ongoing
1-7	Distribute mailers to targeted audience	Brochures/ Pamphlets	General	Developers (Construction)	Building Inspection / Conservation Commission / Planning	2021	Ongoing

BMP #	BMP Description	Outreach Media Category	Purpose of message	Targeted Audience	Responsible Department/P arties	Beginning Year of BMP Implementation	Status¹
1-8	Distribute mailers to targeted audience	Brochures/ Pamphlets	General	Industrial Facilities	DPW Operations	2021	Ongoing
1-9	Distribute messaging on Leaf litter (Sept-Oct)	Brochures/ Pamphlets	Bacteria & Phosphorus TMDL	Businesses, Institutions and Commercial Facilities	DPW Operations	2018	Ongoing
1-10	Distribute messaging on Leaf Litter (Sept-Oct)	Brochures/ Pamphlets	Bacteria & Phosphorus TMDL	Residents	DPW Operations	2018	Ongoing
1-11	Distribute messaging on Grass clippings and fertilizers (March-April)	Brochures/ Pamphlets	Phosphorus TMDL	Businesses, Institutions and Commercial Facilities	DPW Operations	2018	Ongoing
1-12	Distribute messaging on Grass clippings and fertilizers (March-April)	Brochures/ Pamphlets	Phosphorus TMDL	Residents	DPW Operations	2018	Ongoing
1-13	Distribute messaging on pet waste - via rabies clinic (Dec-April)	Brochures/ Pamphlets	Bacteria / Pathogens TMDL	Dog Owners	Board of Health	2018	Ongoing
1-14	Distribute Septic system maintenance information	Brochures/ Pamphlets	Bacteria / Pathogens TMDL	Residents	Board of Health	2018	Ongoing
Notes: (1) To be updated following the submission of each annual report							

4.1.3 Implementation Deadlines and Program Assessment

In line with this MCMs objective to convey information and change behavior surrounding stormwater initiatives, the BMPs described above all have target frequencies and measurable goals to determine the efficacy of the program. A public education and outreach memorandum was developed as a part of the Year 4 Permit Requirements. This memorandum is provided in Appendix I. These are summarized for each BMP in Table 4-3.

Table 4-3: Summary of BMPs and Implementation Plan for MCM 1

BMP #	BMP	Required Frequency/Due Date	Measurable Goals	Status¹
1-1	Post stormwater information for residents on Stormwater Web Page	Once, due 2019	Number of page views	Complete
1-2	Post stormwater information for business on Stormwater Web Page	Once, due 2019	Number of page views	On-going
1-3	Add stormwater brochure / flyer to developer packet through Plan review (Developers)	Once, due 2019	Number of brochures distributed	Complete
1-4	Distribute mailers to targeted audience (Industrial Facilities)	Once, due 2019	Number of brochures distributed	Complete
1-5	Mail stormwater information with Annual Water Quality Report (Residents)	Once, due 2022	Number of brochures distributed	Ongoing
1-6	Distribute mailers to targeted audience (Businesses)	Once, due 2022	Number of brochures distributed	Ongoing
1-7	Distribute mailers to targeted audience (Developers)	Once, due 2022	Number of brochures distributed	Ongoing
1-8	Distribute mailers to targeted audience (Industrial Facilities)	Once, due 2022	Number of brochures distributed	Ongoing
1-9	Distribute messaging on Leaf litter (Businesses)	Annual (Sept-Oct)	Number of brochures distributed	Ongoing
1-10	Distribute messaging on Leaf litter (Residents)	Annual (Sept-Oct)	Number of brochures distributed	Ongoing

1-11	Distribute messaging on Grass clippings and fertilizers (Businesses)	Annual (March-April)	Number of brochures distributed	Ongoing
1-12	Distribute messaging on Grass clippings and fertilizers (Residents)	Annual (March-April)	Number of brochures distributed	Ongoing
1-13	Distribute messaging on pet waste - via rabies clinic (Dog Owners)	Annual (Dec-April)	Number of brochures distributed	Ongoing
1-14	Distribute Septic system maintenance information (Residents with Septic System)	Annual	% of Septic systems reached (Number of brochures distributed/number of properties with septic systems)	Ongoing
Notes: (1) To be updated following the submission of each annual report				

4.2 MCM 2. PUBLIC INVOLVEMENT AND PARTICIPATION

Objective: The permittee shall provide opportunities to engage the public to participate in the review and implementation of the permittee's SWMP.

4.2.1 Permit Summary

Part 2.3.3 of the permit requires the Town to provide an annual opportunity for the public to participate in the review and implementation of the SWMP, and other opportunities for public participation. The Town will adhere to state public notice requirements (MGL Chapter 30A, Sections 18-25 – effective 07/10/2010), and report on all public participation activities in the Annual Report.

4.2.2 Existing and Updated Program

Over the previous permit term, the Town made significant progress in engaging the community around stormwater related topics. The Town was proactive about involving the community in stormwater management leading up to this Permit Term, and since 2017, the Town made a significant effort to implement a Stormwater Utility, which involved educating the public on stormwater management and soliciting input from the public through Public Meetings, Workshops, printed materials, and other avenues of communication. The Town has implemented the Stormwater Utility and has had an annual billing cycle since October 2018.

The MS4 Permit requires the Town to engage as much of the community as possible. Actions required as part of MCM 1 include specific messages for different target audiences. Although not as prescriptive as MCM 1, MCM 2 is designed to reach the entire community through adherence to state public notice requirements. Table 4-4 details the requirements that Millis will undertake to adhere to these requirements.

Table 4-4: Implementation Program for MCM 2

BMP #	BMP	Description	Responsible Department/ Parties	Measurable Goal	Beginning Year of BMP Implementation	Status
2-1	Public Review of Stormwater Management Program	Allow annual review of stormwater management plan and posting of stormwater management plan on website	DPW Operations	Stormwater Management Program is publicly available every year	2019	Complete
2-2	Public Participation in Stormwater Management Program Development	Public Meeting - allow public to comment on stormwater management plan annually	DPW Operations	Annual public input is provided.	2019	Ongoing
2-3	Stormwater Educational Curriculum	DPW will identify or develop curriculum related to stormwater and will present this material to a science class at the local elementary school (4th grade)	DPW Operations	Curriculum presented to local 4th grade classes.	2022	Starting 2022

4.2.3 Implementation Deadlines and Program Assessment

The Town will include meeting dates, attendance, and public input in the Annual Report. A summary of the implementation goals and due dates is included in Table 4-5.

Table 4-5: MCM 2 Measurable Goals and Tracking

BMP #	BMP	Date Due	Status
2-1	SWMP Posted on website	July 1, 2019	Complete
2-2	Program Update at Public Meeting	Annual	On-going
2-3	Stormwater Education Curriculum	Supplemental activity not required by MS4 Permit	Starting 2022

4.3 MCM 3. ILLICIT DISCHARGE DETECTION AND ELIMINATION (IDDE) PROGRAM

Objective: “The permittee shall implement an IDDE program to systematically find and eliminate illicit sources of non-stormwater discharges to its municipal separate storm sewer system and implement procedures to prevent such discharges.”

4.3.1 Permit Summary

The Permit requires the Town to maintain an adequate legal authority to prohibit, investigate, and eliminate illicit discharges, and implement appropriate enforcement mechanisms. An illicit discharge is defined as any discharge to a municipal separate storm sewer system that is not composed entirely of stormwater, except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from firefighting activities. The IDDE program is a systematic plan for identifying and eliminating such discharges. As part of the 2003 Permit, the Town created an IDDE program, and has updated the program annually since 2018 to ensure the requirements of the current Permit are being met (Appendix B).

In 2004, the Town of Millis adopted stormwater regulations to regulate and eliminate discharges and connections to the MS4. This regulation provides the legal authority for enforcing its IDDE program, and it is attached in Appendix C with other applicable regulations.

Major components of the IDDE program include an SSO inventory, system wide storm water mapping, outfall inventory and ranking, outfall screening and sampling, catchment investigations, and employee training. The IDDE program is meant to be an iterative document with continued mapping, ranking, and investigations in the first years of the permit term.

4.3.1.1 Sanitary Sewer Overflow (SSO) Inventory

The Town will identify all SSOs that have occurred within the MS4 in the previous five (5) years. This includes specific information surrounding the circumstances leading to the SSO, and known or potential infrastructure causes. This inventory will be updated and reported annually in the IDDE Program (Appendix B) and Annual Report. In the event of an SSO, the Town will work diligently to eliminate it as quickly as possible and in conformance with applicable regulations, take interim measures to minimize the discharge of pollutants, and report it to MassDEP. As part of the preparation of the IDDE Program, the Town did not identify any SSOs within the past five years.

4.3.1.2 SSO Reporting

As required by the Permit, in the event of an overflow or bypass, a notification must be reported within 24 hours by phone to MassDEP, EPA, and other relevant parties. The Town will follow up the verbal notification with a written report following MassDEP's SSO/Bypass notification form within five (5) calendar days of becoming aware of the overflow, bypass, or backup.

The MassDEP contacts are:

Central Region
(508) 792-7650
8 New Bond Street
Worcester, MA 01606

24-hour Emergency Line
1-888-304-1133

The EPA contacts are:

EPA New England
(617) 918-1510
5 Post Office Square
Boston, MA 02109

4.3.2 Existing and Updated Program

A bylaw prohibiting non-stormwater discharges into the storm sewer system, including appropriate enforcement procedures and actions was required by the 2003 small MS4 Permit. The stormwater regulations passed in 2004 satisfied this requirement, and give the Town the legal authority to:

- Prevent pollutants from entering the Town's MS4;
- Prohibit illicit connections and unauthorized discharges to the MS4;
- Require the removal of all such illicit connections;
- Comply with state and federal statutes and regulations relating to stormwater discharges;
- Establish the legal authority to ensure compliance with the provisions of this regulation through inspection, monitoring, and enforcement.

The IDDE program is also required to create a stormwater system map of the Town. Through a comprehensive GIS and mapping effort in Millis, the Town has completed its Phase 1 stormwater system map. The current map (Appendix D) contains all known MS4 outfalls in the town, preliminary catchment delineations, receiving waters with impairment levels, and municipally owned treatment structures and open channel conveyances. The Phase II map must be completed by July 1, 2028, and requires refined outfall spatial locations, pipes, manholes, catch basins, outfall catchment delineations, municipal sanitary sewer system (if available), and municipal combined sewer system (if available).

Beyond maintaining an SSO inventory and developing a comprehensive map, the IDDE program includes desktop analysis for priority ranking of the Town's outfalls. The IDDE methodology in the 2016 MS4 Permit describes the procedures required for categorizing and further prioritizing outfalls for investigation and elimination of any illicit discharges. First, the outfalls must be designated as either Problem, High Priority, Low Priority, or Excluded outfalls. This determines the level of effort and timeframe for screening each outfall. Once complete, the Town is required to conduct outfall screening on all High and Low Priority Outfalls within three (3) years of the Permit's effective date and reconduct this screening every five years. The Town has completed its initial outfall screening in 2021. The Town initiated catchment investigations as a part of Year 4 of the permit and completed 8 as a part of their training effort.in 2022..

Next the Town must complete catchment investigations for all Problem Outfalls starting before Permit Year 2 and finishing by Permit Year 7. Similarly, the Town will complete all catchment investigations within 10 years of the Permit's effective date. The IDDE program is attached in Appendix B. An overview of all the requirements for MCM 3 is included in Table 4-6.

Table 4-6: Implementation Program for MCM 3

BMP #	BMP	Description	Responsible Department/ Parties	Measurable Goal	Beginning Year of BMP Implementation	Status
3-1	IDDE Legal Authority	Create regulation to provide Town with legal authority to detect and eliminate illicit discharges.	DPW Operations	Completed regulation	2004	Completed
3-2	SSO Inventory	Annually track and report SSOs following IDDE Program methodology.	DPW Operations	Complete within 1 year of effective date of permit	2018	Ongoing
3-3	Storm System Map	Create map and update during IDDE program completion	DPW Operations	Update map within 2 years of effective date of permit and complete full system map 10 years after effective date of permit	2018	Phase I Complete
3-4	Written IDDE Program	Create written IDDE Program	DPW Operations	Completed IDDE Program	2018	Completed
3-5	Employee training	Train employees on IDDE implementation	DPW Operations	Train annually	2018	Ongoing
3-6	Implement IDDE Program	Implement catchment investigations according to program and permit conditions	DPW Operations	Complete within 10 years of effective date of permit	2019	Ongoing
3-6	Conduct dry weather screening	Conduct in accordance with outfall screening procedure and permit condition	DPW Operations	Complete within 3 years of effective date of permit	2019	Completed

BMP #	BMP	Description	Responsible Department/ Parties	Measurable Goal	Beginning Year of BMP Implementation	Status
3-7	Conduct wet weather screening	Conduct in accordance with outfall screening procedure	DPW Operations	Complete within 10 years of effective date of permit	2023	
3-8	Ongoing screening	Conduct dry and wet weather screening as necessary (at least once every five years)	DPW Operations	Complete ongoing outfall screening upon completion of IDDE program	2023	

4.3.3 Implementation Deadlines and Program Assessment

Proper adherence to MCM 3 includes an adequate legal authority and enforcement strategy for illicit discharges, an up-to-date SSO inventory, a robust system wide map, a written IDDE program, trained field staff, and an enhanced understanding of catchments, interconnections, and water quality in the Town. Each aspect of the IDDE program will be reported in the Annual Report, and the IDDE program will be updated to reflect reprioritizations, mapping, and other gathered data. The following summarizes requirements for MCM 3. As this section of the Permit is highly prescriptive, the measurable goals consist of completing the requirements by the specified dates shown below.

Table 4-7: MCM 3 Summary

BMP	Date Due	Status
IDDE Legal Authority	May 1, 2008	Completed June 8, 2004
SSO Inventory	July 1, 2019	Ongoing
Phase I System Mapping	July 1, 2020	Completed, will be updated as needed
Phase II System Mapping	July 1, 2028	In progress
Written IDDE Program	July 1, 2019	Completed June 2019
Assessment and Initial Priority Ranking of Outfalls/Interconnections	July 1, 2019	Completed
Dry Weather Screening and Sampling	July 1, 2021	Completed June 2021
Follow-up Ranking	July 1, 2021	Completed June 2021
Written Catchment Investigation Procedure	January 1, 2020	Completed
Wet Weather Sampling	Complete during Catchment Investigations	
Catchment Investigations for Problem Outfalls	Begin by July 2020/ Finish by July 2025	On-going
Catchment Investigations for High and Low Priority Outfalls	Begin after Problem Outfall Investigations/Finish by July 2028	On-going
Catchment Investigations with Potential Sewer Input	Begin after Problem Outfall Investigations/Finish by July 2025	
Training	Annually	On-going

4.4 MCM 4. CONSTRUCTION SITE STORMWATER RUNOFF CONTROL

Objective: “The objective of an effective construction stormwater runoff control program is to minimize or eliminate erosion and maintain sediment on site so that it is not transported in stormwater and allowed to discharge to a water of the U.S. through the permittee's MS4.”

4.4.1 Permit Summary

The Town is required to enforce a program that reduces pollutants in any stormwater runoff discharged to the MS4 from all construction activities that result in a land disturbance of greater than or equal to one (1) acre within the MS4 area. Construction activities that disturb less than one (1) acre, but are part of a larger common plan are also included. This program must include a regulatory mechanism that requires the use of sediment and erosion control practices at construction sites, written procedures for site inspections and enforcement, and requirements for construction site operators that contribute stormwater discharges to the MS4 implement appropriate BMPs such as those described in the Massachusetts Stormwater Handbook.

4.4.2 Existing and Updated Programs

Under this MCM, the Permit requires the Town to maintain regulations to address construction site stormwater runoff. This includes erosion and sediment controls, as well as waste management during construction. The Town of Millis' Stormwater Management Regulations, adopted in June 2004 and updated in February 2007, include these required regulations and ordinances. These Regulations can be found here:

http://www.millis.org/pages/MillisMA_DPW/StrmWtr/StormAdditional/Article%20I.pdf

The Town's current stormwater regulations address the primary requirements of the Permit. The regulation establishes the necessary legal authority to inspect and enforce the erosion and sediment controls required under the MS4 permit; however, they will require slight modification to comply with all the Permit requirements which will be incorporated in the near-term.

Table 4-8: Implementation Program for MCM 4

BMP #	BMP	BMP Description	Responsible Department/ Parties	Measurable Goal	Beginning Year of BMP Implementation	Status
4-1	Sediment and Erosion Control Ordinance	Adoption of requirements for construction operators to implement a sediment and erosion control program	Board of Health / Conservation Commission	Complete within 1 year of permit effective date	2004	Completed
4-2	Site Plan Review Procedures	Complete written procedures of site plan review and begin implementation	Building	Conduct site plan review of 100% of projects according to the procedures.	2018	Completed
4-3	Site Inspection and Enforcement of Erosion and Sediment Control (ESC) Measures	Complete written procedures of site inspections and enforcement procedures	Board of Selectmen / Board of Health / Conservation Commission	Inspect 100% of construction sites as outlined in ordinance and take enforcement action as needed.	2018	Completed
4-4	Waste Control	Adoption of requirements to control wastes, including but not limited to discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes	Board of Health / Conservation Commission	Complete within 1 year of permit effective date	2018	Completed

4.4.3 Implementation Deadlines and Program Assessment

The Town will conduct a site plan review of 100% of applicable projects according to the guidelines developed as part of this plan and inspect 100% of construction sites for appropriate sediment and erosion control measures. These reviews and inspections will be recorded as they are completed and submitted as part of the Annual Report. The following table summarizes requirements for MCM 4. As this section of the Permit is highly prescriptive, the measurable goals consist of completing the requirements by the specified dates shown below.

Table 4-9: MCM 4 Summary

BMP #	BMP	Date Due	Date Completed	Updated
4-1	Sediment and Erosion Control Ordinance	May 1, 2008	June 28, 2004	February 12, 2007
4-2	Site Plan Review Procedures	July 1, 2019	June 28, 2004	February 12, 2007
4-3	Written Procedures for Site Inspections	July 1, 2019	June 28, 2004	February 12, 2007
4-4	Requirements for operators to control wastes	July 1, 2019	June 28, 2004	February 12, 2007

4.5 MCM 5. POST CONSTRUCTION STORMWATER MANAGEMENT IN NEW DEVELOPMENT AND REDEVELOPMENT

Objective: “The objective of an effective post construction stormwater management program is to reduce the discharge of pollutants found in stormwater to the MS4 through the retention or treatment of stormwater after construction on new or redeveloped sites and to ensure proper maintenance of installed stormwater controls.”

4.5.1 Permit Summary

The Town is required by the Permit to develop, implement, and enforce a program to reduce pollutants in post-construction runoff to their MS4 from new development and redevelopment projects that result in land disturbance of greater than or equal to one acre. Many studies indicate that prior planning and design for the minimization of pollutants in post-construction stormwater discharges is the most cost-effective approach to stormwater quality management. This is best accomplished through combined good municipal planning with thorough project review during the proposal and permitting stages.

4.5.2 Existing and Updated Program

The Town of Millis adopted Article 1 - Land Disturbance and Post-Construction Stormwater Management on June 28, 2004 and amended it June 5, 2006 and again February 12, 2007. Article 1 was created to control the flow of stormwater from new and redeveloped sites in order to prevent flooding and erosion and sedimentation. Article 1 adheres to 2016 Permit requirements including design references to the Massachusetts Stormwater Management Standards/Handbook (Handbook) as the basis for system design and 2016 Permit.

In the Year 4 of the Permit, the Town developed a report assessing current street design, parking lot guidelines, and other applicable local requirements that impact the creation of impervious cover. This report focused on highlighting current impediments to using low impact design options, and detailing improvements for promoting the use of such options. If options to improve regulations to allow for LID were available, the report included recommendations for policies or standards and relevant documents and procedures to minimize impervious cover attributable to parking areas and street design.

In addition to local guidelines regarding the creation of impervious cover, the Town developed a report assessing existing local regulations to determine how to promote the implementation of green infrastructure as a part of the Year 4 requirements of the Permit. In particular, the Town needs to assess the feasibility of allowing green roofs, infiltration practices, and water harvesting devices. During this investigation, the Town may decide to include other types of green infrastructure as well. The parking lot guidelines report and the green infrastructure report are provided in Appendix F.

Prepared in 2016 as a supplement to the Kleinfelder-developed *Water Supply & Demand Assessment in Relation to Exelon Power 'West Medway II' Project, Prepared for the Town of Millis*, the *Minimization & Mitigation Implementation Analysis*¹ included a stormwater BMP assessment. The Town identified at least five (5) permittee-owned properties to retrofit with BMPs designed to reduce frequency, volume, and pollutant loads of stormwater discharges to and from its MS4 area. If during the permit term, any of these properties identified are retrofitted, the list will be updated to always include five (5) properties. This list is provided in Appendix G.

¹ Available from Kleinfelder upon request.

Table 4-10: Implementation Program for MCM 5

BMP #	BMP	BMP Description	Responsible Department/ Parties	Measurable Goal	Beginning Year of BMP Implementation	Status
5-1	Post-Construction Ordinance	Adoption, amendment, or modification of a regulatory mechanism to meet permit requirements	Planning Board / Zoning Board of Appeals	Complete 2 years after effective date of permit	2019	Completed
5-2	Street Design and Parking Lot Guidelines Report	Develop a report assessing requirements that affect the creation of impervious cover. The assessment will help determine if changes to design standards for streets and parking lots can be modified to support low impact design options.	Planning Board, Zoning Board of Appeals	Complete 4 years after effective date of permit and implement recommendations of report	2022	Completed
5-3	Green Infrastructure Report	Develop a report assessing existing local regulations to determine the feasibility of making green infrastructure practices allowable when appropriate site conditions exist	Planning Board / Building Inspection Department	Complete 4 years after effective date of permit and implement recommendations of report	2022	Completed
5-4	List of Municipal Retrofit Opportunities	Target properties to reduce impervious areas: Identify at least 5 permittee-owned properties that could be modified or retrofitted with BMPs to reduce impervious areas and update annually	DPW	Complete 4 years after effective date of permit and report annually on retrofitted properties	2022	On-going

BMP #	BMP	BMP Description	Responsible Department/ Parties	Measurable Goal	Beginning Year of BMP Implementation	Status
5-5	As-built plans for on-site stormwater control	The procedures to require submission of as-built drawings and ensure long term operation and maintenance will be a part of the SWMP	Planning Board / Zoning Board of Appeals	Require submission of as-built plans for completed projects	2018	Completed

4.5.3 Implementation Deadlines and Program Assessment

Results of the impervious cover regulations assessment as well as the green infrastructure recommendations will be implemented by Year 4 of the Permit. Updates from these programs will be reported annually. The list of potential retrofits for the Town will be included in the Annual Report and updated as needed. As this section of the Permit is highly prescriptive, the measurable goals consist of completing the requirements by the specified dates shown below.

Table 4-11: MCM 5 Summary

BMP #	BMP	Date Due	Date Completed	Updated
5-1	Post Construction Ordinance	July 1, 2020	June 28, 2004	February 12, 2007
5-2	Street Design Assessment Report	July 1, 2022; annually report progress	July 1, 2022	
5-3	Green Infrastructure Design Opportunities Report	July 1, 2022; annually report progress	July 1, 2022	
5-4	Inventory of Retrofit Property Opportunities	July 1, 2022; update as needed	March 11, 2016	July 1, 2022

4.6 MCM 6. POLLUTION PREVENTION / GOOD HOUSEKEEPING

Objective: “The permittee shall implement an operations and maintenance program for permittee-owned operations that has a goal of preventing or reducing pollutant runoff and protecting water quality from all permittee-owned operations.”

4.6.1 Permit Summary

Compliance with this MCM results in reductions in pollution that falls on streets, parking lots, open spaces, and storage and vehicle maintenance areas and is carried by stormwater into local waterways, and improvement of management approaches to avoid environmentally destructive development and stormwater management practices or poor maintenance of storm sewer systems.

4.6.2 Existing and Updated Program

In Year 2 of the Permit, the Town developed a Good Housekeeping Manual which includes an inventory of Town owned parks and open spaces, buildings and facilities where pollutants are exposed to stormwater runoff, as well as vehicle and equipment usage and staging areas, and written operations and maintenance procedures for municipal operations at these properties. Beyond maintaining these properties, the Town is responsible for keeping all MS4 infrastructure in good working order.

The Town has established winter road maintenance procedures for the use and storage of salt and sand, while minimizing the use of sodium chloride and other salts. Currently, the Town stores the majority of its salt in the DPW Garage. The procedures include options for using other materials and prohibit the disposal of snow into surface waters. These procedures are distributed to all employees that complete roadway maintenance and plowing.

All stormwater treatment structures such as water quality swales, retention and detention basins, infiltration structures, proprietary treatment devices will be inspected annually. The Town established inspection and maintenance procedures and frequencies to be included in the Good Housekeeping Manual.

The Town created and began implementing Stormwater Pollution Prevention Plans (SWPPPs) for two of its publicly owned facilities, the DPW Transfer Station and DPW Garage, both on Water Street during Permit Year 2. SWPPPs are required for permittee-owned and operated facilities including maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater. No SWPPP is required for facilities covered under the Multi-Sector General Permit (MSGP) or if the discharge is authorized under another NPDES permit. SWPPPs describe potential pollutant sources, site activities, and stormwater controls. An overview of these requirements for MCM 6 is included in Table 4-12.

Table 4-12: Implementation Program for MCM 6

BMP #	BMP	BMP Description	Responsible Department/ Parties	Measurable Goal	Beginning Year of BMP Implementation	Status
6-1	O&M Procedures	Create written O&M procedures including all requirements contained in 2.3.7.a.ii for parks and open spaces, buildings and facilities, and vehicles and equipment	DPW Operations	Complete and implement 2 years after effective date of permit	2019	Completed
6-2	Inventory all permittee-owned parks and open spaces, buildings and facilities, and vehicles and equipment	Create inventory	DPW Operations	Complete 2 years after effective date of permit and implement annually	2019	Completed
6-3	Infrastructure O&M	Establish and implement program for repair and rehabilitation of MS4 infrastructure	DPW Operations	Complete 2 years after effective date of permit	2019	Completed
6-4	Catch Basin Cleaning Program	Establish schedule for catch basin cleaning such that each catch basin is no more than 50% full and clean catch basins on that schedule	DPW Operations	Clean catch basins on established schedule so no catch basin is more than 50% full at any time.	2018	Ongoing
6-5	Street Sweeping Program	Sweep all streets and permittee-owned parking lots in accordance with permit conditions	DPW Operations	Sweep all streets and permittee-owned parking lots once per year in the spring	2018	Ongoing

BMP #	BMP	BMP Description	Responsible Department/ Parties	Measurable Goal	Beginning Year of BMP Implementation	Status
6-6	Winter Road Maintenance Program	Establish and implement a program to minimize the use of road salt	DPW Operations	Implement salt use optimization during deicing season	2018	Ongoing
6-7	Stormwater Treatment Structures Inspection and Maintenance Procedures	Establish and implement inspection and maintenance procedures and frequencies	DPW Operations	Inspect and maintain treatment structures at least annually	2018	Ongoing
6-8	Stormwater Pollution Prevention Plan (SWPPP)	Create SWPPPs for maintenance garages, transfer stations, and other waste-handling facilities	DPW Operations	Complete and implement 2 years after effective date of permit	2019	Completed

4.6.3 Implementation Deadlines and Program Assessment

Through the development and use the Good Housekeeping Manual, the Town will abide by operations and maintenance procedures for all the parks and open spaces, buildings and facilities, and vehicle and equipment areas identified by the Town. All Town-owned stormwater infrastructure will be maintained, all catch basins will be cleaned at the appropriate frequency, and 100% of streets and 50% of municipal parking lots will be swept. The Town will evaluate at least one salt or chloride alternative for road application and inspect and maintain 100% of stormwater treatment structures. The Town has developed and is implementing SWPPPs for its two required facilities. As this section of the Permit is highly prescriptive, the measurable goals consist of completing the requirements by the specified dates shown below.

Table 4-13: MCM 6 Summary

BMP #	BMP	Date Due	Date Completed	Updated
6-1	Written O&M Procedures	July 1, 2020	June 2020	
6-2	Written Property Inventory	July 1, 2020	June 2020	
6-3	Infrastructure O&M Procedures	July 1, 2020	June 2020	
6-4	Catch Basin Cleaning Program	July 1, 2019	June 2019	
6-5	Street Sweeping Program	July 1, 2019	June 2019	
6-6	Winter Road Maintenance Program	July 1, 2019	June 2019	
6-7	Stormwater Treatment Structures Inspection and Maintenance Procedures	July 1, 2019	June 2019	
6-8	SWPPPs	July 1, 2020	June 2020	

5 ANNUAL EVALUATION

Each Annual Report will include the Town's activities and progress with regards to this SWMP from the previous year. The Town will report on public education materials distributed and audiences reached, public participation opportunities and success, IDDE progress, system mapping, outfall ranking, dry weather screening and sampling, SSOs, site plan reviews, construction site inspections, and post construction plans and opportunities, operations and maintenance procedures, properties and infrastructure maintained, and upcoming plans for the Town. Table 5-1 will be updated each year with links to each year's Annual Reports.

Table 5-1: Annual Reports

Report Year	Due Date	Report Link
Year 1 (2019)	September 29, 2019	https://www3.epa.gov/region1/npdes/stormwater/ma/reports/2019/millis-ma-ar19.pdf
Year 2 (2020)	September 29, 2020	https://www3.epa.gov/region1/npdes/stormwater/ma/reports/2020/millis-ma-ar20.pdf
Year 3 (2021)	September 29, 2021	https://www3.epa.gov/region1/npdes/stormwater/ma/reports/2021/MILLIS_MA_AR21.pdf
Year 4 (2022)	September 29, 2022	
Year 5 (2023)	September 29, 2023	

6 TMDLS AND WATER QUALITY LIMITED WATERS

6.1 ACTIONS FOR MEETING TOTAL MAXIMUM DAILY LOAD REQUIREMENTS

6.1.1 Part A.I of Appendix F – Upper/Middle Charles River (Phosphorus)

The EPA approved the TMDL for Nutrients in the Upper/Middle Charles River on June 10, 2011, and the Town of Millis is a part of this watershed. Therefore, the Town must adhere to Part A.1 of Appendix F of the Permit. In order to do this the Town will develop a Phosphorus Control Plan (PCP) designed to reduce the amount of phosphorus in stormwater discharges. The PCP will be completed in three phases.

Phase I of the plan will be created in Permit years one through five and implemented in years five through ten. Phase I includes the creation of a regulatory mechanism to enforce the PCP, a funding source assessment, an analysis of the scope of the baseline phosphorus loading, a description of planned Phase I non-structural and structural controls, planned operation and maintenance practices, an implementation schedule, estimated Phase I costs, a written plan, and a plan for performance evaluation.

Phase II will be created in years five through ten and completed in years ten through fifteen. Phase II will build off of Phase I and includes an update to the regulatory mechanism if required, planned Phase II structural and non-structural controls, an update to operation and maintenance protocols, an implementation schedule, estimated Phase II costs, a written plan, and a plan for performance evaluation.

Phase III will be created in years ten through fifteen and be completed in years fifteen through twenty, while finalizing the PCP. Phase III will work from Phase II and contain the same elements, an update to the regulatory mechanism, if necessary, planned Phase III structural and non-structural controls, an update to operations and maintenance protocols, an implementation schedule, Phase III costs, a written plan, and a plan for performance evaluation.

Scope of PCP and Baseline Assessment Memorandum was created as a part of Permit Year 4. This memorandum is provided in Appendix H. The Town will submit a progress report on the PCP with each Annual Report. In year five, and every year after, Millis will report on all implemented structural and non-structural controls and the corresponding phosphorus reduction, any phosphorus load increases due to development, and an estimated yearly phosphorus export rate. The Town will include certification that all structural BMPs were inspected and maintained and that all municipally owned turf grass areas are managed in accordance with Massachusetts Regulation 331 CMR 31.

6.1.2 Part A.III of Appendix F – Pathogens (Charles River and Bogastow Brook)

Both the Charles River and Bogastow Brook in Millis are impaired for pathogens (specifically, E. coli and fecal coliform), and therefore the Town is required to adhere to Part A.III of Appendix F of the Permit. The enhanced BMPs required to satisfy this requirement include:

- (1) Pet waste management messaging to residents (BMP 1-13)
- (2) Septic system maintenance messaging for residents with septic systems in catchment areas draining to either the Charles River or Bogastow Brook (BMP 1-14)

Descriptions of these actions are included in MCM 1, Section 4-1. Additionally, outfalls in the IDDE program that contain catchment areas draining to either of these impaired waters were designated as Problem or High priority in the IDDE program.

6.2 ACTIONS FOR MEETING WATER QUALITY LIMITED WATERS REQUIREMENTS

The only water quality limited waterbody in the Town of Millis is the Charles River, which is impaired for Dissolved Oxygen (DO) and Turbidity. Millis does not have any additional enhanced BMPs to implement to address these impairments. Although no additional BMPs are required, additional sampling parameters are required as part of the IDDE. These specific requirements are described in the IDDE Program (Appendix B)

APPENDIX A
Notice of Intent

Part I: General Conditions

General Information

Name of Municipality or Organization: State:

EPA NPDES Permit Number (if applicable):

Primary MS4 Program Manager Contact Information

Name: Title:

Street Address Line 1:

Street Address Line 2:

City: State: Zip Code:

Email: Phone Number:

Fax Number:

Other Information

Stormwater Management Program (SWMP) Location (web address or physical location, if already completed):

Eligibility Determination

Endangered Species Act (ESA) Determination Complete? Eligibility Criteria (check all that apply): ☐ A ☐ B ☒ C

National Historic Preservation Act (NHPA) Determination Complete? Eligibility Criteria (check all that apply): ☒ A ☐ B ☐ C

☒ Check the box if your municipality or organization was covered under the 2003 MS4 General Permit

MS4 Infrastructure (if covered under the 2003 permit)

Estimated Percent of Outfall Map Complete? If 100% of 2003 requirements not met, enter an estimated date of completion (MM/DD/YY):

Web address where MS4 map is published:

If outfall map is unavailable on the internet an electronic or paper copy of the outfall map must be included with NOI submission (see section V for submission options)

Regulatory Authorities (if covered under the 2003 permit)

Illicit Discharge Detection and Elimination (IDDE) Authority Adopted? (Part II, III, IV or V, Subpart B.3.(b.) of 2003 permit)	<input type="text" value="Yes"/>	Effective Date or Estimated Date of Adoption (MM/DD/YY):	<input type="text" value="06/28/04"/>
Construction/Erosion and Sediment Control (ESC) Authority Adopted? (Part II, III, IV or V, Subpart B.4.(a.) of 2003 permit)	<input type="text" value="Yes"/>	Effective Date or Estimated Date of Adoption (MM/DD/YY):	<input type="text" value="06/28/04"/>
Post- Construction Stormwater Management Adopted? (Part II, III, IV or V, Subpart B.5.(a.) of 2003 permit)	<input type="text" value="Yes"/>	Effective Date or Estimated Date of Adoption (MM/DD/YY):	<input type="text" value="06/28/04"/>

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part II: Summary of Receiving Waters

Please list the waterbody segments to which your MS4 discharges. For each waterbody segment, please report the number of outfalls discharging into it and, if applicable, any impairments.

Massachusetts list of impaired waters: Massachusetts 2014 List of Impaired Waters- <http://www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf>

Check off relevant pollutants for discharges to impaired waterbodies (see above 303(d) lists) without an approved TMDL in accordance with part 2.2.2.a of the permit. List any other pollutants in the last column, if applicable.

[illegible]

Click to lengthen table

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary

Identify the Best Management Practices (BMPs) that will be employed to address each of the six Minimum Control Measures (MCMs). For municipalities/organizations whose MS4 discharges into a receiving water with an approved Total Maximum Daily Load (TMDL) and an applicable waste load allocation (WLA), identify any additional BMPs employed to specifically support the achievement of the WLA in the TMDL section at the end of part III.

For each MCM, list each existing or proposed BMP by category and provide a brief description, responsible parties/departments, measurable goals, and the year the BMP will be employed (public education and outreach BMPs also requires a target audience). **Use the drop-down menus in each table or enter your own text to override the drop down menu.**

MCM 1: Public Education and Outreach

BMP Media/Category (enter your own text to override the drop down menu)	BMP Description	Targeted Audience	Responsible Department/Parties (enter your own text to override the drop down menu)	Measurable Goal	Beginning Year of BMP Implementation
Web Page	Post stormwater information for residents on Stormwater Web Page	Residents	DPW Operations	Number of page views	2018
Web Page	Post stormwater information for business on Stormwater Web Page	Businesses, Institutions and Commercial Facilities	DPW Operations	Number of page views	2018
Brochures/Pamphlets	Add stormwater brochure / flyer to developer packet through Plan review	Developers (construction)	Building Inspection / Conservation Commission / Planning	Number of brochures distributed	2018
Brochures/Pamphlets	Distribute mailers to targeted audience	Industrial Facilities	DPW Operations	Number of brochures distributed	2018
Brochures/Pamphlets	Mail stormwater information with Annual Water Quality Report	Residents	DPW Operations	Number of brochures distributed	2021
Brochures/Pamphlets	Distribute mailers to targeted audience	Businesses, Institutions and Commercial Facilities	DPW Operations	Number of brochures distributed	2021
Brochures/Pamphlets	Distribute mailers to targeted audience	Developers (construction)	Building Inspection / Conservation Commission / Planning	Number of brochures distributed	2021

[illegible]

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 2: Public Involvement and Participation

[illegible]

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 3: Illicit Discharge Detection and Elimination (IDDE)

BMP Categorization (enter your own text to override the drop down menu)	BMP Description	Responsible Department/Parties (enter your own text to override the drop down menu)	Measurable Goal (all text can be overwritten)	Beginning Year of BMP Implementation
SSO inventory	Develop SSO inventory in accordance of permit conditions	DPW Operations	Complete within 1 year of effective date of permit	2018
Storm sewer system map	Create map and update during IDDE program completion	DPW Operations	Update map within 2 years of effective date of permit and complete full system map 10 years after effective date of permit	2018
Written IDDE program	Create written IDDE program	DPW Operations	Complete within 1 year of the effective date of permit and update as required	2018
Implement IDDE program	Implement catchment investigations according to program and permit conditions	DPW Operations	Complete 10 years after effective date of permit	2019
Employee training	Train employees on IDDE implementation	DPW Operations	Train annually	2018
Conduct dry weather screening	Conduct in accordance with outfall screening procedure and permit conditions	DPW Operations	Complete 3 years after effective date of permit	2019
Conduct wet weather screening	Conduct in accordance with outfall screening procedure	DPW Operations	Complete 10 years after effective date of permit	2023
Ongoing screening	Conduct dry weather and wet weather screening (as necessary)	DPW Operations	Complete ongoing outfall screening upon completion of IDDE program	2023

[illegible]

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary *(continued)*

MCM 4: Construction Site Stormwater Runoff Control

BMP Categorization (enter your own text to override the drop down menu or entered text)	BMP Description	Responsible Department/Parties (enter your own text to override the drop down menu)	Measurable Goal (all text can be overwritten)	Beginning Year of BMP Implementation
Site inspection and enforcement of Erosion and Sediment Control (ESC) measures	Complete written procedures of site inspections and enforcement procedures	Board of Selectmen, Board of Health / Conservation Commission	Complete within 1 year of the effective date of permit	2018
Site plan review	Complete written procedures of site plan review and begin implementation	Building	Complete within 1 year of the effective date of permit	2018
Erosion and Sediment Control	Adoption of requirements for construction operators to implement a sediment and erosion control program	Board of Health / Conservation Commission	Complete within 1 year of the effective date of permit	2018
Waste Control	Adoption of requirements to control wastes, including but not limited to, discarded building materials, concrete truck wash out, chemicals, litter, and sanitary wastes	Board of Health / Conservation Commission	Complete within 1 year of the effective date of permit	2018

[illegible]

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 5: Post-Construction Stormwater Management in New Development and Redevelopment

BMP Categorization (enter your own text to override the drop down menu or entered text)	BMP Description	Responsible Department/Parties (enter your own text to override the drop down menu)	Measurable Goal (all text can be overwritten)	Beginning Year of BMP Implementation
As-built plans for on-site stormwater control	The procedures to require submission of as-built drawings and ensure long term operation and maintenance will be a part of the SWMP	Planning Board, Zoning Board of Appeals	Require submission of as-built plans for completed projects	2018
Target properties to reduce impervious areas	Identify at least 5 permittee-owned properties that could be modified or retrofitted with BMPs to reduce impervious areas and update annually	DPW	Complete 4 years after effective date of permit and report annually on retrofitted properties	2022
Allow green infrastructure	Develop a report assessing existing local regulations to determine the feasibility of making green infrastructure practices allowable when appropriate site conditions exist	Planning Board, Building Inspection Department	Complete 4 years after effective date of permit and implement recommendations of report	2022
Street design and parking lot guidelines	Develop a report assessing requirements that affect the creation of impervious cover. The assessment will help determine if changes to design standards for streets and parking lots can be modified to support low impact design options.	Planning Board, Zoning Board of Appeals	Complete 4 years after effective date of permit and implement recommendations of report	2022

[illegible]

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

MCM 6: Municipal Good Housekeeping and Pollution Prevention

BMP Categorization (enter your own text to override the drop down menu or entered text)	BMP Description	Responsible Department/Parties (enter your own text to override the drop down menu)	Measurable Goal (all text can be overwritten)	Beginning Year of BMP Implementation
O&M procedures	Create written O&M procedures including all requirements contained in 2.3.7.a.ii for parks and open spaces, buildings and facilities, and vehicles and equipment	DPW Operations	Complete and implement 2 years after effective date of permit	2019
Inventory all permittee-owned parks and open spaces, buildings and facilities, and vehicles and equipment	Create inventory	DPW Operations	Complete 2 years after effective date of permit and implement annually	2019
Infrastructure O&M	Establish and implement program for repair and rehabilitation of MS4 infrastructure	DPW Operations	Complete 2 years after effective date of permit	2019
Stormwater Pollution Prevention Plan (SWPPP)	Create SWPPPs for maintenance garages, transfer stations, and other waste-handling facilities	DPW Operations	Complete and implement 2 years after effective date of permit	2019
Catch basin cleaning	Establish schedule for catch basin cleaning such that each catch basin is no more than 50% full and clean catch basins on that schedule	DPW Operations	Clean catch basins on established schedule and report number of catch basins cleaned and volume of material moved annually	2018
Street sweeping program	Sweep all streets and permittee-owned parking lots in accordance with permit conditions	DPW Operations	Sweep all streets and permittee-owned parking lots once per year in the spring	2018
Road salt use optimization program	Establish and implement a program to minimize the use of road salt	DPW Operations	Implement salt use optimization during deicing season	2018

[illegible]

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Part III: Stormwater Management Program Summary (continued)

Actions for Meeting Total Maximum Daily Load (TMDL) Requirements

Use the drop-down menus to select the applicable TMDL, action description to meet the TMDL requirements, and the responsible department/parties. If no options are applicable, or more than one, **enter your own text to override drop-down menus.**

[illegible]

Part III: Stormwater Management Program Summary (continued)

Use the drop-down menus to select the pollutant causing the water quality limitation and enter the waterbody ID(s) experiencing excursions above water quality standards for that pollutant. Choose the action description from the dropdown menu and indicate the responsible party. If no options are applicable, or more than one, **enter your own text to override drop-down menus.**

[illegible]

Part IV: Notes and additional information

Use the space below to indicate the part(s) of 2.2.1 and 2.2.2 that you have identified as not applicable to your MS4 because you do not discharge to the impaired water body or a tributary to an impaired water body due to nitrogen or phosphorus. Provide all supporting documentation below or attach additional documents if necessary. Also, provide any additional information about your MS4 program below.

The results from the U.S. Fish and Wildlife IPaC system determined that the Town of Millis' MS4 area contains the Northern Long-eared Bat. See attached resource list as a reference for IPaC results and a NHESP Habitats map from the MA GIS database. Using the ESA Eligibility criteria as referenced in Appendix C of the MA Small MS4 General Permit, the Town falls under criterion C. Based on our review, there is no discharge related activities involving the habitat of this species of bat therefore the Town's MS4 system does not affect any federally threatened or endangered listed species.

The Town of Millis was a permittee under the 2003 MS4 Permit; therefore the Town meets criteria A of Appendix D to the small MS4 General Permit and completed a consultation with the State Historic Preservation Officer at that time. The Town is not aware of planned projects which would impact historic properties.

An attachment of the Town of Millis's MS4 system map and reference materials related to these screenings are attached.

Additional information:

ESA and NHPA Documentation

Stormwater System Map

Part V: Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name:

Catherine C. MacInnes

Title:

Chair, Board of Selectmen

Signature:

Date:

[To be signed according to Appendix B, Subparagraph B.11, Standard Conditions]

Note: When prompted during signing, save the document under a new file name

Notice of Intent (NOI) for coverage under Small MS4 General Permit

Page 18 of 18

Part V: Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name:

Catherine C. MacInnes

Title:

Chair, Board of Selectmen

Signature:

Catherine C MacInnes

[To be signed according to Appendix B, Subparagraph B.11, Standard Conditions]

Date:

9/10/18

Note: When prompted during signing, save the document under a new file name

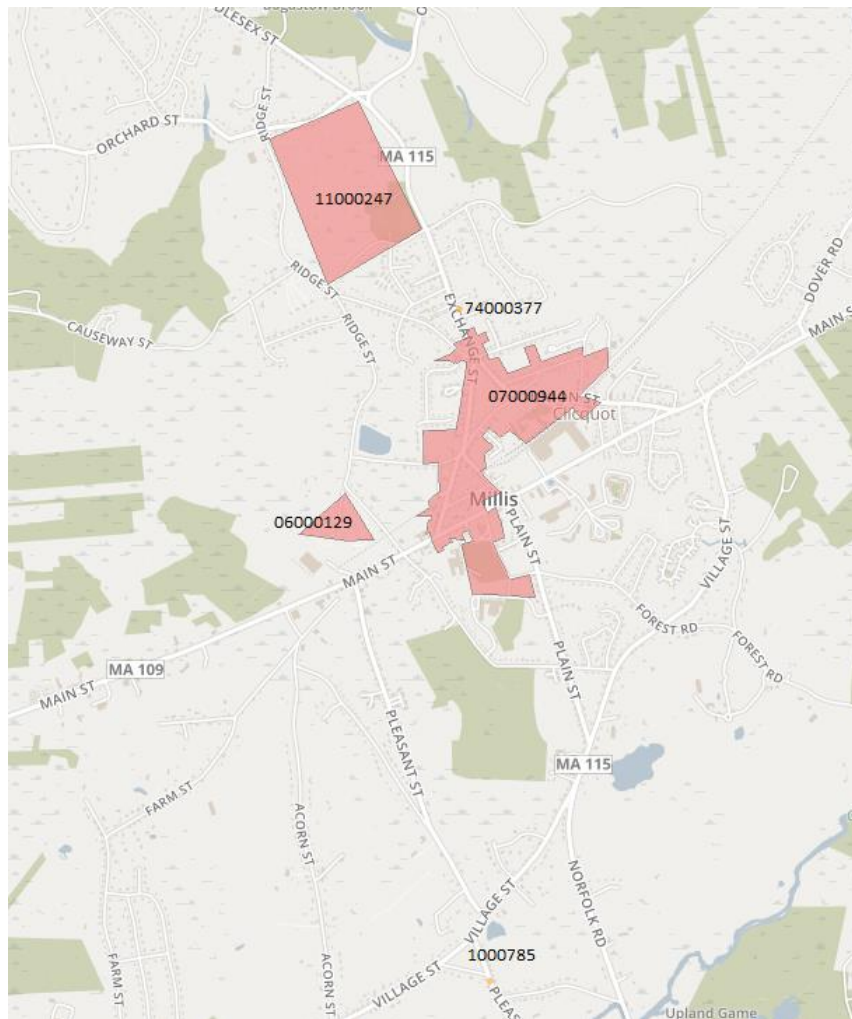
Town of Millis, MA

NOI Screenings

Historic Properties:

- A map of Federally Listed Historic Properties was accessed from the following web location:
<https://www.nps.gov/maps/full.html?mapId=7ad17cc9-b808-4ff8-a2f9-a99909164466>
- The following is a list of Federally Listed Historic Properties in Millis, MA
 - o Oak Grove Farm (#11000247)
 - o Prospect Hill Cemetery (#06000129)
 - o Millis Center Historic District (#07000944)
 - o John Partridge House (#74000377)
 - o Ellice School (#10000785)

The Town's MS4 is an existing system covered under the 2003 permit; therefore, the Town meets Criteria A of Appendix D to the MS4 General Permit and went through consultation with the State Historic Preservation Officer at that time. No discharge related activities are planned which will have an affect on these properties.



Endangered Species:

- Based on Appendix C, eligible under Criterion C: area containing Northern Long-eared Bat

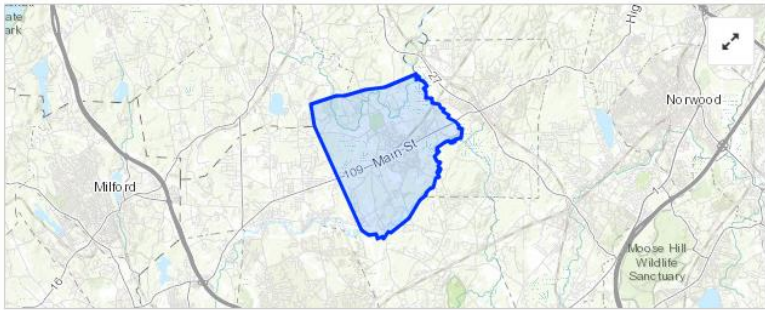
The results from the U.S. Fish and Wildlife IPaC system determined that Millis' MS4 area contains the Northern Long-eared Bat. See attached resource list as a reference for IPac results and A NHESP Habitats map from the MA GIS database. Using the ESA Eligibility criteria as referenced in Appendix C of the MA Small MS4 General Permit, Millis falls under criterion C. Based on our review, there is no planned discharge related activities that will negatively impact the habitat of the Northern Long-eared Bat, and therefore the Town's MS4 system will not affect any federally threatened or endangered listed species.

IPaC Information for Planning and Consultation
MY PROJECTS

PROJECT HOMEREGULATORY REVIEW

Millis Endangered Species

No description provided.



LOCATION Middlesex and Norfolk counties, Massachusetts

CREATED June 12, 2018

1 MEMBER 1 DOCUMENT

Resources

This project potentially impacts 11 resources managed or regulated by the U.S. Fish and Wildlife Service.

- 1 endangered species
- 9 migratory birds
- Known wetlands

SEE RESOURCES



Endangered species

Listed species ¹ and their critical habitats are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries ²).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact [NOAA Fisheries](#) for [species under their jurisdiction](#).

Additional information on endangered species data is provided [below](#).

The following species are potentially affected by activities in this location:

 THUMBNAILS  LIST

Mammals

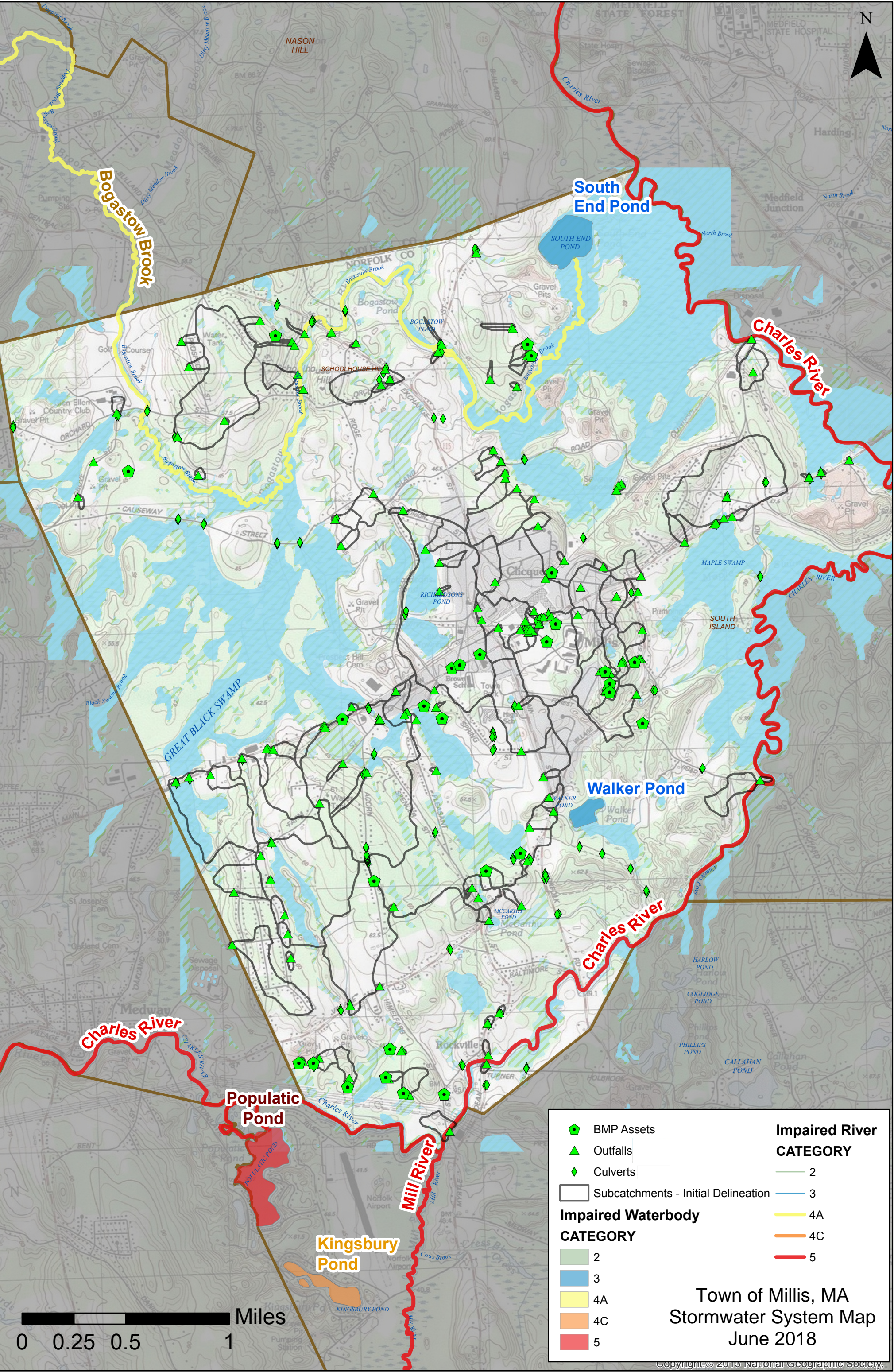


Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

- > What does IPaC use to generate the list of endangered species potentially occurring in my specified location?
- > Do these lists represent all species to be considered at this location?
- > If this resource list is empty, do I still need to coordinate with the USFWS?
- > What is an 'official species list' and why would I need one?



APPENDIX B
Illicit Discharge Detection and Elimination Plan



**ILLCIT DISCHARGE DETECTION AND ELIMINATION
PROGRAM**

**TOWN OF MILLIS, MASSACHUSETTS
KLEINFELDER PROJECT # 20221778.001A**

Revised: June 2022



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- B. Legal Authority (IDDE Stormwater Regulation)
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- L. Standard Operating Procedure for Catchment Investigations (2022)

ILLCIT DISCHARGE DETECTION AND ELIMINATION PROGRAM TOWN OF MILLIS, MASSACHUSETTS

1 PERMIT BACKGROUND

The Town of Millis developed and implemented a robust Illicit Discharge Detection and Elimination (IDDE) plan in September 2004 as a requirement for the 2003 National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) General Permit. The Town diligently began mapping outfalls and structures, dry weather screening and sampling, and identifying potential illicit connections. This IDDE program update has been developed by Millis to address the requirements of the United States Environmental Protection Agency's (USEPA's) 2016 NPDES General Permit for Stormwater Discharges from Small MS4's in Massachusetts, hereafter referred to as the "2016 MS4 Permit" or the "Permit." This IDDE program, initiated in 2018 and updated annually thereafter, is an update of the 2004 plan and will further the progress that Millis has made towards understanding extents and condition of their stormwater system and identifying possible illicit connections.

The 2016 MS4 Permit requires that each permittee address six (6) Minimum Control Measures (MCMs). These measures include the following:

1. Public Education and Outreach;
2. Public Involvement and Participation;
3. Illicit Discharge Detection and Elimination Program;
4. Construction Site Stormwater Runoff Control;
5. Stormwater Management in New and Re-development (Post Construction Stormwater Management); and
6. Good Housekeeping and Pollution Prevention.

Each of the MCMs are included in the Town's Stormwater Management Plan (SWMP). Under MCM 3, the Permit requires Millis to implement an IDDE program to systematically find and eliminate sources of non-stormwater discharges to its municipal separate storm sewer system and implement procedures to prevent such discharges. The Permit specifies the framework for the IDDE program, which includes an evaluation of the Town's legal authority to remove illicit connections, two (2) phases of stormwater system mapping, continual outfall classification, procedures for screening and sampling outfalls, and methods for determining and eliminating illicit connections. The implementation timeline for permit requirements is included in Appendix A.

1.1 ILLICIT DISCHARGES

According to the Permit, “An illicit discharge is any discharge to a municipal separate storm sewer that is not composed entirely of stormwater, except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from firefighting activities.” Additional descriptions of allowable discharges are described in Section 1.2. Common illicit discharges include sanitary wastewater from crushed or collapsed pipes or from surcharges, overflow from septic tanks, vehicle wash wastewater, and improper disposal of automobile and household products.

Illicit discharges can enter the system in many ways: through direct or indirect connections, one-time dumping, system failures, or illegal connections. These connections may not always be obvious and could be continuous, periodic, or irregular. Regardless of the source, the permit requires immediate elimination of these discharges once they are identified due to the potential for these discharges to contribute high levels of pollutants, such as heavy metals, toxics, oil, grease, solvents, and pathogens to surface waters in Millis.

1.2 ALLOWABLE NON-STORMWATER DISCHARGES

The following categories of allowable non-stormwater discharges under the MS4 permit include:

- Water line flushing
- Landscape irrigation
- Diverted stream flows
- Rising ground water
- Uncontaminated ground water infiltration
- Uncontaminated pumped groundwater
- Discharge from potable water sources
- Foundation drains
- Air conditioning condensation
- Irrigation water, springs
- Water from crawl space pumps
- Footing drains
- Lawn watering
- Individual resident car washing
- De-chlorinated swimming pool discharges
- Street wash waters
- Residential building wash waters without detergents

If the permittee, EPA, or the Massachusetts Department of Environmental Protection (MassDEP) determines that any of the above sources are significant contributors of pollutants to the MS4, the discharge will no longer be allowed and will be considered and treated as an illicit discharge.

1.3 WATER QUALITY CONCERNS FOR MILLIS

According to the Massachusetts Year 2016 Integrated List of Waters, *Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act*, the current official list of impaired waters in Massachusetts, there are two (2) Millis water bodies listed: the Bogastow Brook and the Charles River. Due to this designation, outfalls discharging to these water bodies are classified as a high program priority as discussed in Section 4.

Table 3-1: Impaired Waters in the Town of Millis

Water Bodies with Approved TMDLs (Appendix F of MS4 Permit)	
River Name	Impairment Cause
Charles River ¹	Phosphorus
Bogastow Brook	Pathogens
¹ Charles River also water quality limited for DO and Turbidity, but associated BMPs covered under Phosphorus and Pathogens TMDL requirements	

2 IDDE RESPONSIBILITIES

2.1 LEGAL AUTHORITY

The Town of Millis adopted Stormwater Regulations in 2004 to regulate and eliminate illicit discharges and connections to the MS4. A copy of the Regulation is included in Appendix B. Through these regulations, the Town has the legal authority to:

- Prevent pollutants from entering the Town's MS4;
- Prohibit illicit connections and unauthorized discharges to the MS4;
- Require the removal of all such illicit connections;
- Comply with state and federal statutes and regulations relating to stormwater discharges;
- Establish the legal authority to ensure compliance with the provisions of this regulation through inspection, monitoring, and enforcement.

The Regulation defines the following terms:

Discharge of Pollutants: "The addition from any source of any pollutant or combination of pollutants into the municipal storm drain system or into the waters of the United States or Commonwealth from any source."

Illicit Connection: "A surface or subsurface drain or conveyance, which allows an illicit discharge into the municipal storm drain system, including without limitation sewage, process wastewater, or wash water and any connections from indoor drains, sinks, or toilets, regardless of whether said connection was previously allowed, permitted, or approved before the effective date of this regulation. Connections to the municipal storm drain system which constitute illicit discharges as defined below which exist at the time of enactment of this regulation are considered illicit connections."

Illicit Discharge: "Direct or indirect discharge to the municipal storm drain system that is not composed entirely of stormwater, except as exempted in Section 7. The term does not include a discharge in compliance with an NPDES Storm Water Discharge Permit or a Surface Water Discharge Permit or resulting from firefighting activities exempted pursuant to Section 7, subsection 4, of this regulation."

The Town of Millis has reviewed the current Stormwater Regulation and determined it is consistent with the 2016 MS4 Permit.

2.2 RESPONSIBLE TEAMS

The Department of Public Works (DPW) will be lead agency in charge of implementing the IDDE program as stated here and in the Stormwater Regulation attached in Appendix B. The

DPW will be responsible for administering all aspects of the IDDE program and will ask for input from other departments.

2.3 COORDINATION EFFORTS

The Stormwater Management Program Team, as described in the Stormwater Management Program (SWMP), coordinates the Town-wide efforts for adherence to the permit. The DPW employees have been appropriately trained to complete field inspection including dry weather screening and sampling and catchment investigations, and refresher training is provided at requisite intervals in conformance with the Permit. Other Town departments such as the Board of Health and the Building Department will continue to assist with providing relevant records. If there is a need for enforcement action, the DPW will work directly with the Select Board.

3 TOWN OF MILLIS STORMWATER MAPPING

The Town of Millis has developed an updated stormwater map to begin addressing mapping requirements for the 2016 MS4 Permit. The map is included in Appendix C and includes the following information:

- MS4 Outfalls
- Outfall preliminary catchment delineations
- Municipally-owned treatment structures (BMP assets)
- Open channel conveyances (including culverts)
- Receiving waters (with impairment level)
- Note: there are no known interconnections with other MS4s

In the summer of 2018, the Town consolidated existing data from multiple sources and used both desktop analysis and field verification to finalize the existing GIS mapping data. The full GIS methodology for this update can be found attached in Appendix E. The number of MS4 outfalls reported in this IDDE Program increased from the submission of the NOI in 2018 based on more available data. The inventory and ranking will be updated annually as additional information from the outfall screening and catchment investigations becomes available. Narrative summarizing any changes as a result of the screening and catchment investigations is included in Section 4.1.

The mapping requirements under the 2016 Permit are more extensive than those from the 2003 Permit; requiring updates to the stormwater system map in two (2) phases, as described below.

3.1 IDDE MAPPING REQUIREMENTS: PHASE I

The purpose of the stormwater system map is to facilitate identification of key infrastructure and the potential for illicit sanitary sewer discharges. Phase I of the mapping was completed within two (2) years of the permit's effective date and contains the following information:

- Outfalls and their receiving waters (was required by 2003 MS4 Permit);
- Open channel conveyances (swales, ditches, etc.);
- Interconnections with other MS4s and others storm sewer systems;
- Municipally-owned stormwater treatment structures (e.g., detention and retention basins, infiltration systems, bioretention areas, water quality swales, gross particle separators, oil/water separators, or other proprietary systems);
- Waterbodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of waters report pursuant to Clean Water Act section 303(d) and 305(b); and,

- Initial catchment delineations. Any available system data and topographic information may be used to produce initial catchment delineations. For the purpose of this permit, a catchment is the area that drains to an individual outfall or interconnection.

3.2 IDDE MAPPING REQUIREMENTS: PHASE II

Additional system mapping features are required through Phase II mapping requirements. These components are due within 10 years of the effective date of the Permit, though the Town began collecting this data under the 2003 Permit. The required features of Phase II include:

- Outfall spatial location (accuracy of +/-30 feet)
- Pipes
- Manholes
- Catch basins
- Refined catchment delineations. Catchment delineations shall be updated to reflect information collected during catchment investigations
- Municipal sanitary sewer system (if available)
- Municipal combined sewer system (if applicable).

3.3 MAPPING NEXT STEPS

The Stormwater GIS Memo, attached in Appendix E, provides a comprehensive list of data gaps for complying with both the Phase I and Phase II mapping requirements for the Permit. In 2022, Phase II of the mapping requirements was started with the addition of municipal sanitary sewer system information in the Town's stormwater map. The data was acquired from the Town and used as part of the System Vulnerability Factor analysis described in Section 7.1.2. A map of the sanitary sewer system is included in Appendix I. The remaining steps for meeting the Phase II mapping requirements are as follows:

- Phase II:
 - Refine spatial location of outfalls
 - Refine catchment delineations

For the purposes of the IDDE ranking and prioritization, additional data is also included in the stormwater map to categorize the outfalls. The data used and rationale behind these selections is explored in Section 4.

4 ASSESSMENT AND RANKING OF OUTFALLS AND INTERCONNECTIONS

The IDDE Methodology in the 2016 MS4 Permit describes the methods required for categorizing and further prioritizing outfalls for investigation and elimination of any illicit discharges. First, the outfalls must be designated as either Problem, High Priority, Low Priority, or Excluded outfalls (each described further below). This determines the timeframe for screening each outfall. Next, all the outfalls (except Excluded outfalls) must be further ranked within the respective categories based any of the following available information, as dictated by Section 2.3.4.7.a.iii. of the Permit:

- Past discharge complaints and reports
- Poor receiving water quality
- Density of generating sites
- Age of development and infrastructure
- Sewer conversion
- Historic combined sewer systems
- Surrounding density of aging septic systems
- Culverted streams
- Water quality limited waterbodies that receive a discharge from the MS4 or waters with approved TMDLs applicable to the permittee, where illicit discharges have the potential to contain the pollutant identified as the cause of the water quality impairment.

4.1 CLASSIFY AND RANK OUTFALLS

Through the GIS mapping efforts described in Section 3, the Town of Millis identified 162 outfalls that were categorized by illicit discharge risk level. Since that time much has been learned about outfall locations and attributes through the outfall screening effort described in this Section. While some outfalls have been removed from the dataset (due to misidentification, mislabeling in GIS, etc.), some have also been added after learning new information in the field. The outfall database will continue to be updated, as necessary, throughout the permit term. To-date, 162 outfalls have been categorized and ranked. A breakdown of outfalls per risk category is provided in Table 4-1.

Table 4-1: Overview of Outfall Categorization

Category (Risk)	Description	Number of Outfalls
PROBLEM	Known or suspected illicit discharge. This designation is given to any outfall where non-stormwater discharge is suspected from the dry weather inspections (or prior reports).	1
HIGH	High potential for illicit discharge / High priority for investigation.	96
LOW	Low potential for illicit discharge / Low priority for investigation.	65
EXCLUDED	No potential for illicit discharge / No needed investigation.	0

4.1.1 Problem Outfalls

Problem outfalls are determined based on the existence of known or suspected illicit discharge, given currently available outfall information. As described by section 2.3.4.7.a.ii, Problem outfall indicators include:

- Olfactory or visual evidence of sewage,
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water, or
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

Where the source of the illicit discharge to a Problem outfall has been identified, that discharge must be immediately eliminated. If a discharge cannot be eliminated within 60 days, the Town of Millis is required to establish an elimination schedule, as well as record the progress in its Annual Reports. If the source of the illicit discharge has not been identified, the Town must undertake a catchment investigation of the Problem outfall to begin no later than July 2020. Millis currently has one (1) Problem outfall (Outfall ID: E-6) for which the source of the illicit discharge is not yet known and further investigation must be conducted. During a field investigation in November 2006, flow from outfall E-6 was traced to two potential manholes. Based on sampling results, the discharge was determined to be likely just groundwater or a mix of groundwater and stormwater. Following the completion of the System Vulnerability Factor (SVF) analysis, this catchment was additionally prioritized for wet weather sampling due to the presence of multiple SVFs. Sampling and further investigation will occur prior to Year 10. Further investigation may provide better clarity on the system's connectivity and the outfall could be reprioritized.

4.1.2 High Priority Outfalls

There are currently 96 High Priority outfalls in the Town of Millis. Outfalls that drain to impaired waterbodies, are near public recreational areas, or are in close proximity to drinking water

wells are categorized as High Priority. This means that they have a higher likelihood of contributing an illicit discharge, although there is no known indicator of such discharge. All High Priority outfalls were screened within the first three (3) years of the permit effective date, following the procedures detailed in Section 6.

4.1.3 Low Priority Outfalls

Low Priority outfalls are the remaining outfalls with a chance for illicit discharge, but that are not classified as High or Problem outfalls. There are currently 65 Low Priority outfalls in the Town. These will be scored along with the High Priority outfalls to prioritize the screening and sampling process. As with the High Priority outfalls, Low Priority outfalls were required to be screened within the first three (3) years of the permit effective date.

4.1.4 Excluded Outfalls

Any outfall with no potential for illicit discharge is an Excluded outfall and does not need to be considered as a part of the IDDE program. This category includes outfalls leading to roadway drainage in undeveloped areas, athletic field drainage, undeveloped green space or parking without services, or alignments through undeveloped land. Millis does not have any excluded outfalls; therefore all 162 outfalls in the Town will be included in the IDDE methodology.

4.2 OUTFALL PRIORITIZATION METHODOLOGY

After categorizing the outfalls as Problem, High, Low, and Excluded based on the criteria above, the outfalls were then priority ranked to determine the order for outfall screenings and investigations. Based on the categories described at the start of this section and available GIS and Town data, the following characteristics were used in the priority ranking:

- Past discharge complaints: Any outfalls that have historically received discharge complaints.
- Density of generating sites: Outfalls are rated based on the concentration of “high generating sites” within the outfall catchment area. Generating sites are those which have a higher likelihood to contribute pollutants and were determined based on land use. The number of industrial, commercial, and high-density residential parcels were counted and normalized by catchment area for a density value for each corresponding outfall.
- Surrounding density of aging septic systems: All developed parcels that did not have sewer bills were assumed to contain septic systems. Similar to the density calculation above, the number of septic systems in each outfall catchment was normalized by the catchment area to report a septic system density for each outfall.
- Water quality limited waterbodies: Any outfalls that discharge to impaired waterbodies were rated as a higher priority. In Millis, the two impaired waterways of concern are the Bogastow Brook and Charles River.

- Pollutants: Any outfalls with measured pollutants of concern (e.g. for E. coli, fecal coliform, ammonia, surfactants, etc.) were included in the ranking.

Values were assigned to the outfalls for each of the characteristics above. The categories that don't have a quantitative measurement – discharge complaints and water quality limited waterbodies – were assigned a binary “1” or “0” based on if the characteristic was true for each outfall. Calculated or measured values were assigned to the remaining quantitative characteristics for each outfall. In order to prioritize the outfalls based on these values, the Town used a “Preference-Based” ranking tool, which sorts the outfalls across the categories based on how well a value for each outfall scores against the other outfalls. For example, outfalls with higher pollutant concentrations will score as more important to screen first for dry weather flow as compared to outfalls with lower or no pollutants recorded. This ranking method allows the Town to also weight the categories, so that the resulting priority ranking reflects priorities in Millis. The results of the initial priority ranking, originally conducted in 2019, are included in Appendix D.

4.3 REPRIORITIZATION OF OUTFALL RANKING

Based on data from the dry weather outfall screening and sampling, the Town revisited the initial 2019 outfall and interconnection rankings to update and reprioritize per Permit requirements. During the outfall screenings 15 outfalls had dry weather flow, however sampling results indicated that none of the discharges exceeded appropriate water quality thresholds detailed in Section 6.4.3. Although samples were collected for all outfalls with dry weather flows, in some instances sampling protocols were compromised. Preliminary results for these outfalls were utilized in the 2021 reprioritization but will be re-sampled as part of catchment investigations to confirm the results.

All outfalls were assigned a ranking based on the methodology outlined in Section 4.1 and incorporated into the reprioritization (Error! Reference source not found. Appendix H). There were no changes in the reprioritized outfalls from the initial outfall ranking, except that two newly identified outfalls were added to the Low Priority list.

4.4 SUMMARY

The one (1) Problem outfall represents a suspected illicit discharge and therefore needs to be further investigated following the steps outlined in Section 8. All outfalls were screened by Year 3 per the Initial Outfall Ranking in Appendix D, with a few requiring resampling in Year 4 to confirm results (outfalls 64 and 41). All outfalls were reprioritized at the end of Permit Year 3 to direct the catchment investigations described further in Section 7 (Appendix H).

5 SANITARY SEWER OVERFLOWS (SSO)

The 2016 MS4 Permit requires municipalities to prohibit illicit discharges, including sanitary sewer overflows (SSOs), to the separate storm sewer system. SSOs are discharges of untreated sanitary wastewater from a municipal sanitary sewer that can contaminate surface waters, cause serious water quality problems and property damage, and threaten public health. SSOs can be caused by blockages, line breaks, sewer defects that allow stormwater and groundwater to overload the system, power failures, improper sewer design, and vandalism.

Based on a review of available documentation pertaining to SSOs, the Town of Millis has no SSOs to report that have discharged to the MS4 within the five (5) years prior to the effective date of the 2016 MS4 Permit. Moving forward, the Town will maintain an inventory that includes all SSOs occurring during wet or dry weather resulting from inadequate conveyance capacities or where interconnectivity of the storm and sanitary sewer infrastructure allows for transfer of flow between systems.

Upon detection of an SSO, the Town of Millis will eliminate it as expeditiously as possible and take interim measures to minimize the discharge of pollutants to and from its MS4 until the SSO is eliminated. As required by the 2016 Permit, in the event of an overflow or bypass, the Town will formally notify MassDEP, USEPA, and other relevant parties, within 24 hours by phone and follow up with a written report according to MassDEP's SSO/Bypass notification form within five (5) calendar days of the time the Town becomes aware of the overflow, bypass, or backup.

The MassDEP contacts are:

Northeast Region (978) 694-3215
205B Lowell Street
Wilmington, MA 01887

24-hour Emergency Line 1-888-304-1133

The USEPA contacts are:

USEPA New England (617) 918-1510
5 Post Office Square
Boston, MA 02109

The inventory in Table 5-1 will be updated by the Town when new SSOs are detected. The SSO inventory will be included in the Annual Report, including the status of mitigation and corrective measures to address each identified SSO.

Table 5-1: SSO Inventory

SSO Location ¹	Discharge Statement ²	Date ³	Time Start ³	Time End ³	Estimated Volume ⁴	Description ⁵	Mitigation Completed ⁶	Mitigation Planned ⁷

¹ Location (approximate street crossing/address and receiving water, if any)

² A clear statement of whether the discharge entered a surface water directly or entered the MS4

³ Date(s) and time(s) of each known SSO occurrence (i.e., beginning and end of any known discharge)

⁴ Estimated volume(s) of the occurrence

⁵ Description of the occurrence indicating known or suspected cause(s)

⁶ Mitigation and corrective measures completed with dates implemented

⁷ Mitigation and corrective measures planned with implementation schedules

Note: this table should be populated with data from the previous 5 years of Sanitary Sewer Overflows

6 DRY WEATHER SCREENING AND SAMPLING

According to the Permit, all outfalls and interconnections (except for Problem and Excluded Outfalls) were required to be inspected for the presence of dry weather flow within three (3) years of the permit effective date. Dry weather screening and sampling occurred between 2019 and 2021 and was used to update the priority ranking of all outfalls in the MS4 (Section 4.3). The presence of dry weather flow can be a strong indicator of an illicit connection, and this screening is a logical starting point for identifying potential areas of concern. As described in Section 8, after initial outfall screenings are complete, they must be re-screened every five years thereafter. This section outlines the dry weather screening and sampling protocols for outfalls.

6.1 APPROPRIATE WEATHER CONDITIONS

Dry weather screening will be completed only during dry weather (when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring). The Town will refer to data from the closest National Weather Service Station which is located on Sherman Road in Millis (KMAMILLI11). If data isn't available from Sherman Road, the Town can refer to the Independence Lane Station in Millis (KMAMILLI2).

6.2 SCREENING REQUIREMENTS

In the office, before going to the field to screen outfalls, the Town will:

1. Identify outfalls to be screened and/or sampled based on the outfall ranking;
2. Gather appropriate maps, charged iPad, field equipment, and historic data available for the outfall;
3. Check the weather forecast and the weather recorded for the past twenty-four hours; and
4. Print the laboratory's information sheets, and screening and sampling procedures.
 - a. Determine anticipated sampling requirements for each outfall and bring field kits, water quality meters, and necessary laboratory bottles.
 - b. Schedule a tentative laboratory pick-up or be prepared to submit samples directly to the laboratory.

During previous IDDE investigations conducted in 2006, the Town needed a police detail for access to upstream structures in the roadway. When selecting outfalls for screening, the Town will assess the need for a police detail and request one if deemed necessary.

After gathering data available in the office, and confirming the weather is appropriate, the Town will:

1. Conduct the outfall screening inspection (see form in Appendix F).
 - a. Confirm outfall location with GPS;
 - b. Photograph the current condition of the outfall;
 - c. Record screening information in Cityworks using the iPad (if iPad is dead or unavailable use inspection log in Appendix F);
 - d. Look for indications of illicit discharges.
2. If dry weather flow is observed, sample and test the discharge per Section 6.4.
3. If no flow is observed, but evidence of illicit flow exists per the possible sources in Table 6-1, revisit the outfall within one (1) week of the initial observation to reassess and potentially sample the outfall.
4. Provide laboratory's required documentation to their staff during sample bottle pick-up.
5. If paper inspection log was used, record results from screening and sampling into the Town's database.
6. Include all screening and sampling information (collected by Town staff and results provided by laboratory) in the Annual Report.

Dry weather flow is a strong indicator of illicit discharges, but it is not the only physical sign of potential illicit connections. Taking careful note of the conditions around the outfall is critical to finding non-stormwater discharges. Illicit discharges can be intermittent or sporadic. Other indicators of past flow may be present even if there is no active dry weather flow at the time of the field visit. A version of Table 6-1 was included in the Town's 2004 IDDE plan, and although Millis does not have some of the potential source industries listed, it is still a helpful reminder for understanding confusing field observations. This Table, originally adapted from Pitt et al. 1993, was modified for the Town's use in 2019.

Table 6-1: Outfall Observations and Possible Sources

Parameter	Observations	Possible Reason/Source
Odor	Sewage	Stale sanitary wastewater, especially pooled near outfall
	Sulfur (rotten eggs)	Industries discharge sulfide components or organics (meat packers, canneries, dairies, etc.). Also could be petroleum related "high-sulfur" fuels.
	Rancid-sour	Food preparation facilities (restaurants, hotels, etc.)
	Oil and gas	Petroleum refineries or many facilities associated with vehicle maintenance or petroleum product storage
	Chlorine	Residential pool, or drinking water, likely not recurrent
Color	Yellow	Chemical plants, textile and tanning plants
	Brown	Meat packers, printing plants, metal works, stone and concrete, fertilizers, and petroleum refining facilities.
	Green	Chemical plants, textile facilities
	Red	Metal packers, metal works
	Gray	Dairies, and sewage
Turbidity	Cloudy	Sanitary wastewater, concrete or stone operations, fertilizer facilities, and automotive dealers
	Opaque	Food processors, lumber mills, metal operations, pigment plants
Floatable Matter	Oil sheen, grease	Petroleum refineries or storage facilities and vehicle service facilities, and restaurants
	Sewage	Sanitary wastewater
	Soap/bubbles	Sanitary wastewater
Deposits and Stains	Sediment	Construction site erosion
	Oily	Sanitary wastewater
Vegetation	Excessive Growth	Food product facilities, fertilizers, farming agricultural use.
	Inhibited growth, stressed vegetation	High stormwater flows, beverage facilities, printing plants, metal product facilities, drug manufacturing, petroleum facilities, vehicle service facilities and automobile dealers
Damage to Outfall Structures	Concrete cracking	Industrial flows, chemicals
	Concrete spalling	
	Peeling paint	
	Metal corrosion	

6.3 FIELD EQUIPMENT

During outfall field screenings, the Town may encounter a multitude of conditions or obstacles. In preparation for these possibilities, the field equipment in Table 6-2 will be used.

Table 6-2: Field Equipment List

Category	Item	Note
Recordkeeping	Clipboard/Tablet	Recording screening results
	Inspection Sheets/Procedures	For inspection and sampling results
	Chain of Custody Forms	For laboratory submittal
	Pencils/Permanent Markers	For screening results, field notes, COCs, and sample labels
	Camera	For documenting current outfall condition
PPE/Field Gear	Reflective Vest	Safety and Visibility
	Nitrile Gloves and Work Gloves	Safety while working with sampling jars, and environmental conditions
	Safety glasses	
	Safety Boots and Rubber boots	Safety working on uneven surfaces and entering shallow water
	Long pants/sleeves	Protection from environmental conditions such as brush, insects, and poisonous plants
	Insect/plant Repellant and Sunscreen	
	Hand Sanitizer	Decontamination in the field
Outfall Screening Tools	Tape Measure	Measuring the outfall, distances, and depth of flow
	Flashlight with batteries	For looking in outfalls, manholes, and catch basins
	GPS Receiver	Recording location of outfalls and other infrastructure
	Cones	Safety around screening site if adjacent to road way
	Pry Bar, Pick, Shovel	For opening manholes or catch basins
	Hammer	
	Utility Knife	Miscellaneous field requirements
	Machete/Clippers	Accessing overgrown infrastructure
Sampling	Cooler with Ice	Laboratory sample submittals
	Field Test Kits	Field screening of samples
	Rinse Water/Calibration standards	Cleaning equipment and calibration
	Sample Jar Labels	Proper sample recording
	Sample containers	Laboratory sampling
	Water Quality Meters	Field analysis
	Sand bags	For sampling if there is low-flow

It is possible that during outfall screening, the Town may visit outfalls that need maintenance or pose impending problems for the Town. Although not a part of the IDDE, this information will be communicated to the DPW for repair purposes.

6.4 SAMPLE COLLECTION AND ANALYSIS

If during the dry weather screening, there is flow from the outfall, the Town will collect a sample. All analyses except for indicator bacteria and pollutants of concern can be completed in the field. Pollutants of concern are determined based on the impairments of the waterbody. In Millis, the impairments for the applicable segment of the Charles River (MA 72-05) are:

- Non-Native Aquatic Plants
- Algae
- Benthic Macroinvertebrate
- Chlordane in Fish Tissue
- DDT in Fish Tissue
- Dissolved Oxygen
- Dissolved Oxygen Supersaturation
- Mercury in Fish Tissue
- Nutrient/Eutrophication Biological Indicators
- Total Phosphorus
- Turbidity

Appendix G of the Permit (Impaired Waters Monitoring Parameter Requirements) dictates which of these impairments require sampling and the applicable approved method. Based on the above impairments, for outfalls in Millis discharging to the Charles River the following are pollutants of concern:

- Temperature
- Five-day Biochemical Oxygen Demand (BOD₅)
- Total Phosphorus
- Total Suspended Solids (TSS)
- Turbidity

For the Bogastow Brook, the impairments and the resulting pollutants of concern are fecal coliform and E. coli.

The Town owns and maintains its own water quality testing equipment, but relies on laboratory analyses for the following pollutants: E. Coli, Total Phosphorus, TSS, Turbidity, Fecal Coliform, and BOD₅.

The general sampling procedures are as follows:

1. Put on fresh protective gloves before handling laboratory bottles or sampling.

2. Fill out lab sheets and sample labels.
3. If possible, collect sample directly from outfall flow with sample container. If necessary, use a dipper or equivalent device.
 - a. Do not touch the dipper or the sample bottle to the outfall or sediments.
 - b. Do not walk through or disturb sediments upstream of sampling location.
 - c. If using a dipper or other reusable equipment, triple rinse with distilled water and sample water before sampling.
4. Use test strips, kits, and water quality meters, and record data.
 - a. Follow manufacturer's instructions for meter calibration and frequency.
5. Place any laboratory samples on ice for laboratory submission.
 - a. Fill out Chain of Custody for laboratory samples.
 - b. Prepare for laboratory pick-up or drop-off.
6. Enter results into Cityworks using iPad as tests are conducted
7. Safely dispose of used test strips and kits.
8. Use distilled water to decontaminate all equipment.

If sampling the outfall is infeasible because it is submerged, buried, obstructed, damaged or simply inaccessible, the Town will proceed to the first accessible upstream manhole or catch basin for the observation of the flow and sampling. Field staff will continue to the next upstream structure until there is no longer an influence from the receiving water on the visual inspection or sampling. The location of observation and sampling will be recorded with the results.

Table 6-3 summarizes the sampling needs for parameters to be analyzed in the field. The threshold indicator value is included in the permit as an indicator of a potential illicit connection.

Table 6-3: Field Sampling Analyses

Field Sampling & Analysis				
Sampling Parameter	Sampling Container	Volume	Method	Threshold Indicator
Ammonia	Glass or plastic	Enough volume to submerge probe/strip or use provided sample cell	WQ Meter/Test Kit	0.5 mg/L
Chlorine			WQ Meter	0.02 mg/L
Conductivity			WQ Meter	--
Salinity			WQ Meter	--
Surfactants			WQ Meter/Test Kit	0.25 mg/L
Water Temperature			WQ Meter	--
Turbidity			WQ Meter	--

6.4.1 Field Test Kits and Water Quality Meters

The Town currently owns field test kits and water quality meters for sampling to conduct the majority of required monitoring in house. During employee training, the Town will use and select instruments or kits based on ease of use and familiarity with the method. Table 6-4 includes instruments and field test kits that the Town will choose from.

Table 6-4: Field Testing Options

Analyte or Parameter	Instrumentation (Portable Meter)	Field Test Kit
Ammonia	CHEMetrics™ V-2000 Colorimeter Hach™ DR/890 Colorimeter Hach™ Pocket Colorimeter™ II	CHEMetrics™ K-1410 CHEMetrics™ K-1510 (series) *Hach™ NI-SA Hach™ Ammonia Test Strips
Surfactants (Detergents)	CHEMetrics™ I-2017	*CHEMetrics™ K-9400 and K-9404 Hach™ DE-2
Chlorine	*CHEMetrics™ V-3000, K-2513 Hach™ Pocket Colorimeter™ II	NA
Conductivity	CHEMetrics™ I-1200 *YSI Pro30 YSI EC300A Oakton 450	NA
Temperature	*YSI Pro30 YSI EC300A Oakton 450	NA
Salinity	*YSI Pro30 YSI EC300A Oakton 450	NA
Dissolved Oxygen	*YSI Pro30 YSI EC300A Oakton 450	NA

*Town-owned Equipment

6.4.2 Laboratory Analyses

Indicator bacteria and pollutants of concern (Total Phosphorus, TSS, BOD₅, E.coli, Fecal Coliform and Turbidity) need to be analyzed in a laboratory, and if necessary, other sampling parameters can be submitted as well. Table 6-5 includes suitable methods and associated preservation and hold time requirements. Dissolved Oxygen classifies as a pollutant of concern for the Town of Millis, but the hold time is immediate. The Oxidation Reduction Potential (ORP) reading from the YSI Pro30 water quality meter is used instead in order to collect immediate data.

Table 6-5: Laboratory Analyses and Requirements

Laboratory Sampling & Analysis					
Sampling Parameter	Volume	Preservative	Method	Hold Time	Detection Limits
Ammonia	500 mL	Cool $\leq 6^{\circ}\text{C}$, H ₂ SO ₄ to pH <2	EPA 350.2; SM 4500-NH₃C	28 days	0.05 mg/L
Chlorine	500 mL	--	SM 4500-Cl G	15 minutes	0.02 mg/L
Conductivity	500 mL	Cool $\leq 6^{\circ}\text{C}$	(Specific Conductance) EPA 120.1; SM 2510B	28 days	0.2 $\mu\text{S}/\text{cm}$
Salinity	500 mL	Cool $\leq 6^{\circ}\text{C}$	SM 2520	28 days	--
E.coli	125 mL	Cool $\leq 10^{\circ}\text{C}$, 0.0008% Na ₂ S ₂ O ₃	EPA 1603; SM 9221B, 9221F, 9223B	6 hours	1 cfu/100 mL; 2 MPN/100 mL
Surfactants	500 mL	Cool $\leq 6^{\circ}\text{C}$	SM 5540-C	48 hours	0.01 mg/L
Pollutants of Concern					
Phosphorus (Total)	250 mL	Cool $\leq 6^{\circ}\text{C}$, H ₂ SO ₄ to pH <2	EPA 365.1; 365.2; 365.3; SM 4500-P-E	28 days	0.01 mg/L
TSS	1000 mL	Cool $\leq 6^{\circ}\text{C}$	SM 2540D	7 days	2.5 mg/L
BOD ₅	500 mL	Cool $\leq 6^{\circ}\text{C}$	SM 5210	48 hours	--
Fecal Coliform	100 mL	Cool $\leq 6^{\circ}\text{C}$	EPA 1680; 1681	6 hours	1 cfu/100 mL; 2 MPN/100 mL
Turbidity		Cool $\leq 4^{\circ}\text{C}$	EPA: 180.1; SM: 2130 B-2011	48 hours	0.02 NTU

6.4.3 Sample Results and Potential Illicit Connections

Based on the results collected, the Town will determine if there are potential illicit connections from sanitary sources. An illicit sanitary source is likely if outfall sample results include the following values:

- Ammonia ≥ 0.5 mg/L
- Surfactants ≥ 0.25 mg/L, AND
- Bacteria > 235 cfu/mL for swimming or > 410 cfu/mL for other waters
- Or
- Ammonia ≥ 0.5 mg/L
- Surfactants ≥ 0.25 mg/L, AND

- Detectable levels of chlorine (> 0.2 mg/L)

Additionally, if conductivity is measured above 2,000 $\mu\text{S}/\text{cm}$, there is the potential for an illicit connection. Based on the dry weather screening results, the Town will continue to update its ranking and further investigate potential connections through catchment investigations.

6.5 PREVIOUSLY COLLECTED DATA

The Town developed an IDDE plan as part of the 2003 permit, and actively administered the plan which included dry weather screening and sampling. The Town hired a consultant, CEI, to conduct the dry weather outfall screening and sampling starting in December 2004. Sampling efforts by CEI were continued in 2005 and 2006, when they identified seven (7) outfalls with potential illicit connections. In November and December of 2006, CEI screened twenty-seven (27) of the Town's outfalls. Of the outfalls inspected, dry weather flow was observed and sampled in three (3). CEI identified poor water quality indicators, maintenance issues, and possible illicit connections during their analysis. CEI continued drainage system investigations at each of the outfalls with possible illicit connections and determined that poor water quality indicators observed were due to cleaning and maintenance issues, and that groundwater flow could potentially be the source of some of these issues. CEI recommended that the Town complete additional maintenance and further drainage system investigations at these outfalls. The data and observations completed as part of this field work was utilized in the outfall ranking and prioritization as part of this IDDE program.

7 CATCHMENT INVESTIGATIONS

Initial catchment delineations have been completed for the Town as part of their stormwater system mapping. The Town is prepared to investigate each catchment associated with an outfall or interconnection to resolve potential illicit discharges.

7.1 WRITTEN PROCEDURES

Catchment investigations include a combination of historic records review, field inspection, and field confirmation. During the permit term, every catchment associated with an MS4 jurisdictional outfall (excepting Excluded outfalls) or interconnection will be investigated.

7.1.1 Records Review

The Town will review available records for storm system information. These records may include:

- Maps;
- Construction plans for storm drain or sanitary sewer networks;
- Board of Health data, including available septic information;
- Storm drain or sanitary sewer repair or upgrade information; and
- Complaint records related to SSOs, sewer surcharges or septic system failures.

The Town has already made significant progress in its stormwater mapping. The existing work was used as a starting point, and additional information gathered during these investigations will be used to update and improve the Town's mapping.

7.1.2 System Vulnerability Factors

Following the records review, each catchment area was assessed to identify System Vulnerability Factors (SVFs). SVFs are factors listed by the Permit that place a catchment at higher risk of illicit connections being present and, as a result, lead to the need for additional investigation. The presence of SVFs in a catchment area will indicate the need for wet weather sampling as described in Section 7.3. The following eight (8) SVFs were assessed that require mandatory wet weather sampling:

- History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages;
- Common or twin-invert manholes serving storm and sanitary sewer alignments;
- Common trench construction serving both storm and sanitary sewer alignments;
- Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system;

- Sanitary sewer alignments known or suspected to have been constructed with an underdrain system;
- Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints;
- Areas formerly served by combined sewer systems;
- Sanitary sewer infrastructure defects such as leaking service laterals, cracked, broken, or offset sanitary infrastructure, directly piped connections between storm drain and sanitary sewer infrastructure, or other vulnerability factors identified through Inflow/Infiltration Analyses, Sanitary Sewer Evaluation Surveys, or other infrastructure investigations;

Four additional SVFs are included in the Town's Permit are recommended but not required to check for in determining catchment areas to undergo wet weather sampling. As part of the SVF analysis, the following factors were also checked for and noted, however, it is only recommended that wet weather sampling occur when one of these optional SVFs is present in tandem with one of the required 8 SVFs above.

- Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs;
- Any sanitary sewer and storm drain infrastructure greater than 40 years old;
- Widespread code-required septic system upgrades required at property transfers (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance);
- History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance).

The assessment relied primarily on a GIS analysis using the system maps developed in Section 3 to identify potential SVFs. Additionally, record information including the Town's Infiltration and Inflow (I-I) report. A full methodology and results of the SVF analysis are included in Appendix J. Table 7-1 below shows the template for recording SVFs for all outfalls and will be maintained in all reporting years going forward. A full inventory of the Town's 162 outfalls and corresponding SVFs is included in Appendix J.

Table 7-1: System Vulnerability Factor (SVF) Inventory

Outfall ID	Receiving Water	1 History of SSOs	2 Common or Twin Invert Manholes	3 Common Trench Construction	4 Storm/Sanitary Crossings (Sanitary Above)	5 Sanitary Lines with Underdrains	6 Inadequate Sanitary Level of Service	7 Areas Formerly Served by Combined Sewers	8 Sanitary Infrastructure Defects	9 SSO Potential In Event of System Failures	10 Sanitary and Storm Drain Infrastructure >40 years Old	11 Septic with Poor Soils or Water Table Separation	12 History of BOH Actions Addressing Septic Failure
A	XYZ River	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No

- Presence/Absence Evaluation Criteria:**
- 1. History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages
 - 2. Common or twin-invert manholes serving storm and sanitary sewer alignments
 - 3. Common trench construction serving both storm and sanitary sewer alignments
 - 4. Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system
 - 5. Sanitary sewer alignments known or suspected to have been constructed with an underdrain system
 - 6. Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints
 - 7. Areas formerly served by combined sewer systems
 - 8. Sanitary sewer infrastructure defects such as leaking service laterals, cracked, broken, or offset sanitary infrastructure, directly piped connections between storm drain and sanitary sewer infrastructure, or other vulnerability factors identified through Inflow/Infiltration Analyses, Sanitary Sewer Evaluation Surveys, or other infrastructure investigations
 - 9. Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs
 - 10. Any sanitary sewer and storm drain infrastructure greater than 40 years old
 - 11. Widespread code-required septic system upgrades required at property transfers (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance)
 - 12. History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather than poor owner maintenance)

7.2 KEY INFRASTRUCTURE INSPECTIONS

The Town will inspect key junction manholes and gather catchment information on the locations for MS4 pipes, manholes, and the portion of the catchment associated with the structure. This information is invaluable in initiating this program and will be the starting point for these inspections.

The Town will be responsible for implementing this dry weather manhole inspection program and making updates as necessary. Infrastructure information will be incorporated into the storm system map, and catchment delineations will be refined based on the field investigation, where necessary. The SVF inventory will also be updated based on information obtained during the field investigations, where necessary. Catchment areas determined to have potential SVFs (such as sanitary and storm sewer crossings with undetermined inverts) will be prioritized for investigation in order to verify assumptions made during the SVF analysis.

Several important terms related to the dry weather manhole inspection program are defined by the MS4 Permit as follows:

- **Junction Manhole** is a manhole or structure with two or more inlets accepting flow from two or more MS4 alignments. Manholes with inlets solely from private storm drains, individual catch basins, or both are not considered junction manholes for these purposes.
- **Key Junction Manholes** are those junction manholes that can represent one or more junction manholes without compromising adequate implementation of the illicit discharge program. Adequate implementation of the illicit discharge program would not be compromised if the exclusion of a particular junction manhole as a key junction manhole would not affect the permittee's ability to determine the possible presence of an upstream illicit discharge. A permittee may exclude a junction manhole located upstream from another located in the immediate vicinity or that is serving a drainage alignment with no potential for illicit connections.

For all catchments identified for investigation, during dry weather, field crews will systematically inspect **key junction manholes** for evidence of illicit discharges. This program involves progressive inspection and sampling at manholes in the storm drain network to isolate and eliminate illicit discharges.

The manhole inspection methodology will be conducted in one of two ways (or a combination of both):

- By working progressively up from the outfall and inspecting key junction manholes along the way, or
- By working progressively down from the upper parts of the catchment toward the outfall.

For most catchments, manhole inspections will proceed from the outfall moving up into the system. However, the decision to move up or down the system depends on the nature of the

drainage system and the surrounding land use and the availability of information on the catchment and drainage system. Moving up the system can begin immediately when an illicit discharge is detected at an outfall, and only a map of the storm drain system is required. Moving down the system requires more advance preparation and reliable drainage system information on the upstream segments of the storm drain system, but it may be more efficient if the sources of illicit discharges are believed to be located in the upstream portions of the catchment area. Once a manhole inspection methodology has been selected, investigations will continue systematically through the catchment.

Inspection of key junction manholes will proceed as follows:

1. Manholes will be opened and inspected for visual and olfactory evidence of illicit connections. A sample field inspection form is provided in Appendix F.
2. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants. Field kits can be used for these analyses. Sampling and analysis will be in accordance with procedures outlined in Section 6. Additional indicator sampling may assist in determining potential sources (e.g., bacteria for sanitary flows, conductivity to detect tidal backwater, etc.).
3. Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs, the area draining to the junction manhole will be flagged for further upstream manhole investigation and/or isolation and confirmation of sources as described in Section 7.4.
4. Subsequent key junction manhole inspections will proceed until the location of suspected illicit discharges or SSOs can be isolated to a pipe segment between two (2) manholes.
5. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.

7.3 WET WEATHER SAMPLING

Where a minimum of one (1) required System Vulnerability Factor (SVF) is identified based on previous information or the catchment investigation, a wet weather investigation must also be conducted at the associated outfall. A full list of catchment areas containing at least one (1) SVF is included in Appendix J.

These outfalls will be inspected and sampled under wet weather conditions, to the extent necessary, to determine whether wet weather-induced high flows in sanitary sewers or high groundwater in areas served by septic systems result in discharges of sanitary flow to the MS4.

Wet weather outfall sampling will proceed as follows:

1. At least one (1) wet weather sample will be collected at the outfall for the same parameters required during dry weather screening.
2. Wet weather sampling will occur during or after a storm event of sufficient depth or intensity to produce a stormwater discharge at the outfall. There is no specific rainfall

amount that will trigger sampling, although minimum storm event intensities that are likely to trigger sanitary sewer interconnections are preferred. To the extent feasible, sampling should occur during the spring (March through June) when groundwater levels are relatively high.

3. If wet weather outfall sampling indicates a potential illicit discharge, then additional wet weather source sampling will be performed, as warranted, or source isolation and confirmation procedures will be followed as described in Section 8.4.
4. If wet weather outfall sampling does not identify evidence of illicit discharges, and no evidence of an illicit discharge is found during dry weather manhole inspections, catchment investigations will be considered complete.

7.4 SOURCE ISOLATION AND CONFIRMATION

After a potential source is identified, and the location is narrowed down to two (2) manholes, the Town will use more advanced techniques to isolate the source. There are many methods that the Town can use that include:

- Sandbagging
- Smoke Testing
- Dye Testing
- CCTV/Video Inspections
- Optical Brightener Monitoring
- IDDE Canines

These are all options that Millis can rely on. However, sand bagging, dye testing, and CCTV inspections if necessary will be utilized first. Any homeowners or businesses that will be impacted by these investigations will be notified prior to starting.

7.4.1 Sandbagging

This technique can be particularly useful when attempting to isolate intermittent illicit discharges or those with very little perceptible flow. The technique involves placing sandbags or similar barriers (e.g., caulking, weirs/plates, or other temporary barriers) within outlets to manholes to form a temporary dam that collects any intermittent flows that may occur. Sandbags are typically left in place for 48 hours and should only be installed when dry weather is forecast. If flow has collected behind the sandbags/barriers after 48 hours, it can be assessed using visual observations or by sampling. If no flow collects behind the sandbag, the upstream pipe network can be ruled out as a source of the intermittent discharge. Finding appropriate durations of dry weather and the need for multiple trips to each manhole makes this method both time-consuming and somewhat limiting.

7.4.2 Dye Testing

Dye testing involves flushing non-toxic dye into plumbing fixtures such as toilets, showers, and sinks and observing nearby storm drains and sewer manholes as well as stormwater outfalls for the presence of the dye. It is important to inform local residents and business owners before dye testing is performed. Police, fire, and local public health staff should also be notified prior to testing in preparation for responding to citizen phone calls concerning the dye and their presence in local surface waters.

A team of two or more people is needed to perform dye testing (ideally, all with two-way radios). One person is inside the building, while the others are stationed at the appropriate storm sewer and sanitary sewer manholes (which should be opened) and/or outfalls. The person inside the building adds dye into a plumbing fixture (i.e., toilet or sink) and runs a sufficient amount of water to move the dye through the plumbing system. The person inside the building then radios to the outside crew that the dye has been dropped, and the outside crew watches for the dye in the storm sewer and sanitary sewer, recording the presence or absence of the dye.

The test can be relatively quick (about 30 minutes per test), effective (results are usually definitive), and inexpensive. Dye testing is best used when the likely source of an illicit discharge has been narrowed down to a few specific houses or businesses.

7.4.3 CCTV Inspections

Another method of source isolation involves the use of mobile video cameras that are guided remotely through stormwater drain lines to observe possible illicit discharges. IDDE program staff can review the videos and note any visible illicit discharges. While this tool is both effective and usually definitive, it can be costly and time consuming when compared to other source isolation techniques.

7.5 TIMELINE

Using the written procedures and strategies outlined in Section 6, the Town will begin catchment investigations according to the following timeline:

- Catchment investigations for Problem Outfalls will be started by Year 2 (July 2020) and finished by Year 7 (July 2025).
- Catchment investigations for High and Low Priority Outfalls will be completed by rank, started in Year 3 (July 2021), and finished by Year 10 (July 2028).
- Catchments associated with outfalls or interconnections that had potential sewer input will be completed by Year 7 (July 2025).

7.6 ILLICIT DISCHARGE ELIMINATION

When the specific source of an illicit discharge is identified, the Town will exercise its authority as necessary to require its removal. The Annual Report will include the status of IDDE investigation and removal activities including the following information for each confirmed source:

- The location of the discharge and its source(s)
- A description of the discharge
- The method of discovery
- Date of discovery
- Date of elimination, mitigation or enforcement action OR planned corrective measures and a schedule for completing the illicit discharge removal
- Estimate of the volume of flow removed.

7.7 CONFIRMATORY OUTFALL SCREENING

Within one (1) year of removal of all identified illicit discharges within a catchment area, confirmatory outfall or interconnection screening will be conducted. The confirmatory screening will be conducted in dry weather unless System Vulnerability Factors have been identified, in which case both dry weather and wet weather confirmatory screening will be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment will be scheduled for additional investigation.

7.8 STATUS OF OUTFALL SCREENING

As per the requirements of EPA's 2016 Permit, the Town is required to complete catchment investigations of its separated stormwater conveyance system at all the outfalls by the end of Year 10 of the permit. On June 15, 2022, Kleinfelder completed training of the DPW staff to carry out these catchment investigations. A record of the training is included in Appendix G. The Town staff along with Kleinfelder staff have additionally completed investigations of eight (8) outfalls and associated drainage network. The field records from these investigations are detailed in Appendix K.

The catchment investigations were started at an outfall and continued upstream through the drainage network including catch basins and junction manholes. The workflow and SOP followed for the catchment investigations is provided in Appendix L. Structure information including weather information, inverts, observed flow conditions, and sampling results will be recorded in the Town's online Survey123 form.

8 ONGOING SCREENING

Upon completion of all catchment investigations and illicit discharge removal and confirmation (if necessary), each outfall or interconnection will be re-prioritized for screening and scheduled for ongoing screening once every five (5) years. Ongoing screening will consist of dry weather screening and sampling consistent with the procedures described in Section 6 of this program. Ongoing wet weather screening and sampling will also be conducted at outfalls where wet weather screening was required due to System Vulnerability Factors and will be conducted in accordance with the procedures described in Section 8. All sampling results will be reported in the Annual Report.

9 EMPLOYEE TRAINING

The Town will provide annual training for employees beginning in the Spring of each year. This training will be for employees that are slated for field work investigations as well as provide DPW services within the Town. The training will include an emphasis on recognizing illicit discharges and SSOs, dry weather screening and sampling, catchment investigations, and proper reporting. The frequency and type of employee training will be included in the Annual Report.

10 REFERENCES

General Permits for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts. United States Environmental Protection Agency, issued April 4, 2016.

Illicit Discharge Detection and Elimination (IDDE) Plan Template. Central Massachusetts Regional Stormwater Coalition, June 30, 2016.

Massachusetts Year 2016 Integrated List of Waters, Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act. Massachusetts Department of Environmental Protection, January 2016.

Stormwater Illicit Discharge Detection & Elimination Plan. Millis, Massachusetts, September 2004.

Town of Millis Stormwater Management Regulations Article II, Regulation Governing Discharges to the Municipal Storm Drain System, Town of Millis, Adopted June 28, 2004.

2018 NPDES MS4 Program Assistance Stormwater System Map Memorandum. Betsy Frederick, Kleinfelder, June 21, 2018.

APPENDIX A
IDDE IMPLEMENTATION TIMELINE

Effective

Date

1 yr

2 yr

3 yr

4 yr

5 yr

6 yr

7 yr

8 yr

9 yr

10 yr

Annual
Report

Annual
Report

Annual
Report

Annual
Report

Annual
Report

Annual
Report

Annual
Report

Annual
Report

Annual
Report

Phase I map due

Phase II map due

Mapping

Update map w/ outfalls, receiving
waters, certain other structures

Update mapping information, including catchment delineations, outfalls, and infrastructure locations (pipes, manholes, catch basins)
based on information collected during catchment investigations

Outfall Screening

Initial Outfall
Ranking due

Updated Outfall
Ranking due

Dry Weather outfall screen-
ing and sampling

Wet weather screening of outfalls and interconnections will be performed as necessary during catchment investigations

Catchment Work

Written catchment
investigation
procedure due

100% problems and catchments with
sewage evidence investigated

100% catchments
investigated

Perform **catchment investigations** for Problem Outfalls and outfalls/
interconnections where dry weather testing indicates sewer input

Perform catchment investigations for remain-
ing outfalls

Written programs

Written IDDE program, SSO
inventory due

Ordinance must be in place
for new permittees

APPENDIX B
Legal Authority

**TOWN OF MILLIS
STORMWATER MANAGEMENT REGULATIONS
ARTICLE II**

Adopted June 28, 2004

**Regulation Governing Discharges To
The Municipal Storm Drain System**

SECTION 1. PURPOSE

Increased and contaminated stormwater runoff is a major cause of

- (1) impairment of water quality and flow in lakes, ponds, streams, rivers, wetlands and groundwater;
- (2) contamination of drinking water supplies;
- (3) alteration or destruction of aquatic and wildlife habitat; and
- (4) flooding.

Regulation of illicit connections and discharges to the municipal storm drain system is necessary for the protection of the town's water bodies and groundwater, and to safeguard the public health, safety, welfare and the environment.

The objectives of this regulation are:

- (1) to prevent pollutants from entering the town's municipal separate storm sewer system (MS4);
- (2) to prohibit illicit connections and unauthorized discharges to the MS4;
- (3) to require the removal of all such illicit connections;
- (4) to comply with state and federal statutes and regulations relating to stormwater discharges; and
- (5) to establish the legal authority to ensure compliance with the provisions of this regulation through inspection, monitoring, and enforcement.

SECTION 2. DEFINITIONS

For the purposes of this regulation, the following shall mean:

AUTHORIZED ENFORCEMENT AGENCY: The Board of Selectmen (hereafter the Board), its employees or agents designated to enforce this regulation.

BEST MANAGEMENT PRACTICE (BMP): An activity, procedure, restraint, or structural improvement that helps to reduce the quantity or improve the quality of stormwater runoff.

CLEAN WATER ACT: The Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq.*) as hereafter amended.

DISCHARGE OF POLLUTANTS: The addition from any source of any pollutant or combination of pollutants into the municipal storm drain system or into the waters of the United States or Commonwealth from any source.

GROUNDWATER: Water beneath the surface of the ground.

ILLCIT CONNECTION: A surface or subsurface drain or conveyance, which allows an illicit discharge into the municipal storm drain system, including without limitation sewage, process wastewater, or wash water and any connections from indoor drains, sinks, or toilets, regardless of whether said connection was previously allowed, permitted, or approved before the effective date of this regulation. Connections to the municipal storm drain system which constitute illicit discharges as defined below which exist at the time of enactment of this regulation are considered illicit connections.

ILLCIT DISCHARGE: Direct or indirect discharge to the municipal storm drain system that is not composed entirely of stormwater, except as exempted in Section 7. The term does not include a discharge in compliance with an NPDES Storm Water Discharge Permit or a Surface Water Discharge Permit, or resulting from fire fighting activities exempted pursuant to Section 7, subsection 4, of this regulation.

IMPERVIOUS SURFACE: Any material or structure on or above the ground that prevents water infiltrating the underlying soil. Impervious surface includes without limitation roads, paved parking lots, sidewalks, and rooftops.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (M54) or MUNICIPAL STORM DRAIN SYSTEM: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or manmade or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the town.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORM WATER DISCHARGE PERMIT: A permit issued by United States Environmental Protection Agency or jointly with the State that authorizes the discharge of pollutants to waters of the United States.

NON-STORM WATER DISCHARGE: Discharge to the municipal storm drain system not composed entirely of stormwater or groundwater.

PERSON: An individual, partnership, association, firm, company, trust, corporation, agency, authority, department or political subdivision of the Commonwealth or the federal government, to the extent permitted by law, and any officer, employee, or agent of such person.

POLLUTANT: Any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter whether originating at a point or nonpoint source, that is or may be introduced into any sewage treatment works or waters of the Commonwealth. Pollutants shall include without limitation:

- (1) paints, varnishes, and solvents;
- (2) oil and other automotive fluids;
- (3) non-hazardous liquid and solid wastes and yard wastes;
- (4) refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordnances, accumulations and floatables;
- (5) pesticides, herbicides, and fertilizers;
- (6) hazardous materials and wastes; sewage, bacteria, fecal coliform and pathogens;
- (7) dissolved and particulate metals;
- (8) animal wastes;
- (9) rock, sand; salt, soils;
- (10) construction wastes and residues;
- (11) and noxious or offensive matter of any kind.

PROCESS WASTEWATER: Water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any material, intermediate product, finished product, or waste product.

RECHARGE: The process by which groundwater is replenished by precipitation through the percolation of runoff and surface water through the soil.

STORMWATER: Storm water runoff, snow melt runoff, and surface water runoff and drainage.

SURFACE WATER DISCHARGE PERMIT. A permit issued by the Department of Environmental Protection (DEP) pursuant to 314 CMR 3.00 that authorizes the discharge of pollutants to waters of the Commonwealth of Massachusetts.

TOXIC OR HAZARDOUS MATERIAL or WASTE: Any material, which because of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances, constitutes a present or potential threat to human health, safety, welfare, or to the environment. Toxic or hazardous materials include any synthetic organic chemical, petroleum product, heavy metal, radioactive or infectious waste, acid and alkali, and any substance defined as Toxic or Hazardous under G.L. Ch.2 1 C and Ch.2 1 E, and the regulations at 310 CMR 30.000 and 310 CMR 40.0000.

WATERCOURSE: A natural or man-made channel through which water flows or a stream of water, including a river, brook or underground stream.

WATERS OF THE COMMONWEALTH: All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, costal waters, and groundwater.

WASTE WATER: Any sanitary waste, sludge, or septic tank or cesspool overflow, and water that during manufacturing, cleaning or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct or waste product.

SECTION 3. APPLICABILITY

This regulation shall apply to flows entering the municipally owned storm drainage system.

SECTION 4. AUTHORITY

This Regulation is adopted under the authority granted by the Home Rule Amendment of the Massachusetts Constitution and the Home Rule Procedures Act, the Millis Home Rule Charter, and pursuant to the regulations of the federal Clean Water Act found at 40 CFR 122.34.

SECTION 5. RESPONSIBILITY FOR ADMINISTRATION

The Board shall administer, implement and enforce this regulation. Any powers granted to or duties imposed upon the Board may be delegated in writing by the Board to employees or agents of the Board.

SECTION 6. REGULATIONS

The Board may promulgate rules and regulations to effectuate the purposes of this Regulation. Failure by the Board to promulgate such rules and regulations shall not have the effect of suspending or invalidating this regulation.

SECTION 7. PROHIBITED ACTIVITIES

- A. Illicit Discharges.** No person shall dump, discharge, cause or allow to be discharged any pollutant or non-stormwater discharge into the municipal separate storm sewer system (MS4), into a watercourse, or into the waters of the Commonwealth.

B. Illicit Connections. No person shall construct, use, allow, maintain or continue any illicit connection to the municipal storm drain system, regardless of whether the connection was permissible under applicable law, regulation or custom at the time of connection.

C. Obstruction of Municipal Storm Drain System. No person shall obstruct or interfere with the normal flow of stormwater into or out of the municipal storm drain system without prior written approval from the Board .

D. Exemptions

1. Discharge or flow resulting from fire fighting activities;
2. The following non-stormwater discharges or flows are exempt from the prohibition of non-stormwaters provided that the source is not a significant contributor of a pollutant to the municipal storm drain system:
 - (a) Waterline flushing;
 - (b) Flow from potable water sources;
 - (c) Springs;
 - (d) Natural flow from riparian habitats and wetlands;
 - (e) Diverted stream flow;
 - (f) Rising groundwater;
 - (g) Uncontaminated groundwater infiltration as defined in 40 CFR 3 5.2005(20), or uncontaminated pumped groundwater;
 - (h) Water from exterior foundation drains, footing drains (not including active groundwater dewatering systems), crawl space pumps, or air conditioning condensation;
 - (i) Discharge from landscape irrigation or lawn watering;
 - (j) Water from individual residential car washing;
 - (k) Discharge from dechlorinated swimming pool water (less than one ppm chlorine) provided the water is allowed to stand for one week prior to draining and the pool is drained in such a way as not to cause a nuisance;
 - (l) Discharge from street sweeping.

- (m) Dye testing, provided verbal notification is given to the Department of Public Works forty-eight hours prior to the time of the test;
- (n) Non-stormwater discharge permitted under an NPDES permit or a Surface Water Discharge Permit, waiver, or waste discharge order administered under the authority of the United States Environmental Protection Agency or the Department of Environmental Protection, provided that the discharge is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations; and
- (o) Discharge for which advanced written approval is received from the Board as necessary to protect public health, safety, welfare or the environment.

SECTION 8. EMERGENCY SUSPENSION OF STORM DRAINAGE SYSTEM ACCESS

The Board may suspend municipal storm drain system access to any person or property without prior written notice when such suspension is necessary to stop an actual or threatened discharge of pollutants that presents imminent risk of harm to the public health, safety, welfare or the environment. In the event any person fails to comply with an emergency suspension order, the Authorized Enforcement Agency may take all reasonable steps to prevent or minimize harm to the public health, safety, welfare or the environment.

SECTION 9. NOTIFICATION OF SPILLS

Notwithstanding other requirements of local, state or federal law, as soon as a person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of or suspects a release of materials at that facility or operation resulting in or which may result in discharge of pollutants to the municipal drainage system or waters of the Commonwealth, the person shall take all necessary steps to ensure containment, and cleanup of the release. In the event of a release of oil or hazardous materials, the person shall immediately notify the municipal fire and police departments and the department of public works, Board of health, and Conservation Commission. In the event of a release of non-hazardous material, the reporting person shall notify the Authorized Enforcement Agency no later than the next business day. The reporting person shall provide to the Authorized Enforcement Agency written confirmation of all telephone, facsimile or in-person notifications within three business days thereafter. If the discharge of prohibited materials is from a commercial or industrial facility, the facility owner or operator of the facility shall retain on-site a written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

SECTION 10. ENFORCEMENT

The Board or an authorized agent of the Board including the Building Inspector, Director of Public Works or Assistant Director of Public Works, shall enforce this regulation, regulations, orders, violation notices, and enforcement orders, and may pursue all civil and criminal remedies for such violations.

A. Civil Relief If a person violates the provisions of this regulation, regulations, permit, notice, or order issued thereunder, the Board may seek injunctive relief in a court of competent jurisdiction restraining the person from activities which would create further violations or compelling the person to perform abatement or remediation of the violation.

B. Orders The Board or an authorized agent of the Board may issue a written order to enforce the provisions of this regulation or the regulations thereunder, which may include: (a) elimination of illicit connections or discharges to the MS4; (b) performance of monitoring, analyses, and reporting; (c) that unlawful discharges, practices, or operations shall cease and desist; and (d) remediation of contamination in connection therewith.

If the enforcing person determines that abatement or remediation of contamination is required, the order shall set forth a deadline by which such abatement or remediation must be completed. Said order shall further advise that, should the violator or property owner fail to abate or perform remediation within the specified deadline, the town may, at its option, undertake such work, and expenses thereof shall be charged to the violator.

Within thirty (30) days after completing all measures necessary to abate the violation or to perform remediation, the violator and the property owner will be notified of the costs incurred by the town, including administrative costs. The violator or property owner may file a written protest objecting to the amount or basis of costs with the Board within thirty (30) days of receipt of the notification of the costs incurred. If the amount due is not received by the expiration of the time in which to file a protest or within thirty (30) days following a decision of the Board affirming or reducing the costs, or from a final decision of a court of competent jurisdiction, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall begin to accrue on any unpaid costs at the statutory rate provided in G.L. Ch. 59, § 57 after the thirty-first day at which the costs first become due.

C. Criminal Penalty Any person who violates any provision of this regulation, regulation, order or permit issued thereunder, shall be punished by a fine of not more than **\$100.00** Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

D. Entry to Perform Duties Under this Regulation To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the Board its agents, officers, and employees may enter upon privately owned property for the purpose of performing their duties under this regulation and regulations and may make or cause to be made such examinations, surveys or sampling as the Board deems reasonably necessary.

E. Appeals The decisions or orders of the Board shall be final. Further relief shall be to a court of competent jurisdiction.

G. Remedies Not Exclusive The remedies listed in this regulation are not exclusive of any other remedies available under any applicable federal, state or local law.

SECTION 11. SEVERABILITY

The provisions of this regulation are hereby declared to be severable. If any provision, paragraph, sentence, or clause, of this regulation or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this regulation.

To the Board of Selectmen:

The undersigned wishes to submit a Municipal Storm Drain Permit Application as defined in the Stormwater Management and Municipal Storm Drain Regulation of the Town of Millis, and requests a review and determination by the Selectmen of said Municipal Storm Drain Plan.

The Municipal Storm Drain Plan involves property where owner's title to the land is derived under deed from

_____ dated _____, and
recorded in the

_____ County Registry of Deeds, Book _____, Page _____, or Land Court
Certificate

of Title No. _____, Registered in _____ District, Book _____, Page

Give a brief summary of the nature of the project.

The property (building) is described as being located at

it is currently used as _____,
and the

changes proposed to be made are

The project is located on the parcel shown on Assessors Map _____, Parcel _____

Applicant's Signature

Applicant's Name (print)

Applicant's Address

Owners' Signature(s)

Owners' Names(s)

Owners' Address

Date Received by Town Clerk: _____

Signature

Please note: 1) An applicant for a Municipal Storm Drain Plan Review must file with the Building Inspector a completed Municipal Storm Drain Permit Application, a list of abutters, three (3) copies of the Municipal Storm Drain Plan Package, and the application and review fees as noted in the Municipal Storm Drain Plan Review Fee Schedule. 2) The applicant shall also file a copy of the Municipal Storm Drain Plan and the application with the Town Clerk. The date of receipt by the Town Clerk shall be the official filing date.

MUNICIPAL STORM DRAIN PERMIT APPLICATION

FEE SCHEDULE

The following fee schedules are minimum fees. *[The Board]* may require higher fees if deemed necessary for proper review of an application or to ensure compliance.

<u>Lot Area</u>	<u>Professional Review Fee</u>	<u>Application Fee</u>
Less Than 3 Acres	\$500.00	\$500.00
3 to 10 Acres	\$1000.00	\$750.00
Greater than 10 Acres	\$1500.00	\$1000.00

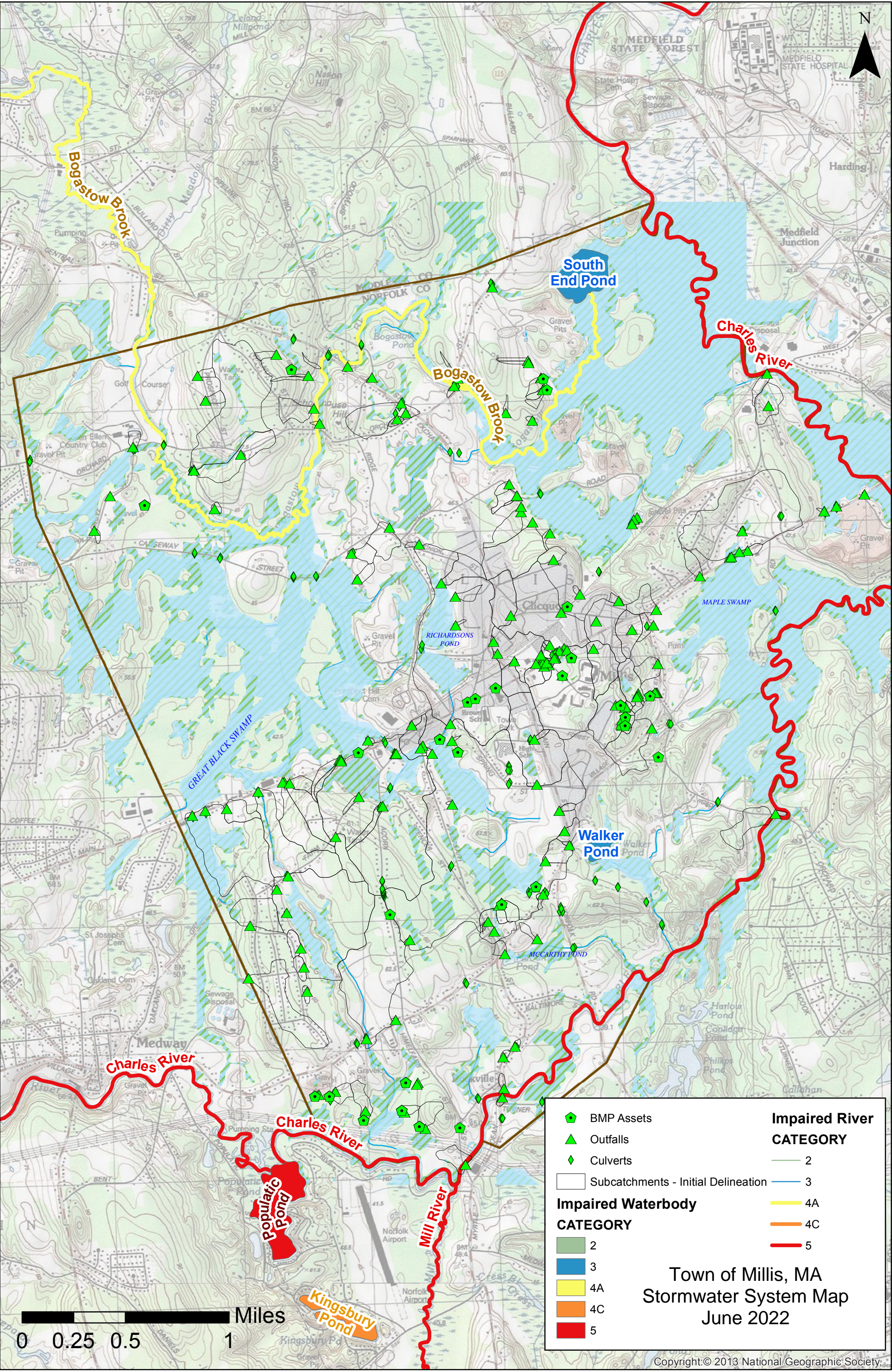
Resubmittal/Amendment	
Filing Fee	\$250.00
Review Fee	\$ at cost determined by the Board


GENERAL


1. Any application not accompanied by the appropriate fee shall be deemed incomplete. Payment must be made to the Town of Millis in cash, money order, bank or certified check payable to the Town.
2. An Applicant's failure to pay any additional review or inspection fee within five business days of receipt of the notice that further fees are required shall be grounds for disapproval.
3. The applicant will publish the public notice and send abutter notifications. Abutter notification shall be by certified mail-return receipt requested. The applicant shall pay all costs associated with the publication and notification requirements. The applicant must provide the Board with the return receipt cards.


Professional review fees include engineering review, legal review, and clerical fees associated with the public hearing and permit processing. A fee estimate may be provided by the Board's consulting engineer.


APPENDIX C
Storm System Mapping





 BMP Assets


 Outfalls


 Culverts


 Subcatchments - Initial Delineation

 2


 3


 4A


 4C


 5


Impaired River
CATEGORY

 2


 3


 4A


 4C


 5


Impaired Waterbody
CATEGORY

 2

 3

 4A

 4C

 5

Town of Millis, MA

Stormwater System Map

June 2022

APPENDIX D
Initial Outfall Ranking

Town of Millis, MA
 Illicit Discharge Detection and Elimination Program
 Outfall Priority Ranking
 Revised: May 2020

POTENTIAL PROBLEM OUTFALLS	
Outfall ID	Priority Level
E-6	PROBLEM

HIGH PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
D-6	HIGH	1	3/28/2019
6	HIGH	2	3/28/2019
B-7	HIGH	2	3/28/2019
D-5	HIGH	4	3/28/2019
C-43	HIGH	5	
33	HIGH	6	
61	HIGH	6	
3	HIGH	8	
31	HIGH	9	
C-21	HIGH	10	
43	HIGH	11	
C-13	HIGH	12	
8	HIGH	13	
51	HIGH	14	
C-44	HIGH	15	
C-25B	HIGH	16	
4	HIGH	17	
17	HIGH	18	
C-11	HIGH	19	
13	HIGH	20	
39	HIGH	21	
A-1	HIGH	22	3/28/2019
56	HIGH	23	
20	HIGH	24	3/28/2019
D-19	HIGH	25	
21	HIGH	26	
C-30	HIGH	27	
9	HIGH	28	

HIGH PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
37	HIGH	29	
2	HIGH	30	
7	HIGH	30	3/28/2019
14	HIGH	30	
15	HIGH	30	
16	HIGH	30	
18	HIGH	30	
22	HIGH	30	3/28/2019
23	HIGH	30	
24	HIGH	30	
29	HIGH	30	
30	HIGH	30	
32	HIGH	30	
34	HIGH	30	
35	HIGH	30	
36	HIGH	30	
40	HIGH	30	
44	HIGH	30	
45	HIGH	30	
46	HIGH	30	
49	HIGH	30	
50	HIGH	30	
52	HIGH	30	
53	HIGH	30	
54	HIGH	30	
55	HIGH	30	
57	HIGH	30	
58	HIGH	30	
59	HIGH	30	
63	HIGH	30	3/28/2019
64	HIGH	30	
B-1	HIGH	30	3/28/2019
B-11	HIGH	30	
B-12	HIGH	30	
B-13	HIGH	30	
B-14	HIGH	30	
B-15	HIGH	30	
B-18	HIGH	30	
B-8	HIGH	30	3/28/2019
C-10	HIGH	30	

HIGH PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
C-12	HIGH	30	
C-14	HIGH	30	
C-19	HIGH	30	
C-23	HIGH	30	
C-45	HIGH	30	
C-46A	HIGH	30	
C-47	HIGH	30	
C-8	HIGH	30	
C-8A	HIGH	30	
C-9	HIGH	30	
D-1	HIGH	30	
D-10	HIGH	30	
D-2	HIGH	30	
D-21	HIGH	30	
D-22	HIGH	30	
D-23	HIGH	30	
D-24	HIGH	30	
D-27	HIGH	30	
D-7	HIGH	30	3/28/2019
D-8	HIGH	30	3/28/2019
F-1	HIGH	30	
G-10	HIGH	30	
G-6	HIGH	30	
G-7	HIGH	30	
G-8	HIGH	30	
G-9	HIGH	30	
E-14	HIGH	123	

LOW PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
47	LOW	30	
12	LOW	97	
48	LOW	98	
F-5	LOW	99	
E-9B	LOW	100	
F-8	LOW	101	
11	LOW	102	

LOW PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
D-16	LOW	103	
28	LOW	104	
66	LOW	105	
E-25	LOW	106	
0	LOW	107	
E-9A	LOW	108	
E-27	LOW	109	
F-9	LOW	110	
D-14	LOW	111	
D-12	LOW	112	
E-10	LOW	113	
41	LOW	114	
D-13	LOW	115	
C-31	LOW	116	
E-29	LOW	117	
F-7	LOW	118	
E-24	LOW	119	
E-26	LOW	120	
38	LOW	121	
F-11	LOW	122	
1	LOW	123	
5	LOW	123	
10	LOW	123	
19	LOW	123	
25	LOW	123	
26	LOW	123	
27	LOW	123	
42	LOW	123	
60	LOW	123	
62	LOW	123	
65	LOW	123	
C-32	LOW	123	
C-33	LOW	123	
C-34	LOW	123	
C-36	LOW	123	
C-36	LOW	123	
C-37	LOW	123	
C-38	LOW	123	
C-39	LOW	123	
C-4	LOW	123	

LOW PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
C-41	LOW	123	
D-11	LOW	123	
D-17	LOW	123	
E-1	LOW	123	
E-16	LOW	123	
E-22	LOW	123	
E-23	LOW	123	
E-28	LOW	123	
E-5	LOW	123	
E-7	LOW	123	
F-3	LOW	123	
F-4	LOW	123	
F-6	LOW	123	
H-2	LOW	123	
I-1A	LOW	123	
I-1B	LOW	123	
I-2	LOW	123	

APPENDIX E
2018 GIS STORMWATER MEMORANDUM



MEMORANDUM

TO: James McKay, Town of Millis
FROM: Betsy Frederick
DATE : June 21, 2018
SUBJECT: 2018 NPDES MS4 Program Assistance: Stormwater System Map
CC: Michael Guzinski, Town Administrator; Andrew Goldberg, Kleinfelder

1 PROJECT BACKGROUND AND PRIOR WORK

Kleinfelder has performed stormwater management services for the Town of Millis since 2014. These services have been predicated both on requirements of the 2003 MS4 General Permit (2003 Permit) and those of the 2016 Permit scheduled to come into effect on July 1, 2018. This task focuses on Town compliance with MS4 System Mapping Phase I requirements described in the 2016 Permit.

Under the 2016 Permit, the Town must develop a stormwater system map intended to facilitate the identification of key infrastructure and factors influencing proper system operation and the potential for illicit sanitary sewer discharges. Mapping requirements under the 2016 Permit are more extensive and must provide greater detail than minimally required under the 2003 Permit. This revised map is to be completed in two phases. The system map required under Phase I, which must be complete within two years of the permit's effective date, must include the following information:

- Outfalls and their receiving waters (was required by 2003 MS4 Permit);
- Open channel conveyances (swales, ditches, etc.);
- Interconnections with other MS4s and others storm sewer systems;
- Municipally-owned stormwater treatment structures (e.g., detention and retention basins, infiltration systems, bioretention areas, water quality swales, gross particle separators, oil/water separators, or other proprietary systems);
- Waterbodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of waters report pursuant to Clean Water Act section 303(d) and 305(b); and,
- Initial catchment delineations. Any available system data and topographic information may be used to produce initial catchment delineations. For the purpose of this permit, a catchment is the area that drains to an individual outfall or interconnection.

Additional system mapping features are required through Phase II mapping requirements. These components are due within 10 years of the effective date of the Permit, though the



Town began collecting this data under the 2003 Permit. The required features of Phase II include:

- Outfall spatial location (accuracy of +/-30 feet)
- Pipes
- Manholes
- Catch basins
- Refined catchment delineations. Catchment delineations shall be updated to reflect information collected during catchment investigations
- Municipal sanitary sewer system (if available)
- Municipal combined sewer system (if applicable).

During the 2003 Permit term, the Town took steps to meet mapping requirements. Much of this work was captured through Geographic Information Systems (GIS) data development performed by engineering firms CEI and GCG. Results of these efforts are described in greater detail in Section 2. Through this scope of work, Kleinfelder performed a review of Millis' (Town provided) stormwater GIS inventory to assess the current status of the Town's GIS data as it relates to 2016 Permit requirements. Following the inventory assessment, Kleinfelder created a new stormwater system base map (2018 Stormwater Map) which integrated prior work performed by previous consultants. The new base map rectified readily apparent errors, inaccuracies or conflicts between the datasets in order to establish current baseline understanding of the system. We additionally recommended a data model (schema) for the Town's drainage system GIS going forward. Upon development of the base map, Kleinfelder identified the steps required to achieve compliance with the 2016 Permit's Phase I mapping requirements and have included these recommendations in Section 3.

1.1 COMPREHENSIVE ENVIRONMENTAL (CEI) INC DATA

In a stormwater planning document dated July of 2003, Comprehensive Environmental Inc. (CEI) provided several of the required elements of the stormwater system map and incorporated them into the Town's Stormwater Management Plan (SWMP). The initial GIS drainage base map was developed using existing plans of the drainage system and interviews with Town employees and included roads, hydrology, resource waters, topography, and drainage sub-basins. The SWMP recommended verification of the location of stormwater features, identification/inventory of unmapped features, and a description of each outfall's discharge location.

CEI made updates and improvements to the drainage map following the development of the SWMP. From 2004-2007, CEI appended this inventory with 27 outfalls, which were GPS-located. Condition data collected through the outfall inspection program was also included in an updated system map which was provided to the Town in 2012. Table 1,



below, provides an inventory of each feature within the CEI database as it relates to the 2016 Final MS4 Permit requirements.

Table 1: CEI Mapped Asset Summary

MS4 System Map Layer	Number of Features
Outfalls & receiving waters	148
Open channel conveyances (culverts)	64
Interconnections with other MS4s and other storm sewer systems	NA
Municipally-owned stormwater treatment structures (BMPs)	32 features (detention ponds)
Water bodies (name and impairments)	Included in IDDE Plan but digitized version unavailable
Initial catchment delineations	Included in IDDE Plan but digitized version unavailable
Drainage Lines (Phase II requirement)	26.27 Miles*
Stormwater Manholes (Phase II requirement)	462 features
Catch Basins (Phase II requirement)	985 features

*Pipe length calculated relative to Mass State Plane coordinate system, due to spatial inconsistency between the datasets, this value may be exaggerated or misleading.

Figure 1 presents the asset inventory provided through the CEI dataset. Water bodies are presented for spatial reference and were not a part of the original dataset.

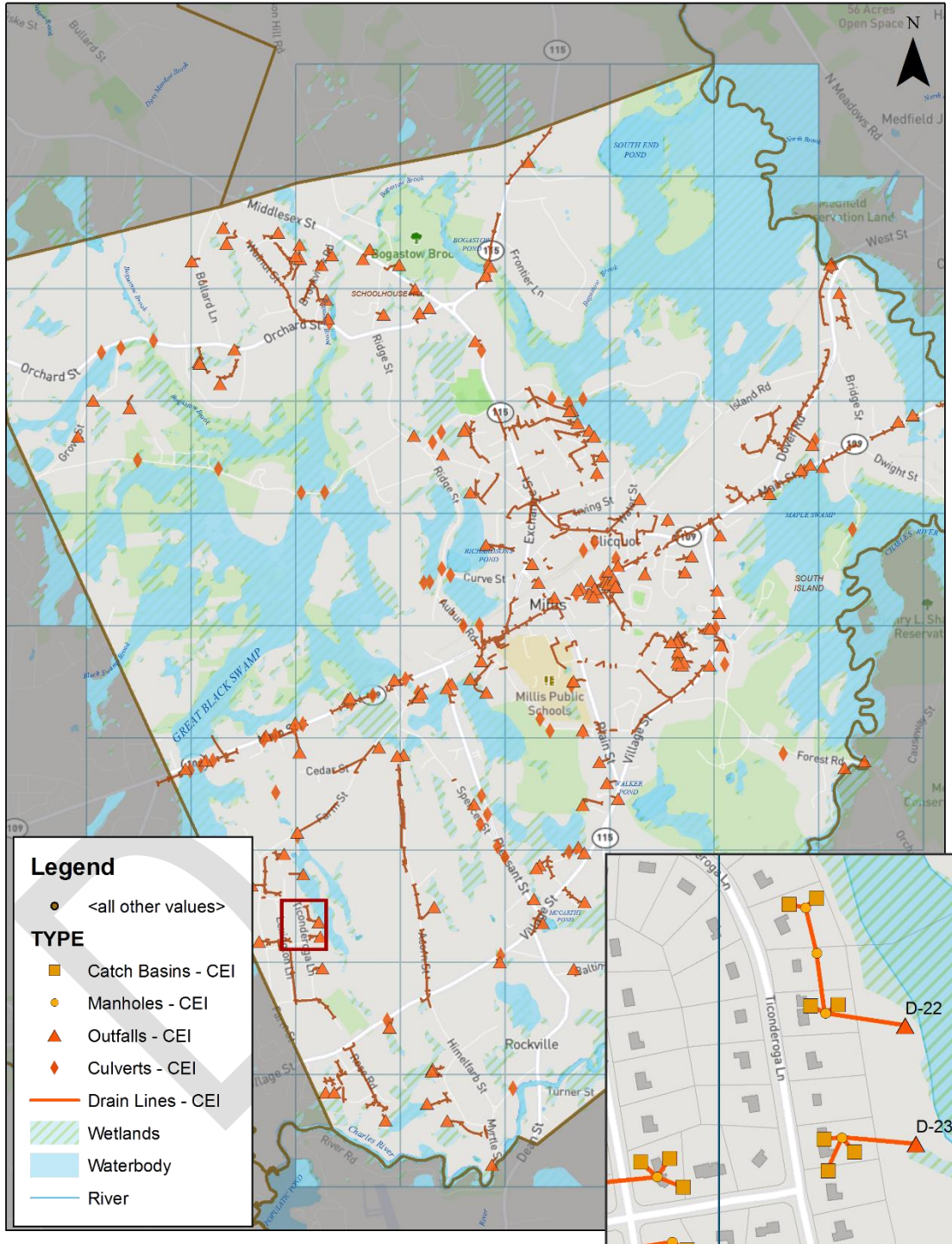


Figure 1: CEI Database

1.1.1 CEI Assets Required Under Phase I

The CEI data contained locations and data for 148 outfalls, 32 BMPs, and 64 culverts. These assets were documented from 2004 to 2007. Each asset type was stored in a layer with the schema as describe below.

A. Outfalls

The “outfalls” shapefile contained a variety of attribute fields. These included physical description of the structure, such as outfall ID, outlet structure type, construction material, diameter, slope and sampling data. Other fields included characterization of surrounding condition, including deposits, vegetation, erosion, odor, observed maintenance activity, weather, and discharge characteristics.

Below is a list of information collected by CEI and documented in the database.

Data collected for all outfalls included:

- Physical characteristics of the outfall
- Physical characteristics of the surrounding area
- GPS location

Data collected related to water samples from four flowing outfalls included:

- Temperature
- pH
- Conductivity
- Total dissolved solids

At three suspected illicit discharges, samples were collected and analyzed for:

- E. coli
- Fecal coliform
- Surfactants
- Ammonia
- Fluoride residual
- Chlorine residual

The CEI outfalls shapefile contains a large number of assets captured with relatively complete data, but there are location inaccuracies and the shapefile does not encompass the entire drainage system. Additionally, in the Illicit Discharge Observations & Investigation Report dated March 19, 2007, CEI reported that 17 outfalls were either not associated with the Town’s MS4, buried with sediment, or unable to be located. A list of these outfalls is provided in Table 3 of the aforementioned report. The Town should collect inventory data on the outfalls that were not able to be inspected previously, as discussed further in Section 3 of this technical memorandum.

B. Best Management Practices (BMPs)

A “detention ponds” shapefile contained 32 point assets with no additional information stored or characterized. The existing CEI schema stored only the location of each feature. Kleinfelder could not verify the location accuracy of the mapped BMPs from aerial images or discussions with the Town. Since this data only stored information on detention basins, Kleinfelder determined that this shapefile is not inclusive of all the BMPs requiring inventory. Typical BMP types include:

- Detention and retention basins
- Swales
- Rain gardens
- Permeable pavement

The majority of the BMPs in the CEI database were located in a southern portion of Millis. With the exception of two of the BMPs, all are located south of Main Street.

C. Culverts

The culverts shapefile contained attribute table fields listing size, material, and slope angle. The CEI culverts shapefile has location inaccuracies and does not include the full system. Figure 2 shows distribution of material type across the inventory and Figure 3 shows the size of culverts in the CEI dataset.

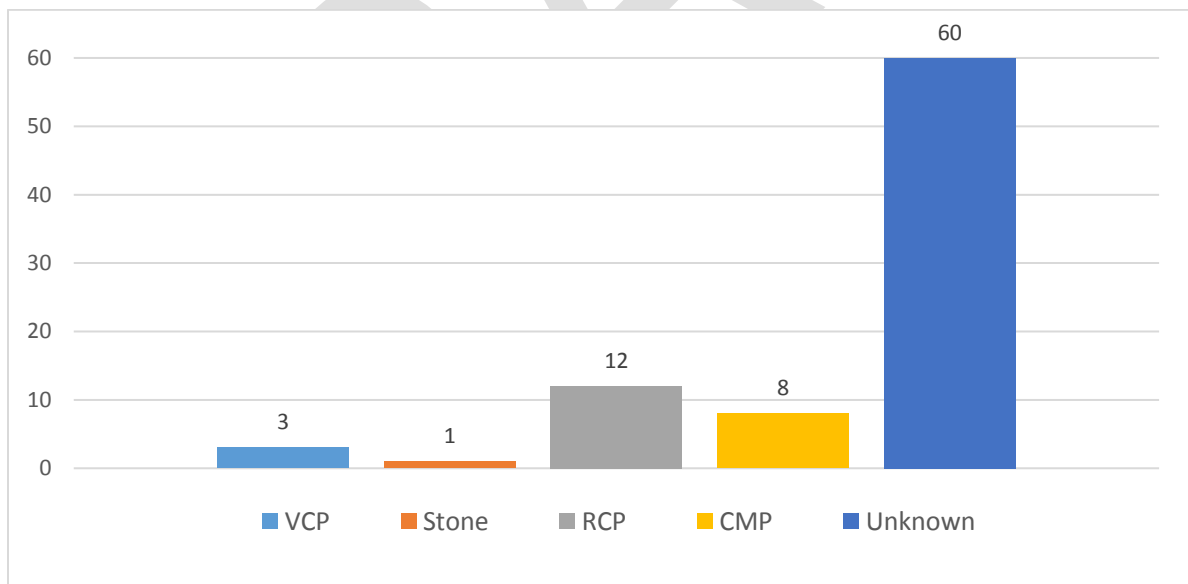


Figure 2: CEI Culvert Materials

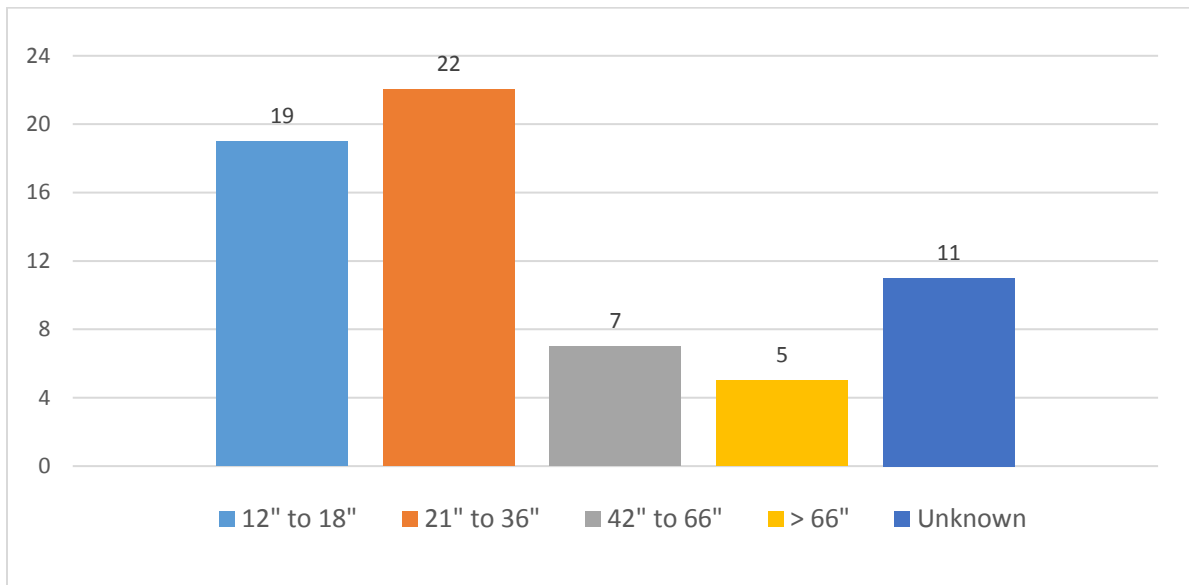


Figure 3: CEI Culvert Sizes

As the figures above show, the material is unknown for 71% of the culverts and the size is unknown for 17% of the culverts.

1.1.2 CEI Assets Required Under Phase II

A. Stormwater Pipes (Drain Lines)

The CEI data contained 1,360 stormwater pipes with a total length of 26.3 miles stored in their own shapefile. The connectivity between pipes and inlet structures (catch basins) or a discharge structures (outfalls) is nearly complete, though in some cases the assets did not line up spatially. There are some instances where a catch basin or outfall is mapped without a drainage pipe connecting, which indicates that drainage pipes are not mapped completely.

The stormwater pipes shapefile contained attribute fields for pipe diameter, length, and material. Figure 4 and Figure 5 show the material types and sizes of the stormwater pipes stored in the CEI dataset.

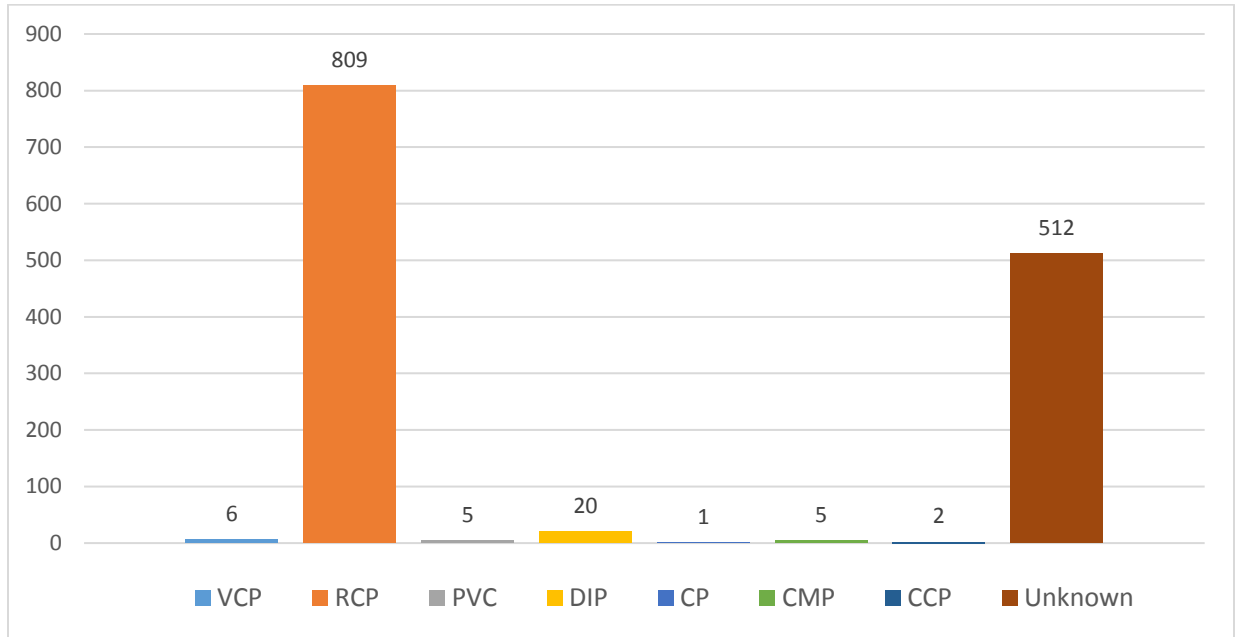


Figure 4: CEI Stormwater Pipe Materials

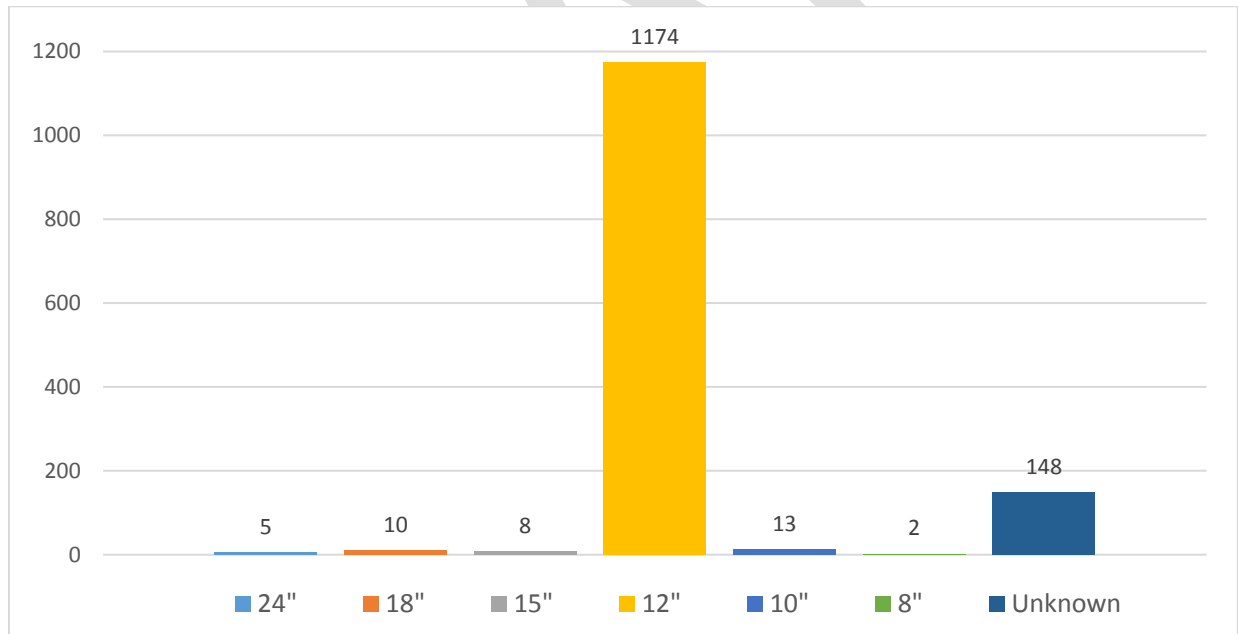


Figure 5: CEI Stormwater Pipe Sizes

Pipe material is unknown for 38% of the stormwater pipes captured in this data and the size is unknown for 11% of the stormwater pipes captured in this data.

B. Manholes and Catch Basins

Stormwater manholes and catch basins were stored in a single, large shapefile titled “drainage structures” containing approximately 1,448 assets. No attribute information about the stormwater manholes or catch basins was stored in the attribute table, beyond a “TYPE” field which distinguished between catch basins and drainage manholes.

1.2 GCG ASSOCIATES DATA

In 2013, GCG Associates (GCG) GPS-located approximately 5,300 sewer and drainage features through a sewer assessment program. Outfalls, catch basins, sewer manholes, drainage manholes, and BMPs were the stormwater features included in this dataset. Of these features, some were duplicative of the information gathered by CEI. Identifiers were different between the two data sets, so matching was inferred based on spatial location and commonalities in attribute data, as described in Section 2. Other features were new as compared to the CEI dataset. Table 2 provides an inventory of each feature within the GCG database as it relates to the 2016 Final MS4 Permit requirements

Table 2: Summary of GCG Asset Mapping

MS4 System Map Layer	Number of Features
Outfalls & receiving waters	229 features
Open channel conveyances (culverts)	83 features
Interconnections with other MS4s and other storm sewer systems	NA
Municipally-owned stormwater treatment structures (BMPs)	3 features
Water bodies (name and impairments)	None
Initial catchment delineations	None
Drainage Lines (Phase II requirement)	12.8 Miles
Stormwater Manholes (Phase II requirement)	567 features
Catch Basins (Phase II requirement)	1114 features

The GCG drainage structures shapefile contained information such as object ID, feature type, date, condition, shape, material, street, presence of flow (at time of inspection), and owner within the attribute table data fields. 1897 stormwater related assets were stored in the same drainage structures shapefile. Kleinfelder separated features by asset type to assess data quality and completeness compared to the CEI dataset and to develop an appropriate schema for data collection.

Figure 6 presents the asset inventory provided in the GCG dataset. Water bodies are presented for spatial reference and were not a part of the original dataset.

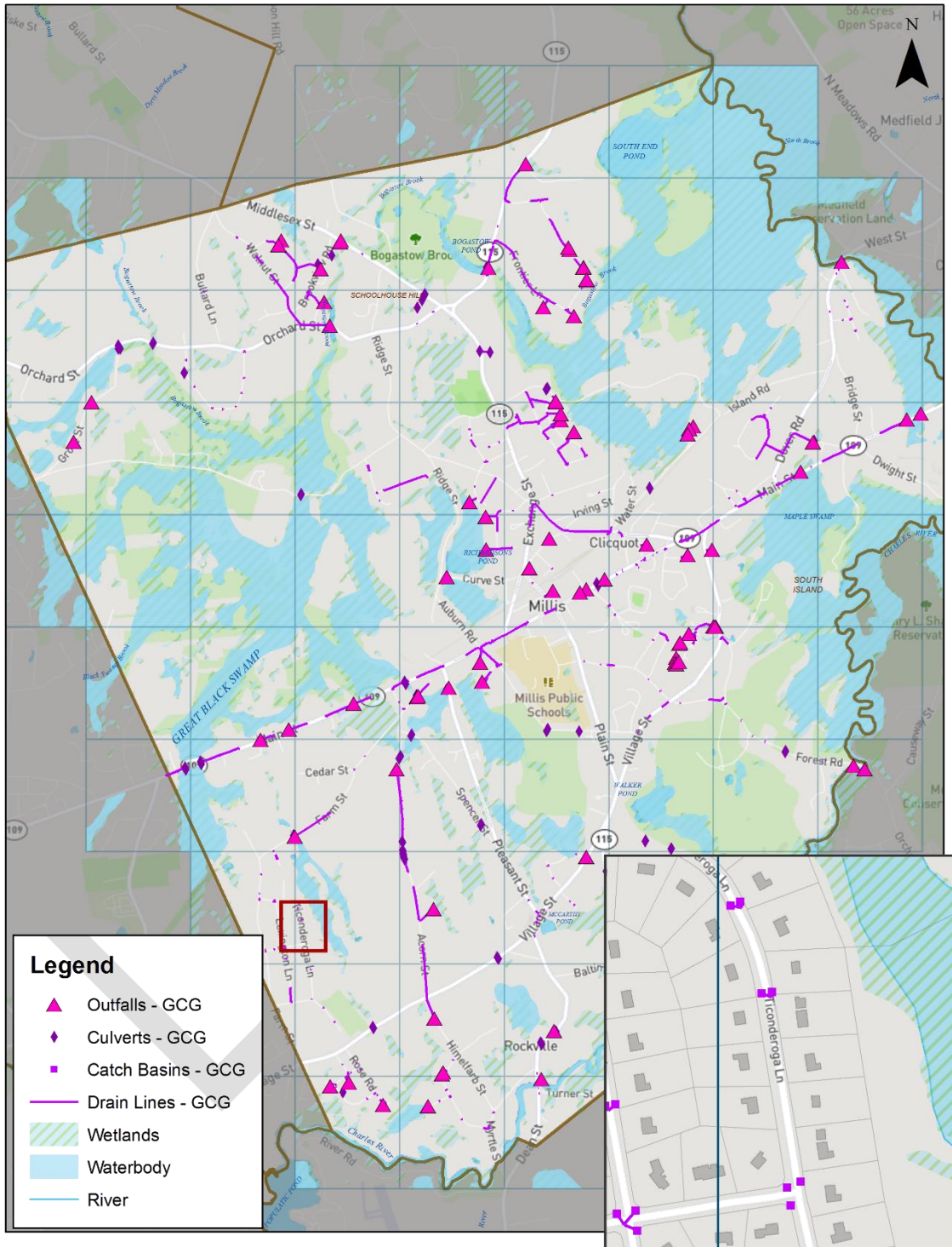


Figure 6: GCG Database

1.2.1 GCG Assets Required Under Phase I

A. Outfalls

Of the 80 outfalls in the GCG data, 72 were listed as Town owned and 8 privately owned. Figure 7 below shows the outfall materials as documented in the GCG data.

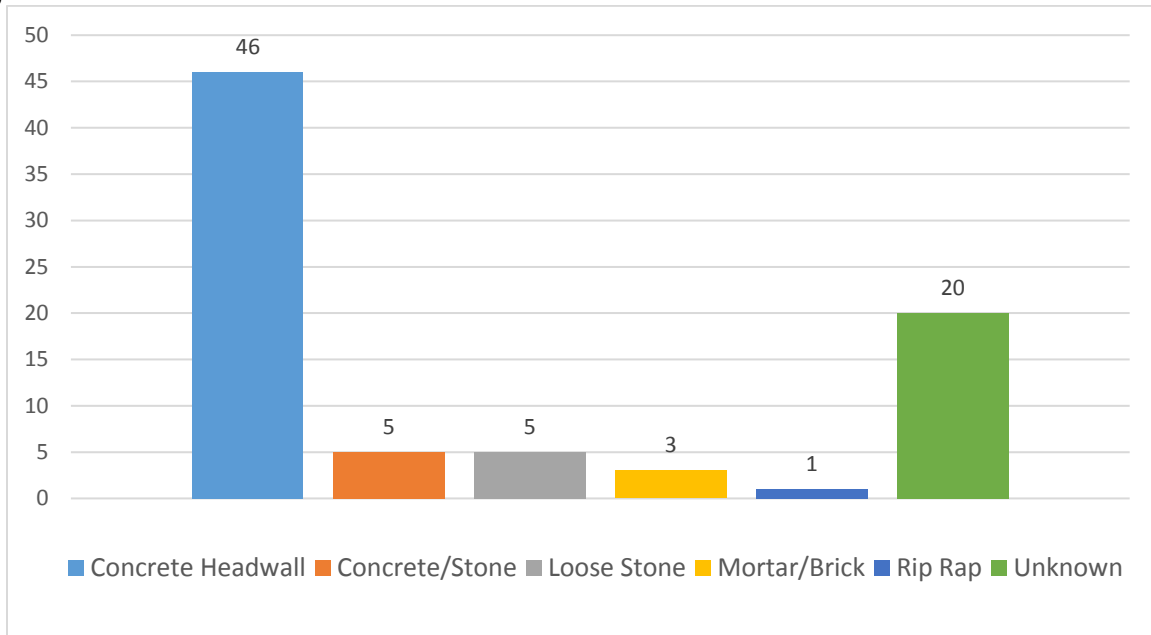


Figure 7: GCG Outfall Material

As the figure above shows, the material is unknown for 25% of the outfalls.

B. Culverts

Of the 83 culvert features in the GCG data, 41 were listed as inlets and 42 as outlets. All of the culverts were listed as Town owned. Figure 8 below shows the culvert materials as documented in the GCG data.

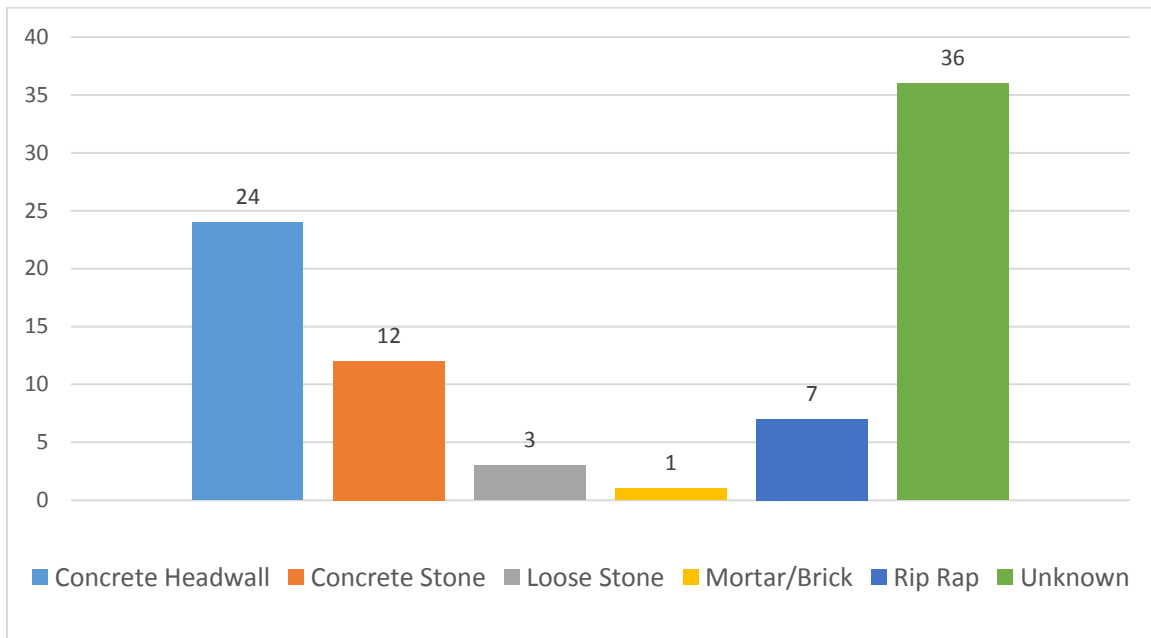


Figure 8: GCG Culvert Materials

As the figure above shows, the material is unknown for 43% of the culverts.

C. Best Management Practices (BMPs)

The GCG data contained 3 BMPs, each listed as a retention pond. The two retention ponds at Beech Street were listed as privately owned. The retention pond at Milliston Road was listed as Town-owned.

1.2.2 GCG Assets Required Under Phase II

A. Stormwater Pipes

The GCG data contained 1,180 stormwater pipes with a total length of 12.8 miles. The GCG stormwater pipes were stored in a separate drainage pipe shapefile. Location data was generally good in terms of accuracy, however the data did not include the entirety of the drainage system. This was evident when compared to the inventory of drainage pipes included in the CEI data. In the figure below, both CEI and GCG show drainage pipes within the extent, however, the GCG data is less complete. Figure 9 is a representative area (Dover Road) depicting the differences between data sets with respect to stormwater pipes. While the GCG catch basins are spatially aligned with the road, this dataset did not include connectivity.

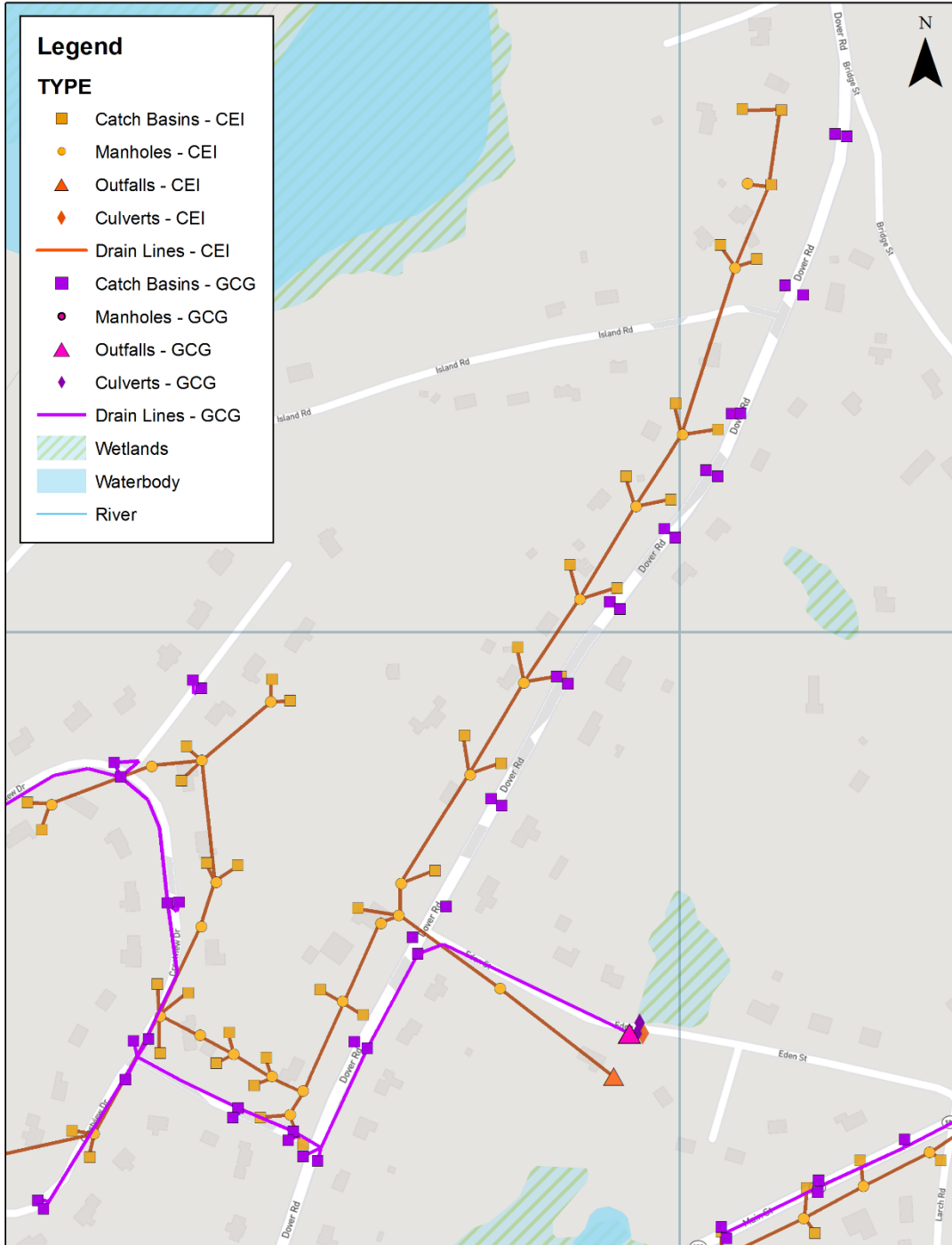


Figure 9: GCG and CEI Stormwater Features at Dover Road

Based on discussions with GCG staff in December 2017, the connectivity of stormwater features was mapped based on observed, rather than inferred, conditions in the field. Kleinfelder therefore assumed that the GCG dataset is accurate in terms of connectivity but is incomplete. Attribute data for these features included pipe diameter, material, condition (as of last inspection), and date of last inspection. Within these pipe assets, diameter was unknown for approximately 52% of drain lines by count, and material unknown for approximately 29%. Since a complete system inventory of drainage pipes was not included in GCG's scope of work, we recommend using the CEI data set as a starting point for developing an updated drainage pipe inventory.

B. Manholes and Catch Basins

The GCG data contained 567 stormwater manholes and 1,114 catch basins. Both stormwater manholes and catch basins were stored in the drainage structures shapefile. GCG referred to stormwater manholes as clean outs in the drainage structures shapefile. The same attributes as the outfalls, culverts, and BMPs was stored for stormwater manholes and catch basins (object ID, feature type, date, condition, shape, material, street, presence of flow, and owner). The location of assets were found to be generally spatially accurate.

1.3 MAPPING ASSESSMENT SUMMARY

Kleinfelder assessed the databases from CEI and GCG and found that the asset inventory, mapped coverage of each feature type, and the current data schema were not suitable for compliance with the MS4 requirements described in Section 1 of this technical memorandum. Kleinfelder determined that the CEI data was more comprehensive than the GCG data in terms of line features. GCG data was more complete in terms of point features, such as catch basins, outfalls, and stormwater manholes. Generally, features were inaccurately positioned with errors ranging from approximately 5 to 100 feet compared to aerial imagery. Overall, attribute data was can be characterized as incomplete but extent of omissions varied by asset type. To improve the Town's stormwater system map, Kleinfelder developed a consolidated stormwater inventory, as described in Section 2. This effort improves the Town's status in terms of compliance with the 2016 Permit and will also assist in future data collection, inspection and rehab tracking, and maintenance of the Town's GIS.

2 2018 STORMWATER MAP

2.1 2018 STORMWATER MAP DATABASE ASSET INVENTORY

At a meeting with Jim McKay on December 20, 2017 Kleinfelder discussed the status of the Town's GIS. Based on Kleinfelder's assessment of the existing system map, Kleinfelder recommended that the datasets should be consolidated and managed within

one system map. Kleinfelder created a new database from the existing shapefiles and changes, corrections, and additions to the GIS were performed within this database. Table 3 provides a summary of the inventory of each feature contained within the 2018 Stormwater Map database, as it relates to the 2016 Final MS4 Permit requirements.

Table 3: 2018 Stormwater Map Database Data

MS4 System Map Layer	Description
Outfalls & receiving waters	162 features
Open channel conveyances (culverts)	143 features
Interconnections with other MS4s and other storm sewer systems	NA
Municipally-owned stormwater treatment structures (BMPs)	79 features
Water bodies (name and impairments)	All 2014 Integrated List of Waterbodies
Initial catchment delineations	162 Features
Drainage Lines (Phase II requirement)	Est. 20 Miles
Stormwater Manholes (Phase II requirement)	734 features
Catch Basins (Phase II requirement)	1149 features

2.2 OVERVIEW OF THE DATABASE CONSOLIDATION PROCESS

The first step to create the 2018 Stormwater Map database was to consolidate information from both the CEI and GCG databases and address incomplete, contradictory or inaccurate information between them. Initially, Kleinfelder separated the features by asset type. For example, in the GCG database, multiple asset types were included in a single shapefile, however, stored data is different between outfalls (material, diameter, etc.), BMPs (manufacturer, capacity, year installed, etc.), and catch basins (depth, grate type, etc.). By storing these features in independent feature classes, attribute tables can be designed to better track and organize the relevant fields for each asset type.

The database consolidation process had multiple steps. First, shapefiles that included more than one asset type (e.g. manholes and catch basins) were created as separate shapefiles containing a single asset type. Second, assets were consolidated by asset type. Where assets existed in both data sets, pertinent attribute data was transferred and the duplicate asset was removed. This was an asset-by-asset approach that required detailed attention. Finally, where drainage lines were present, missing outfalls were added in an approximate spatial location based on areal imagery and engineering judgement. Since connectivity could not be determined from this desktop assessment, these connectivity repairs will require site verification and additional data collection.

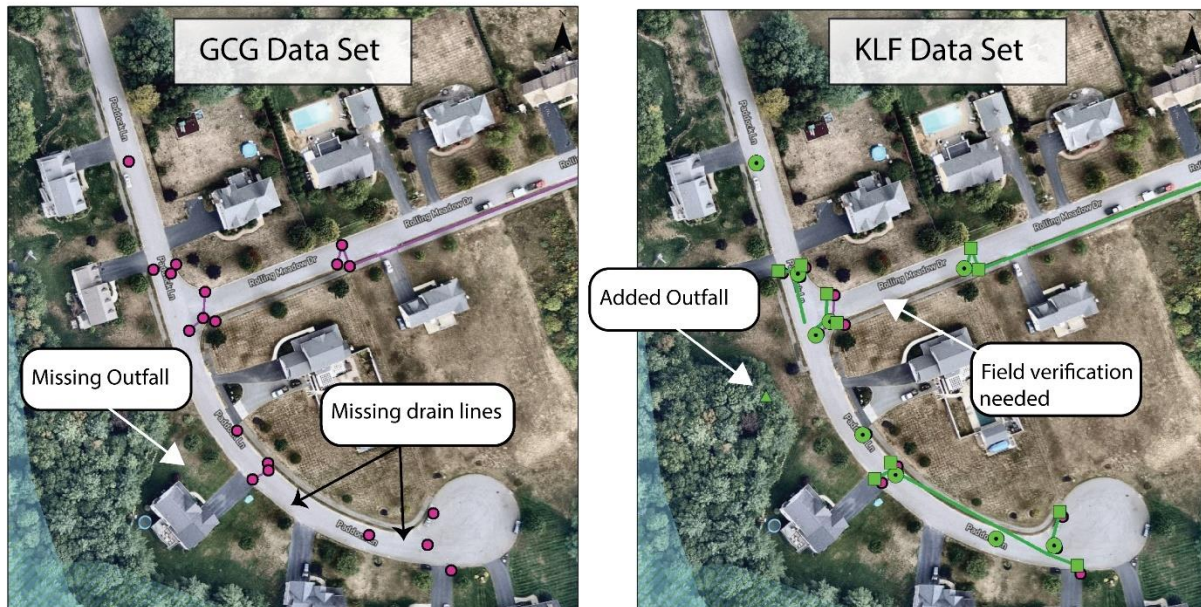


Figure 10: Example of Database Development Process

To correct location and connectivity of features, Kleinfelder performed a visual verification for the documented outfalls and catch basin locations using aerial imagery and Google Street View. GCG point features were found to be relatively accurate based on the aerial images and were used to geographically position the assets within the 2018 Stormwater Map database. Kleinfelder attempted several methods of batch correcting the spatial alignment of this data using the Spatial Adjustment toolbox in ArcGIS; however, this was unsuccessful since errors were not constant across the system. Kleinfelder manually adjusted the spatial location of features from the GCG dataset and aligned these features based on areal imagery. Connectivity of features was recreated based on the CEI data as well as a review of areal imagery, where possible.

Kleinfelder developed a schema for the 2018 Stormwater Map database that is consistent to meet the requirements of the 2016 MS4 Permit. Fields were populated with preexisting attribute information collected by CEI and GCG, where possible. The schema is provided as Appendix B of this memorandum. Attribute data for each modified feature was incorporated into the new 2018 Stormwater Map database. Since the data collected by CEI differed from GCG, when a feature was stored in only one dataset, the asset may be missing certain attribute data in the 2018 System Map database.

Table 4 compares the number of features across the three datasets and provides a qualitative (good, fair, poor, none) analysis of completeness of attribute data compared to the 2018 System Map schema.

Table 4: Comparison of Asset Inventory and Completeness of Attribute Data by Source

Asset Type	CEI Data		GCG Data		2018 Stormwater Map Database	
	Count / Length	Attribute Data	Count / Length	Attribute Data	Count / Length	Attribute Data
Outfalls	148	Good (~100%)	309	Fair (26%)	162	Fair (54%)
Open channel conveyances (culverts)	64	Fair	83	Fair	143	Fair
BMPs	32	Poor	3	Fair	79	Poor
Stormwater Manholes	463	None	567	Poor	734	Poor
Drain Pipes	1,360 pipes 26.3 miles	Fair (62%)	1,180 pipes 12.8 miles	Fair (70%)	1,488 pipes 20 miles	Fair (56%)
Catch Basins	985	None	1114	Good	1149	Good (97%)

The integration process for each asset type is detailed below and each asset is explained further in the following sections.

2.3 OUTFALLS, CATCH BASINS, AND MANHOLES

In the 2018 Stormwater System Map, 162 outfalls, 734 stormwater manholes, and 1,149 catch basins were consolidated and incorporated into the 2018 Stormwater Map database. Based on the desktop analysis, we believe these asset types are located accurately and contain accurate attribute data. Catch basins and manholes are not required until Phase II of the MS4 General Permit, but updates and location corrections were made in the process of updating the outfalls.

Kleinfelder initially based asset locations for these assets from the GCG data. These assets were then checked using aerial imagery and Google Street View. The location of features found to be incorrectly located were corrected based on the available imagery. Kleinfelder used the connectivity logic from the CEI dataset to re-create (where possible) connectivity, using corrected spatial data, based on a combination of GCG points, and visual inspection using Google areal and street-level imagery. Existing attribute data from the CEI dataset was transferred over to the corresponding assets in the new database wherever possible.

Figure 11 and Figure 12 show the 2018 Stormwater Map database, referred to as KLF in the legend, overlaid on the old CEI data. These figures show the changes that were made in regards to location of assets and the shape of the drainage system. GCG data was not included in these figures as GCG asset locations were the same or close to the 2018 Stormwater Map database assets and would have overlapped.

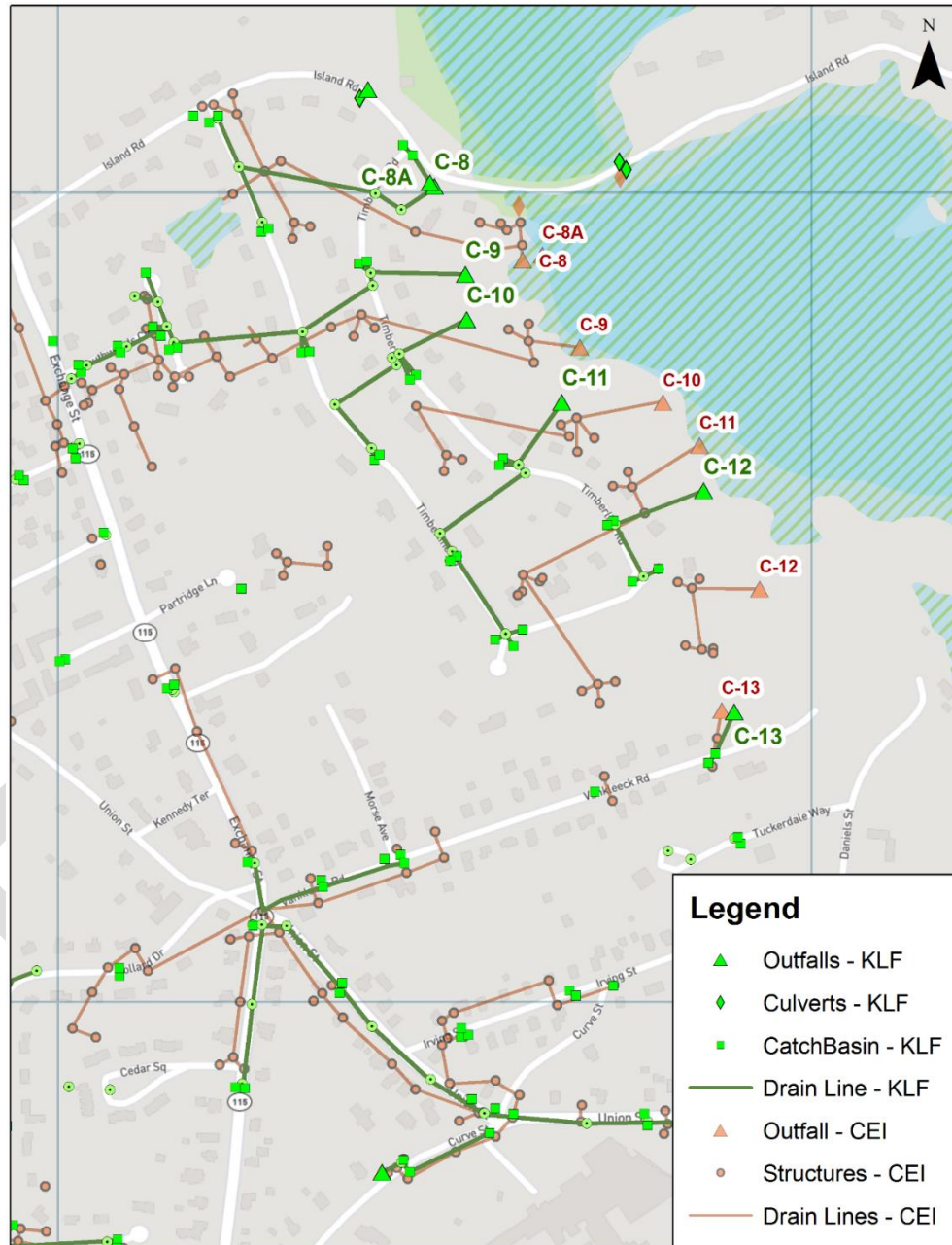


Figure 11: 2018 Stormwater Map Database vs CEI Database

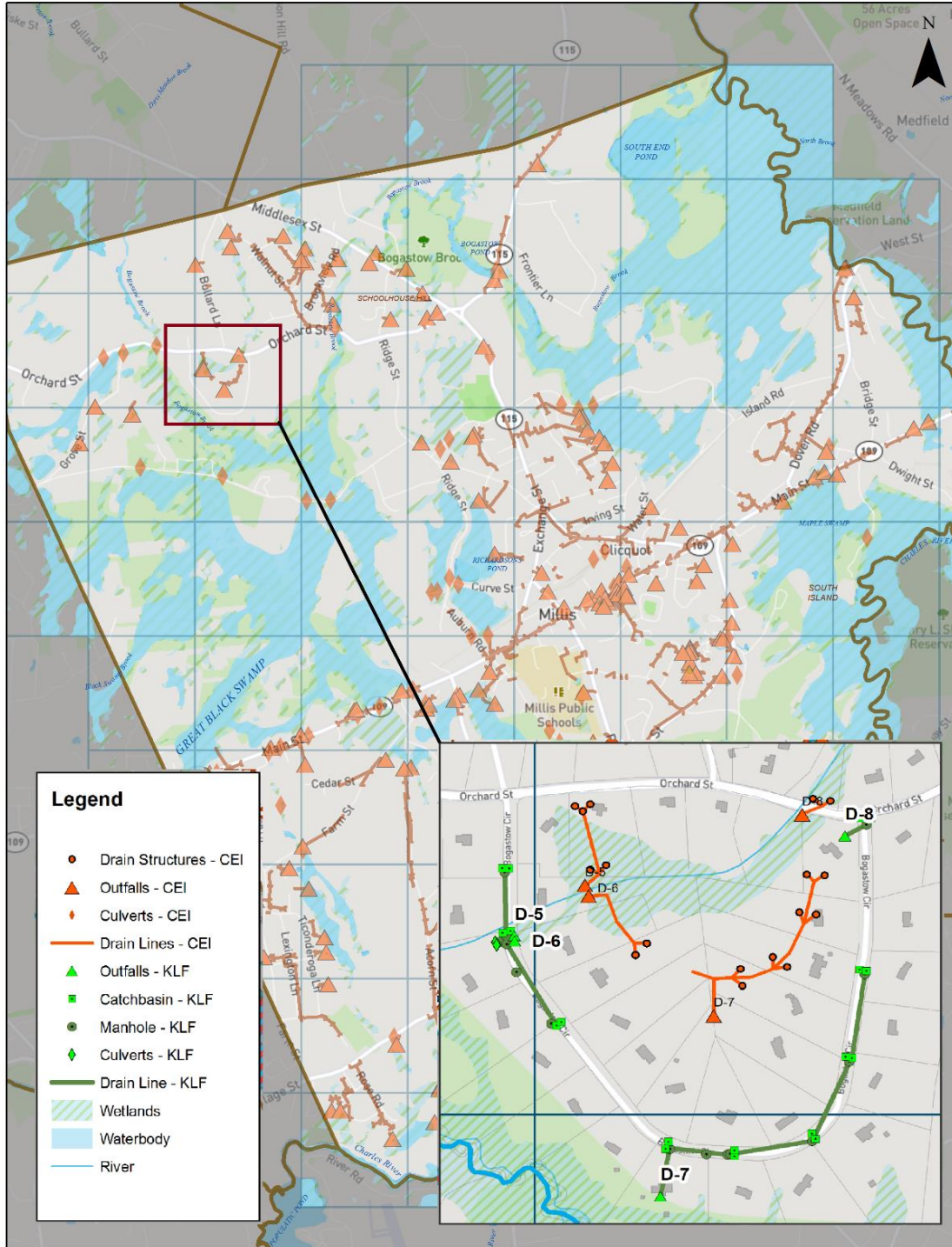


Figure 12: 2018 Stormwater Map Database vs CEI Database

2.4 CULVERTS

143 culverts were updated and brought into the 2018 Stormwater Map database. Initially, Kleinfelder identified pipes in the GCG data that went across roads where there were no catch basins. Then, if CEI data showed culverts in the area, they were added at the ends of the pipe, to a new shapefile, in the 2018 Stormwater Map database. . Our methodology assumed that if CEI included culvert locations and these were in the vicinity of GCG documented pipes under/across roads, we added these as culverts to the 2018 Stormwater Map database.

There are also more complicated scenarios where catch basins appear to discharge to waterbodies near culverts. In these instances the connectivity is not obvious and therefore assumptions regarding such connectivity were not made. These locations will require field verification. Figure 14 shows the location of culverts within the 2018 Stormwater Map database.

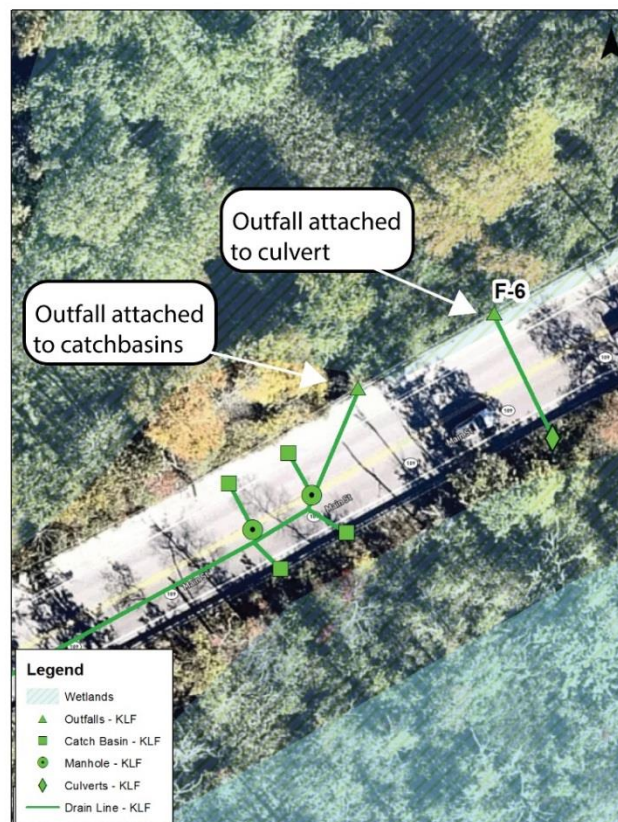


Figure 13: Manual correction of feature type was required based on connectivity

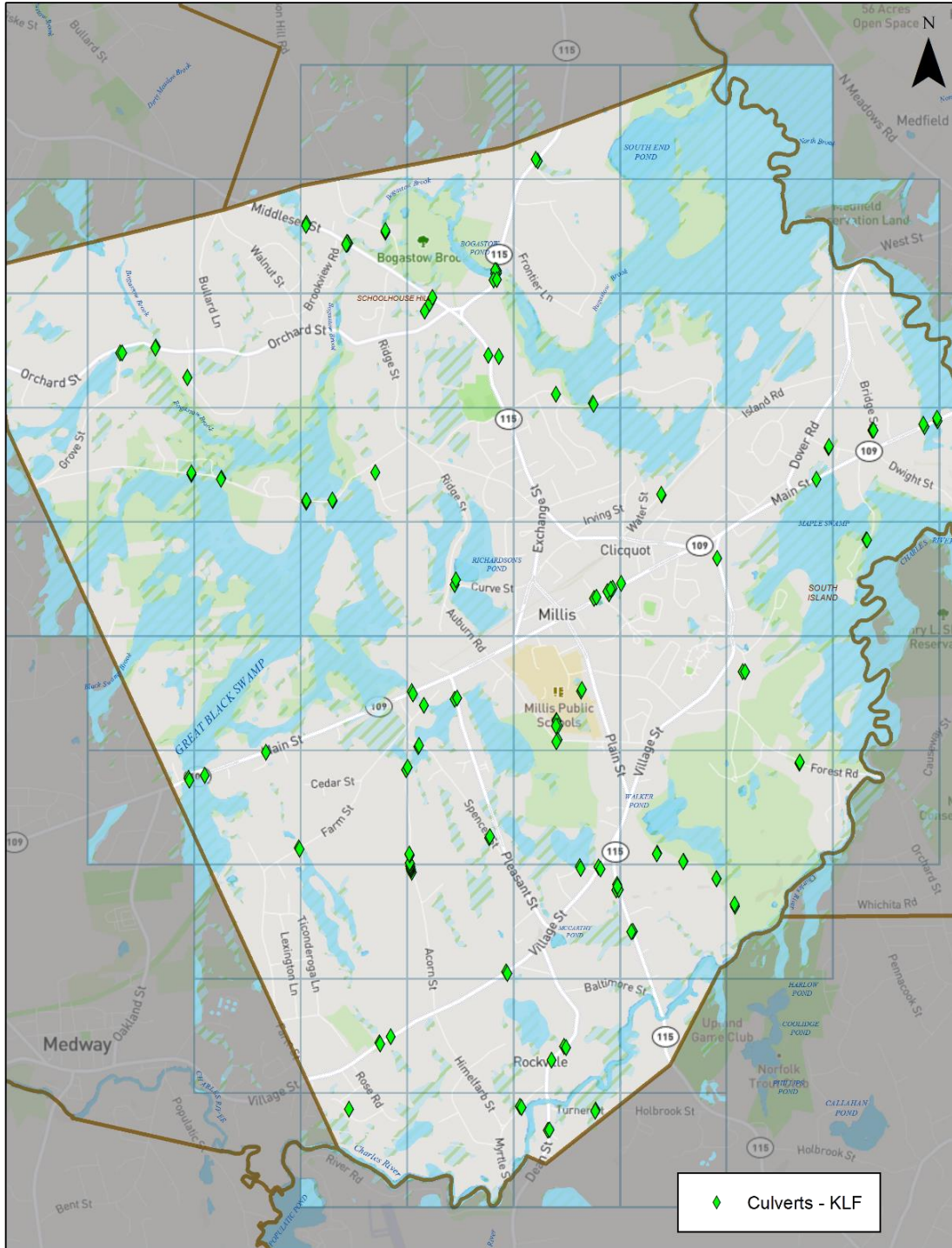


Figure 14: Culvert Locations in the 2018 Stormwater Map



2.5 PRELIMINARY DELINIATION OF CATCHMENT AREAS

Phase I mapping in the 2016 Permit requires an initial delineation of stormwater catchment areas. Kleinfelder performed initial catchment delineations based on available digital elevation data from MassGIS. Kleinfelder imported the digital elevation data from MassGIS into PCSWMM, a hydraulic modeling software, and used it to create initial catchment areas for each outfall. Kleinfelder imported the catchment areas into GIS and made minor manual corrections to the extent of catchment areas based on topography. The resulting preliminary delineation is included as a layer in the 2018 Stormwater Map database.

These catchment areas are acceptable under Phase I, but will need to be updated for Phase II compliance. At this time, the 2018 Stormwater Map lacks a sufficiently complete understanding of the connectivity of Millis' stormwater system. Once a greater understanding of the stormwater connectivity has been achieved, these initial catchment areas must be adjusted to reflect stormwater captured within the system and discharged to a specific outfall. Each initial delineation should be reviewed against topography contour data as well as any drainage areas captured by upstream catch basins that are routed to the outfall. The MS4 program recognizes that this is an iterative process based on new information received over time and in the course of field investigation.

Until this refined layer is developed, the delineations created with PCSWMM will provide a general idea of how the final catchment delineations will look. The delineation serves multiple purposes. It provides critical information for IDDE investigations and identification of illicit discharge sources. It is also the basis for prioritization of IDDE investigations. For that reason, as new information is uncovered regarding catchment extents, connectivity and system condition, re-prioritization of catchments is an anticipated result of program implementation. It is important to have an accurate understanding of how much area and what land uses are contributing to each outfall and catchment delineations provide this information.

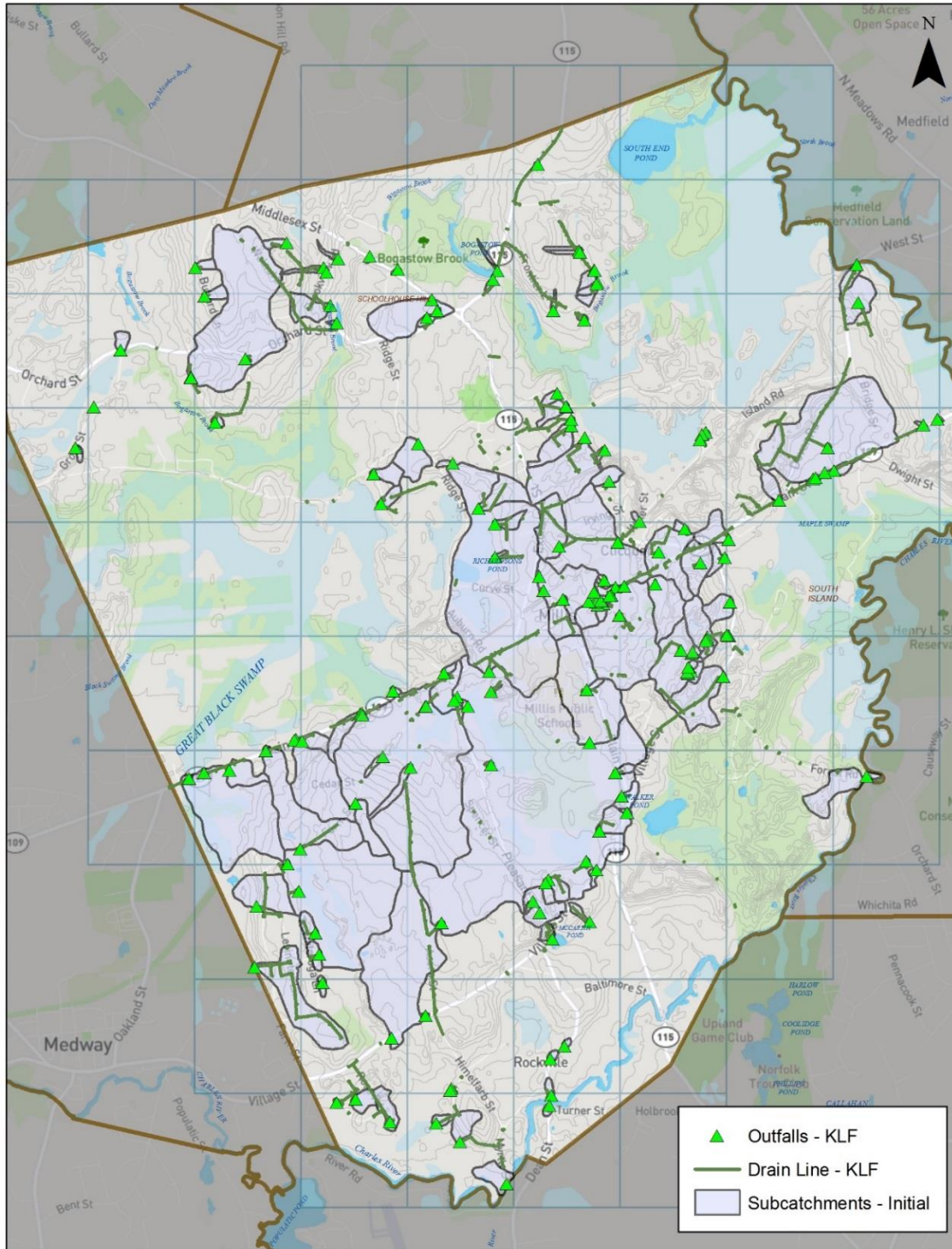


Figure 15: Preliminary Subcatchment Delineations

2.6 BEST MANAGEMENT PRACTICES (BMPS)

Kleinfelder incorporated information on the location of Town-owned stormwater BMPs as provided by Jim McKay on February 20, 2018. In total, 14 additional town owned BMPs were identified including six (6) underground storm chambers, five (5) closed underground chambers, two (2) open retention areas, and one (1) open swale with sump basins. Kleinfelder located 13 of these BMPS by address and added them to the 2018 Stormwater Map database. One underground storm chamber at Lincoln Street could not be located and we will require further information from the Town regarding its location.

All Town-owned BMPs will require data collection to record their types, sizes, materials, and any other important physical characteristics. These BMPs were combined with the 35 additional BMPs included in CEI and GCG's inventories.

Typically, for proper operations and maintenance tracking, it is helpful to document the BMP type, location, year installed, and capacity for each BMP. Since this data is not readily available, these assets were grouped as one layer.

Figure 16 shows the location of these BMPs. Note that many of the features are located at the same spatial location currently and therefore overlap within the figure.

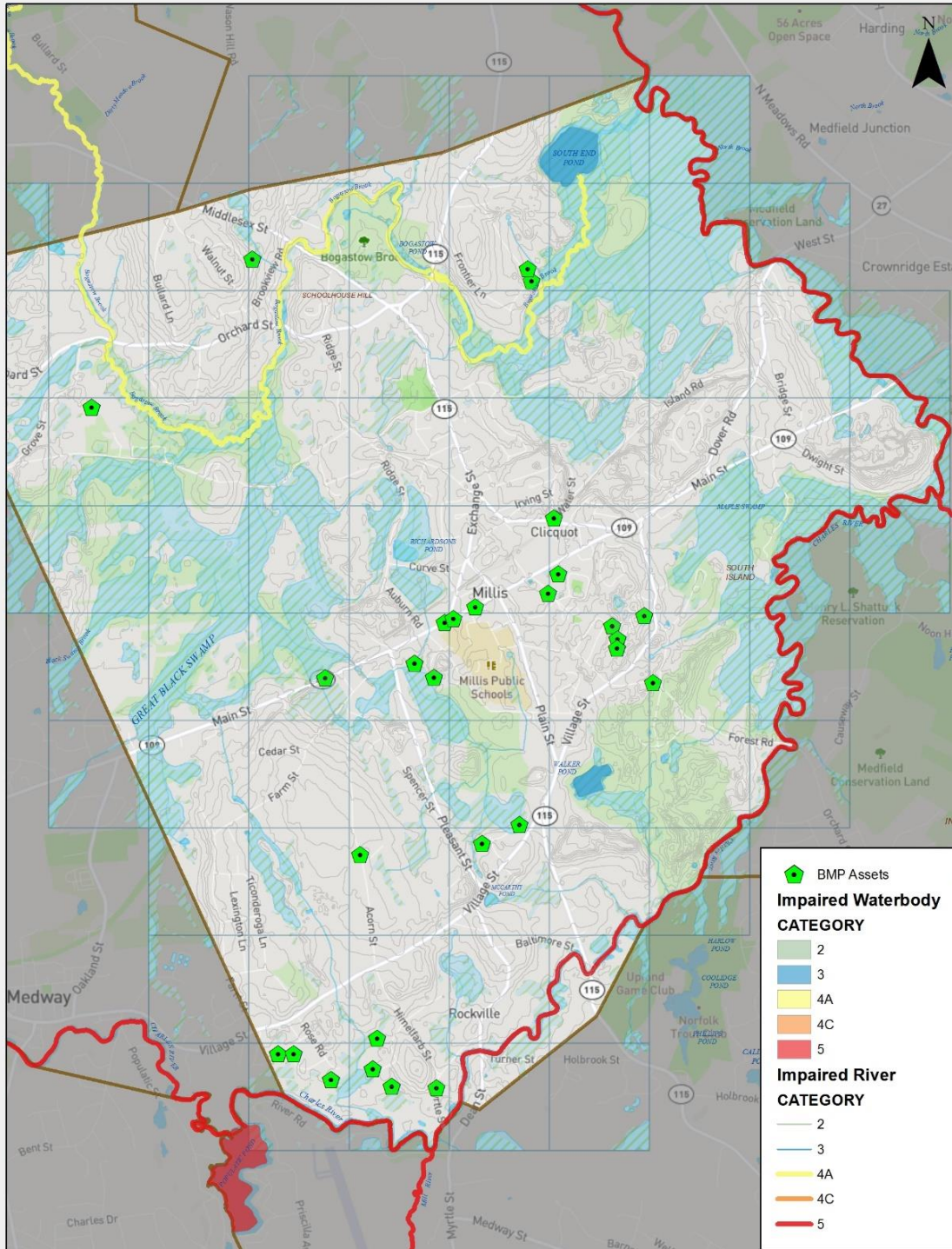


Figure 16: Town Owned BMPs Added to 2018 Stormwater Map Database

2.7 IMPAIRED WATERBODIES

Phase I of the 2016 Permit requires water bodies to be identified along with any impairments. Three components regarding waterbodies are included 2016 Permit:

- Water quality-based effluent limitations (WQBEL)
- Discharges to certain impaired waters that have Total Maximum Daily Loads (TMDLs)
- Requirements to reduce pollutants to the maximum extent practicable

The WQBEL requirement “includes provisions to ensure that discharges from the MS4 do not cause or contribute to an exceedance of water quality standards.” TMDLs are put into place when a water body is impaired to the point that it can no longer support its designated use. TMDLs are legally enforceable and set specific mass load allocations for the pollutant causing the impairments to all permitted point sources discharging to the tributary waterways. The Town of Millis is required to develop a Phosphorus Control Plan which describes the ways the Town will reduce the amount of phosphorus discharged from its MS4 to the Charles River and its tributaries.

Table 5 lists the impaired water bodies within Millis according to the Massachusetts Integrated Water Bodies List.

Table 5: Impaired Waterbodies in Millis

Water Body	Impairment	Impairment Classification
Charles River	TMDL for Phosphorus	5 ¹
Bogastow Brook	Fecal Coliform	4A ²
¹ Category 5 – Impaired or threatened by pollutant(s) for one or more designated uses and requiring a TMDL. These are the waters entered onto a states’ 303(d) list. ² Category 4A – Impaired or threatened for one or more uses but not needing a TMDL because one has been completed.		

Kleinfelder imported water bodies and impaired waterbodies layers from MassGIS. An additional 2016 MS4 General Permit requirement is that all outfalls have their receiving water bodies identified.

Kleinfelder created a new field within the outfalls shapefile to store the name of the respective receiving water body as they were identified. Kleinfelder also created a field to flag impaired water bodies. The following figure shows the location of impaired water bodies within Millis.

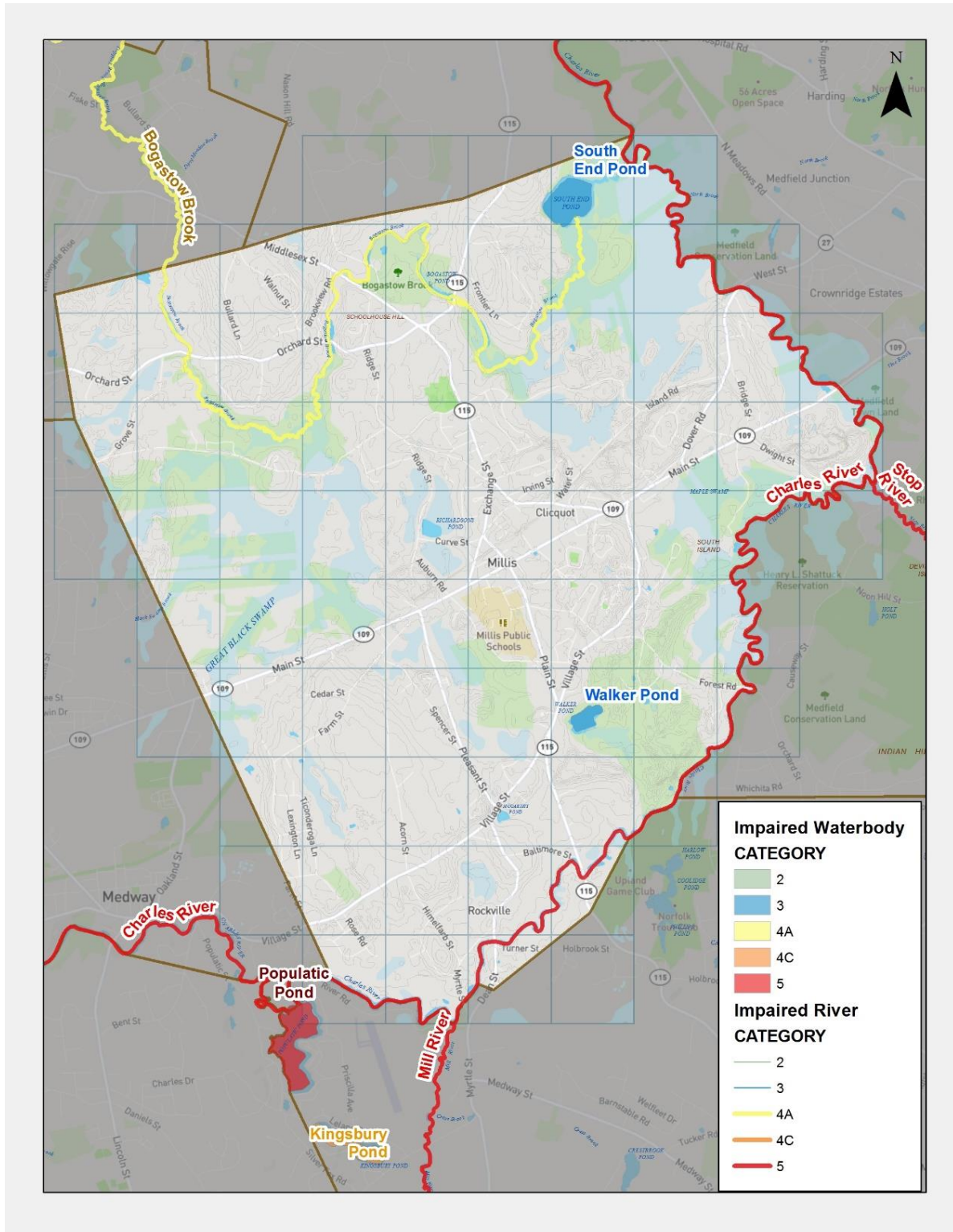


Figure 17: Impaired Waterways in Millis, MA (2014 Integrated List of Waters)

3 SUMMARY AND RECOMMENDATIONS

The following sub-sections describe a summary and near-term recommendations related to the Town's Stormwater System Map.

3.1 MS4 SYSTEM MAPPING REQUIREMENTS AND RECOMMENDATIONS

The layers listed in the table below were included in the Town's Stormwater system map to meet the Phase I and Phase II mapping requirements. The rightmost column lists recommended next steps to improve the accuracy and completeness of the existing inventory.

MS4 System Map Layer	Mapping completed under existing 2018 MS4 contract	Actions for Task 1	Additional Recommended Inventory Actions
Outfalls & receiving waters	Consolidated data sets, corrected spatial location, developed schema, and transferred culverted outfalls to culverts layer	Populate each outfall's receiving water body in GIS	Priority rank each outfall through Town's IDDE program and field verify attributes and locations
Open channel conveyances (culverts)	Consolidated data sets, corrected geometry of inlets and outlets, and developed schema	Add estimated geometry of culverted pipes	Field verify attributes and locations through catchment investigations
Interconnections with other MS4s and other storm sewer systems	NA	NA	Add interconnections to GIS, if identified
Municipally-owned stormwater treatment structures (BMPs)	Added town-owned BMPs to GIS at 7 approximate locations using ESRI's address geocoding service	Confirm completeness of inventory, develop schema, populate fields using additional data provided by Town, and correct spatial location	None
Water bodies (name and impairments)	Added water bodies and impairments based on 2014 Integrated List of Waters (CWA Section 303d)	None	None

MS4 System Map Layer	Mapping completed under existing 2018 MS4 contract	Actions for Task 1	Additional Recommended Inventory Actions
Initial catchment delineations	Developed initial catchment delineation using topography and available drainage inventory using PCSWMM	None	Refine delineation based on improved inventory
Drainage Lines (Phase II requirement)	Corrected geometry to center of roads	Correct geometry and connectivity based on findings of Task 3	Correct geometry and connectivity across the drainage system
Stormwater Manholes (Phase II requirement)	Incorporated data	None	Add new manholes, as needed
Catch Basins (Phase II requirement)	Incorporated data	None	Collect inventory data through catch basin cleanout program

3.2 DATA MAINTENANCE AND COLLECTION

Proper maintenance of the 2018 Stormwater Map database will allow for more efficient planning, budgeting, and system maintenance in the future. Maintenance includes regularly updating the database when new stormwater infrastructure is built or when existing infrastructure is changed. The highest priority is the collection of asset GPS coordinates and associated attribute data for assets that are not currently within the database.

We recommend that data collection should focus in two areas. High priority areas, based on the function of the drainage system should drive the collection of missing or out-of-date information. Additionally, efforts could focus on collecting inventory data in areas that appear to be incomplete. Potential data collection methods are described below.

To ensure that as data is collected it can be maintained and incorporated into a work management system, we also recommend that a unique identifier be assigned to each asset and asset type.

3.3 DATA COLLECTION METHODS

3.3.1 Catch Basin Cleanouts

Kleinfelder recommends that the Town collect attribute and condition data through the catch basin cleanout program. The spatial location of catch basins should be verified in the field at the time of cleaning. Additional data, such as depth to sediment and depth to bottom of catch basin can be collected to assess how full an asset is at the time of inspection. These values can be used to optimize the frequency of maintenance, as required by the 2016 Permit.

3.3.2 Outfall Inspections

The Town plans to conduct outfall inspections in accordance with the Permit requirements. The outfall prioritization process should incorporate the best available information from the 2018 system map as well as the findings and recommendations from the Illicit Discharge Observations & Investigations memorandum provided by CEI on March 27, 2007. Through the outfall investigation process, the Town's asset inventory should be updated for accuracy and completeness.

3.3.3 Best Management Practices (BMPs)

The MS4 Permit requires that stormwater BMPs be inventoried within two years of the Permit's effective date and inspected on an annual basis. The Town should confirm that the inventory of BMPs is accurate and complete. Additional modifications to the schema may support the collection of data related to the type of BMP, capacity, and year installed, as examples. This information should be populated through a review of record plans or field based inspection.

3.3.4 Condition Assessment of Drainage Pipes

Understanding the condition and connectivity of the drainage system is critical to accurately delineating catchment areas, understanding if pipes are sized correctly, and understanding how much stormwater runoff each water body receives after a precipitation event. Additionally, having an accurate and up to date inventory of all stormwater pipes will improve planning, budgeting, and efforts to maintain the system going forward.

For pipes where connectivity is incomplete or undetermined, Kleinfelder recommends conducting a condition assessment (using CCTV or similar technology). A condition inspection program will provide insights on the remaining service life of pipes and will validate Capital Improvement needs and recommendations. This information can be used



to develop more cost effective rehabilitation projects that address the highest priority locations. An approach to begin this process is described further through a Proposal for Drainage Infrastructure Improvement Plan and Pilot Investigation dated June 6, 2018.

DRAFT



APPENDICES

Appendix A: 2018 Stormwater Geodatabase Hierarchy and Schema
Appendix B: 2018 Stormwater Geodatabase Data Dictionary

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APPENDIX A: 2018 STORMWATER GEODATABASE HIERARCHY AND SCHEMA

- **Basemap**
 - Buildings (Building footprint polygons)
 - Hydro25k (Water body polygons)
 - Hydro25kLine (Water body lines / rivers)
 - WetlandAreas (MassGIS Wetland Area polygons)
 - Wetlands (MassGIS Wetland Area polygons, clipped)
 - Roads (MassGIS roads)
 - Topo Contours (MassGIS Contours)
 - Town Boundary (Town boundary line)
 - Town Boundary Poly (Town boundary polygon)
 - Town_Grid_10 (KLF created Grid, each cell approx. 1000x1000ft)
- **Legacy** (copies of previous data, as-received)
 - GCG Outfalls
 - CEI Stormwater Structures
 - CEI Detention Ponds
 - CEI Outfalls
 - GCG Stormwater Structures
 - GCG Outfalls
- **MS4**
 - MA_Integrated_List_Water_Line (Impaired Rivers)
 - MA_Integrated_List_Water_Poly (Impaired waterbodies)
 - Subcatchments KLF (KLF Initial Subcatchment Delineation)
- **Stormwater**
 - CatchBasin (KLF Version)
 - Culverts (KLF Version)
 - DrainLine (KLF Version)
 - Manhole (KLF Version)
 - Outfalls (KLF Version)
 - BMP Assets (KLF Version)
- **TaxParcels**
 - Tax Parcels (FY17 Boundary)



APPENDIX B: 2018 STORMWATER GEODATABASE DATA DICTIONARY

Outfalls

Note: **Highlighted text** represent inspection fields which ideally should not be stored in GIS as they get written over after every inspection. While these fields have not been removed, the Town should consider moving the inspection data to a work management or alternative data storage system.

Field Name	Data Type	Description	KLF Recommendation
OBJECTID_1 *	Numeric	Generated from most recent merge	Replace with final ID or keep as is
OBJECTID	Numeric	OID from GCG Points	Delete
Shape *	N/A	Generic field	Keep as is
OUTFALL_ID	Text	CEI outfall ID Code	Keep, update for assets which are missing
GPS_COLLE2	Date	Date collected (CEI)	Keep for records or delete
GPS_COLLEC	Time	Time Collected	Delete
OBSERVER	Text	Says "CEI" if was found by CEI	Keep for records or delete
DEPOSITS	Text	Records if trash, sediment, oil grease found	Keep for records
VEGETATION	Text	Records vegetation in vicinity?	Keep for records or delete. Likely outdated
ERODIBILIT	Text	Records erosion status	Keep for records or delete. Likely outdated
SURROUNDIN	Text	Residential / Commercial status of nearby area	Update for missing
ODOR	Text	Fields are either Null or None	Delete
SEDIMENT_D	Numeric	Sediment Depth?	
MAINTENANC	Text	Maintenance. Some assets have "Cleaning" but rest are null or none.	Keep for records or delete. Likely outdated



Field Name	Data Type	Description	KLF Recommendation
DIAMETER	Numeric	Outfall diameter in inches	Update for missing from CEI data or field investigation
PIPE_MATER	Text	Pipe Material	Update for missing from CEI data or field investigation
PERFORATED	Text	Unsure, no field has any input.	Delete
PIPE_CONDI	Text	Condition at last inspection	Would need to be updated based on latest inspections
SLOPE	Text	Grades slope as flat, moderate, steep, or unknown	Update for missing assets
OUTLET_STR	Text	Describes outlet type (Headwall, Flared end, etc.)	Update for missing from CEI data or field investigation
DRY_WEATHE	Yes/No	Dry weather discharge from last inspection	
DISCHARGE_	Yes/No	Wet weather discharge from last inspection	
FLOW_APPEA	Text	Flow Appearance from last sample, values for clear, sheen, etc. Not well populated	Update from latest inspections
FLOW_DEPTH	Numeric	Depth at discharge point? Not well populated	Update from latest inspections
SAMPLE_BOT	Yes/No	Unknown	
SAMPLING_D	Date	Date last sampled	Not well populated, either update for new inspections or remove
SAMPLING_T	Time	Time last sampled	Not well populated, either update for new inspections or remove
FLOW_TEMPE	Numeric	Temperature in degrees C. Not well populated	Not well populated, either update for new inspections or remove
PH	Numeric	pH value from last sample	Not well populated, either update for new inspections or remove
TDS	Numeric	Total Dissolved Solids from last sample	Not well populated, either update for new inspections or remove
CONDUCTIVI		Conductivity from last sample	



Field Name	Data Type	Description	KLF Recommendation
COMMENT	Text	Comment Field	Includes comments on access conditions or noted. Keep
E_COLI		E. coli sample results from last sample	
FECAL		Fecal coliform sample results from last sample	
AMMONIA		Ammonia sample results from last sample	
SURFACTANT		Surfactant sample results from last sample	
FLUORIDE		Fluoride sample results from last sample	
CHLORINE		Chlorine sample results from last sample	
Field_A		Unknown	
MS4_PriorityLevel	Numeric	MS4 Priority Level	KLF Created. Needs to be populated.
MS4_ExcludedYN	Yes/No	If the asset is included or excluded from MS4	KLF Created. Needs to be populated.
ReceivingWaterBody	Text	Receiving Water body in this field	KLF Created. Populated by KLF.
NearestRoad	Text	Nearest town roadway (for access and ID)	KLF Created.

Culverts

Field Name	Data Type	Description	KLF Recommendation
OBJECTID	Numeric	Object ID (default)	
Shape *	N/A	Default ESRI Field	
Loc_Date	Date	Date located	
Loc_Insp	Text	Initials of Inspector (If Inspected)	
Loc_Meth	Text	GPS/Manual/Etc	

Field Name	Data Type	Description	KLF Recommendation
Edit_Date	Date	Last Edit Date	
Edit_Insp	Text	Unknown	
FeatType	Text	Defines feature type (example: Culvert Outlet)	
Condition	Text	Condition from last inspection	
Cover_Cond	Text	Cover condition from last inspection (if applicable)	
Cover_Shap	Text	Cover shape (if applicable)	
Primary_Ma	Text	Primary Material (example: Concrete/Stone)	
Secondary_	Text	Secondary Material (if applicable)	
Street	Text	Nearest Street	
Intersecti	N/A	Nearest intersection	
Flow	Text	Flow Observed	
Owner	Text	Owner (Town/Private)	
DPW_ID	Numeric	DPW_ID (Not populated)	
Comment	Text	Comments from field observation	

Catch Basins

Field Name	Data Type	Description	KLF Recommendation
OBJECTID *	Numeric	Default GIS Field	
Shape *	N/A	Default GIS Field	
Loc_Date	Date	Date located	
Loc_Insp	Text	Initials of Inspector (If Inspected)	
Loc_Meth	Text	GPS/Manual/Etc	
Edit_Date	Date	Last Edit Date	
Edit_Insp	Text	Unknown	
FeatType	Text	Defines feature type (example: Culvert Outlet)	



Field Name	Data Type	Description	KLF Recommendation
Condition	Text	Condition from last inspection	
Cover_Cond	Text	Cover condition from last inspection (if applicable)	
Cover_Shap	Text	Cover shape	
Primary_Ma	Text	Primary Material (example: Concrete/Stone)	
Secondary_	Text	Secondary Material (if applicable)	
Street	Text	Nearest Street	
Intersecti	Text	Nearest Intersection	
Flow	Text	Flow Observed (Yes/No)	
Owner	Text	Owner (Town/Private)	
DPW_ID	Numeric	DPW_ID (Not populated)	
Comment	Text	Comments from field observation	

Storm Drain Lines

Field Name	Data Type	Description	KLF Recommendation
OBJECTID	Numeric	Default GIS Field	
Shape *	N/A	Default GIS Field	
FromStruct	Numeric	Designates Connecting MH	Update with new asset ID
ToStruct	Numeric	Designates Connecting MH	Update with new asset ID
Loc_Date	Date	Date located	
Loc_Insp	Text	Initials of Inspector (If Inspected)	
Edit_Date	Date	Last Edit Date	
Edit_Insp	Text	Unknown	
LengthFt	Numeric	Length (Feet)	
FeatType	Text	Defines feature type (example: Culvert Outlet)	



Field Name	Data Type	Description	KLF Recommendation
Diameter	Numeric	Diameter (inches)	
Pipe_Mater	Text	Material (example: Reinforced Concrete)	
Pipe_Condi	Text	Condition Rating (example: good)	
Owner	Text	Owner (Town/Private)	
Comment	Text	Comments	
Shape_Length	Numeric	Auto Calculated length (GIS)	

BMP Assets

Note: This is a preliminary schema which should be updated as additional data is available

Field Name	Data Type	Description	KLF Recommendation
OBJECTID *	Numeric	Asset ID field	
Town_owned	Text	Description of Town-Owned BMP	
Address	Text	Nearest Address	
Parcel	Text	Parcel ID of containing parcel	Updated as needed
Descriptio	Text	Description of BMP asset	
Owner	Text	Owner (Town/Private)	

Impaired Waterbody

Field Name	Data Type	Description	KLF Recommendation
OBJECTID	Numeric	Default GIS Field	
Shape *	N/A	Default GIS Field	
WBID_2012	MA36065_2012	Assessment Unit ID (AU_ID) with the reporting cycle year.	
WATERSHED	Text	Containing Watershed	
WATERBODY	Text	Waterbody Name	
AU_ID	Text	ID Field	

Field Name	Data Type	Description	KLF Recommendation
LOCATION1	Text	Town Name	
LOCATION2	Text	Continuation of the location description if LOCATION1 exceeds 254 characters.	
WATERCODE	Text	MassDEP Water Code	
WATERTYPE	FRESHWATER LAKE	MassDEP Water Type (example: Freshwater Lake)	
AU_SIZE	15	Size of the water body segment	
SIZE_UNIT	ACRES	Water body size units: - Miles (Rivers) - Acres (Lakes) - Square Miles (Estuaries)	
CLASS	A	Water body class as defined in the Massachusetts Surface Water Quality Standards (314 CMR 4.00)	
QUALIFIER	PWS\ORW	Class qualifiers (e.g., WWF [warm water fishery], CWF [cold water fishery], etc.) assigned to water body as defined in the Massachusetts Surface Water Quality Standards (314 CMR 4.00).	
CATEGORY	Numeric	MassDEP Impairment Category (2,3,4A,4C,5)	
TMDL_COUNT	Numeric	Count of TMDL's	
Shape_Length	Numeric	Area of perimeter	
Shape_Area	Numeric	Area of polygon	

Impaired Rivers

Field Name	Data Type	Description	KLF Recommendation
OBJECTID	Numeric	Default GIS Field	
Shape *	N/A	Default GIS Field	
WBID_2012	MA36065_2012	Assessment Unit ID (AU_ID) with the reporting cycle year.	
WATERSHED	Text	Containing Watershed	

Field Name	Data Type	Description	KLF Recommendation
WATERBODY	Text	Waterbody Name	
AU_ID	Text	ID Field	
LOCATION1	Text	Description of river location (segment)	
LOCATION2	Text	Continuation of the location description if LOCATION1 exceeds 254 characters.	
WATERCODE	Text	MassDEP Water Code	
WATERTYPE	FRESHWATER LAKE	MassDEP Water Type (example: Freshwater Lake)	
AU_SIZE	15	Size of the water body segment	
SIZE_UNIT	MILES	Water body size units: - Miles (Rivers) - Acres (Lakes) - Square Miles (Estuaries)	
CLASS	B\WWF	Water body class as defined in the Massachusetts Surface Water Quality Standards (314 CMR 4.00)	
QUALIFIER	CSO	Class qualifiers (e.g., WWF [warm water fishery], CWF [cold water fishery], etc.) assigned to water body as defined in the Massachusetts Surface Water Quality Standards (314 CMR 4.00).	
CATEGORY	Text	Impairment Category (2,3,4A,4C,5)	
TMDL_COUNT	Numeric	Count of TMDL's	
Shape_Length	Numeric	Length of river segment	

Graphics Disclaimer:

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APPENDIX F
Inspection Field Forms and Sampling Procedures

OUTFALL INVENTORY FIELD SHEET

Section 1: Background Data

City/Town:	Street:	Tax Map #:	Outfall ID: OF-
Owner: <input type="checkbox"/> City <input type="checkbox"/> State <input type="checkbox"/> Private <input type="checkbox"/> Other: _____		Nearest House/Utility Pole #:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.): Last 24 hours: Last 48 hours:		
Northing:	Easting:	GPS Unit:	GPS LMK #:
Rim Elevation:	Invert Elevation:		
Elevation Datum:	Receiving Water:		
Camera:	Photo #s: -- Take 1 Upstream (head on) and 1 Downstream view		
Land Use in Drainage Area (Check all that apply):			
<input type="checkbox"/> Industrial		<input type="checkbox"/> Open Space	
<input type="checkbox"/> Urban Residential		<input type="checkbox"/> Institutional	
<input type="checkbox"/> Suburban Residential		Other: _____	
<input type="checkbox"/> Commercial		Known Industries: _____	
Notes (e.g., origin of outfall, if known):			

Section 2: Outfall Description

TYPE	MATERIAL	SHAPE		DIMENSIONS (IN.)	SUBMERGED
<input type="checkbox"/> Closed Pipe	<input type="checkbox"/> RCP <input type="checkbox"/> CMP <input type="checkbox"/> PVC <input type="checkbox"/> HDPE <input type="checkbox"/> Steel <input type="checkbox"/> Other: _____	<input type="checkbox"/> Circular <input type="checkbox"/> Elliptical <input type="checkbox"/> Box <input type="checkbox"/> Other: _____	<input type="checkbox"/> Single <input type="checkbox"/> Double <input type="checkbox"/> Triple <input type="checkbox"/> Other: _____	Diameter/Dimensions: _____ _____	In Water: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully With Sediment: <input type="checkbox"/> No <input type="checkbox"/> Partially <input type="checkbox"/> Fully
<input type="checkbox"/> Open drainage	<input type="checkbox"/> Concrete <input type="checkbox"/> Pavement/Scupper <input type="checkbox"/> Earthen <input type="checkbox"/> rip-rap <input type="checkbox"/> Other: _____	<input type="checkbox"/> Trapezoid <input type="checkbox"/> Parabolic <input type="checkbox"/> Other: _____		Depth: _____ Top Width: _____ Bottom Width: _____	
Flow Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <i>If No, Skip to Section 3. If Yes, Notify Town and continue field reconnaissance.</i>				
Flow Description (If present)	<input type="checkbox"/> Trickle <input type="checkbox"/> Moderate <input type="checkbox"/> Substantial			Flow Direction (If Present):	

Section 3: Sketch

Outfall Inventory Field Sheet

Section 4: Physical Indicators for Flowing Outfalls Only

Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No (If No, Skip to Section 5)

INDICATOR	CHECK if Present	DESCRIPTION	RELATIVE SEVERITY INDEX (1-3)		
Odor	<input type="checkbox"/>	<input type="checkbox"/> Sewage <input type="checkbox"/> Rancid/sour <input type="checkbox"/> Petroleum/gas <input type="checkbox"/> Sulfide <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Faint	<input type="checkbox"/> 2 – Easily detected	<input type="checkbox"/> 3 – Noticeable from a distance
Color	<input type="checkbox"/>	<input type="checkbox"/> Clear <input type="checkbox"/> Brown <input type="checkbox"/> Gray <input type="checkbox"/> Yellow <input type="checkbox"/> Green <input type="checkbox"/> Orange <input type="checkbox"/> Red <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Faint colors in outfall flow	<input type="checkbox"/> 2 – Clearly visible in outfall flow	<input type="checkbox"/> 3 – Clearly visible in outfall flow
Turbidity	<input type="checkbox"/>	See severity	<input type="checkbox"/> 1 – Slight cloudiness	<input type="checkbox"/> 2 – Cloudy	<input type="checkbox"/> 3 – Opaque
Floatables -Does Not Include Trash!!	<input type="checkbox"/>	<input type="checkbox"/> Sewage (Toilet Paper, etc.) <input type="checkbox"/> Suds <input type="checkbox"/> Petroleum (oil sheen) <input type="checkbox"/> Other:	<input type="checkbox"/> 1 – Few/slight; origin not obvious	<input type="checkbox"/> 2 – Some; indications of origin (e.g., possible suds or oil sheen)	<input type="checkbox"/> 3 – Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls

Are physical indicators that are not related to flow present? ☐ Yes ☐ No (If No, Skip to Section 6)

INDICATOR	CHECK if Present	DESCRIPTION	COMMENTS
Outfall Damage	<input type="checkbox"/>	<input type="checkbox"/> Spalling, Cracking or Chipping <input type="checkbox"/> Peeling Paint <input type="checkbox"/> Corrosion	
Deposits/Stains	<input type="checkbox"/>	<input type="checkbox"/> Oily <input type="checkbox"/> Flow Line <input type="checkbox"/> Paint <input type="checkbox"/> Other:	
Abnormal Vegetation	<input type="checkbox"/>	<input type="checkbox"/> Excessive <input type="checkbox"/> Inhibited	
Poor pool quality	<input type="checkbox"/>	<input type="checkbox"/> Odors <input type="checkbox"/> Colors <input type="checkbox"/> Floatables <input type="checkbox"/> Oil Sheen <input type="checkbox"/> Suds <input type="checkbox"/> Excessive Algae <input type="checkbox"/> Other:	
Pipe benthic growth	<input type="checkbox"/>	<input type="checkbox"/> Brown <input type="checkbox"/> Orange <input type="checkbox"/> Green <input type="checkbox"/> Other:	

Section 6: Potential for Illicit Discharge

<input type="checkbox"/> Unlikely <input type="checkbox"/> Potential (presence of two or more indicators) <input type="checkbox"/> Suspect (one or more indicators with a severity of 3) <input type="checkbox"/> Obvious

Section 7: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?



Ammonia Nitrogen Test Kit

NI-SA (2428700)

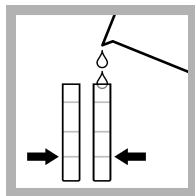
DOC326.98.00007

Test preparation

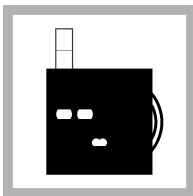
CAUTION: ⚠️ *Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.*

- Put the color disc on the center pin in the color comparator box (numbers to the front).
- Use sunlight or a lamp as a light source to find the color match with the color comparator box.
- Rinse the tubes with sample before the test. Rinse the tubes with deionized water after the test.
- If the color match is between two segments, use the value that is in the middle of the two segments.
- If the color disc becomes wet internally, pull apart the flat plastic sides to open the color disc. Remove the thin inner disc. Dry all parts with a soft cloth. Assemble when fully dry.
- To verify the test accuracy, use a standard solution as the sample.
- This test kit is for seawater. If used for brackish or fresh water, the test kit gives a higher than actual value. The error in brackish water is usually less than 10%. The error in low salinity or fresh water is a maximum 16%.
- This test is very sensitive to contamination. Try to get the same result on a second test. Fully rinse the tubes with fresh sample before the second test. The reagents clean the tubes during the first test.
- To increase the range of this test to 4 mg/L $\text{NH}_3\text{-N}$, dilute the sample as follows. Use a 3-mL syringe to add 2.5 mL of sample to each tube. Dilute the sample to the 5-mL mark with deionized water. Use the diluted sample in the test procedure and multiply the result by 2.

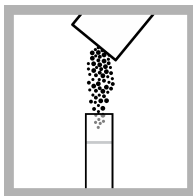
Test procedure—Ammonia-nitrogen (0–2.0 mg/L $\text{NH}_3\text{-N}$)



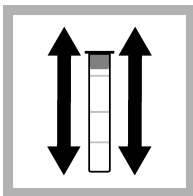
1. Fill two tubes to the first line (5 mL) with sample.



2. Put one tube into the left opening of the color comparator box.



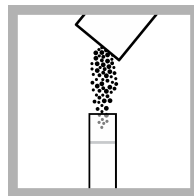
3. Add one Ammonia Salicylate Reagent Powder Pillow to the second tube.



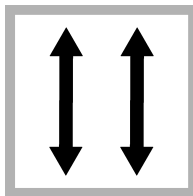
4. Put a stopper on the tube. Shake until the powder fully dissolves.



5. Wait 3 minutes.



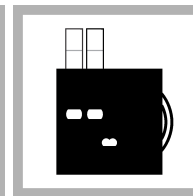
6. Add one Ammonia Cyanurate Reagent Powder Pillow to the same tube. Put a stopper on the tube.



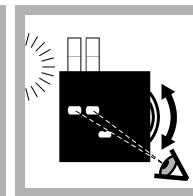
7. Shake until the powder fully dissolves.



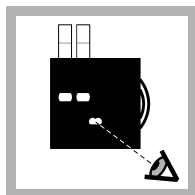
8. Wait 15 minutes. A green color develops.



9. Put the second tube into the color comparator box.



10. Hold the color comparator box in front of a light source. Turn the color disc to find the color match.



11. Read the result in mg/L in the scale window.

Replacement items

Description	Unit	Item no.
Ammonia Salicylate Reagent Powder Pillows, 5 mL	50/pkg	2395266
Ammonia Cyanurate Reagent Powder Pillows, 5 mL	50/pkg	2395466
Color disc, ammonia nitrogen, salicylate, 0–2.0 mg/L	each	9261300
Color comparator box	each	173200
Glass viewing tubes, glass, 18 mm	6/pkg	173006
Stoppers for 18-mm glass tubes and AccuVac Ampuls	6/pkg	173106

Optional items

Description	Unit	Item no.
Nitrogen ammonia standard solution, 1.0 mg/L $\text{NH}_3\text{-N}$	500 mL	189149
Water, deionized	500 mL	27249
Syringe, Luer-Lok® Tip, 3 mL	each	4321300

Calculate the mg/L NH₃ and mg/L NH₄⁺

Ammonia in water is in the form of the ammonium ion (NH₄⁺) and un-ionized ammonia (NH₃). NH₃ is toxic to fish. [Table 1](#) shows that the percent of NH₃ increases as the pH and temperature increase. This test kit measures both NH₄⁺ and NH₃ as ammonia nitrogen (NH₃-N).

To calculate the mg/L NH₃ in the sample, refer to [Table 1](#) and the equation that follows.

$$\text{mg/L NH}_3 = ((\text{mg/L NH}_3\text{-N} \times \text{percent NH}_3 \text{ from Table 1}) \div 100) \times 1.2$$

Example: The test result was 1.6 mg/L NH₃-N. The sample pH was 7.6 and the sample temperature was 16 °C. The mg/L NH₃ is $((1.6 \times 1.16) \div 100) \times 1.2 = 0.02 \text{ mg/L NH}_3$.

To calculate the mg/L NH₄⁺ in the sample, refer to [Table 1](#) and the equation that follows.

$$\text{mg/L NH}_4^+ = ((\text{mg/L NH}_3\text{-N} \times (100 - \text{percent NH}_3 \text{ from Table 1})) \div 100) \times 1.3$$

Example: The test result was 1.6 mg/L NH₃-N. The sample pH was 7.6 and the sample temperature was 16 °C. The mg/L NH₄⁺ is $((1.6 \times (100 - 1.16)) \div 100) \times 1.3 = 2.056 \text{ mg/L NH}_4^+$.

Table 1 Percent of NH₃ in water

pH	16 °C	18 °C	20 °C	22 °C	24 °C	26 °C	28 °C	30 °C	32 °C
7.0	0.29	0.34	0.39	0.46	0.52	0.60	0.69	0.80	0.91
7.2	0.46	0.54	0.62	0.82	0.83	0.96	1.10	1.26	1.44
7.4	0.73	0.85	0.98	1.14	1.31	1.50	1.73	1.98	2.26
7.6	1.16	1.34	1.55	1.79	2.06	2.36	2.71	3.10	3.53
7.8	1.82	2.11	2.44	2.81	3.22	3.70	4.23	4.82	5.48
8.0	2.86	3.30	3.81	4.38	5.02	5.74	6.54	7.43	8.42
8.2	4.45	5.14	5.90	6.76	7.72	8.80	9.98	11.29	12.72
8.4	6.88	7.90	9.04	10.31	11.71	13.26	14.95	16.78	18.77
8.6	10.48	11.97	13.61	15.41	17.37	19.50	21.78	24.22	26.80
8.8	15.66	17.73	19.98	22.41	25.00	27.74	30.62	33.62	36.72
9.0	22.73	25.46	28.36	31.40	34.56	37.83	41.16	44.53	47.91
9.2	31.80	35.12	38.55	42.04	45.57	49.09	52.58	55.99	59.31
9.4	42.49	46.18	49.85	53.48	57.02	60.45	63.73	66.85	69.79
9.6	53.94	57.62	61.17	64.56	67.77	70.78	73.58	76.17	78.55
9.8	64.99	68.31	71.40	74.28	76.92	79.33	81.53	83.51	85.30
10.0	74.63	77.35	79.83	82.07	84.08	85.88	87.49	88.92	90.19
10.2	82.34	84.41	86.25	87.88	89.33	90.60	91.73	92.71	93.58



Detergents CHEMets Kit

K-9400/R-9400: 0 - 3 ppm

Test Procedure

1. Rinse the reaction tube with the sample to be tested, and then fill it to the 5 mL mark with the sample.
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip breaking tool (fig. 1).
3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the contents to drain into the reaction tube (fig. 1).
4. Cap the reaction tube and shake it vigorously for **30 seconds**. Allow the tube to stand undisturbed for **1 minute**.
5. Make sure that the flexible tubing is firmly attached to the CHEMet ampoule tip.
6. Insert the CHEMet assembly (tubing first) into the reaction tube making sure that the end of the flexible tubing is at the bottom of the tube. Break the tip of the CHEMet ampoule by gently pressing it against the side of the reaction tube (fig. 2). The ampoule should draw in fluid only from the organic phase (bottom layer).
7. When filling is complete, remove the CHEMet assembly from the reaction tube.
8. Remove the flexible tubing from the CHEMet ampoule and wipe all liquid from the exterior of the ampoule. Place an ampoule cap firmly onto the tip of the CHEMet ampoule. Invert the ampoule several times, allowing the bubble to travel from end to end.

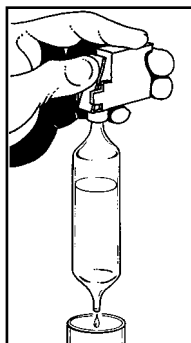


Figure 1

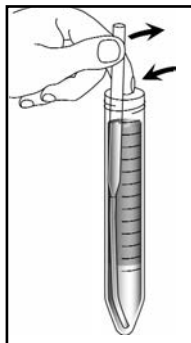


Figure 2

9. Obtain a test result by placing the ampoule, flat end first, into the comparator. Hold the comparator up toward a source of light and view from the bottom. Rotate the comparator until the best color match is found (fig. 3).

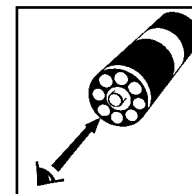


Figure 3

Tip Breaker

The tip breaker opens for easy disposal of the glass tips (pull lever away from body of tip breaker or pull open the side wall). The tip breaker will work most effectively if the tips are emptied out frequently.

Test Method

The Detergents CHEMets®¹ test kit employs the methylene blue extraction method^{2,3,4}. Anionic detergents react with methylene blue to form a blue complex that is extracted into an immiscible organic solvent. The intensity of the blue color is directly related to the concentration of "methylene blue active substances (MBAS)" in the sample. Anionic detergents are one of the most prominent methylene blue active substances. Test results are expressed in ppm (mg/Liter) linear alkylbenzene sulfonate (equivalent weight 325).

1. CHEMets is a registered trademark of CHEMetrics, Inc. U.S. Patent No. 3,634,038
2. APHA Standard Methods, 22nd ed., Method 5540 C - 2000
3. EPA Methods for Chemical Analysis of Water and Wastes, Method 425.1 (1983)
4. ASTM D 2330-02, Methylene Blue Active Substances

Safety Information

Read SDS (available at www.chemetrics.com) before performing this test procedure. Wear safety glasses and protective gloves.



www.chemetrics.com
4295 Catlett Road, Midland, VA 22728 U.S.A.
Phone: (800) 356-3072; Fax: (540) 788-4856
E-Mail: orders@chemetrics.com

Feb. 18, Rev. 10

CHLORINE, TOTAL, Low Range (0 to 2.00 mg/L Cl₂)

For water, wastewater and seawater

DPD Method* USEPA accepted (powder pillows only)**

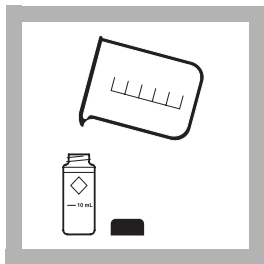
Measuring Hints

If the sample temporarily turns yellow after reagent addition or the display shows overrange (flashing **2.20** in display), dilute a fresh sample and repeat the test. A slight loss of chlorine may occur because of the dilution. Multiply the result by the appropriate dilution factor.

* Adapted from *Standard Methods for the Examination of Water and Wastewater*.

** Procedure is equivalent to USEPA method 330.5 for wastewater and Standard Method 4500-Cl G for drinking water.

CHLORINE, TOTAL, Low Range, continued



- 1.** Fill a 10-mL cell to the 10-mL line with sample. Cap.

Note: Samples must be analyzed immediately and cannot be preserved for later analysis.

Note: Be sure the instrument is in the low range mode. See page 37.



- 2.** Add the contents of one DPD Total Chlorine Powder Pillow to the sample cell (the prepared sample). Cap and gently shake for 20 seconds.

Note: Gently shaking dissipates bubbles which may form in samples containing dissolved gases.

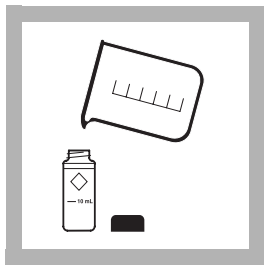


- 3.** Wait 3 minutes. During this period, proceed with steps 4–8.

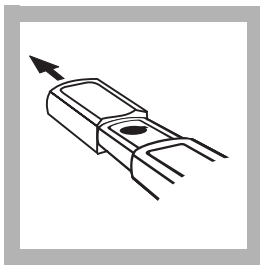
Note: A pink color will form if chlorine is present.

Note: Accuracy is not affected by undissolved powder.

CHLORINE, TOTAL, Low Range, continued

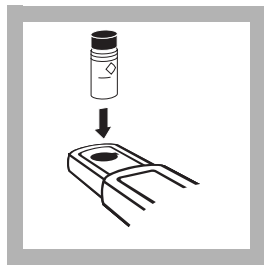


4. Fill a 10-mL sample cell to the 10-mL line with sample (the blank). Cap.



5. Remove the instrument cap.

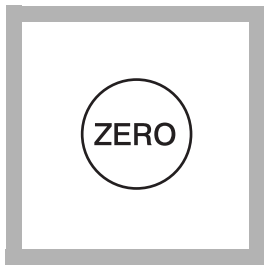
Note: For best results, zero the instrument and read the sample under the same lighting conditions.



6. Place the blank in the cell holder, with the diamond mark facing you. Tightly cover the cell with the instrument cap (flat side should face the back of the instrument).

Note: Wipe liquid off sample cells.

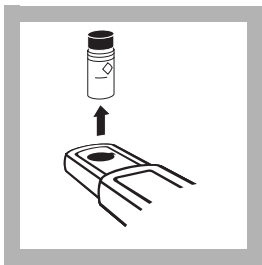
CHLORINE, TOTAL, Low Range, continued



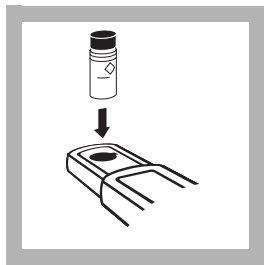
7. Press: ZERO

The instrument will turn on and the display will show - - - followed by 0.00.

Note: The instrument automatically shuts off after 1 minute and stores the last zero in memory. Press **READ** to complete the analysis.



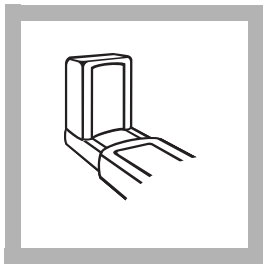
8. Remove the cell from the cell holder.



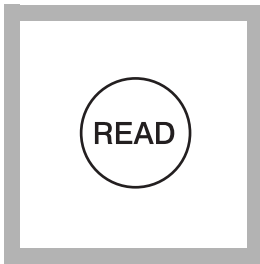
9. Within 3 minutes after the 3-minute reaction period, place the prepared sample in the cell holder.

Note: Wipe liquid off sample cells.

CHLORINE, TOTAL, Low Range, continued



10. Cover the cell with instrument cap.



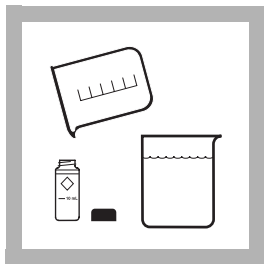
11. Press: **READ**

The instrument will show
- - - followed by the result
in mg/L total chlorine.

Note: *If the sample temporarily turns yellow after reagent addition or shows overrange (flashing 2.20), dilute a fresh sample and repeat the test. Some loss of chlorine may occur. Multiply the result by the dilution factor.*

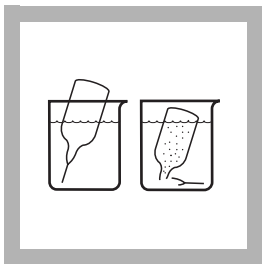
CHLORINE, TOTAL, Low Range, continued

Using AccuVac® Ampuls



1. Fill a 10-mL sample cell to the 10-mL line with sample (the blank). Cap. Collect at least 40 mL of sample in a 50-mL beaker.

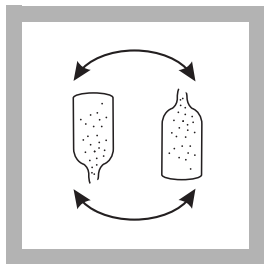
Note: Samples must be analyzed immediately and cannot be preserved for later analysis.



2. Fill a DPD Total Chlorine Reagent AccuVac Ampul with sample (the prepared sample).

Note: Keep the tip immersed until the ampul fills completely.

Note: Be sure the instrument is in low range. See page 37.



3. Quickly invert the ampul several times to mix. Wipe off any liquid or fingerprints.

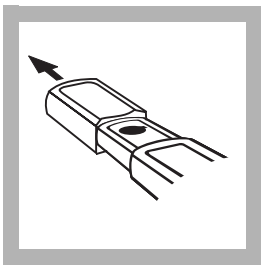
Note: A pink color will develop if chlorine is present.

Note: Accuracy is not affected by undissolved powder.

CHLORINE, TOTAL, Low Range, continued

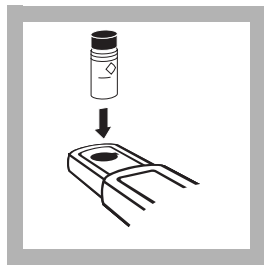


4. Wait 3 minutes. During this period, proceed with steps 5–8.



5. Remove the instrument cap.

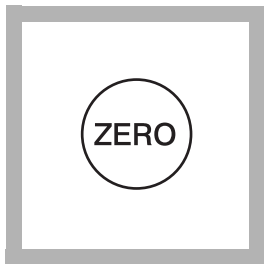
Note: For best results, zero and read the sample measurements under the same lighting conditions.



6. Place the blank in the cell holder with the diamond mark facing you. Tightly cover the cell with the instrument cap (flat side should face the back of the instrument).

Note: Wipe liquid off sample cells.

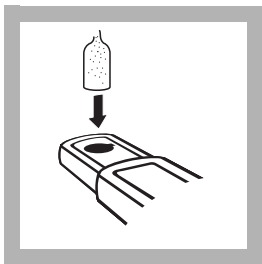
CHLORINE, TOTAL, Low Range, continued



7. Press: ZERO

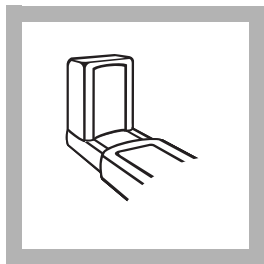
The instrument will turn on and the display will show - - - then **0.00**.

Note: The instrument automatically shuts off after 1 minute and stores the last zero in memory. Press **READ** to complete the analysis.



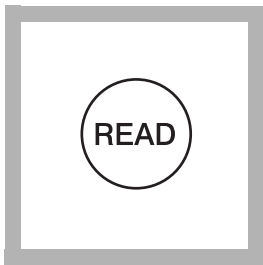
8. Within 3 minutes after the 3-minute reaction period, place the prepared sample in the cell holder.

Note: Wipe liquid off sample cells.



9. Cover the ampule with the instrument cap.

CHLORINE, TOTAL, Low Range, continued



10. Press: **READ**

The instrument will show
- - - followed by the result
in mg/L total chlorine.

Note: *If the sample temporarily turns yellow after reagent addition or shows overrange (flashing 2.20), dilute a fresh sample and repeat the test. Some loss of chlorine may occur. Multiply the result by the dilution factor.*

CHLORINE, TOTAL, Low Range, continued

Accuracy Check

Standard Additions Method

- a. Snap the neck off a Chlorine Standard Solution Voluette® Ampule.
- b. Use a TenSette® pipet to add 0.1, 0.2, and 0.3 mL of standard to three 25-mL samples. Swirl gently to mix. (For AccuVac Ampuls, use 50-mL beakers.)
- c. Analyze a 10-mL aliquot of each sample as described in the procedure. Each 0.1 mL of standard will cause an incremental increase in chlorine, the exact value depends on the concentration of the Voluette ampule standard. Check the certificate enclosed with the Voluette ampules for this value.
- d. If these increases do not occur, call Hach at 800-227-4224. Outside the United States, contact the Hach office or distributor serving you.

Interferences

Samples containing more than the 250 mg/L alkalinity or 150 mg/L acidity as CaCO_3 may inhibit full color development, or the color may fade instantly. Neutralize these samples to pH 6–7 with 1 N Sulfuric Acid or 1 N Sodium Hydroxide. Determine the

CHLORINE, TOTAL, Low Range, continued

amount required on a separate 10-mL sample. Add the same amount to the sample to be tested. Correct for the additional volume.

Bromine, iodine, ozone and oxidized forms of manganese and chromium may also react and read as chlorine.

To compensate for the effects of manganese (Mn^{4+}) or chromium (Cr^{6+}), adjust the pH to 6–7 as described above. To a 25-mL sample, add 3 drops of 30 g/L Potassium Iodide Solution, mix, and wait one minute. Add 3 drops of 5 g/L Sodium Arsenite and mix. If chromium is present, allow exactly the same reaction period with DPD for both analyses. Subtract the result of this test from the original analysis to obtain the accurate chlorine concentration.

DPD Total Chlorine Reagent Powder Pillows and AccuVac Ampuls contain a buffer formulation that withstands high levels (at least 1000 mg/L) of hardness without interference.

CHLORINE, TOTAL, Low Range, continued

REQUIRED REAGENTS

Description	Unit	Cat. No.
DPD Total Chlorine Reagent Powder Pillows	100/pkg.....	21056-69
or		
DPD Total Chlorine Reagent AccuVac® Ampuls.....	25/pkg.....	25030-25

REQUIRED APPARATUS (AccuVac® Ampuls)

Beaker, 50 mL.....	each.....	500-41
--------------------	-----------	--------

OPTIONAL REAGENTS

Chlorine Standard Solution Voluette®		
Ampules, 50-75 mg/L, 10 mL.....	16/pkg.....	14268-10
Chlorine Standards, secondary, Specv™,		
0.0, 0.2, 0.8, and 1.5 mg/L	4/set.....	26353-00
DPD Total Chlorine Reagent w/dispensing cap	250 tests.....	21056-29
Potassium Iodide Solution, 30 g/L.....	100 mL MDB*.....	343-32
Sodium Arsenite Solution, 5 g/L	100 mL MDB.....	1047-32
Sodium Hydroxide Standard Solution, 1 N	100 mL MDB.....	1045-32
Sulfuric Acid Standard Solution, 1 N	100 mL MDB.....	1270-32
Water, deionized	4 L.....	272-56

* Marked Dropper Bottle

CHLORINE, TOTAL, Low Range, continued

OPTIONAL APPARATUS

Description	Unit	Cat. No.
AccuVac® Snapper Kit.....	each	24052-00
Batteries, AAA, alkaline.....	4/pkg	46743-00
Caps for 10-mL sample cells.....	12/pkg	24018-12
Cylinder, graduated, 25 mL, poly.....	each	1081-40
Cylinder, graduated, 100 mL, PMP.....	each	2172-42
sens <i>ion</i> ™ I Basic Portable pH Meter, with electrode	each	51700-10
Pipet, TenSette®, 0.1 to 1.0 mL.....	each	19700-01
Pipet Tips, For 19700-01 TenSette®.....	50/pkg	21856-96
Sample Cells, 10-mL with screw caps.....	6/pkg	24276-06

REPLACEMENT PARTS

Instrument Cap/light shield	each	46704-00
Instrument Manual.....	each	46760-88



Pro30



USER MANUAL

English

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Item #606082
Rev A
Drawing # A606082
July 2011

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WARRANTY

The YSI Professional 30 instrument (Pro30) is warranted for three (3) years from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damage caused by defective batteries. Pro30 cable/ probe assemblies are warranted for two (2) years from date of purchase by the end user against defects in material and workmanship. Pro30 instruments & cables are warranted for 90 days from date of purchase by the end user against defects in material and workmanship when purchased by rental agencies for rental purposes. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937 767-7241, 800-897-4151 or visit www.YSI.com for a Product Return Form. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by:

1. Failure to install, operate or use the product in accordance with YSI's written instructions;
2. Abuse or misuse of the product;
3. Failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
4. Any improper repairs to the product;
5. Use by you of defective or improper components or parts in servicing or repairing the product;
6. Modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI'S LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

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INTRODUCTION

Thank you for purchasing the YSI Pro30, an instrument from the YSI *Professional Series* product family. The Pro30 measures conductivity and temperature in water. The Pro30 features an impact resistant and waterproof (IP-67) case, a rugged MS-8 (military-spec) cable connector, backlit display, user-selectable sensor options, 50 data set memory, internal barometer and a rubber over-mold case.

The Pro30 provides valuable instructions and prompts near the bottom of the display that will guide you through operation and use. However, reading the entire manual is recommended for a better understanding of the instrument's features.




The Pro30 cannot communicate to a PC via a Pro Series communications saddle. Connecting the Pro30 to a communication saddle may cause erratic instrument behavior.

GETTING STARTED

INITIAL INSPECTION

Carefully unpack the instrument and accessories and inspect for damage. Compare received parts with items on the packing list. If any parts or materials are damaged or missing, contact YSI Customer Service at 800-897-4151 (+1 937 767-7241) or the authorized YSI distributor from whom the instrument was purchased.

BATTERY INSTALLATION

The instrument requires 2 alkaline C-cell batteries. Under normal conditions, the average battery life is 425 hours at room temperature without using the back light. A battery symbol  will blink in the lower, left corner of the display to indicate low batteries when approximately 1 hour of battery life remains.

To install or replace the batteries:

1. Turn the instrument off and flip over to view the battery cover on the back.
2. Unscrew the four captive battery cover screws.
3. Remove the battery cover and remove the old batteries if necessary.
4. Install the new batteries, ensuring correct polarity alignment (figure 1).

- Place the battery cover on the back of the instrument and tighten the four screws. Do not over-tighten.

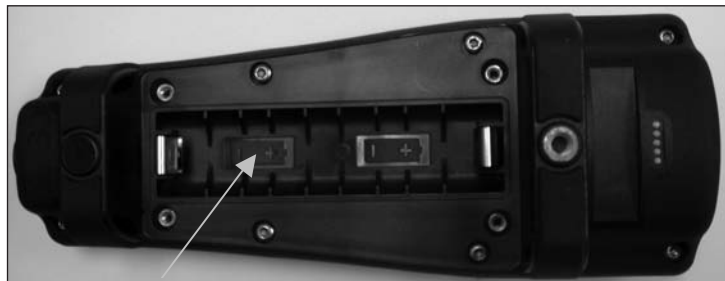


Figure 1. Pro30 with battery cover removed. Notice battery symbols indicating polarities.



The waterproof instrument case is sealed at the factory and is not to be opened, except by authorized service technicians. Do not attempt to separate the two halves of the instrument case as this may damage the instrument, break the waterproof seal, and will void the warranty.

KEY PAD

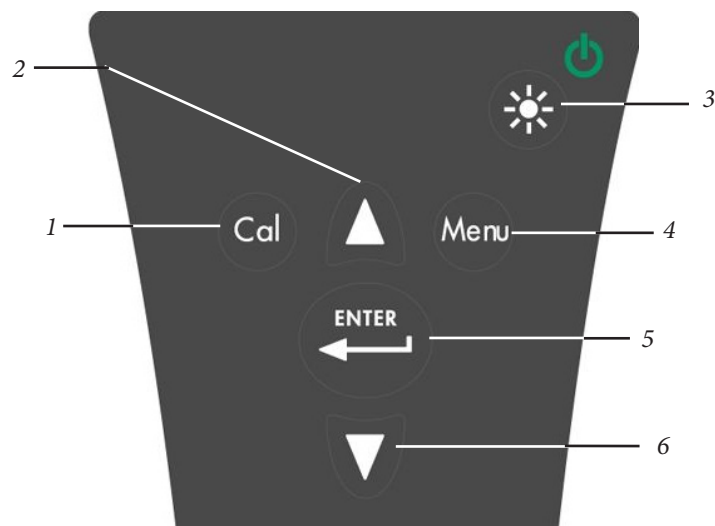


Figure 2, Keypad

Number	Key	Description
1		Calibrate Press and hold for 3 seconds to calibrate. Opens Calibrate menu from the Run screen.
2		Up Arrow Use to navigate through menus, to navigate through box options along the bottom of the Run screen and to increase numerical inputs.
3		Power and Backlight Press once to turn instrument on. Press a second time to turn backlight on. Press a third time to turn backlight off. Press and hold for 3 seconds to turn instrument off.
4		Menu Use to enter the System Setup menu from the Run screen.
5		Enter Press to confirm entries and selections.
6		Down Arrow Use to navigate through menus, to navigate through box options at the bottom of the Run screen and to decrease numerical inputs.

CONNECTING THE PROBE/CABLE ASSEMBLY TO THE INSTRUMENT


The conductivity and temperature sensors are integral to the cable assembly; therefore, they cannot be removed from the cable.

To connect the cable, align the keys on the cable connector to the slots on the instrument connector. Push together firmly and then twist the outer ring until it locks into place (figure 3). This connection is water-proof.



Figure 3, Note the keyed connector.

RUN SCREEN

Press the power/backlight key  to turn the instrument on. The instrument will run through a self test and briefly display a splash screen with system information before displaying the main Run screen (figure 4). The first time the Pro30 is turned on, it will prompt you to select a language; see the First Power On section of this manual for more information.

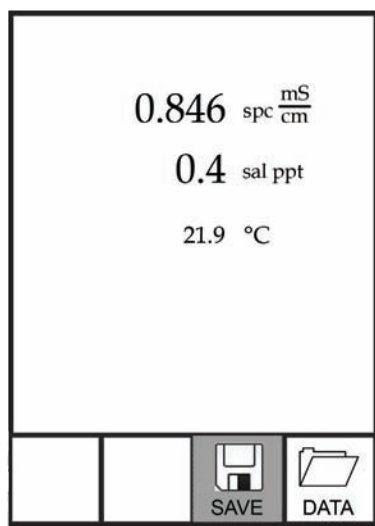




Figure 4, Run screen.

BACKLIGHT

Once the instrument is powered on, pressing the power/backlight key  will turn on the display backlight. The backlight will remain on until the key is pressed again or after two minutes of not pressing any key on the keypad.



POWERING OFF

To turn the instrument off, press and hold the power/backlight key  for three seconds.



NAVIGATION

The up  and down  arrow keys allow you to navigate through the functions of the Pro30.

NAVIGATING THE RUN SCREEN

When in the Run screen, the up  and down  arrow keys will move the highlighted box along the bottom options. Once a box is highlighted, press enter to access the highlighted option.

Description of Run screen box functions from left to right:

Option	Description
 SAVE	Highlight and press enter to save displayed data to memory.
 DATA	Highlight and press enter to view and/or erase saved data.

NAVIGATING THE SYSTEM SETUP MENU

When in the System Setup menu, the up and down arrow keys will move the highlighted bar up and down the system setup options. See the System Setup menu section of this manual for more information about these options.

FIRST POWER ON

The instrument will step through an initial language configuration when powered on for the first time. Use the up or down arrow keys to highlight the

appropriate language then press enter to confirm (figure 5). If an incorrect language is selected, it may be changed in the System Setup menu.

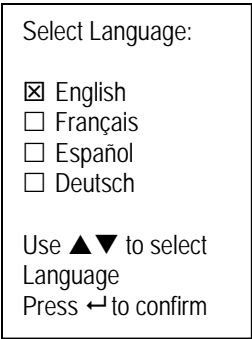



Figure 5, Select language.

After selecting a language, the Run screen will be displayed. The next time the instrument is powered up, the Run screen will display immediately after the splash screen.

SYSTEM SETUP MENU

Press the menu  key to access the System Setup menu. The System Setup menu contains multiple screens that are notated as 'pages'. The current page is indicated near the bottom of the display (figure 6).

Use the up and down arrow keys to scroll through menu options and menu pages.

EXITING THE SYSTEM SETUP MENU

To exit the System Setup menu, press the down arrow key until the ESC - Exit box is highlighted, then press enter to return to the Run screen.

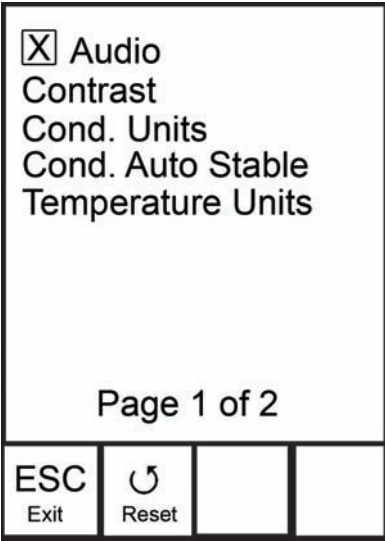


Figure 6, page 1 of System Setup menu. Audio is enabled.

AUDIO

Audio can be enabled or disabled by using the up or down arrow keys to highlight Audio and pressing enter. When enabled, there will be an 'X' in the box next to Audio.

When Audio is enabled, the Pro30 will beep twice to indicate stability when Auto Stable is enabled. The instrument will also beep when a key is pressed. When Audio is disabled, the Pro30 will not beep.

CONTRAST

To adjust the display Contrast, use the up or down arrow keys to highlight Contrast, then press enter. Next, use the up or down arrow keys to adjust the contrast. The up arrow key will darken the contrast and the down arrow key will lighten the contrast. After adjusting the contrast, press enter to save and exit the Contrast adjustment option.

EMERGENCY CONTRAST ADJUSTMENT

If necessary, there is an alternate method of adjusting the contrast. To adjust the contrast, press and hold the menu key, then press the up arrow key to darken the contrast or press the down arrow key to lighten the contrast.

CONDUCTIVITY UNITS (COND. UNITS)

Highlight Cond. Units (Conductivity Units) and press enter to open a submenu that allows you to select the conductivity units to be displayed on the Run screen. Highlight a unit and press enter to enable or disable it. An enabled conductivity unit will have an 'X' in the box next to it. Highlight the ESC-Exit box along the bottom of the display and press enter to save any changes and to close the conductivity units submenu.

There are seven options for displaying conductivity. Only four units can be enabled at the same time:

- COND-mS/cm displays conductivity in milliSiemens per centimeter.
- COND-uS/cm displays conductivity in microSiemens per centimeter.
- SPC-mS/cm displays Specific Conductance in milliSiemens per centimeter. Specific Conductance is temperature compensated conductivity.
- SPC-uS/cm displays Specific Conductance in microSiemens per centimeter. Specific Conductance is temperature compensated conductivity.
- Sal ppt displays salinity in parts per thousand. The salinity reading is calculated from the instrument's conductivity and temperature values using algorithms found in *Standard Methods for the Examination of Water and Wastewater*.
- TDS g/L displays Total Dissolved Solids in grams per liter. TDS is calculated from conductivity and temperature using a user-selectable TDS constant.
- TDS mg/L displays Total Dissolved Solids in milligrams per liter. TDS is calculated from conductivity and temperature using a user-selectable TDS constant.

Note: 1 milliSiemen = 1,000 microSiemens.

SPECIFIC CONDUCTANCE

The conductivity of a sample is highly dependent on temperature, varying as much as 3% for each change of one degree Celsius (temperature coefficient = 3%/°C). In addition, the temperature coefficient itself varies with the nature of the ionic species present in the sample. Therefore, it is useful to compensate for this temperature dependence in order to quickly compare conductivity readings taken at different temperatures.

The Pro30 can display non-temperature compensated conductivity as well as temperature compensated Specific Conductance. If Specific Conductance is selected, the Pro30 uses the temperature and conductivity values associated with

each measurement to calculate a specific conductance value compensated to a user selected reference temperature, see below. Additionally, the user can select the temperature coefficient from 0% to 4%.

Using the Pro30's default reference temperature and temperature coefficient (25 °C and 1.91%), the calculation is carried out as follows:

$$\text{Specific Conductance (25°C)} = \frac{\text{Conductivity of sample}}{1 + 0.0191 * (T - 25)}$$

T = Temperature of the sample in °C

CONDUCTIVITY AUTO STABLE (COND. AUTO STABLE)

Auto Stable utilizes preset values to indicate when a reading is stable. The preset values are adjustable in the System Setup menu. The user can input a % change in readings (0.0 to 1.9) over 'x' amount of time in seconds (3-19).

Highlight Cond. Auto Stable, then press enter to open the submenu.

Use the up or down arrow keys to highlight the % change or seconds (secs) input field, then press enter to make the highlighted field adjustable. Use the up or down arrow keys to adjust the selected value, then press enter to confirm changes. Once you have confirmed any changes, highlight the ESC-Exit box along the bottom of the display and press enter to close the Auto Stable submenu.

To disable Auto Stable, set the % Change input to 0.0.

When Auto Stable is enabled, an AS symbol will display next to the reading on the Run screen and blink during stabilization. When the dissolved oxygen and/or conductivity reading stabilizes based on the Auto Stable settings, the AS symbol will display steadily and the instrument will beep twice if Audio is turned on.

TEMPERATURE UNITS

Highlight Temperature Units and press enter to open a submenu that allows you to change the temperature units displayed on the Run screen. Highlight the desired unit (Celsius or Fahrenheit) and press enter to enable. The enabled temperature unit will have an 'X' in the box next to it. Only one unit may be enabled at a time. Highlight the ESC-Exit box and press enter to save any changes and to close the Temperature Units submenu.

SPECIFIC CONDUCTANCE REFERENCE TEMPERATURE (SPC REF. TEMP.)

SPC Ref. Temp. (Specific Conductance Reference Temperature) is the reference temperature used to calculate Specific Conductance. The reference temperature range is 15 and 25 °C. The default value is 25 °C.

To change the reference temperature, highlight SPC Ref. Temp. and press enter to open the submenu. With the reference temperature highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. Press enter to save the new reference temperature. Next, highlight the ESC-Exit box and press enter to close the submenu.

SPECIFIC CONDUCTANCE TEMPERATURE COEFFICIENT (SPC %/°C)

SPC %/°C (Specific Conductance Temperature Coefficient) is the temperature coefficient used to calculate Specific Conductance. The coefficient range is 0.00 to 4.00. The default value is 1.91% which is based on KCl standards.

To change the temperature coefficient, highlight SPC %/°C and press enter to open the submenu. With the temperature coefficient highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. Press enter to save the new coefficient. Next, highlight the ESC-Exit box and press enter to close the submenu.

TDS CONSTANT

TDS Constant is a multiplier used to calculate an estimated TDS (Total Dissolved Solids) value from conductivity. The multiplier is used to convert Specific Conductance in mS/cm to TDS in g/L. The Pro30's default value is 0.65. This multiplier is highly dependent on the nature of the ionic species present in the water sample. To be assured of moderate accuracy for the conversion, you must determine a multiplier for the water at your sampling site. Use the following procedure to determine the multiplier for a specific sample:

1. Determine the specific conductance of a water sample from the site;
2. Filter a sample of water from the site;
3. Completely evaporate the water from a carefully measured volume of the filtered sample to yield a dry solid;
4. Accurately weigh the remaining solid;
5. Divide the weight of the solid (in grams) by the volume of water used (in liters) to yield the TDS value in g/L for this site;
6. Divide the TDS value in g/L by the specific conductance of the water in mS/cm to yield the conversion multiplier. Be certain to use the correct units.

If the nature of the ionic species at the site changes between sampling studies, the TDS values will be in error. TDS cannot be calculated accurately from specific conductance unless the make-up of the chemical species in the water remains constant.

To change the TDS Constant in the Pro30, highlight TDS Constant and press enter to open the submenu. With the TDS Constant highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. The input range is 0.30 to 1.00. Press enter to save the new TDS Constant. Next, highlight the ESC-Exit box and press enter to close the submenu.

LANGUAGE

Highlight Language and press enter to open a submenu that allows you to change the language. Highlight the desired language (English, Spanish, German, or French) and press enter to enable. The enabled language will have an 'X' in the box next to it. Highlight ESC-Exit box and press enter to save any changes and to close the Language submenu.

The text in the boxes along the bottom of the Run screen will always be displayed in English regardless of the language enabled in the System Setup menu.

AUTO SHUTOFF


Auto Shutoff allows you to set the instrument to turn off automatically after a period of time. Use the up or down arrow keys to highlight Auto Shutoff, then press enter to open the submenu. Press enter while the minute field is highlighted to make it adjustable. Next, use the up or down arrow keys to adjust the shut off time from 0 to 60 minutes. Press enter to save the new shutoff time. Next, highlight the ESC-Exit box and press enter to close the submenu.

To disable Auto Shutoff, set the Time in Minutes to 0 (zero).

CELL CONSTANT

The Cell Constant displays the cell constant of the conductivity cell. The cell constant is calculated and updated each time a conductivity calibration is performed. The cell constant range is 4.0 to 6.0. Resetting the System Menu resets the cell constant to 5.0.

RESETTING THE SYSTEM SETUP MENU TO FACTORY DEFAULT

To reset the Pro30 settings to factory default, press the down arrow key while in the System Setup menu until the Reset -  box is highlighted, then press enter. The instrument will ask you to confirm the reset. Highlight Yes and press enter to continue with the reset or highlight No and press enter to cancel the reset. A Factory Reset will not affect data saved in the instrument’s memory.

The following will be set in the Pro30 after performing a reset:

Parameter	Reset Defaults
Audio	On
Contrast	Set to mid range
Conductivity Units	cond uS/cm, spc mS/cm, spc uS/cm and sal ppt
Conductivity Auto Stable	Off (0.0 % Change and 10 seconds)
SPC Reference Temperature	25°C
SPC Temperature Coefficient	1.91%/°C
TDS Constant	0.65
Temperature Units	°C
Language	English
Auto Shutoff	30 minutes
Conductivity Cell Constant	Cell constant reset to 5.0*

*It is recommended to perform a Conductivity calibration after performing a reset.

CALIBRATION

TEMPERATURE

All Pro30 cables have built-in temperature sensors. Temperature calibration is not required nor is it available.

CONDUCTIVITY CALIBRATION

Ensure the conductivity sensor is clean and dry before performing a conductivity, specific conductance or salinity calibration.



It is not necessary to calibrate conductivity, specific conductance and salinity. Calibrating one of these parameters will simultaneously calibrate the others. YSI recommends calibrating specific conductance for greatest ease.

CALIBRATING SPECIFIC (SP.) CONDUCTANCE OR CONDUCTIVITY

Note: When calibrating Specific Conductance, the Pro30 uses the factory default values for the Specific Conductance Reference Temperature and the Specific Conductance Temperature Coefficient regardless of what is configured in the System Setup Menu. The default value for the Reference Temperature is 25°C and the default value for the Temperature Coefficient is 1.91%/°C. It is important to note that the Temperature Coefficient of a calibration solution is dependent on the contents of the solution. Therefore, YSI recommends using a traceable calibration solution made of KCl (potassium chloride) when calibrating Specific Conductance since these solutions typically have a Temperature Coefficient of 1.91%/°C. Additionally, be sure to enter the value of the solution as it is listed for 25°C when calibrating Specific Conductance.

1. Fill a clean container (i.e. plastic cup or glass beaker) with fresh, traceable conductivity calibration solution and place the sensor into the solution. The solution must cover the holes of the conductivity sensor that are closest to the cable (figure 7). Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately half the expected value. Gently move the probe up and down to remove any air bubbles from the conductivity sensor.

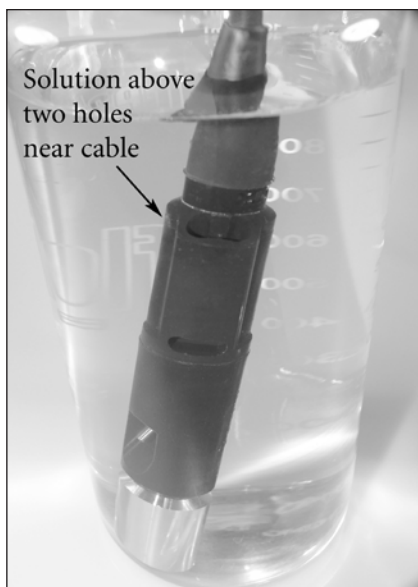


Figure 7, solution above two holes near cable.

2. Turn the instrument on and allow the conductivity and temperature readings to stabilize. Press and hold the Cal key for 3 seconds. Highlight Conductivity and press enter. Next, highlight the desired calibration method, Sp. Conductance or Conductivity, and press enter.
3. Highlight the units you wish to calibrate, either uS/cm or mS/cm, and press enter. 1 mS = 1,000 uS. Next, use the up or down arrow key to adjust the value on the display to match the value of the conductivity calibration solution. If calibrating conductivity, it is necessary to look up the value of the solution at the current temperature and enter that value into the Pro30. Most conductivity solutions are labeled with a value at 25°C. If calibrating specific conductance, enter the value listed for 25°C. Depressing either the up or down arrow key for 5 seconds will move the changing digit one place to the left. The Pro30 will remember the entered calibration value and display it the next time a conductivity calibration is performed.
4. Press enter to complete the calibration. Or, press Cal to cancel the calibration and return to the Run screen.
5. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
6. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting guide for possible solutions.

CALIBRATING IN SALINITY

1. Fill a clean container (i.e. plastic cup or glass beaker) with fresh, traceable salinity calibration solution and place the sensor into the solution. The solution must cover the holes of the conductivity sensor that are closest to the cable (figure 7). Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately half the expected value. Gently move the probe up and down to remove any air bubbles from the conductivity sensor.
2. Turn the instrument on and allow the conductivity and temperature readings to stabilize. Press and hold the Cal key for 3 seconds. Highlight Conductivity and press enter. Next, highlight Salinity and press enter.
3. Use the up or down arrow key to adjust the value on the display to match the value of the salinity solution. Depressing either the up or down arrow key for 5 seconds will move the changing digit one place to the left. The Pro30 will remember the entered calibration value and display it the next time a salinity calibration is performed.
4. Press enter to complete the calibration. Or, press Cal to cancel the calibration and return to the Run screen.
5. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
6. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting guide for possible solutions.


TAKING MEASUREMENTS

Before taking measurements, be sure the instrument has been calibrated to ensure the most accurate readings. Place the probe in the sample to be measured and give the probe a quick shake to release any air bubbles. Be sure the conductivity sensor is completely submerged in the sample. The two holes near the cable should be covered by the sample for accurate conductivity readings (figure 7). Allow the temperature readings to stabilize.

SAVING AND VIEWING DATA

The Pro30 can store 50 data sets in non-volatile memory for later viewing. A data set includes the values currently on the display, i.e. temperature, dissolved oxygen and two conductivity parameters. Each data point is referenced with a data set number, 01 through 50.

SAVING DATA

 The Pro30 can not communicate to a PC via a Pro Series communications saddle. Connecting the Pro30 to a communication saddle may cause erratic instrument behavior.

From the Run screen, use the up or down arrow keys to highlight the Save box and press enter to save the current readings. The instrument will indicate the data set is saved and display the saved data set's number (figure 8).

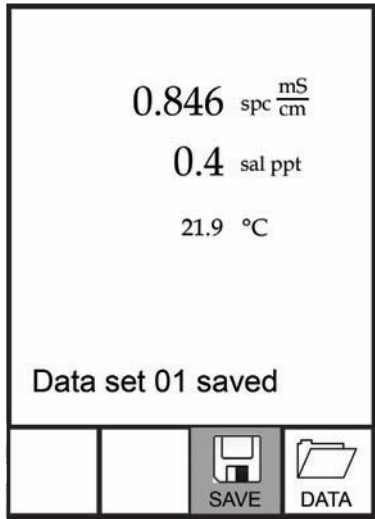


Figure 8, data set saved.

The instrument will display ‘Memory Full’ if all 50 data sets have been saved and you attempt to save another data set.

VIEWING AND ERASING SAVED DATA - DATA MODE

Data mode allows you to view and erase saved data. From the Run screen, use the up or down arrow keys to highlight Data and press enter to access Data mode. Note that the function boxes at the bottom of the display are different in Data mode (figure 9).

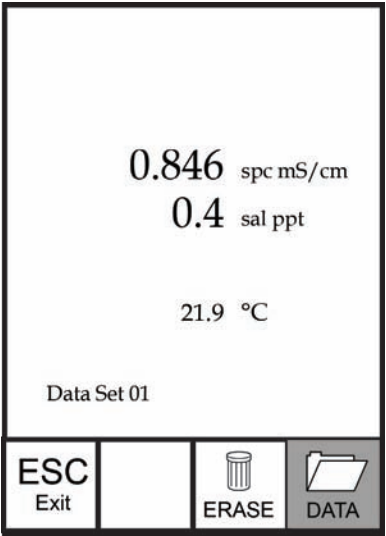


Figure 9, Data mode.

VIEWING DATA

Once in Data mode, use the up and down arrow keys to view saved data sets in sequential order or press enter to access the bottom functions. After accessing the bottom functions, highlight the Data box and press enter to regain access to viewing data. The data set displayed is indicated by the data set number, 01 through 50.

ERASING DATA

While viewing saved data, press the enter key to access the function boxes at the bottom of the display. Next, use the up or down arrow keys to highlight Erase, then press enter. The instrument will give you the option to erase one data set or all data sets (figure 10).

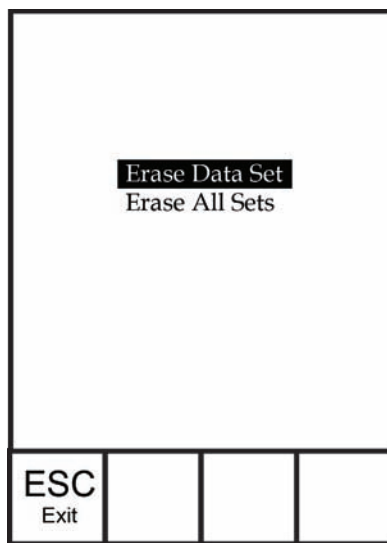


Figure 10, Erase data mode.

Use the up or down arrow key to select Erase Data Set, Erase All Sets or the ESC-Exit function box, then press enter to confirm.

Select ESC-Exit and press enter to exit Erase mode without erasing any data.

Select Erase Data Set and press enter to erase the data set that was displayed before entering Erase mode. For example, if data set 12 was displayed before entering erase mode, and Erase Data Set is selected, Data Set 12 will be erased from memory and the data sets AFTER that number will move up to keep them sequential. For example, if there are 15 records and number 12 is erased then 13 becomes 12, 14 becomes 13, and 15 becomes 14. The instrument will return to Data mode after erasing one data set.

Select Erase All Data Sets and press enter to clear the Pro30 memory and return to Data mode.

EXITING DATA MODE

While in Data mode, press enter to access the bottom functions. Next, highlight the ESC-Exit box and press enter to return to the Run screen.

CARE, MAINTENANCE AND STORAGE

This section describes the proper procedures for care, maintenance and storage of the instrument. The goal is to maximize their lifetime and minimize down-time associated with improper instrument usage.

GENERAL MAINTENANCE

GENERAL MAINTENANCE - GASKET

The instrument utilizes a gasket as a seal to prevent water from entering the battery compartment. Following the recommended procedures will help keep the instrument functioning properly.

If the gasket and sealing surfaces are not maintained properly, it is possible that water can enter the battery compartment. If water enters this area, it can severely damage the battery terminals causing loss of battery power and corrosion to the battery terminals. Therefore, when the battery compartment lid is removed, the gasket that provides the seal should be carefully inspected for contamination (i.e. debris, grit, etc.) and cleaned with water and mild detergent if necessary.

SENSOR MAINTENANCE

SENSOR MAINTENANCE - TEMPERATURE

You must keep the temperature sensor free of build up. Other than that, no additional maintenance is required. A toothbrush can be used to scrub the temperature sensor if needed.

SENSOR MAINTENANCE - CONDUCTIVITY

The openings that allow sample access to the conductivity electrodes should be cleaned regularly. The small cleaning brush included in the Maintenance Kit is intended for this purpose. Dip the brush in clean water and insert it into each hole 10 to 12 times. In the event that deposits have formed on the electrodes, it may be necessary to use a mild detergent (laboratory grade soap or bathroom foaming tile cleaner) with the brush. Rinse thoroughly with clean water, then check the response and accuracy of the conductivity cell with a calibration solution.

SENSOR STORAGE

SHORT AND LONG TERM STORAGE

For both short and long term storage, the conductivity sensor should be stored clean and dry.

Remove the batteries from the instrument when storing it for long periods of time (>30 days).

Long Term Storage Temperature: -5 to 70°C (23 to 158°F)

TROUBLESHOOTING

<i>Symptom</i>	<i>Possible Solution</i>
Instrument will not turn on, a battery symbol appears, or “Critical Shutdown” displays on the screen.	<ol style="list-style-type: none"> 1. Low battery voltage, replace batteries. 2. Batteries installed incorrectly, check battery polarity. 3. Return system for service.
Temperature values display Over or Undr on Run screen.	<ol style="list-style-type: none"> 1. Sample temperature is less than -5° C or more than +55°C. Increase or decrease the sample temperature to bring within the allowable range. 2. Contact YSI Tech Support.
Instrument will not calibrate the Conductivity sensor; instrument displays “Calibration Over”, “Calibration Under”, or “Unstable Reading” during calibration.	<ol style="list-style-type: none"> 1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the calibration solution is above the two holes near the cable, see figure 8. 3. Verify the calibration solution is not expired or contaminated. Try a new bottle of solution. 4. Ensure you are entering in the correct value for the solution according to the measurement units. 1 mS = 1,000 uS. 5. Allow sufficient stabilization time for conductivity and temperature AND wait at least 3 seconds before confirming a calibration. 6. Contact YSI Tech Support.

<i>Symptom</i>	<i>Possible Solution</i>
Conductivity readings are inaccurate.	<ol style="list-style-type: none"> 1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the sample is above the two holes near the cable, see figure 8. 3. Verify calibration. 4. Verify temperature readings are accurate. 5. Verify the correct units are setup in the System Setup menu, i.e. uS vs mS and Conductivity vs. Specific Conductance. 6. Contact YSI Tech Support.
Conductivity values display Over or Undr on Run screen.	<ol style="list-style-type: none"> 1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the sample is above the two holes near the cable, see figure 8 3. Verify calibration. 4. Verify temperature readings are accurate. 5. Sample conductivity is outside the measurement range of the instrument, i.e. 0-200 mS. 6. Contact YSI Tech Support.

SPECIFICATIONS

These specifications represent typical performance and are subject to change without notice. For the latest product specification information, please visit YSI's website at www.ysi.com or contact YSI Tech Support.

<i>Parameter</i>	<i>Range</i>	<i>Resolution</i>	<i>Accuracy</i>
Temperature	-5 to 55°C	0.1°C	± 0.2°C
Conductivity	0-500 uS/cm 0-5 mS/cm 0-50 mS/cm 0-200 mS/cm (auto ranging)	0.0001 to 0.1 mS/cm; 0.1 to 0 uS/cm (range dependent)	Instrument only: ± 0.5% of the reading or 1 uS/cm, whichever is greater. Instrument with 1 or 4 meter cables: ± 1.0% of the reading or 1 uS/cm, whichever is greater. Instrument with 10, 20, or 30 meter cables: ± 2.0% of the reading or 1 uS/cm, whichever is greater.
Salinity	0 to 70 ppt	0.1 ppt	± 1.0% of the reading or ± 0.1 ppt, whichever is greater.
Total Dissolved Solids (TDS)	0 to 100 g/L. TDS Constant range: 0.3 to 1.00 (0.65 default)	0.0001 to 0.1 g/L (range dependent)	Dependent on accuracy of temperature, conductivity and TDS Constant.

ACCESSORIES / PART NUMBERS

<i>Part Number</i>	<i>Description</i>
6050030	Pro30 Instrument
60530-1, -4, -10, -20, or -30	1, 4, 10, 20, 30-meter cable assembly*
603077	Flow cell
603056	Flow cell mounting spike
603075	Carrying case, soft-sided
603074	Carrying case, hard-sided
603069	Belt clip
063517	Ultra clamp for instrument
063507	Tripod for instrument
603062	Cable management kit, included with all cables longer than 1 meter.
605978	Cable weight, 4.9 oz, stackable
603070	Shoulder strap
060907	Conductivity Calibration Solution, 1,000 µS/cm. 1 box of 8 pints.
060911	Conductivity Calibration Solution, 10,000 µS/cm. 1 box of 8 pints.
060660	Conductivity Calibration Solution, 50,000 µS/cm. 1 box of 8 pints.
065274	Conductivity Calibration Solution, 100,000 µS/cm. 1 box of 8 pints.

*All cables include a temperature and conductivity sensor.

DECLARATION OF CONFORMITY

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for the listed European Council Directive(s) and carries the CE mark accordingly.

<i>Manufacturer:</i>	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
<i>Product Name:</i>	Pro30 Water Quality Instrument
<i>Model Numbers</i>	
<i>Instrument/Accessory:</i>	Pro30 (6050030)
<i>Probe/Cable Assemblies:</i>	60530-1, -4, -10, -20, and -30
<i>Conforms to the following:</i>	
<i>Directives:</i>	IEC 61326-1:2005 RoHS 2002/95/EC WEEE 2002/96/EC IP-67 Protection per ANSI/IEC 60529-2004
<i>Harmonized Standards:</i>	<ul style="list-style-type: none">EN61326-1:2006 (IEC 61326-1:2005) Basic Immunity
<i>Supplementary Information:</i>	All performance met the operation criteria as follows: 1. ESD, IEC 61000-4-2:2001, Performance Criterion B 2. Radiated Immunity, IEC 61000-4-3, Performance Criterion A 3. Electrical Fast Transient (EFT), IEC 61000-4-4:2004, +Corr. 1:2006 + Corr. 2:2007, Performance Criterion B 4. Radio Frequency, Continuous Conducted Immunity, IEC61000-4-6, Performance Criterion A 5. Radiated Emissions, EN 61326-1:2006 (IEC61326-1:2005) Class B
<i>Authorized EU Representative</i>	YSI Hydrodata Ltd Unit 2 Focal Point, Lacerta Court, Works Road Letchworth, Hertfordshire, SG6 1FJ UK



Signed: Lisa M. Abel
Title: Director of Quality

Date: 27 June 2011

RECYCLING

YSI is committed to reducing the environmental footprint in the course of doing business. Even though materials reduction is the ultimate goal, we know there must be a concerted effort to responsibly deal with materials after they've served a long, productive life-cycle. YSI's recycling program ensures that old equipment is processed in an environmentally friendly way, reducing the amount of materials going to landfills.

- Printed Circuit Boards are sent to facilities that process and reclaim as much material for recycling as possible.
- Plastics enter a material recycling process and are not incinerated or sent to landfills.
- Batteries are removed and sent to battery recyclers for dedicated metals.

When the time comes for you to recycle, follow the easy steps outlined at www.ysi.com.

BATTERY DISPOSAL

The Pro30 is powered by alkaline batteries which the user must remove and dispose of when the batteries no longer power the instrument. Disposal requirements vary by country and region, and users are expected to understand and follow the battery disposal requirements for their specific locale.

CONTACT INFORMATION

ORDERING AND TECHNICAL SUPPORT

Telephone: 800 897 4151 (USA)
+1 937 767 7241 (Globally)
Monday through Friday, 8:00 AM to 5:00 ET

Fax: +1 937 767 9353 (orders)
+1 937 767 1058 (technical support)

Email: environmental@ysi.com
Mail: YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387 USA

Internet: www.ysi.com

When placing an order please have the following available:

- 1.) YSI account number (if available)
- 2.) Name and phone number
- 3.) Purchase Order or Credit Card number
- 4.) Model Number or brief description
- 5.) Billing and shipping addresses
- 6.) Quantity

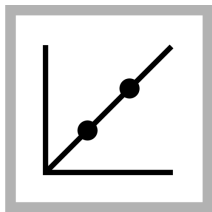
SERVICE INFORMATION

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click 'Support' or contact YSI Technical Support directly at 800-897-4151 (+1 937-767-7241).

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from www.ysi.com by clicking on the 'Support'.

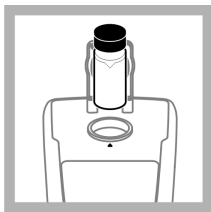
Item # 606082
Rev A
Drawing # A606082
July 2011

©2011 YSI Incorporated.

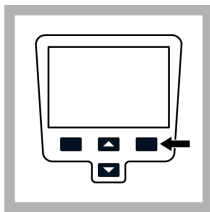


1. Push the **CALIBRATION** key to enter the Calibration mode. Follow the instructions on the display.

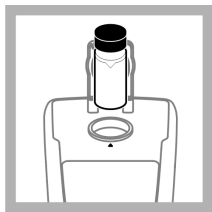
Note: Gently invert each standard before inserting the standard.



2. Insert the 20 NTU StablCal Standard and close the lid.
Note: The standard to be inserted is bordered.

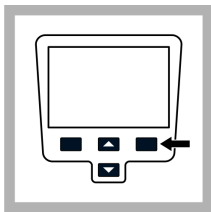


3. Push **Read**. The display shows Stabilizing and then shows the result.

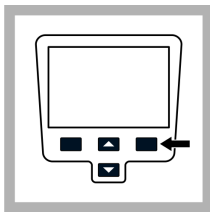


4. Repeat Step 2 and 3 with the 100 NTU and 800 NTU StablCal Standard.

Note: Push **Done** to complete a 2 point calibration.



5. Push **Done** to review the calibration details.



6. Push **Store** to save the results. After a calibration is complete, the meter automatically goes into the Verify Cal mode. Refer to [Calibration verification \(Verify Cal\)](#) on page 16.

Turbidity measurement

⚠ WARNING

Potential explosion and fire hazard. This turbidimeter is designed for water based samples. Do not measure solvent or combustible based samples.

Readings can be taken with the Normal reading mode, Signal Average mode or in the Rapidly Settling Turbidity mode. Refer to [Reading modes](#) on page 16 for more information. For accurate turbidity readings use clean sample cells and remove air bubbles (degassing).

Measurement notes

Proper measurement techniques are important in minimizing the effects of instrument variation, stray light and air bubbles. Use the following measurement notes for proper measurements.

Instrument

- Make sure that the meter is placed on a level, stationary surface during the measurement.
Note: Do not hold the meter in the hand during measurement.
- Always close the sample compartment lid during measurement, calibration and storage.
- Remove sample cell and batteries from the instrument if the instrument is stored for an extended time period (more than a month).
- Keep the sample compartment lid closed to prevent the entry of dust and dirt.

Sample cells

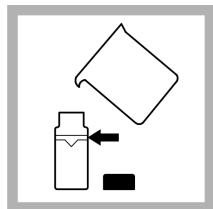
- Always cap the sample cell to prevent spillage of the sample into the instrument.
- Always use clean sample cells in good condition. Dirty, scratched or damaged cells can cause inaccurate readings.
- Make sure that cold samples do not "fog" the sample cell.
- Store sample cells filled with distilled or deionized water and cap tightly.

Measurement

- Measure samples immediately to prevent temperature changes and settling. Before a measurement is taken, always make sure that the sample is homogeneous throughout.
- Avoid sample dilution when possible.
- Avoid operation in direct sunlight.

Turbidity measurement procedure

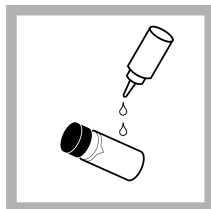
Note: Before a measurement is taken, always make sure that the sample is homogeneous throughout.



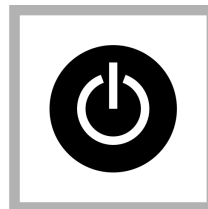
1. Collect a representative sample in a clean container. Fill a sample cell to the line (about 15 mL). Take care to handle the sample cell by the top. Cap the cell.



2. Wipe the cell with a soft, lint-free cloth to remove water spots and fingerprints.

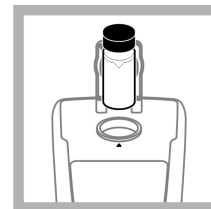


3. Apply a thin film of silicone oil. Wipe with a soft cloth to obtain an even film over the entire surface ([Apply silicone oil to a sample cell](#) on page 17).

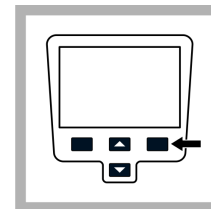


4. Push the **Power** key to turn the meter on. Place the instrument on a flat, sturdy surface.

Note: Do not hold the instrument while making measurements.



5. Gently invert and then insert the sample cell in the instrument cell compartment so the diamond or orientation mark aligns with the raised orientation mark in front of the cell compartment. Close the lid.



6. Push **Read**. The display shows Stabilizing then the turbidity in NTU (FNU). The result is shown and stored automatically (Refer to [Data management](#) on page 11)

Data management

About stored data

The following types of data are stored in the data log:

- Reading Log: stores automatically each time a sample reading is taken (500 records).
- Calibration Log: stores only when **Store** is selected at the end of a calibration (25 records).
- Verify Cal Log: stores only after **Done** is selected at the end of a verification calibration (250 records).

When the data log becomes full, the oldest data point is deleted when more data is added to the log.

View data log

The data log contains Reading Log, Calibration Log and Verify Cal log. All logs can be sorted by date.



MANHOLE INSPECTION FORM

Fill out form,
>Save to file<
Click Update
button =
Fills Summary
line page 2 &
Clears Form

Manhole ID:

Inspection Date:

Inspector:

Street Name:

Nearest Address #:

Manhole Depth:

Overall Rating (1 to 5):

(1=new ... 5=failing)

Inflow Infiltration Rate:

(0=none ... 5=gusher)

Conditions: Dry ☐ Wet ☐ Standing Water ☐ Frozen ☐

MH DETAILS

Location:	Material:	MH Cover size:	MH Barrel size:	Direction Effluent:
Roadway <input type="checkbox"/>	Brick <input type="checkbox"/>	22" <input type="checkbox"/>	48" <input type="checkbox"/>	NW/ <input type="text"/>
Gutter <input type="checkbox"/>	Block <input type="checkbox"/>	24" <input type="checkbox"/>	60" <input type="checkbox"/>	
Paved Alley <input type="checkbox"/>	Concrete <input type="checkbox"/>	30" <input type="checkbox"/>	Other (below) <input type="checkbox"/>	
Unpaved Alley <input type="checkbox"/>	Lined <input type="checkbox"/>	36" <input type="checkbox"/>	<input type="text"/>	
Easement <input type="checkbox"/>	Other <input type="checkbox"/>	Other (describe) <input type="text"/>	<input type="text"/>	
Other (describe) <input type="text"/>				# of Influent: <input type="text"/>

CONDITION

Cover:	Ring & Frame	Cone & Riser:	Barrel:	Rungs:
Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>
Loose <input type="checkbox"/>	Loose <input type="checkbox"/>	Cracked/Broken <input type="checkbox"/>	Cracked/Broken <input type="checkbox"/>	Unsafe <input type="checkbox"/>
Below Grade <input type="checkbox"/>	Displaced <input type="checkbox"/>	Corroded <input type="checkbox"/>	Corroded <input type="checkbox"/>	Missing any <input type="checkbox"/>
Damaged <input type="checkbox"/>	Missing Grout <input type="checkbox"/>	Misaligned <input type="checkbox"/>	Misaligned <input type="checkbox"/>	Corroded <input type="checkbox"/>
Sealed <input type="checkbox"/>	Raise <input type="checkbox"/>	Infiltration <input type="checkbox"/>	Infiltration <input type="checkbox"/>	N/A - no rungs <input type="checkbox"/>
Holes (# of holes) <input type="text"/>	Lower <input type="checkbox"/>	Roots at Joints <input type="checkbox"/>	Roots at Joints <input type="checkbox"/>	

Bench:	Channel:
Serviceable <input type="checkbox"/>	Serviceable <input type="checkbox"/>
Cracked/Broken <input type="checkbox"/>	Obstructed <input type="checkbox"/>
Bad base joint <input type="checkbox"/>	Bad joints <input type="checkbox"/>
	Roots at connection <input type="checkbox"/>

Hydraulics

Indications of

Surcharge?:

None ☐

Minor ☐

Yes, need followup ☐

Infiltration, if yes, note below
(None, Minor, Some, Excessive)

Issues:

Grease ☐

Debris ☐

Silt ☐

Describe Flow:

Steady ☐

Pulsing ☐

Turbulent ☐

Surcharging ☐

Sluggish ☐

COMMENTS:

APPENDIX G
IDDE EMPLOYEE TRAINING RECORD



TRAINING ATTENDANCE

CATCHMENT INVESTIGATION TRAINING

TOWN OF MILLIS, MA

June 15, 2022

NAME (PRINT)	DEPARTMENT
Jim McIlroy	Millis DPW
Paul Everett	Millis DPW
Brandon R. Gorgone	Millis DPW
Kyle Lopez	DPW
JONATHAN LOVETT	MILLIS DPW

APPENDIX H
Re-prioritized Outfall Ranking

Town of Millis, MA
 Illicit Discharge Detection and Elimination Program
 Outfall Priority Ranking
 Revised: June 2021

POTENTIAL PROBLEM OUTFALLS	
Outfall ID	Priority Level
E-6	PROBLEM

HIGH PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
D-6	HIGH	1	3/28/2019
6	HIGH	2	3/28/2019
B-7	HIGH	2	3/28/2019
D-5	HIGH	4	3/28/2019
C-43	HIGH	5	
33	HIGH	6	
61	HIGH	6	6/8/2021
3	HIGH	8	
31	HIGH	9	
C-21	HIGH	10	
43	HIGH	11	
C-13	HIGH	12	
8	HIGH	13	
51	HIGH	14	
C-44	HIGH	15	
C-25B	HIGH	16	
4	HIGH	17	
17	HIGH	18	5/13/2021
C-11	HIGH	19	
13	HIGH	20	
39	HIGH	21	
A-1	HIGH	22	3/28/2019
56	HIGH	23	
20	HIGH	24	3/28/2019
D-19	HIGH	25	
21	HIGH	26	
C-30	HIGH	27	
9	HIGH	28	

HIGH PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
37	HIGH	29	
2	HIGH	30	
7	HIGH	30	3/28/2019
14	HIGH	30	
15	HIGH	30	
16	HIGH	30	
18	HIGH	30	
22	HIGH	30	3/28/2019
23	HIGH	30	
24	HIGH	30	
29	HIGH	30	
30	HIGH	30	
32	HIGH	30	
34	HIGH	30	
35	HIGH	30	
36	HIGH	30	
40	HIGH	30	
44	HIGH	30	
45	HIGH	30	
46	HIGH	30	
49	HIGH	30	
50	HIGH	30	
52	HIGH	30	
53	HIGH	30	
54	HIGH	30	
55	HIGH	30	
57	HIGH	30	
58	HIGH	30	
59	HIGH	30	
63	HIGH	30	3/28/2019
64	HIGH	30	6/2/2021
B-1	HIGH	30	3/28/2019
B-11	HIGH	30	
B-12	HIGH	30	
B-13	HIGH	30	
B-14	HIGH	30	
B-15	HIGH	30	
B-18	HIGH	30	
B-8	HIGH	30	3/28/2019
C-10	HIGH	30	

HIGH PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
C-12	HIGH	30	
C-14	HIGH	30	
C-19	HIGH	30	
C-23	HIGH	30	
C-45	HIGH	30	
C-46A	HIGH	30	
C-47	HIGH	30	
C-8	HIGH	30	
C-8A	HIGH	30	
C-9	HIGH	30	9/4/2020
D-1	HIGH	30	
D-10	HIGH	30	
D-2	HIGH	30	
D-21	HIGH	30	
D-22	HIGH	30	
D-23	HIGH	30	
D-24	HIGH	30	
D-27	HIGH	30	
D-7	HIGH	30	3/28/2019
D-8	HIGH	30	3/28/2019
F-1	HIGH	30	
G-10	HIGH	30	
G-6	HIGH	30	
G-7	HIGH	30	
G-8	HIGH	30	
G-9	HIGH	30	
41	HIGH	30	3/24/2021
E-14	HIGH	30	

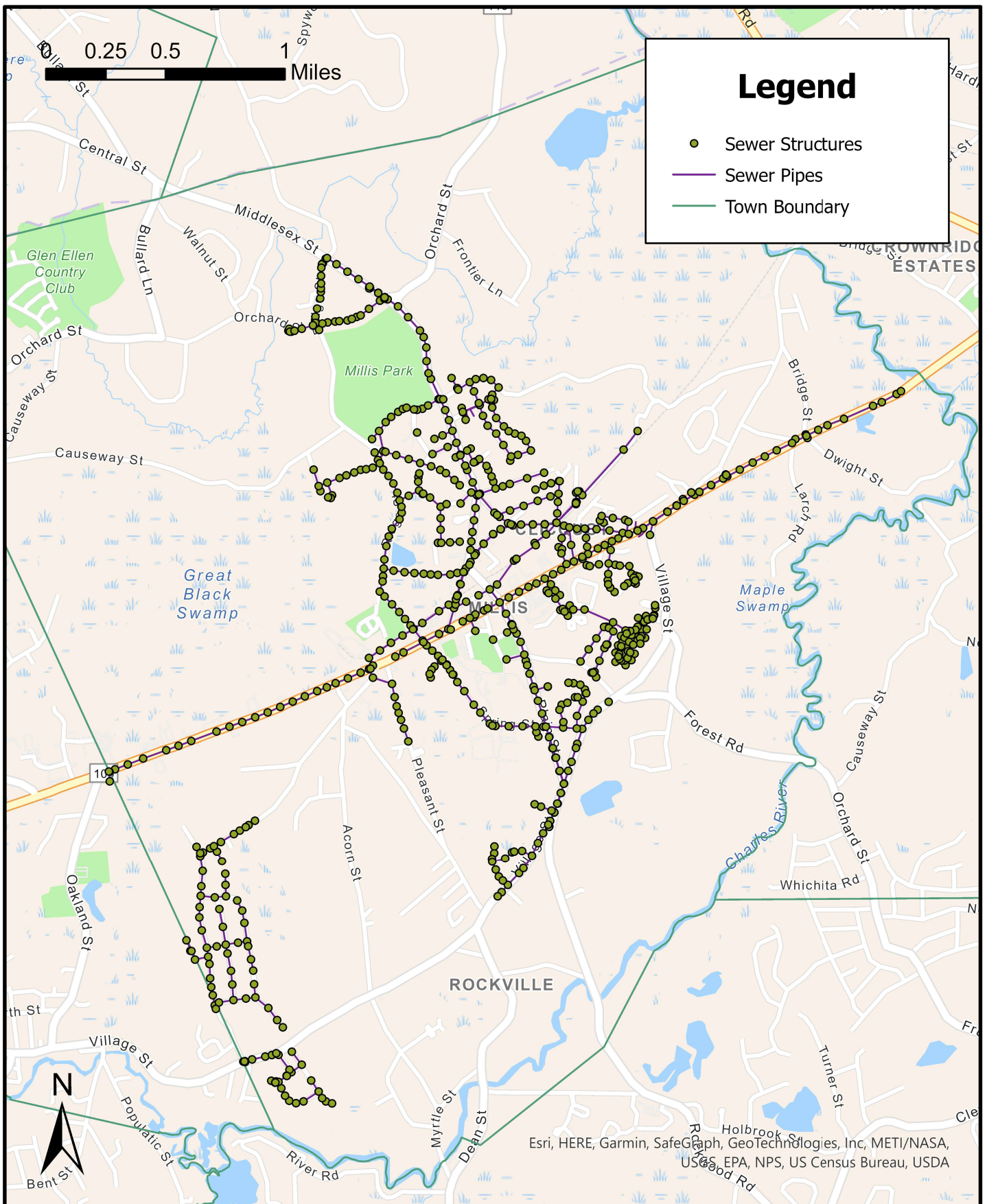
LOW PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
47	LOW	95	
12	LOW	97	
48	LOW	98	
F-5	LOW	99	5/13/2021
E-9B	LOW	100	
F-8	LOW	101	
11	LOW	102	
D-16	LOW	103	5/13/2021

LOW PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
28	LOW	104	
66	LOW	105	
E-25	LOW	106	
0	LOW	107	
E-9A	LOW	108	
E-27	LOW	109	
F-9	LOW	110	
D-14	LOW	111	
D-12	LOW	112	
E-10	LOW	113	
E-11	LOW	113	6/18/2021
D-13	LOW	114	6/28/2021
C-31	LOW	115	
E-29	LOW	116	6/8/2021
F-7	LOW	117	
E-24	LOW	118	
E-26	LOW	119	
38	LOW	120	
F-11	LOW	121	
1	LOW	123	
5	LOW	123	
10	LOW	123	
19	LOW	123	
25	LOW	123	
26	LOW	123	
27	LOW	123	6/18/2021
42	LOW	123	
60	LOW	123	
62	LOW	123	
65	LOW	123	
67	LOW	123	
C-32	LOW	123	
C-33	LOW	123	
C-34	LOW	123	
C-36	LOW	123	
C-36	LOW	123	
C-37	LOW	123	
C-38	LOW	123	
C-39	LOW	123	
C-4	LOW	123	

LOW PRIORITY OUTFALLS			
Outfall ID	Priority Level	Ranking	Prior Screening Date
C-41	LOW	123	
D-11	LOW	123	
D-17	LOW	123	
E-1	LOW	123	6/8/2021
E-16	LOW	123	6/18/2021
E-22	LOW	123	
E-23	LOW	123	
E-28	LOW	123	
E-5	LOW	123	
E-7	LOW	123	
F-3	LOW	123	
F-4	LOW	123	
F-6	LOW	123	
H-2	LOW	123	
I-1A	LOW	123	
I-1B	LOW	123	
I-2	LOW	123	

APPENDIX I
Municipal Sanitary Sewer System GIS Information

Date: 6/21/2022 User: SBryant Path: \\azrgisstor01\GIS_Projects\Client\MA_Millis\Millis FY22 MS4\SVF\Millis_SVF_2022.aprx



Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA



PROJECT NO.	20221778.001A
CREATED:	6/21/2022
CREATED BY:	SBryant
CHECKED BY:	
FILE NAME:	Millis_SVF_2022.mxd

Town of Millis Sanitary Sewer System

Town of Millis, Massachusetts
MS4 Stormwater Services

Appendix

H

APPENDIX J
System Vulnerability Factor Analysis Memorandum



MEMORANDUM

TO: Jim McKay, Director, Department of Public Works, Town of Millis
FROM: Peter Varga, Kleinfelder
DATE : 6/20/2022
SUBJECT: System Vulnerability Factor Analysis
CC: Kirsten Ryan, Adria Fichter (KLEINFELDER)

1.1 BACKGROUND

The 2016 National Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts ("MS4 Permit") requires the Town of Millis to investigate and document all drainage catchments owned by the Town during dry weather. Additionally, drainage catchments that contain factors that place a catchment at higher risk of illicit connections (System Vulnerability Factors, or SVFs) are required to undergo wet weather sampling to screen for the presence of interconnection caused by high groundwater or excess runoff.

The Town of Millis' MS4 system currently contains 162 separate outfall points, all of which were assessed for the presence of SVFs that indicate the need for wet weather sampling.

1.2 SYSTEM VULNERABILITY FACTORS

The MS4 Permit requires that for each catchment being investigated, the presence of any SVFs must be documented. Twelve distinct SVF general criteria exist, eight of which are deemed critical enough to require investigation for illicit connections while the remaining four are recommended factors that may be considered in determining catchments requiring investigation. The eight SVFs requiring wet weather investigation are:



1. History of Sanitary Sewer Overflows (SSOs)
2. Common or twin-invert manholes serving storm and sanitary sewer alignments
3. Common trench construction serving storm and sanitary sewer alignments
4. Crossings of storm and sanitary sewer alignments where the sanitary system is shallower
5. Sanitary sewers with underdrain systems
6. Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging or back-ups
7. Areas formerly served by combined sewers
8. Sanitary sewer infrastructure defects

The additional SVFs recommended by the EPA include:

9. Sewer pumps, lift stations, siphons, or sewer restrictions where power failures could result in SSOs
10. Sanitary sewer and storm drain infrastructure greater than 40 years old
11. Widespread code-required septic system upgrades required at property transfers
12. History of multiple Board of Health actions addressing widespread septic system failures

1.3 SVF IDENTIFICATION

The following SVFs were deemed as not applicable to the Town of Millis' MS4 system for all catchments based on interviews with members of the Millis Department of Public Works: 1, 4, 5, 6, 7, 9, 11, 12

SVF 10 (infrastructure greater than 40 years old) was determined to be likely applicable to all catchments being investigated. While record drawings were not available for all sewer and drain infrastructure, the likely timeframe for construction of most of the Town's sewer and drain infrastructure was deemed earlier than 1982 and all catchments were assigned this SVF to be conservative. Because SVF 10 is a recommended but not required factor from the permit for completed wet weather sampling, the presence of this factor alone was not deemed sufficient to require wet weather sampling.



GIS information was used to identify catchments that contained the following SVFs:

- **Common and twin-invert manholes serving storm and sanitary sewer alignments:**

Drainage and sewer structures in the Town's GIS database were compared and overlapping structures and junctions were noted. Only one catchment (Outfall 51) was found to have a potential common manhole, although because record drawings were not available it is recommended that field investigation be completed to confirm if the manholes in question are serving both the sewer and drainage system.

- **Common trench construction serving storm and sanitary sewer alignments:**

GIS data available for both sewer and drainage pipe networks were compared to identify locations where both networks were running parallel and in proximity. Satellite imagery was used to further investigate these locations to confirm if the manholes for each network were overlapping in alignment to signal a potential common trench. Only one catchment (Outfall 51) was found to have a potential common trench and should be investigated to confirm.

- **Crossings of storm and sanitary sewer alignments where the sanitary system is shallower:**

GIS data was compared for both the drainage and sewer networks and all intersections between the two systems were identified. For cases where the intersection occurred along drainage pipes connected to catch basins, it was assumed the drainage network was shallower and the intersection removed. The remaining 29 catchments that contained intersections between the sewer and drainage network represent potential locations where the SVF may be applicable, but it is suggested that further investigation take place to confirm that wet weather sampling is required.

The final SVF, characterized by sanitary infrastructure defects, was assessed using the Infiltration and Inflow (I-I) assessment completed by GCG Associates in 2021. The assessment found 47 sewer manholes where either illicit inflow or defects were present. The listed manholes were sorted by drainage catchment and reported for SVF 8.



1.4 CATCHMENTS REQUIRING FURTHER INVESTIGATION

For drainage catchments where SVF categories 2, 3, or 4 were the only present SVFs, it is recommended that field investigation occur prior to scheduling wet weather sampling in order to confirm if wet weather sampling is needed. The assessments were made conservatively based on the resolution provided by the Town's GIS system and, lacking invert elevations of most infrastructure in the GIS database, may not apply.

1.5 SVF TABLE

A complete assessment of all drainage catchments for all SVFs is provided in the following table:



Outfall ID	Receiving Water	1	2	3	4	5	6	7	8	9	10	11	12
		History of SSOs	Common or Twin Invert Manholes*	Common Trench Construction*	Storm/ Sanitary Crossings (Sanitary Above)*	Sanitary Lines with Underdrains	Inadequate Sanitary Level of Service	Areas Formerly Served by Combined Sewers	Sanitary Infrastructure Defects	SSO Potential In Event of System Failures	Sanitary and Storm Drain Infrastructure >40 years Old	Septic with Poor Soils or Water Table Separation	History of BOH Actions Addressing Septic Failure
B-14	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
1	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
F-9	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-23	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
2	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
3	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
4	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-44	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
I-1B	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
5	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
I-1A	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
B-8	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
B-15	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
B-18	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
G-8	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
G-6	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
G-7	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
6	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
7	Charles River	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
8	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
F-1	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
F-3	Maple Swamp	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
F-5	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
G-9	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-30	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO



Outfall ID	Receiving Water	1	2	3	4	5	6	7	8	9	10	11	12
		History of SSOs	Common or Twin Invert Manholes*	Common Trench Construction*	Storm/ Sanitary Crossings (Sanitary Above)*	Sanitary Lines with Underdrains	Inadequate Sanitary Level of Service	Areas Formerly Served by Combined Sewers	Sanitary Infrastructure Defects	SSO Potential In Event of System Failures	Sanitary and Storm Drain Infrastructure >40 years Old	Septic with Poor Soils or Water Table Separation	History of BOH Actions Addressing Septic Failure
D-21	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
9	Charles River	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
10	Mccarthy Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-12	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-11	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-16	Great Black Swamp	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
11	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
12	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-9A	Great Black Swamp	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
D-13	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-25	Mccarthy Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-6	Great Black Swamp	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
13	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
14	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
15	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
16	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
17	Charles River	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
D-23	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-22	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
18	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
F-8	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
F-7	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
19	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
F-6	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
A-1	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
20	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
B-11	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO



Outfall ID	Receiving Water	1	2	3	4	5	6	7	8	9	10	11	12
		History of SSOs	Common or Twin Invert Manholes*	Common Trench Construction*	Storm/ Sanitary Crossings (Sanitary Above)*	Sanitary Lines with Underdrains	Inadequate Sanitary Level of Service	Areas Formerly Served by Combined Sewers	Sanitary Infrastructure Defects	SSO Potential In Event of System Failures	Sanitary and Storm Drain Infrastructure >40 years Old	Septic with Poor Soils or Water Table Separation	History of BOH Actions Addressing Septic Failure
21	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
D-27	Charles River	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
B-1	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
B-5	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
22	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
B-6	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-43	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
23	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
24	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
25	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-16	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-17	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
26	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
27	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-14	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
28	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
29	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
30	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
31	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-19	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-21	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
32	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
33	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
34	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
35	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
36	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-25B	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO



Outfall ID	Receiving Water	1	2	3	4	5	6	7	8	9	10	11	12
		History of SSOs	Common or Twin Invert Manholes*	Common Trench Construction*	Storm/ Sanitary Crossings (Sanitary Above)*	Sanitary Lines with Underdrains	Inadequate Sanitary Level of Service	Areas Formerly Served by Combined Sewers	Sanitary Infrastructure Defects	SSO Potential In Event of System Failures	Sanitary and Storm Drain Infrastructure >40 years Old	Septic with Poor Soils or Water Table Separation	History of BOH Actions Addressing Septic Failure
G-10	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
37	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
E-5	Richardsons Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-11	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-10	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
38	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-19	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
39	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
H-2	Walker Pond	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
E-22	Walker Pond	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
E-23	Walker Pond	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
40	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-24	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
41	Walker Pond	NO	NO	NO	NO	NO	NO	NO	YES	NO	YES	NO	NO
B-13	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
B-12	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
42	Richardsons Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-29	Mccarthy Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-1	Richardsons Pond	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
C-10	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
C-11	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
C-12	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
43	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
44	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
45	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
46	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
47	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO



Outfall ID	Receiving Water	1	2	3	4	5	6	7	8	9	10	11	12
		History of SSOs	Common or Twin Invert Manholes*	Common Trench Construction*	Storm/ Sanitary Crossings (Sanitary Above)*	Sanitary Lines with Underdrains	Inadequate Sanitary Level of Service	Areas Formerly Served by Combined Sewers	Sanitary Infrastructure Defects	SSO Potential In Event of System Failures	Sanitary and Storm Drain Infrastructure >40 years Old	Septic with Poor Soils or Water Table Separation	History of BOH Actions Addressing Septic Failure
C-14	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-36	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-37	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-32	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-34	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-33	Maple Swamp	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
48	Great Black Swamp	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
C-41	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-39	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-38	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-36	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-13	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-1	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-2	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-47	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-46A	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-45	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-9	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
C-8	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-8A	Bogastow Brook	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
E-7	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-5	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-6	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-7	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
D-8	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
49	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
50	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO



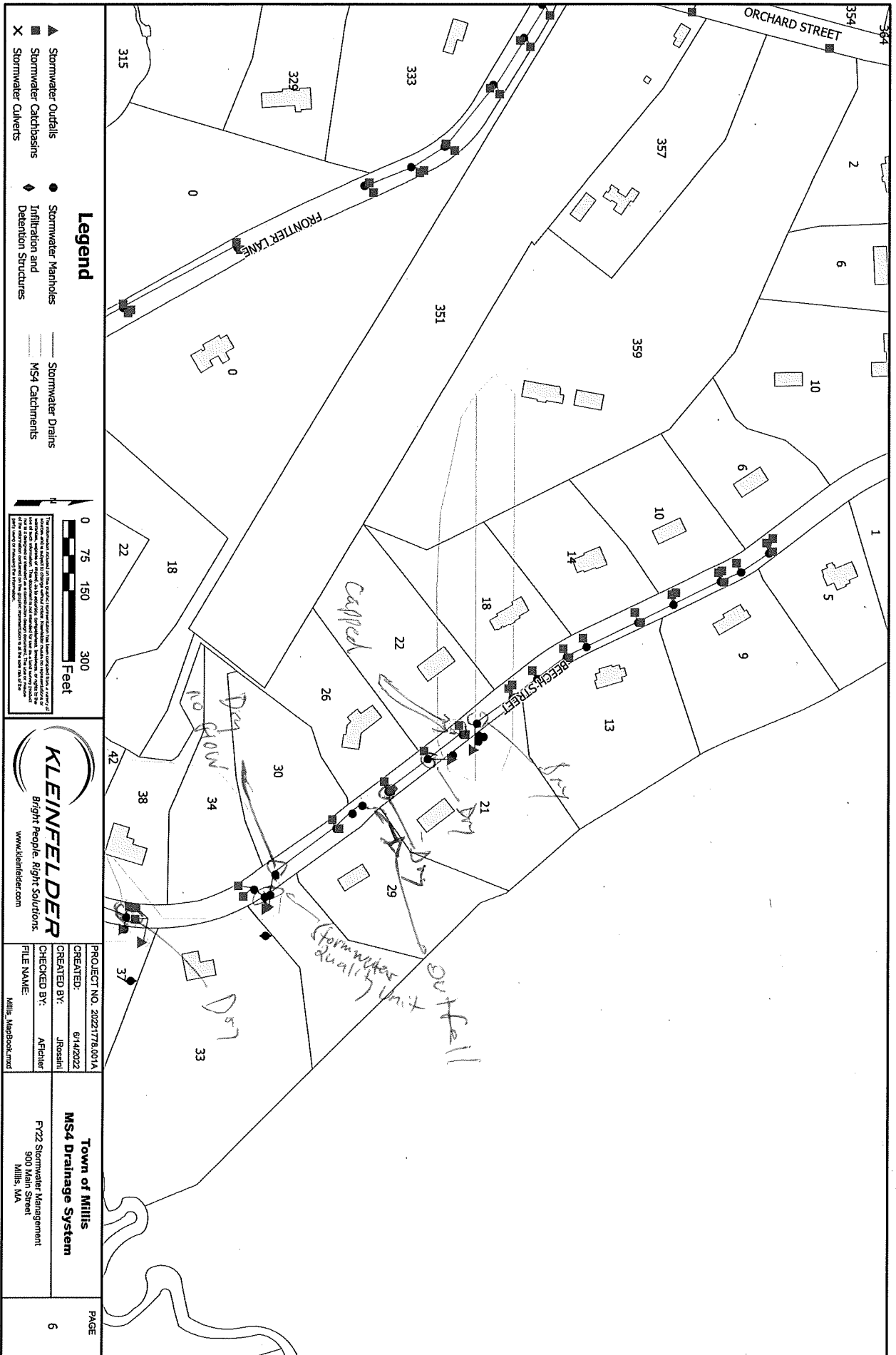
Outfall ID	Receiving Water	1	2	3	4	5	6	7	8	9	10	11	12
		History of SSOs	Common or Twin Invert Manholes*	Common Trench Construction*	Storm/ Sanitary Crossings (Sanitary Above)*	Sanitary Lines with Underdrains	Inadequate Sanitary Level of Service	Areas Formerly Served by Combined Sewers	Sanitary Infrastructure Defects	SSO Potential In Event of System Failures	Sanitary and Storm Drain Infrastructure >40 years Old	Septic with Poor Soils or Water Table Separation	History of BOH Actions Addressing Septic Failure
I-2	Maple Swamp	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
E-14	Walker Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-31	Maple Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
51	Bogastow Brook	NO	YES	YES	YES	NO	NO	NO	NO	NO	YES	NO	NO
F-11	Maple Swamp	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
52	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
53	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
54	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
55	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
56	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
57	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
58	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
59	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
60	Mccarthy Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-26	Mccarthy Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-27	Mccarthy Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
61	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
B-7	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
E-24	Mccarthy Pond	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES	NO	NO
62	Richardsons Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
C-4	Richardsons Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
63	Charles River	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
F-4	Maple Swamp	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
E-28	Mccarthy Pond	NO	NO	NO	YES	NO	NO	NO	YES	NO	YES	NO	NO
D-10	Bogastow Brook	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
64	Charles River	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
65	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO

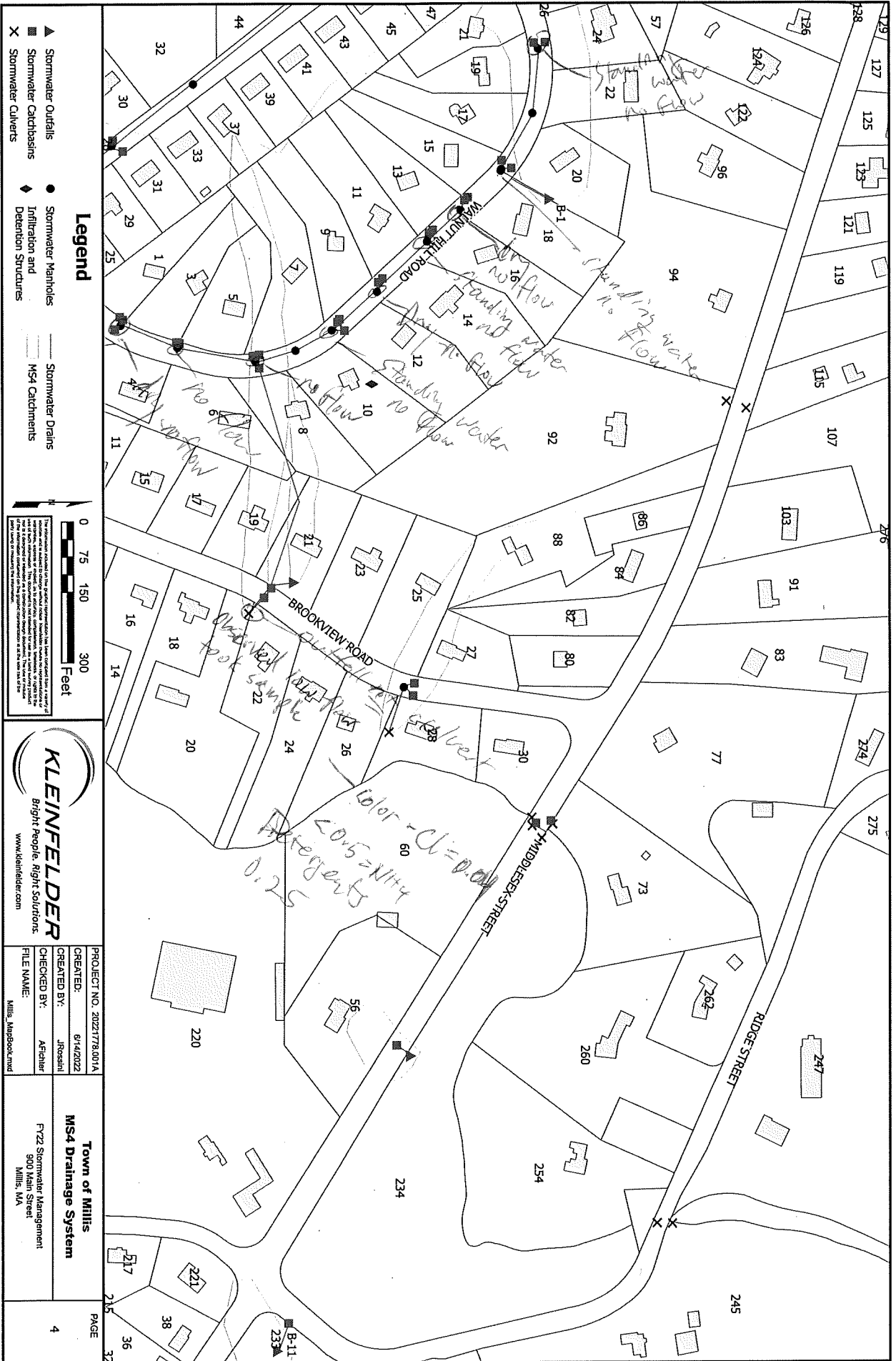


Outfall ID	Receiving Water	1	2	3	4	5	6	7	8	9	10	11	12
		History of SSOs	Common or Twin Invert Manholes*	Common Trench Construction*	Storm/ Sanitary Crossings (Sanitary Above)*	Sanitary Lines with Underdrains	Inadequate Sanitary Level of Service	Areas Formerly Served by Combined Sewers	Sanitary Infrastructure Defects	SSO Potential In Event of System Failures	Sanitary and Storm Drain Infrastructure >40 years Old	Septic with Poor Soils or Water Table Separation	History of BOH Actions Addressing Septic Failure
E-9B	Great Black Swamp	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO
66	Mccarthy Pond	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	NO	NO

*Requires additional investigation

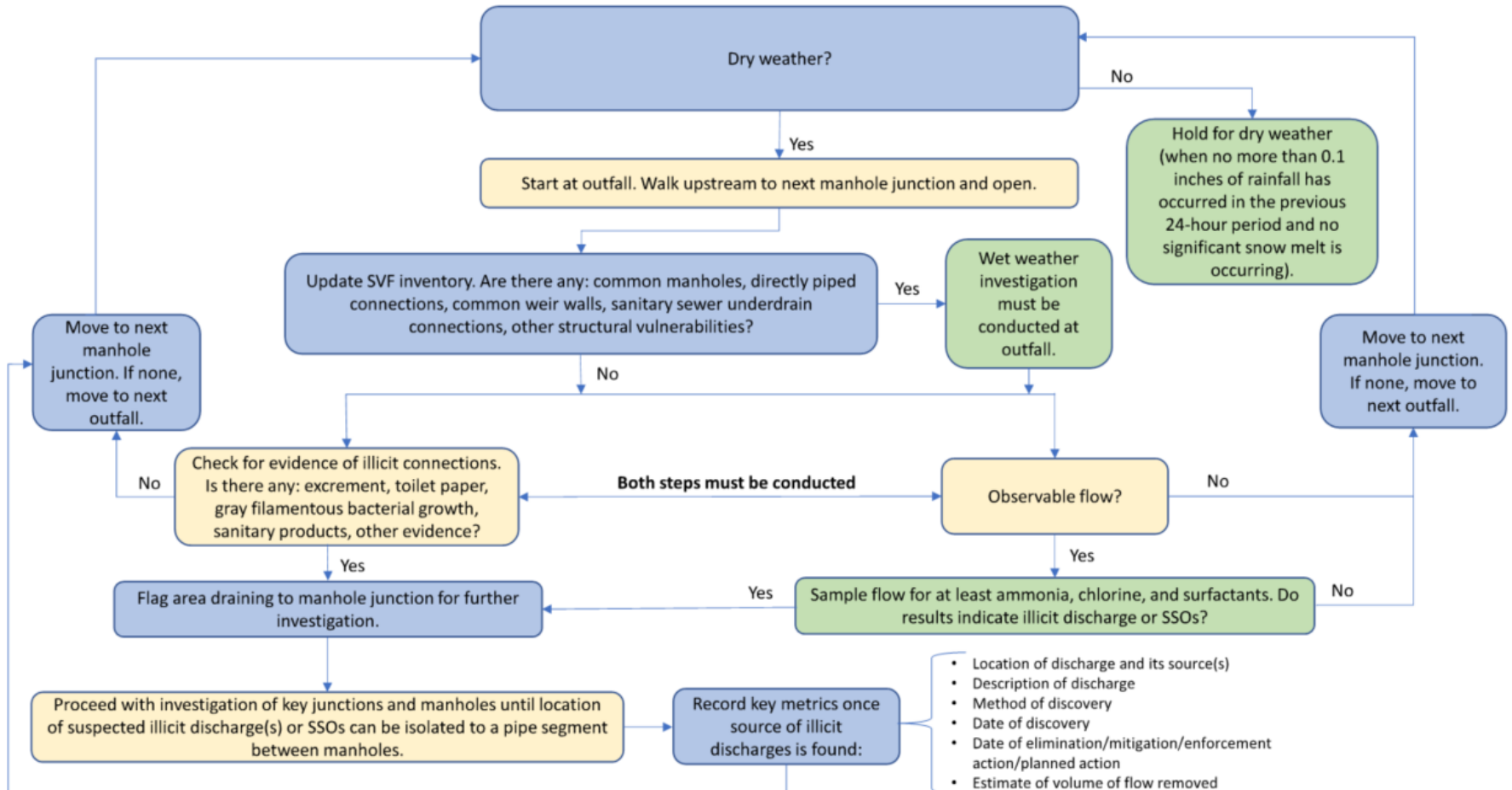
APPENDIX K
Field Records from Initial Catchment Investigations





APPENDIX L
Standard Operating Procedures for Catchment Investigations

Catchment Investigations – SOP – June 2022



APPENDIX C
Millis Stormwater Bylaws and Regulations

TOWN OF MILLIS
STORMWATER MANAGEMENT REGULATIONS
Adopted June 28, 2004, Amended June 5, 2006, Amended February 12, 2007
ARTICLE I
LAND DISTURBANCE AND POST-CONSTRUCTION STORMWATER
MANAGEMENT

SECTION 1. PURPOSE

A. Regulation of discharges to the municipal separate storm sewer system (MS4) is necessary for the protection of water bodies and groundwater, and to safeguard the public health, safety, welfare and the environment. Increased and contaminated stormwater runoff associated with developed land uses and the accompanying increase in impervious surface are major causes of impairment of water quality and flow in lakes, ponds, streams, rivers, wetlands and groundwater. Increased and contaminated runoff is a major cause of:

1. Impairment of water quality and flow in lakes, ponds, streams, rivers, wetlands and groundwater,
2. Contamination of drinking water supplies,
3. Erosion of stream channels;
4. Alteration or destruction of aquatic and wildlife habitat; and
5. Flooding.

B. The harmful impacts of soil erosion and sedimentation are:

1. Impairment of water quality and flow in lakes, ponds, streams, rivers, wetlands and groundwater;
2. Contamination of drinking water supplies;
3. Alteration or destruction of aquatic and wildlife habitat;
4. Flooding; and,
5. Overloading or clogging of municipal catch basins and storm drainage systems.

Therefore, this Regulation establishes stormwater management standards for the final conditions that result from development and redevelopment projects to minimize adverse impacts offsite and downstream which may affect abutters, townspeople and the general public.

C. The objectives of this regulation are:

1. To require practices to control the flow of stormwater from new and redeveloped sites into the town storm drainage system in order to prevent flooding and erosion and sedimentation;

2. To protect groundwater and surface water from degradation;
3. To promote groundwater recharge;
4. To prevent pollutants from entering the town's municipal separate storm sewer system (MS4) and to minimize discharge of pollutants from the MS4;
5. To ensure adequate long-term operation and maintenance of structural stormwater best management practices so that they work as designed;
6. To comply with state and federal statutes and regulations relating to stormwater discharges; and
7. To protect water resources ensure that soil erosion and sedimentation control measures and stormwater runoff control practices are incorporated into the site planning and design process and are implemented and maintained; require practices to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality.
8. To establish the legal authority to ensure compliance with the provisions of this regulation through inspection, monitoring, and enforcement.

SECTION 2. DEFINITIONS

ABUTTER: The owner(s) of land directly abutting and across the street from the parcel on which the activity takes place.

AGRICULTURE: The normal maintenance or improvement of land in agricultural or aquacultural use, as defined by the Massachusetts Wetlands Protection Act and its implementing regulations.

ALTERATION OF DRAINAGE CHARACTERISTICS: Any activity on an area of land that changes the water quality, force, direction, timing or location of runoff flowing from the area. Such changes include: change from distributed runoff to confined, discrete discharge, change in the volume of runoff from the area; change in the peak rate of runoff from the area; and change in the recharge to groundwater on the area.

APPLICANT: Any person, individual, partnership, association, firm, company, corporation, trust, authority, agency, department, or political subdivision, of the Commonwealth or the Federal government to the extent permitted by law requesting a soil erosion and sediment control permit for proposed land-disturbance activity.

AUTHORIZED ENFORCEMENT AGENCY: The Department of Public Works and the Building Inspector and its employees or agents designated to enforce this regulation.

BEST MANAGEMENT PRACTICE (BMP): An activity, procedure, restraint, or structural improvement that helps to reduce the quantity or improve the quality of stormwater runoff.

BOARD: The Board of Selectmen of the Town of Millis or its authorized agents.

CLEARING: Any activity that removes the vegetative surface cover.

DEVELOPMENT: The modification of land to accommodate a new use or expansion of use, usually involving construction.

DISTURBANCE OF LAND: Any action that causes a change in the position, location, or arrangement of soil, sand rock, gravel or similar earth material.

EROSION: The wearing away of the land surface by natural or artificial forces such as wind, water, ice, gravity, or vehicle traffic and the subsequent detachment and transportation of soil particles.

EROSION AND SEDIMENTATION CONTROL PLAN: A document containing narrative, drawings and details developed by a qualified professional engineer (PE) or a Certified Professional in Erosion and Sedimentation Control (CPESC), which includes best management practices, or equivalent measures designed to control surface runoff, erosion and sedimentation during pre-construction and construction related land disturbance activities.

ESTIMATED HABITAT OF RARE WILDLIFE AND CERTIFIED VERNAL POOLS: Habitats delineated for state-protected rare wildlife and certified vernal pools for use with the Wetlands Protection Act Regulations (310 CMR 10.00) and the Forest Cutting Practices Act Regulations (304 CMR 11.00).

GRADING: Changing the level or shape of the ground surface.

GRUBBING: The act of clearing land surface by digging up roots and stumps.

IMPERVIOUS SURFACE: Any material or structure on or above the ground that prevents water infiltrating the underlying soil. Impervious surface includes without limitation roads, paved parking lots, sidewalks, and rooftops.

LAND-DISTURBING ACTIVITY: Any activity that causes a change in the position or location of soil, sand, rock, gravel, or similar earth material.

MASSACHUSETTS ENDANGERED SPECIES ACT: (G.L. c. 131A) and its implementing regulations at (321 CMR 10.00) which prohibit the “taking” of any rare plant or animal species listed as Endangered, Threatened, or of Special Concern.

MASSACHUSETTS STORM WATER MANAGEMENT POLICY: The Policy issued by the Department of Environmental Protection, and as amended, that coordinates the requirements prescribed by state regulations promulgated under the authority of the Massachusetts Wetlands Protection Act G.L. c. 131 § 40 and Massachusetts Clean Waters Act G.L. c. 21, §. 23-56. The Policy addresses stormwater impacts through implementation of performance standards to reduce or prevent pollutants from reaching water bodies and control the quantity of runoff from a site.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (M54) or MUNICIPAL STORM DRAIN SYSTEM: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or manmade or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the town.

OPERATION AND MAINTENANCE PLAN: A plan setting up the functional, financial and

organizational mechanisms for the ongoing operation and maintenance of a stormwater management system to insure that it continues to function as designed.

OUTFALL: The point at which stormwater flows out from a point source discernible, confined and discrete conveyance into waters of the Commonwealth.

OUTSTANDING RESOURCE WATERS (ORWs): Waters designated by Massachusetts Department of Environmental Protection as ORWs. These waters have exceptional sociologic, recreational, ecological and/or aesthetic values and are subject to more stringent requirements under both the Massachusetts Water Quality Standards (314 CMR 4.00) and the Massachusetts Stormwater Management Standards. ORWs include vernal pools certified by the Natural Heritage Program of the Massachusetts Department of Fisheries and Wildlife and Environmental Law Enforcement, all Class A designated public water supplies with their bordering vegetated wetlands, and other waters specifically designated.

OWNER: A person with a legal or equitable interest in property.

PERSON: An individual, partnership, association, firm, company, trust, corporation, agency, authority, department or political subdivision of the Commonwealth or the federal government, to the extent permitted by law, and any officer, employee, or agent of such person.

POINT SOURCE: Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, or container from which pollutants are or may be discharged.

PRE-CONSTRUCTION: All activity in preparation for construction.

POST CONSTRUCTION: The time after a final report issued under section 10.

PRIORITY HABITAT OF RARE SPECIES: Habitats delineated for rare plant and animal populations protected pursuant to the Massachusetts Endangered Species Act and its regulations.

REDEVELOPMENT: Development, rehabilitation, expansion, demolition or phased projects that disturb the ground surface or increase the impervious area on previously developed sites.

RUNOFF: Rainfall, snowmelt, or irrigation water flowing over the ground surface.

SEDIMENT: Mineral or organic soil material that is transported by wind or water, from its origin to another location; the product of erosion processes.

SEDIMENTATION: The process or act of deposition of sediment.

SITE: Any lot or parcel of land or area of property where land-disturbing activities are, were, or will be performed.

SLOPE: The incline of a ground surface expressed as a ratio of horizontal distance to vertical distance.

SOIL: Any earth, sand, rock, gravel, or similar material.

STABILIZATION: The use, singly or in combination, of mechanical, structural, or vegetative methods, to prevent or retard erosion.

STORM WATER MANAGEMENT PLAN: A plan required as part of the application for a Stormwater Management Permit. See Section 7.

STORM WATER: Storm water runoff, snow melt runoff, and surface water runoff and drainage.

STRIP: Any activity which removes the vegetative ground surface cover, including tree removal, clearing, grubbing, and storage or removal of topsoil.

TOWN: Town of Millis

TSS: Total Suspended Solids.

VERNAL POOLS: Temporary bodies of freshwater which provide critical habitat for a number of vertebrate and invertebrate wildlife species.

WATERCOURSE: A natural or man-made channel through which water flows or a stream of water, including a river, brook, or underground stream.

WETLAND RESOURCE AREA: Areas specified in the Massachusetts Wetlands Protection Act G.L. c. 131, § 40 and in the (city or town's) wetland regulation/ordinance.

WETLANDS: Tidal and non-tidal areas characterized by saturated or nearly saturated soils most of the year that are located between terrestrial (land-based) and aquatic (water based) environments, including freshwater marshes around ponds and channels (rivers and streams), brackish and salt marshes; common names include marshes, swamps and bogs; also wet meadows, marshes, swamps, bogs, areas where groundwater, flowing or standing surface water or ice provide a significant part of the supporting substrate for a plant community for at least five months of the year; emergent and submergent communities in inland waters; that portion of any bank which touches any inland water. (MGL c.131 s.40)

SECTION 3. AUTHORITY

This Regulation is adopted under authority granted by the Home Rule Amendment of the Massachusetts Constitution, the Home Rule statutes and pursuant to the regulations of the Federal Clean Water Act found at 40 CFR 122.34, and the Home Rule Charter of the Town of Millis

SECTION 4. APPLICABILITY

A. No person may, by development or redevelopment activity, alter the drainage characteristics of one or more acres of land without a permit from the Board. The regulated projects shall include without limitation:

1. Land disturbance associated with construction or reconstruction of structures;
2. Development or redevelopment involving multiple separate activities in discontinuous locations or on different schedules if the activities are part of a larger common plan of

development that all together disturbs one or more acres.

3. Paving or other change in surface material causing a significant reduction of permeability or increase in runoff;
4. Construction of a new drainage system or alteration of an existing drainage system or conveyance serving a drainage area of one or more acres
5. Any activity that will, or may, result in increased rate or volume of stormwater runoff flowing from the property into a public way or the MS4.

B. This regulation shall apply to all activities that result in disturbance of one or more acres of land. Except as authorized by the Board of Selectmen or its agent, [hereafter known as Selectmen] in a Land Disturbance Permit or as otherwise provided in this regulation, no person shall perform any activity that results in disturbance of an acre or more of land. Normal maintenance and improvement of land in agricultural or aquacultural use, as defined by the Wetlands Protection Act regulation 310 CMR 10.4, are exempt.

C. Other Exemptions

1. Normal maintenance and improvement of land in agricultural use as defined by the Wetlands Protection Act regulation 310 CMR 10.04;
2. Maintenance of existing landscaping, gardens or lawn areas associated with a single family dwelling provided such maintenance does not include the addition of soil material, construction of any walls or alteration of existing grades;
3. The construction of fencing that will not alter existing terrain or drainage patterns;
4. Construction of utilities other than drainage (gas, water, electric, telephone, etc.) which will not alter terrain, ground cover, or drainage patterns;

SECTION 5. ADMINISTRATION

A. The Board shall administer, implement and enforce this Regulation. Any powers granted to or duties imposed upon the Board may be delegated in writing by the Board to its employees or agents.

B. Rules and Regulations. The Board may adopt, and periodically amend, rules and regulations relating to the procedures and administration of this Stormwater Management Regulation, by majority vote of the Board, after conducting a public hearing to receive comments on any proposed revisions. Such hearing dates shall be advertised in a newspaper of general local circulation, at least seven (7) days prior to the hearing date.

C. Waiver. The Selectmen may waive strict compliance with any requirement of this regulation or the rules and regulations promulgated hereunder, where:

- (1) Such action is allowed by federal, state and local statutes and/or regulations,

(2) Is in the public interest, and

(3) Is not inconsistent with the purpose and intent of this regulation.

SECTION 6. PERMITS and PROCEDURE

A. Filing Application. The site owner or his agent shall file with the Board of Selectmen six (6) copies and Town Clerk one (1) original of a completed application package for a Stormwater Management Permit (SMP) or Land Disturbance Permit (LDP), or both. Permit issuance is required prior to any site activity. While the applicant can be a representative, the permit tee must be the owner of the site. The SMP Application package shall include:

1. a completed Application Form with original signatures of all owners;
2. a list of abutters, certified by the Assessor's Office;
3. the Stormwater Management Plan and project description as specified below;
4. the Operation and Maintenance Plan as required by this Regulation;
5. the Erosion and Sedimentation Control Plan
6. payment of the application and review fees.
7. a certification from the Building Inspector that the application is complete.

B. Entry. Filing an application for a permit grants the Board, or its agent, permission to enter the site to verify the information in the application and to inspect for compliance with the resulting permit

C. Other Boards. The Selectmen shall give one copy of the application package to the Planning Board, the Conservation Commission, Department of Public Works, and Board of Health along with a request for comment.

D. Fee Structure. The Board shall obtain with each submission an Application Fee established by the Board to cover expenses connected with the public hearing and application review of the Stormwater Management Permit and a technical Review Fee sufficient to cover professional review. The Board is authorized to retain a Registered Professional Engineer or other professional consultant to advise the Board on any or all aspects of these plans. Applicants must pay review fees before the review process may begin.

E. Public Hearing. The Board shall hold a public hearing within twenty-one (21) days of the receipt of a complete application from the Building Inspector and shall take final action within forty-five (45) days from the close of the hearing unless such time is extended by agreement between the applicant and the Board. Notice of the public hearing shall be given by the applicant by publication in a local paper of general circulation, by posting and by first-class mailings to abutters, certified return receipt requested, at least seven (7) days prior to the hearing. Failure of the applicant to supply return receipt notices to the Selectmen prior to the hearing shall be cause for the rejection of the application without prejudice.

F. Actions. The Board's action, rendered in writing, shall consist of either:

1. Approval of the Stormwater Management Permit Application or Land Disturbance Permit based upon determination that the proposed plan meets the Standards in Section 7 and will adequately protect the water resources of the community and is in compliance with the requirements set forth in this regulation;

2. Approval of the Stormwater Management Permit or Land Disturbance Permit Application subject to any conditions, modifications or restrictions required by the Board which will ensure that the project meets the Standards in Section 7 and adequately protect water resources, set forth in this regulation;
3. Disapproval of the Stormwater Management Permit or Land Disturbance Permit Application based upon a determination that the proposed plan, as submitted, does not meet the Standards in Section 7 or adequately protect water resources, as set forth in this regulation.

G. Failure of the Board to take final action upon an Application within the time specified above shall be deemed to be approval of said Application. Upon certification by the Town Clerk that the allowed time has passed without Board action, the Board must issue a Stormwater Management Permit or Land Disturbance Permit.

H. Plan Changes. The permittee must notify the Board in writing of any drainage change or alteration in the system authorized in a **Stormwater Management Permit or Land Disturbance Permit** before any change or alteration is made. If the Board determines that the change or alteration is significant, based on the Stormwater Management Standards in Section 7.B. and accepted construction practices, the Board may require that an amended application be filed and a public hearing held.

I. Project Completion. At completion of the project the permittee shall submit as-built record drawings of all structural stormwater controls and treatment best management practices required for the site. The as-built drawing shall show deviations from the approved plans, if any, and be certified by a Registered Professional Engineer.

SECTION 7. PLANS

7.1 STORMWATER MANAGEMENT PLAN

A. The application for a stormwater management permit shall consist of submittal of a Stormwater Management Plan to the Board. This Stormwater Management Plan shall contain sufficient information for the Board to evaluate the environmental impact, effectiveness, and acceptability of the measures proposed by the applicant for reducing adverse impacts from stormwater. The Plan shall be designed to meet the Massachusetts Stormwater Management Standards as set forth in Part B of this section and DEP Stormwater Management Handbook Volumes I and II. The Stormwater Management Plan shall fully describe the project in drawings, and narrative. It shall include

1. A locus map,
2. The existing zoning, and land use at the site,
3. The proposed land use,
4. The location(s) of existing and proposed easements,
5. The location of existing and proposed utilities,
6. The site's existing & proposed topography with contours at 2 foot intervals,
7. The existing site hydrology,
8. A description & delineation of existing stormwater conveyances, impoundments, and wetlands on or adjacent to the site or into which stormwater flows.
9. A delineation of 100-year flood plains, if applicable
10. Estimated seasonal high groundwater elevation (November to April) in areas to be used

for stormwater retention, detention, or infiltration.

11. The existing and proposed vegetation and ground surfaces with runoff coefficient for each,
12. A drainage area map showing pre and post construction watershed boundaries, drainage area and stormwater flow paths,
13. A description and drawings of all components of the proposed drainage system including:
 - a. locations, cross sections, and profiles of all brooks, streams, drainage swales and their method of stabilization,
 - b. all measures for the detention, retention or infiltration of water,
 - c. all measures for the protection of water quality,
 - d. the structural details for all components of the proposed drainage systems and stormwater management facilities,
 - e. notes on drawings specifying materials to be used, construction specifications, and typicals, and
 - f. expected hydrology with supporting calculations.
14. Proposed improvements including location of buildings or other structures, impervious surfaces, and drainage facilities, if applicable,
15. Timing, schedules, and sequence of development including clearing, stripping, rough grading, construction, final grading, and vegetative stabilization,
16. A maintenance schedule for the period of construction, and
17. Any other information requested by the Board.
18. Scale, minimum 40 scale.

B. Standards

Projects shall meet the Standards of the Massachusetts Stormwater Management Policy, which are as follows:

1. No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or water of the Commonwealth.
2. Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.
3. Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to the maximum extent practicable. The annual recharge from the post-development site should approximate the annual recharge rate from the predevelopment or existing site conditions, based on soil types.
4. For new development, stormwater management systems must be designed to remove 80% of the average annual load (post development conditions) of Total Suspended Solids (TSS). It is presumed that this standard is met when:
 - a. Suitable nonstructural practices for source control and pollution prevention and implemented;
 - b. Stormwater management best management practices (BMPs) are sized to capture the prescribed runoff volume; and
 - c. Stormwater management BMPs are maintained as designed.
5. Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs (see Stormwater Management Volume I: Stormwater Policy Handbook). The use of infiltration practices without pretreatment is prohibited.

6. Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas (see Stormwater Management Volume I: Stormwater Policy Handbook). Critical areas are Outstanding Resource Waters (ORWs), shellfish beds, swimming beaches, cold water fisheries and recharge areas for public water supplies.
7. Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.
8. Erosion and sediment controls must be implemented to prevent impacts during disturbance and construction activities.
9. All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed.

7.2 EROSION AND SEDIMENT CONTROL PLAN

- A.** The Erosion and Sediment Control Plan shall contain sufficient information to describe the nature and purpose of the proposed development, pertinent conditions of the site and the adjacent areas, and proposed erosion and sedimentation controls. The applicant shall submit such material as is necessary to show that the proposed development will comply with the design requirements listed in Section 7.B. below.
- B.** The **design requirements** of the Erosion and Sediment Control Plan are:
 1. Minimize total area of disturbance;
 2. Sequence activities to minimize simultaneous areas of disturbance;
 3. Minimize peak rate of runoff in accordance with the Massachusetts Stormwater Policy;
 4. Minimize soil erosion and control sedimentation during construction, provided that prevention of erosion is preferred over sedimentation control;
 5. Divert uncontaminated water around disturbed areas;

6. Maximize groundwater recharge;
7. Install, and maintain all Erosion and Sediment Control measures in accordance with the manufacturer's specifications and good engineering practices;
8. Prevent off-site transport of sediment;
9. Protect and manage on and off-site material storage areas (overburden and stockpiles of dirt, borrow areas, or other areas used solely by the permitted project are considered a part of the project);
10. Comply with applicable Federal, State and local laws and regulations including waste disposal, sanitary sewer or septic system regulations, and air quality requirements, including dust control;
11. Prevent adverse impact from the proposed activities to habitats mapped by the Massachusetts Natural Heritage & Endangered Species Program as Endangered, Threatened or Of Special Concern, Estimated Habitats of Rare Wildlife and Certified Vernal Pools, and Priority Habitats of Rare Species;
12. Institute interim and permanent stabilization measures, which shall be instituted on a disturbed area as soon as practicable but no more than 14 days after construction activity has temporarily or permanently ceased on that portion of the site;
13. Properly manage on-site construction and waste materials; and
14. Prevent off-site vehicle tracking of sediments.

C. Erosion and Sedimentation Control Plan Content. The Plan shall contain the following information:

1. Names, addresses, and telephone numbers of the owner, applicant, and person(s) or firm(s) preparing the plan;
2. Title, date, north arrow, names of abutters, scale (40 scale minimum), legend, and locus map, Assessor's map and parcel number.
3. Location and description of natural features including:
 - (a) Watercourses and water bodies, wetland resource areas and all floodplain information, including the 100-year flood elevation based upon the most recent Flood Insurance Rate Map, or as calculated by a professional engineer for areas not assessed on these maps;
 - (b) Existing vegetation of various kinds including tree lines, shrub layer, ground cover and herbaceous vegetation, and trees with a caliper twelve (12) inches or larger, noting specimen trees and forest communities;
 - (c) Habitats mapped by the Massachusetts Natural Heritage & Endangered Species Program as Endangered, Threatened or of Special Concern, Estimated Habitats of Rare Wildlife and Certified Vernal Pools, and Priority Habitats of

Rare Species within five hundred (500) feet of any construction activity.

3. Lines of existing abutting streets showing drainage and driveway locations and curb cuts;
4. Existing soils, volume and nature of imported soil materials
6. Topographical features including existing and proposed contours at intervals no greater than two (2) feet with spot elevations provided when needed;
7. Surveyed property lines showing distances and monument locations, all existing and proposed easements, rights-of-way, and other encumbrances, the size of the entire parcel, and the delineation and number of square feet of the land area to be disturbed;
8. Drainage patterns and approximate slopes anticipated after major grading activities (Construction Phase Grading Plans);
9. Location and details of erosion and sediment control measures with a narrative of the construction sequence/phasing of the project, including both operation and maintenance for structural and non-structural measures, interim grading, and material stockpiling areas;
10. Path and mechanism to divert uncontaminated water around disturbed areas, to the maximum extent practicable;
11. Location and description of industrial discharges, including stormwater discharges from dedicated asphalt plants and dedicated concrete plants, which are covered by this permit;
12. Stormwater runoff calculations in accordance with the Department of Environmental Protection's Stormwater Management Policy;
13. Location and description of and implementation schedule for temporary and permanent seeding, vegetative controls, and other stabilization measures;
14. A description of construction and waste materials expected to be stored on-site. The Plan shall include a description of controls to reduce pollutants from these materials, including storage practices to minimize exposure of the materials to stormwater, and spill prevention and response;
15. A description of provisions for phasing the project where one acre of area or greater is to be altered or disturbed;
16. Plans must be stamped and certified by a qualified Professional Engineer registered in Massachusetts or a Certified Professional in Erosion and Sediment Control and
17. Such other information as is required by the Selectmen.

When one or more of the Standards cannot be met, an applicant may demonstrate that an equivalent level of environmental protection will be provided.

C. Project Changes

The permittee, or their agent, shall notify the Board in writing of any change or alteration of a land-disturbing activity authorized in a Stormwater Management Permit before any change or alteration occurs. If the Board determines that the change or alteration is significant, based on the design requirements listed in Section 7 and accepted construction practices, the Board may require that an amended Stormwater Management Permit application be filed and a public hearing held. If any change or deviation from the Stormwater Management Permit occurs during a project, the Board may require the installation of interim measures before approving the change.

SECTION 8. OPERATION AND MAINTENANCE PLANS

An Operation and Maintenance plan (O&M Plan) is required at the time of application for all projects. The maintenance plan shall be designed to ensure compliance with the Permit, this Regulation and that the Massachusetts Surface Water Quality Standards, 314, CMR 4.00 are met in all seasons and throughout the life of the system. The Board shall make the final decision of what maintenance option is appropriate in a given situation. The Board will consider natural features, proximity of site to water bodies and wetlands, extent of impervious surfaces, size of the site, the types of stormwater management structures, and potential need for ongoing maintenance activities when making this decision. The Operation and Maintenance Plan shall remain on file with the Board and shall be an ongoing requirement. The O&M Plan shall include:

A. The name(s) of the owner(s) for all components of the system

B. Maintenance agreements that specify:

1. The names and addresses of the person(s) responsible for operation and maintenance
2. The person(s) responsible for financing maintenance and emergency repairs.
3. A Maintenance Schedule for all drainage structures, including swales and ponds.
4. A list of easements with the purpose and location of each.
5. The signature(s) of the owner(s).

C. Stormwater Management Easement(s).

1. Stormwater management easements shall be provided by the property owner(s) to the Town and to the property owner or association responsible for maintenance as necessary for:
 - a. access for facility inspections and maintenance,
 - b. preservation of stormwater runoff conveyance, infiltration, and detention areas and facilities, including flood routes for the 100-year storm event.
 - c. direct maintenance access by heavy equipment to structures requiring regular cleanout.
 - d. The Town shall reserve the right to perform maintenance and recover said costs from the owner or association responsible for maintenance.
2. The purpose of each easement shall be specified in the maintenance agreement signed by the property owner.
3. Stormwater management easements are required for all areas used for off-site

stormwater control, unless a waiver is granted by the Board.

4. Easements shall be recorded with the Norfolk County Registry of Deeds prior to issuance of a Certificate of Completion by the Board.

D. Changes to Operation and Maintenance Plans

1. The owner(s) of the stormwater management system must notify the Board of changes in ownership or assignment of financial responsibility.
2. The maintenance schedule in the Maintenance Agreement may be amended to achieve the purposes of this regulation by mutual agreement of the Board and the Responsible Parties. Amendments must be in writing and signed by all Responsible Parties. Responsible Parties shall include owner(s), persons with financial responsibility, and persons with operational responsibility.

SECTION 9. SURETY

The Board may require the permittee to post before the start of land disturbance or construction activity, a surety bond, irrevocable letter of credit, cash, or other acceptable security. The form of the bond shall be approved by town counsel, and be in an amount deemed sufficient by the Board to ensure that the work will be completed in accordance with the permit. If the project is phased, the Board may release part of the bond as each phase is completed in compliance with the permit but the bond may not be fully released until the Board has received the final inspection report as required by Section 10 and issued a Certificate of Completion.

SECTION 10. INSPECTIONS

The Board or its designee shall inspect the project site at least at the following stages:

- A. Initial Site Inspection: prior to approval of any plan.
- B. Erosion Control Inspection: to ensure erosion control practices are in accord with the filed plan.
- C. Pre-backfill Inspection: prior to backfilling of any underground drainage or stormwater conveyance structures.
- D. Final Inspection. After the stormwater management system has been constructed and before the surety has been released, the applicant must submit a record plan detailing the actual stormwater management system as installed. The permittee shall submit a report (including certified as-built construction plans) from a Professional Engineer (P.E.), surveyor, or Certified Professional in Erosion and Sediment Control (CPESC), certifying that all erosion and sediment control devices, and approved changes and modifications, have been completed in accordance with the conditions of the approved permit. Any discrepancies should be noted in the cover letter. The Board shall inspect the system to confirm its "as-built" features. This inspector shall also evaluate the effectiveness of the system in an actual storm. If the inspector finds the system to be adequate he shall so report to the Board which will issue a Certificate of Completion.

If the system is found to be inadequate by virtue of physical evidence of operational failure, even though it was built as called for in the Stormwater Management Plan, it shall be

corrected by the permittee before the performance guarantee is released. If the permittee fails to act the Board may use the surety bond to complete the work. Examples of inadequacy shall be limited to: errors in the infiltrative capability, errors in the maximum groundwater elevation, failure to properly define or construct flow paths, or erosive discharges from basins.

Prior to starting clearing, excavation, construction, or land disturbing activity the applicant, the applicant's technical representative, the general contractor or any other person with authority to make changes to the project, shall meet with town staff including the Building Inspector, Department of Public Works staff, and the Health Director, to review the permitted plans and their implementation.

The Selectmen, the Building Inspector, or DPW staff shall make inspections as hereinafter required and shall either approve that portion of the work completed or shall notify the permittee wherein the work fails to comply with the land disturbance permit as approved. The Permit and associated plans for grading, stripping, excavating, and filling work, bearing the signature of approval of the Selectmen, shall be maintained at the site during the progress of the work. In order to obtain inspections, the permittee shall notify the Building Inspector at least two (2) working days before each of the following events:

1. Erosion and sediment control measures are in place and stabilized;
2. Site clearing has been substantially completed;
3. Rough Grading has been substantially completed;
4. Final Grading has been substantially completed;
5. Close of the Construction Season; and
6. Final landscaping (permanent stabilization) and project final completion.

The permittee or his/her agent shall conduct and document inspections of all control measures) no less than weekly or as specified in the permit, and prior to and following anticipated storm events. The purpose of such inspections will be to determine the overall effectiveness of the control plan, and the need for maintenance or additional control measures. The permittee or his/her agent shall submit monthly reports to the Building Inspector in a format approved by the Selectmen. The Building Inspector shall disseminate copies of said reports to the Selectmen, DPW, Board of Health and Conservation Commission.

E. Access Permission

To the extent permitted by state law, or if authorized by the owner or other party in control of the property, Selectmen, its agents, officers, and employees may enter upon privately owned property for the purpose of performing their duties under this regulation and may make or cause to be made such examinations, surveys or sampling as Selectmen deems reasonably necessary to determine compliance with the permit.

SECTION 11. WAIVERS

A. The Board may waive strict compliance with any requirement of this regulation or the rules and regulations promulgated hereunder, where:

1. such action is allowed by federal, state and local statutes and/or regulations,
2. is in the public interest, and
3. is not inconsistent with the purpose and intent of this regulation.

B. Any applicant may submit a written request to be granted such a waiver. Such a request shall be accompanied by an explanation or documentation supporting the waiver request and demonstrating that strict application of the regulation does not further the purposes or objectives of this Regulation.

C. All waiver requests shall be discussed and voted on at the public hearing for the project.

D. If in the Board's opinion, additional time or information is required for review of a waiver request, the Board may continue a hearing to a date certain announced at the meeting. In the event the applicant objects to a continuance, or fails to provide requested information, the waiver request shall be denied.

SECTION 12. CERTIFICATE OF COMPLETION

The Board will issue a letter certifying completion upon receipt and approval of the final inspection reports and/or upon otherwise determining that all work of the permit has been satisfactorily completed in conformance with this Regulation.

SECTION 13. ENFORCEMENT

A. The Board or an authorized agent of the Board including but not limited to the Building Inspector, Director of Public Works, or Assistant Director of Public Works shall enforce this regulation, regulations, orders, violation notices, and enforcement orders, and may pursue all civil and criminal remedies for such violations.

B. Orders

1. The Board or an authorized agent of the Board may issue a written order to enforce the provisions of this regulation or the regulations thereunder, which may include requirements to:

a. cease and desist from construction or land disturbing activity until there is compliance with the regulation and the stormwater management permit;

b. repair, maintain; or replace the stormwater management system or portions thereof in accordance with the operation and maintenance plan.

c. perform monitoring, analyses, and reporting;

d. remediate adverse impact resulting directly or indirectly from malfunction of the stormwater management system.

2. If the enforcing person determines that abatement or remediation of adverse impacts is required, the order shall set forth a deadline by which such abatement or remediation must be completed. Said order shall further advise that, should the violator or property owner fail to abate or perform remediation within the specified deadline, the town may, at its option, undertake such work, and the property owner shall reimburse the town's expenses.

3. Within thirty (30) days after completing all measures necessary to abate the violation or to perform remediation, the violator and the property owner shall be notified of the costs incurred by the town, including administrative costs. The violator or property owner may file a written protest objecting to the amount or basis of costs with the Board within thirty (30) days of receipt of the notification of the costs incurred. If the amount due is not received by the expiration of the time in which to file a protest or within thirty (30) days following a decision of the Board affirming or reducing the costs, or from a final decision of a court of competent jurisdiction, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall begin to accrue on any unpaid costs at the statutory rate provided in G.L. Ch. 59, § 57, after the thirty-first day at which the costs first become due.

C. Penalty. Any person who violates any provision of this regulation, order or permit issued thereunder, shall be punished by a fine of not more than \$100. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

D. Appeals

The decisions or orders of the Board shall be final. Further relief shall be to a court of competent jurisdiction.

E. Remedies Not Exclusive

The remedies listed in this regulation are not exclusive of any other remedies available under any applicable federal, state or local law.

SECTION 14. SEVERABILITY

If any provision, paragraph, sentence, or clause of this regulation shall be held invalid for any reason, all other provisions shall continue in full force and effect

STORMWATER MANAGEMENT and LAND DISTURBANCE PLAN REVIEW FEE SCHEDULE

The following fee schedules are minimum fees. *[The Board]* may require higher fees if deemed necessary for proper review of an application or to ensure compliance.

<u>Lot Area</u>	<u>Professional Review Fee</u>	<u>Application Fee</u>
Less Than 3 Acres	\$500.00	\$500.00
3 to 10 Acres	\$1000.00	\$750.00
Greater than 10 Acres	\$1500.00	\$1000.00
Resubmittal/Amendment		
Filing Fee	\$250.00	
Review Fee	\$ at cost determined by the Board	

GENERAL

1. Any application not accompanied by the appropriate fee shall be deemed incomplete. Payment must be made to the Town of Millis in cash, money order, bank or certified check payable to the Town.
2. An Applicant's failure to pay any additional review or inspection fee within five business days of receipt of the notice that further fees are required shall be grounds for disapproval.
3. The applicant will publish the public notice and send abutter notifications. Abutter notification shall be by certified mail-return receipt requested. The applicant shall pay all costs associated with the publication and notification requirements. The applicant must provide the Board with the return receipt cards.

Professional review fees include engineering review, legal review, and clerical fees associated with the public hearing and permit processing. A fee estimate may be provided by the Board's consulting engineer.

STORM WATER MANAGEMENT PERMIT APPLICATION

To the Board of Selectmen:

The undersigned wishes to submit a Stormwater Management Permit Application as defined in the Stormwater Management Regulations of the Town of Millis, Article II and requests a review and determination by the Board of the Stormwater Management Plan.

The Stormwater Management Plan involves property where owner's title to the land is

derived under deed from _____ Dated _____, and

Recorded in the [Insert] County Registry of Deeds, Book _____, Page, or Land
Court Certificate of Title No. _____, Registered in _____ District,
Book _____, Page _____

Give a brief summary of the nature of the project.

The property (building) is described as being located at

it is currently used as

and the changes proposed to be made are

The project is located on the parcel shown on Assessors Map _____, Parcel _____

Applicant's Signature

Applicant's Name (print)

Applicant's Address

Owners' Signature(s)

Owners' Names(s)

Owners' Address

Date Received by Building Inspector:

Date Filed with Town Clerk:

Signature

Please note: 1) An applicant for a Stormwater Management Plan Review must file with the Building Inspector a completed Stormwater Management Permit Application Form, a list of abutters, six (6) copies of the Stormwater Management Plan Package, six (6) copies of the Operation and Maintenance Plan, and the Application and Review Fees as noted in the Stormwater Management Plan Review Fee Schedule. 2) The applicant shall also file a copy of the Stormwater Management Plan, Operation & Maintenance Plan, and the Application Form with the Town Clerk. The date of receipt by the Town Clerk shall be the official filing date. 3) This application grants the Board and its agents permission to enter the property for inspection and verification of information submitted in the application.

TOWN OF MILLIS - LAND DISTURBANCE PERMIT APPLICATION

To the Board of Selectmen:

The undersigned wishes to submit a Land Disturbance Permit Application as defined in the Stormwater Management and Land Disturbance Regulation of the Town of Millis, and requests a review and determination by the Selectmen of said Land Disturbance Plan.

The Land Disturbance Plan involves property where owner's title to the land is derived under deed from _____ Dated _____, and recorded in the _____ County Registry of Deeds, Book _____, Page _____, or Land Court Certificate of Title No. _____, Registered in _____ District, Book _____, Page _____

Give a brief summary of the nature of the project.

The property (building) is described as being located at

it is currently used as _____, and the

changes proposed to be made are

The project is located on the parcel shown on Assessors Map _____, Parcel _____

Applicant's Signature

Owners' Signature(s)

Applicant's Name (print)

Owners' Names(s)

Applicant's Address

Owners' Address

Date Received by Town Clerk: _____

Signature

Please note: 1) An applicant for a Land Disturbance Plan Review must file with the Building Inspector a completed Land Disturbance Permit Application, a list of abutters, three (3) copies of the Land Disturbance Plan Package, and the application and review fees as noted in the Land Disturbance Plan Review Fee Schedule. 2) The applicant shall also file a copy of the Land Disturbance Plan and the application with the Town Clerk. The date of receipt by the Town Clerk shall be the official filing date.

**TOWN OF MILLIS
STORMWATER MANAGEMENT REGULATIONS
ARTICLE II**

Adopted June 28, 2004

**Regulation Governing Discharges To
The Municipal Storm Drain System**

SECTION 1. PURPOSE

Increased and contaminated stormwater runoff is a major cause of

- (1) impairment of water quality and flow in lakes, ponds, streams, rivers, wetlands and groundwater;
- (2) contamination of drinking water supplies;
- (3) alteration or destruction of aquatic and wildlife habitat; and
- (4) flooding.

Regulation of illicit connections and discharges to the municipal storm drain system is necessary for the protection of the town's water bodies and groundwater, and to safeguard the public health, safety, welfare and the environment.

The objectives of this regulation are:

- (1) to prevent pollutants from entering the town's municipal separate storm sewer system (MS4);
- (2) to prohibit illicit connections and unauthorized discharges to the MS4;
- (3) to require the removal of all such illicit connections;
- (4) to comply with state and federal statutes and regulations relating to stormwater discharges; and
- (5) to establish the legal authority to ensure compliance with the provisions of this regulation through inspection, monitoring, and enforcement.

SECTION 2. DEFINITIONS

For the purposes of this regulation, the following shall mean:

AUTHORIZED ENFORCEMENT AGENCY: The Board of Selectmen (hereafter the Board), its employees or agents designated to enforce this regulation.

BEST MANAGEMENT PRACTICE (BMP): An activity, procedure, restraint, or structural improvement that helps to reduce the quantity or improve the quality of stormwater runoff.

CLEAN WATER ACT: The Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq.*) as hereafter amended.

DISCHARGE OF POLLUTANTS: The addition from any source of any pollutant or combination of pollutants into the municipal storm drain system or into the waters of the United States or Commonwealth from any source.

GROUNDWATER: Water beneath the surface of the ground.

ILLCIT CONNECTION: A surface or subsurface drain or conveyance, which allows an illicit discharge into the municipal storm drain system, including without limitation sewage, process wastewater, or wash water and any connections from indoor drains, sinks, or toilets, regardless of whether said connection was previously allowed, permitted, or approved before the effective date of this regulation. Connections to the municipal storm drain system which constitute illicit discharges as defined below which exist at the time of enactment of this regulation are considered illicit connections.

ILLCIT DISCHARGE: Direct or indirect discharge to the municipal storm drain system that is not composed entirely of stormwater, except as exempted in Section 7. The term does not include a discharge in compliance with an NPDES Storm Water Discharge Permit or a Surface Water Discharge Permit, or resulting from fire fighting activities exempted pursuant to Section 7, subsection 4, of this regulation.

IMPERVIOUS SURFACE: Any material or structure on or above the ground that prevents water infiltrating the underlying soil. Impervious surface includes without limitation roads, paved parking lots, sidewalks, and rooftops.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (M54) or MUNICIPAL STORM DRAIN SYSTEM: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or manmade or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the town.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORM WATER DISCHARGE PERMIT: A permit issued by United States Environmental Protection Agency or jointly with the State that authorizes the discharge of pollutants to waters of the United States.

NON-STORM WATER DISCHARGE: Discharge to the municipal storm drain system not composed entirely of stormwater or groundwater.

PERSON: An individual, partnership, association, firm, company, trust, corporation, agency, authority, department or political subdivision of the Commonwealth or the federal government, to the extent permitted by law, and any officer, employee, or agent of such person.

POLLUTANT: Any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter whether originating at a point or nonpoint source, that is or may be introduced into any sewage treatment works or waters of the Commonwealth. Pollutants shall include without limitation:

- (1) paints, varnishes, and solvents;
- (2) oil and other automotive fluids;
- (3) non-hazardous liquid and solid wastes and yard wastes;
- (4) refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordnances, accumulations and floatables;
- (5) pesticides, herbicides, and fertilizers;
- (6) hazardous materials and wastes; sewage, bacteria, fecal coliform and pathogens;
- (7) dissolved and particulate metals;
- (8) animal wastes;
- (9) rock, sand; salt, soils;
- (10) construction wastes and residues;
- (11) and noxious or offensive matter of any kind.

PROCESS WASTEWATER: Water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any material, intermediate product, finished product, or waste product.

RECHARGE: The process by which groundwater is replenished by precipitation through the percolation of runoff and surface water through the soil.

STORMWATER: Storm water runoff, snow melt runoff, and surface water runoff and drainage.

SURFACE WATER DISCHARGE PERMIT. A permit issued by the Department of Environmental Protection (DEP) pursuant to 314 CMR 3.00 that authorizes the discharge of pollutants to waters of the Commonwealth of Massachusetts.

TOXIC OR HAZARDOUS MATERIAL or WASTE: Any material, which because of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances, constitutes a present or potential threat to human health, safety, welfare, or to the environment. Toxic or hazardous materials include any synthetic organic chemical, petroleum product, heavy metal, radioactive or infectious waste, acid and alkali, and any substance defined as Toxic or Hazardous under G.L. Ch.2 1 C and Ch.2 1 E, and the regulations at 310 CMR 30.000 and 310 CMR 40.0000.

WATERCOURSE: A natural or man-made channel through which water flows or a stream of water, including a river, brook or underground stream.

WATERS OF THE COMMONWEALTH: All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, costal waters, and groundwater.

WASTE WATER: Any sanitary waste, sludge, or septic tank or cesspool overflow, and water that during manufacturing, cleaning or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct or waste product.

SECTION 3. APPLICABILITY

This regulation shall apply to flows entering the municipally owned storm drainage system.

SECTION 4. AUTHORITY

This Regulation is adopted under the authority granted by the Home Rule Amendment of the Massachusetts Constitution and the Home Rule Procedures Act, the Millis Home Rule Charter, and pursuant to the regulations of the federal Clean Water Act found at 40 CFR 122.34.

SECTION 5. RESPONSIBILITY FOR ADMINISTRATION

The Board shall administer, implement and enforce this regulation. Any powers granted to or duties imposed upon the Board may be delegated in writing by the Board to employees or agents of the Board.

SECTION 6. REGULATIONS

The Board may promulgate rules and regulations to effectuate the purposes of this Regulation. Failure by the Board to promulgate such rules and regulations shall not have the effect of suspending or invalidating this regulation.

SECTION 7. PROHIBITED ACTIVITIES

- A. Illicit Discharges.** No person shall dump, discharge, cause or allow to be discharged any pollutant or non-stormwater discharge into the municipal separate storm sewer system (MS4), into a watercourse, or into the waters of the Commonwealth.

B. Illicit Connections. No person shall construct, use, allow, maintain or continue any illicit connection to the municipal storm drain system, regardless of whether the connection was permissible under applicable law, regulation or custom at the time of connection.

C. Obstruction of Municipal Storm Drain System. No person shall obstruct or interfere with the normal flow of stormwater into or out of the municipal storm drain system without prior written approval from the Board .

D. Exemptions

1. Discharge or flow resulting from fire fighting activities;
2. The following non-stormwater discharges or flows are exempt from the prohibition of non-stormwaters provided that the source is not a significant contributor of a pollutant to the municipal storm drain system:
 - (a) Waterline flushing;
 - (b) Flow from potable water sources;
 - (c) Springs;
 - (d) Natural flow from riparian habitats and wetlands;
 - (e) Diverted stream flow;
 - (f) Rising groundwater;
 - (g) Uncontaminated groundwater infiltration as defined in 40 CFR 3 5.2005(20), or uncontaminated pumped groundwater;
 - (h) Water from exterior foundation drains, footing drains (not including active groundwater dewatering systems), crawl space pumps, or air conditioning condensation;
 - (i) Discharge from landscape irrigation or lawn watering;
 - (j) Water from individual residential car washing;
 - (k) Discharge from dechlorinated swimming pool water (less than one ppm chlorine) provided the water is allowed to stand for one week prior to draining and the pool is drained in such a way as not to cause a nuisance;
 - (l) Discharge from street sweeping.

- (m) Dye testing, provided verbal notification is given to the Department of Public Works forty-eight hours prior to the time of the test;
- (n) Non-stormwater discharge permitted under an NPDES permit or a Surface Water Discharge Permit, waiver, or waste discharge order administered under the authority of the United States Environmental Protection Agency or the Department of Environmental Protection, provided that the discharge is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations; and
- (o) Discharge for which advanced written approval is received from the Board as necessary to protect public health, safety, welfare or the environment.

SECTION 8. EMERGENCY SUSPENSION OF STORM DRAINAGE SYSTEM ACCESS

The Board may suspend municipal storm drain system access to any person or property without prior written notice when such suspension is necessary to stop an actual or threatened discharge of pollutants that presents imminent risk of harm to the public health, safety, welfare or the environment. In the event any person fails to comply with an emergency suspension order, the Authorized Enforcement Agency may take all reasonable steps to prevent or minimize harm to the public health, safety, welfare or the environment.

SECTION 9. NOTIFICATION OF SPILLS

Notwithstanding other requirements of local, state or federal law, as soon as a person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of or suspects a release of materials at that facility or operation resulting in or which may result in discharge of pollutants to the municipal drainage system or waters of the Commonwealth, the person shall take all necessary steps to ensure containment, and cleanup of the release. In the event of a release of oil or hazardous materials, the person shall immediately notify the municipal fire and police departments and the department of public works, Board of health, and Conservation Commission. In the event of a release of non-hazardous material, the reporting person shall notify the Authorized Enforcement Agency no later than the next business day. The reporting person shall provide to the Authorized Enforcement Agency written confirmation of all telephone, facsimile or in-person notifications within three business days thereafter. If the discharge of prohibited materials is from a commercial or industrial facility, the facility owner or operator of the facility shall retain on-site a written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

SECTION 10. ENFORCEMENT

The Board or an authorized agent of the Board including the Building Inspector, Director of Public Works or Assistant Director of Public Works, shall enforce this regulation, regulations, orders, violation notices, and enforcement orders, and may pursue all civil and criminal remedies for such violations.

A. Civil Relief If a person violates the provisions of this regulation, regulations, permit, notice, or order issued thereunder, the Board may seek injunctive relief in a court of competent jurisdiction restraining the person from activities which would create further violations or compelling the person to perform abatement or remediation of the violation.

B. Orders The Board or an authorized agent of the Board may issue a written order to enforce the provisions of this regulation or the regulations thereunder, which may include: (a) elimination of illicit connections or discharges to the MS4; (b) performance of monitoring, analyses, and reporting; (c) that unlawful discharges, practices, or operations shall cease and desist; and (d) remediation of contamination in connection therewith.

If the enforcing person determines that abatement or remediation of contamination is required, the order shall set forth a deadline by which such abatement or remediation must be completed. Said order shall further advise that, should the violator or property owner fail to abate or perform remediation within the specified deadline, the town may, at its option, undertake such work, and expenses thereof shall be charged to the violator.

Within thirty (30) days after completing all measures necessary to abate the violation or to perform remediation, the violator and the property owner will be notified of the costs incurred by the town, including administrative costs. The violator or property owner may file a written protest objecting to the amount or basis of costs with the Board within thirty (30) days of receipt of the notification of the costs incurred. If the amount due is not received by the expiration of the time in which to file a protest or within thirty (30) days following a decision of the Board affirming or reducing the costs, or from a final decision of a court of competent jurisdiction, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall begin to accrue on any unpaid costs at the statutory rate provided in G.L. Ch. 59, § 57 after the thirty-first day at which the costs first become due.

C. Criminal Penalty Any person who violates any provision of this regulation, regulation, order or permit issued thereunder, shall be punished by a fine of not more than **\$100.00** Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

D. Entry to Perform Duties Under this Regulation To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the Board its agents, officers, and employees may enter upon privately owned property for the purpose of performing their duties under this regulation and regulations and may make or cause to be made such examinations, surveys or sampling as the Board deems reasonably necessary.

E. Appeals The decisions or orders of the Board shall be final. Further relief shall be to a court of competent jurisdiction.

G. Remedies Not Exclusive The remedies listed in this regulation are not exclusive of any other remedies available under any applicable federal, state or local law.

SECTION 11. SEVERABILITY

The provisions of this regulation are hereby declared to be severable. If any provision, paragraph, sentence, or clause, of this regulation or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this regulation.

To the Board of Selectmen:

The undersigned wishes to submit a Municipal Storm Drain Permit Application as defined in the Stormwater Management and Municipal Storm Drain Regulation of the Town of Millis, and requests a review and determination by the Selectmen of said Municipal Storm Drain Plan.

The Municipal Storm Drain Plan involves property where owner's title to the land is derived under deed from

_____ dated _____, and
recorded in the

_____ County Registry of Deeds, Book _____, Page _____, or Land Court
Certificate

of Title No. _____, Registered in _____ District, Book _____, Page

Give a brief summary of the nature of the project.

The property (building) is described as being located at

it is currently used as _____,
and the

changes proposed to be made are

The project is located on the parcel shown on Assessors Map _____, Parcel _____

Applicant's Signature

Applicant's Name (print)

Applicant's Address

Owners' Signature(s)

Owners' Names(s)

Owners' Address

Date Received by Town Clerk: _____

Signature

Please note: 1) An applicant for a Municipal Storm Drain Plan Review must file with the Building Inspector a completed Municipal Storm Drain Permit Application, a list of abutters, three (3) copies of the Municipal Storm Drain Plan Package, and the application and review fees as noted in the Municipal Storm Drain Plan Review Fee Schedule. 2) The applicant shall also file a copy of the Municipal Storm Drain Plan and the application with the Town Clerk. The date of receipt by the Town Clerk shall be the official filing date.

MUNICIPAL STORM DRAIN PERMIT APPLICATION

FEE SCHEDULE

The following fee schedules are minimum fees. *[The Board]* may require higher fees if deemed necessary for proper review of an application or to ensure compliance.

<u>Lot Area</u>	<u>Professional Review Fee</u>	<u>Application Fee</u>
Less Than 3 Acres	\$500.00	\$500.00
3 to 10 Acres	\$1000.00	\$750.00
Greater than 10 Acres	\$1500.00	\$1000.00

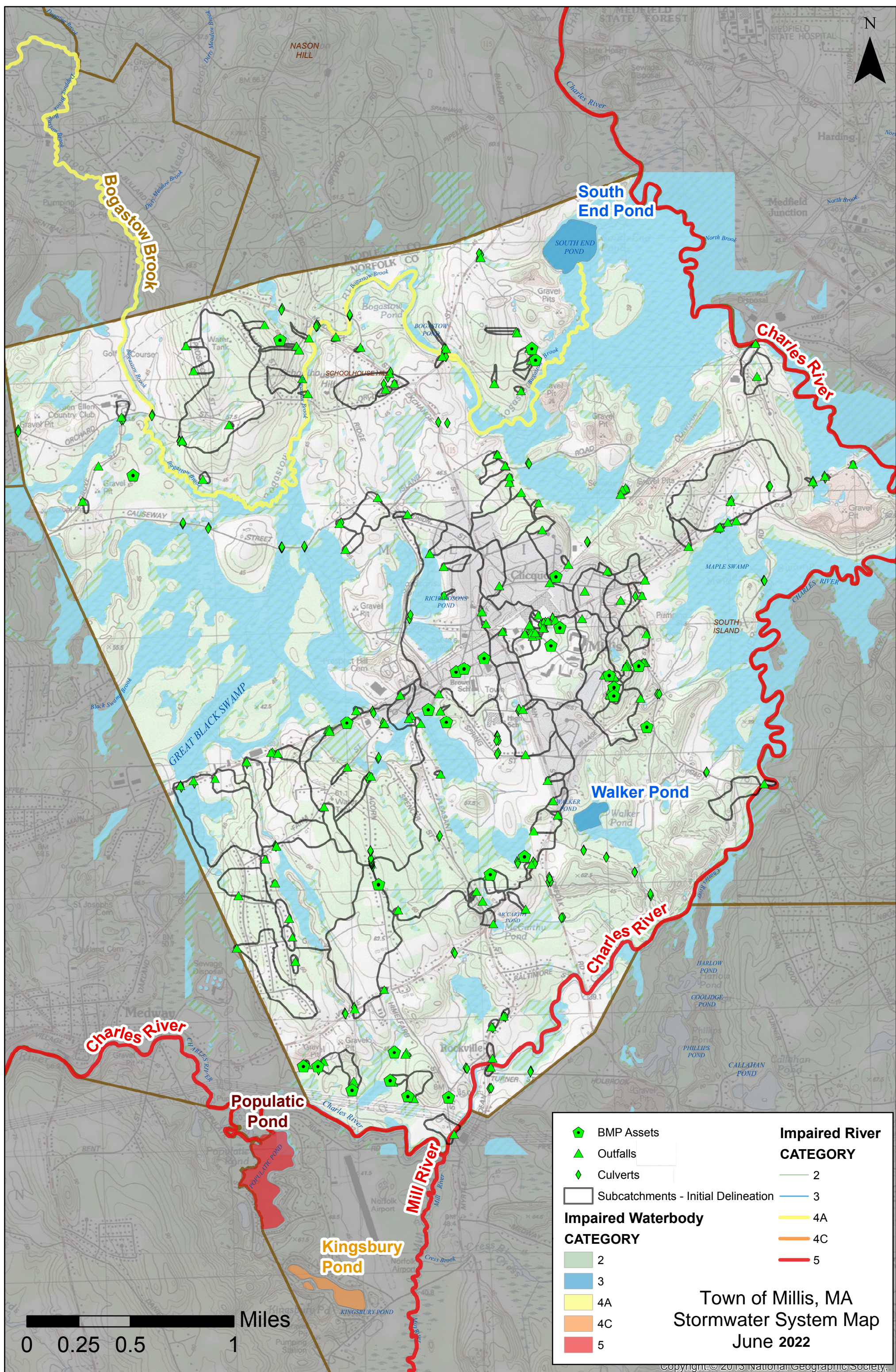
Resubmittal/Amendment	
Filing Fee	\$250.00
Review Fee	\$ at cost determined by the Board

GENERAL

1. Any application not accompanied by the appropriate fee shall be deemed incomplete. Payment must be made to the Town of Millis in cash, money order, bank or certified check payable to the Town.
2. An Applicant's failure to pay any additional review or inspection fee within five business days of receipt of the notice that further fees are required shall be grounds for disapproval.
3. The applicant will publish the public notice and send abutter notifications. Abutter notification shall be by certified mail-return receipt requested. The applicant shall pay all costs associated with the publication and notification requirements. The applicant must provide the Board with the return receipt cards.

Professional review fees include engineering review, legal review, and clerical fees associated with the public hearing and permit processing. A fee estimate may be provided by the Board's consulting engineer.

APPENDIX D
Stormwater System Map



APPENDIX E
Delegation of Authority Letter



TOWN OF MILLIS

Loring Barnes Edmonds, Chair
James J. McCaffrey, Vice Chair
Peter C. Jurmain, Clerk

OFFICE OF THE BOARD OF SELECTMEN

Veterans Memorial Building
900 Main Street • Millis, MA 02054
Phone: 508-376-7040
Fax: 508-376-7053

Michael Guzinski
Town Administrator
mguzinski@millisma.gov

Karen M. Bouret
Operations Support Manager
kbouret@millisma.gov

June 26, 2019

MEMO TO FILE

Re: Documentation for delegation of "Authorized Representative" for NPDES 2016 Massachusetts Small Municipal Separate Storm Sewer System (MS4) General Permit

This document serves to affirm that James McKay, Director of Public Works, has responsibility for the operation of the MS4 and is hereby designated as an authorized person for signing all reports including but not limited to the Stormwater Management Plan (SWMP), Stormwater Pollution Prevention Plans (SWPPPs), inspection reports, annual reports, monitoring reports, reports on training, and other information required by the General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts for the Town of Canton. This authorization cannot be used for signing a NPDES permit application (e.g., Notice of Intent (NOI)) in accordance with 40 CFR 122.22).

By signing this authorization, I confirm that I meet the following requirements to make such a designation as set forth in Part B.11 of Appendix B of the Small MS4 General Permit:

For a municipality, state, federal, or other public agency: By either a principal executive officer or ranking elected official.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Loring Barnes Edmonds
Board of Selectmen, Chairperson

Date

APPENDIX F
Street Design & Parking Lot Guidelines Analysis and
Green Infrastructure Feasibility Analysis

MEMORANDUM

TO: Jim McKay, Town of Millis
FROM: Peter Varga, Kleinfelder
DATE : June 20, 2022
SUBJECT: Street Design and Parking Lot Guidelines Analysis; Green Infrastructure Feasibility Analysis
CC: Kirsten Ryan, Adria Fichter

The Town of Millis administers a Stormwater Management Program in conformance with requirements of the Massachusetts General Permit for stormwater discharges from Small Municipal Separate Storm Sewer Systems (MS4). As an element of that program, the Town is required to evaluate current street design and parking lot guidelines (and other local requirements) that affect the creation of impervious cover. Per the language of the permit (Section 2.3.6(b)):

“This assessment shall be used to provide information to allow the permittee to determine if changes to design standards for streets and parking lots can be made to support low impact design options. If the assessment indicates that changes can be made, the assessment shall include recommendations and proposed schedules to incorporate policies and standards into relevant documents and procedures to minimize impervious cover attributable to parking areas and street designs.”

Upon completion of the evaluation, the Town must implement the recommendations in accordance with the schedules contained in the assessment. The results of the evaluation, therefore, effectively become a condition of the permit. As such, it is critical that all jurisdictional concerns within the Town with responsibility or interest in the design, operation, maintenance or ownership of the assets be in agreement regarding meeting the objectives of the evaluation within the broader context of the Town’s vision and Master Planning goals.

Similarly, under Section 2.3.6(c), the Town is required to assess existing regulations to determine the feasibility of making certain practices allowable when appropriate site conditions exist. These practices specifically include:

- Green roofs

- Infiltration practices such as rain gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; and
- Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses.

The purpose of the analysis is to determine if the practices are allowed, and if not, what are the circumstances that hinder use of the practices. Thereafter, the Town is to determine what changes in regulations are appropriate to optimize use of such practices, and as with the street/parking analysis, establish recommendations and an implementation schedule to put these practices into common usage.

The Town will be responsible for reporting on the status of both of these assessments including any planned or completed changes to local regulations and guidelines in annual reports which are a required submittal to US EPA and the Massachusetts Department of Environmental Protection. This Technical Memorandum documents the approach, results and recommendations of the required evaluations.

Methodology

To complete the analyses, the following documents were reviewed:

- *The Town of Millis General Bylaws (referred to as ‘General Bylaws’)*
- *Town of Millis Master Plan (referred to as ‘Master Plan’)*
- *The Land Subdivision Rules and Regulations of the Planning Board of the Town of Millis, Massachusetts (referred to as ‘LSRR’)*
- *Town of Millis Zoning By-Law (referred to as ‘Zoning By-Laws’)*
- *Town of Millis Stormwater Management Regulations (including Article I: Land Disturbance and Post-Construction Stormwater Management, and Article II: Regulation Governing Discharges to the Municipal Storm Drain System) (Referred to as ‘Article I’ and ‘Article II’)*
- *Town of Millis Stormwater Utility Credit Manual (referred to as ‘SW Utility Credit Manual’)*

The matrix attached to this Technical Memorandum (Attachment 1) is adapted from the Massachusetts Audubon-created Analysis Tool for Local Land Use Regulations found on the US EPA’s website ([Stormwater Tools in New England | US EPA](https://www.epa.gov/stormwater-tools-in-new-england)). The purpose of such an approach is to allow the Town to compare current policies and regulations to examples of “best practices” that optimize potential for improved stormwater management outcomes (primarily as it relates to water quality, but with respect to water quantity in some instances.) Ultimately, the Town must determine if improved outcomes can be

practically and effectively achieved through modification of existing Town policies and regulations.

The analysis was completed by reviewing relevant sections of the cited reference documents to determine where, or if, pertinent criteria currently exist in the Town's regulations as a basis for comparison to recommended best practices. Existing practices that were determined to be less than optimum based on the matrix tool definitions were flagged for further consideration. If the Town had no current regulation addressing the specific practice or design intent (e.g. allowing use of rain barrels) this was noted. Note that the lack of language specifically allowing a particular best practice was not deemed to constitute a challenge or hindrance to use of such practices, given that the Town requires the use of low impact design practices "unless infeasible" in accordance with MS4 Permit requirements. Consequently, any proposed stormwater best management practice designed to achieve water quality improvement would be evaluated on a case by case basis with respect to constructability and technical considerations regarding site suitability.

Analysis and Recommendations

The analysis is summarized in the tables below and is itemized by design factor. Relevant regulations and guidelines are cited as necessary. Regulations and guidelines are as rated conventional, better, and best practices. Current regulations, hinderances, and recommendations are discussed.

Street Design and Parking Lot Guidelines: Summary of Findings

Street design and parking lot standards and guidelines are detailed mostly in the LSRR, and the Zoning By-law documents. References to relevant by-laws and regulations are made for each design element or practice. Regulations or guidelines that hinder best practices are called out. Refer to Attachment 1 for criteria and detailed matrices. The following summary of findings will discuss relevant street and parking lot design guidelines that are related to decreasing impervious area or incorporating low impact designs (LID).

Current regulations are graded "worse than conventional", "conventional", "better", and "best" to describe the level of which they promote and allow LID features for streets and parking lots. "Worse than conventional" regulations explicitly or implicitly impede or prevent implementation LID practices. "Conventional" regulations follow general historic practices that do not address stormwater LID practices, they typically do not impede the use of LID practices but can hinder LID. "Better" guidelines offer flexibility in guidelines which allow implementation of stormwater LID practices. "Best" guidelines explicitly encourage and promote LID features and go above NPDES minimum requirements. This can include incentivizing with Stormwater Utility credits or development opportunities.



Criteria for design factors were taken from an EPA guidance/sample document on the matter. Full criteria definitions are detailed in Attachment 1.

Factor	Regulation Source	Rating	Discussion
Street Location	LSRR 5.1.1. a.	Conventional	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Focused on safe vehicular travel and maximum livability – Special consideration is given to preservation of natural features <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – There are no other requirements or considerations on area of impact, grading, or road lengths to reducing impervious area <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Incorporate limitations on area of impact, grading, road lengths to raise this design guideline from conventional to best practice
Road Width	LSRR 4.7 Table 1 Geometric Design Standards	Worse than conventional	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Low-density and high-density subdivision secondary streets widths are set at 26' and 32', respectively – Primary street width standard is set at 36' <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Current standards promote high amounts of impervious area – Conventional criteria typically set street width to 24'-30' <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Create wide, medium, narrow, and alley categories where widths are limited to 24' for busy two travel lane roads with 2' shoulders, and 18'-20' for low traffic residential neighborhoods – Allow/encourage permeable paving materials for shoulders and low-traffic, narrow, or secondary streets
ROW Width	LSRR 4.7 Table 1 Geometric Design Standards; Zoning By-Laws XIII 4.7.d.	Conventional	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – ROW widths for Type I, II, and I & II are 50', 60', 60', respectively – Clearing of stumps, brush, roots, and like materials within the ROW is required. – Best practice is to limit ROW to 20-50' depending on road type. <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – There are no exceptions or flexibilities on clearing for vegetation part of roadside LID features, or GI <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Limit ROW width to 20-50' depending on road type

Factor	Regulation Source	Rating	Discussion
Access Option	LSRR 4.7 Table 1 Geometric Design Standards; Zoning By-Laws VIII Table 4, VIII C.2.q.	Better	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Limits length of dead ends to 500' – Allows common drives for multi-family, planned business, and planned industrial developments <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Does not explicitly allow one way loop streets, which would decrease street width necessary <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Explicitly allow one way loop streets
Dead Ends/Cul-de-sacs	LSRR 4.7 Table 1 Geometric Design Standards	Better	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Minimum turnaround radius is 50' <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Does not explicitly allow hammer head turnarounds, which limit impervious area – Requires full paving standards for cul-de-sacs, which prevents design and implementation of landscaped bioretention islands <p><i>Improvements:</i></p> <ul style="list-style-type: none"> – Require either a hammerhead turnaround or center landscaped bioretention island
Curbing	LSRR 5.3.1	Conventional	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Requires sloped granite curbing to be installed on both sides of the road, sans driveway openings – Openings for driveways must be placed 15' from catch basin structures <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Continuous curbing limits curb breaks to enable water to flow to vegetated LID features by the roadside <p><i>Improvements:</i></p> <ul style="list-style-type: none"> – Allow curb breaks to enable water to flow to vegetation or vegetated LID features – Preference for no curbs and open drainage with roadside swales

Factor	Regulation Source	Rating	Discussion
Roadside Swales	LSRR 5.12.2.1.g, 5.6.1	Worse than conventional	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Swales in easements shall be provided to redirect flow from 10-year or higher storms <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – No distinction for roadside swales and seems to imply that swales are just for redirecting flow from outfalls in easements – Curbing requirement prevents runoff on impervious surfaces to flow off streets to roadside swales – Grass strips between the sidewalk and the curbing are required to be sloped towards the road preventing roadside swales <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Create exceptions in curbing and grass strip grading to allow roadside swales – Prefer roadside swales to closed drainage and adopt technical specifications and design templates for GI
Utilities	LSRR 5.20 Figure 1-A, 1-B, 1-C	Better	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Current standard widths between drain, sewer, and water does not limit ROW widths – Current standards also show telecom, gas, and electricity in the grassy strip between curbing and sidewalk – No explicit limits to where utilities can go <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – May prevent placement of roadside swales <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Explicitly allow under sidewalks to prevent utilities from impeding installation of LID/GI/BMP features on roadside
Sidewalks	LSRR 5.4.2; 5.4.3., 5.4.5	Conventional	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Requires sidewalks to be constructed on both sides of the street – Require 5' wide bituminous concrete <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Doesn't allow permeable pavement material – Creates unnecessary impervious area on both sides of the road <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Encourage permeable pavement or allow flexibility in material and design – Prefer siting that considers land contours and best pedestrian utility (not necessarily immediately parallel to road) and allow only on one side of the road in low density neighborhoods

Factor	Regulation Source	Rating	Discussion
Sidewalk Drainage	LSRR 5.20 Figure 1-A, 1-B, 1-C, 5.6.1	Best	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Sidewalks are buffered to the road by a mandatory 6'-8' green strip that can absorb sheet flow <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Green strip vegetation is limited to loam and grass and minimum sloping directs sheet flow to the road <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Add flexibility on vegetation and provide exceptions to the minimum sloping grass strip
Parking	Zoning By-Laws VIII Table 4	Conventional	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Sets specific minimums on projected use for Off Street parking per unit dwelling <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Does not encourage minimum number of parking spots – Does not establish maximum parking limits <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Set maximum parking limits – Allow tenants separate optional lease agreements for parking
Commercial Parking	Zoning By-Laws Section VIII Table 4, Section VIII B.3, Section XIX 3.b.9, Section XIII 4.3.3.	Better	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Off-street parking requirements may be fulfilled by use of common off-street parking areas in Commercial districts – Shared parking is encouraged – Transportation Demand Management Program allows density bonus incentives for development size for structured parking, paratransit, pedestrian/bicycle connections or ride sharing programs. <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Does not limit parking space size <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Limit parking stall size to 9' x 18' maximum and 30% smaller for compact cars

Factor	Regulation Source	Rating	Discussion
LID in Parking Areas	Zoning By-Laws Section VIII C.2.p.	Better	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – 1 tree is required per four parking spaces dispersed in lots larger than ¼ acre for visual relief – 5' wide islands/dividers are required for each 20,000 square feet in lots larger than 1 acre, unless it is an automotive/industrial lot <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Vegetative island requirements are for “visual relief” – Unclear if curbing is required <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Modify existing regulations to require islands as LID or bioretention – Require landscape area to be at a minimum of 10% of interior parking lot area
Easy Siting of LID features (bioretention, swales, etc.)	Zoning By-Laws Section XIII 4.3.3.d.e., Section XVIII E.3; LSRR 5.5	Better	<p><i>Current design standards:</i></p> <ul style="list-style-type: none"> – Reconstruction of existing dwelling units call for the reconstruction and maintenance of existing stormwater drains to more natural state using BMPs – Incentives for incorporating landscape design and construction techniques in accord with LEED standards and LID. – Open spaces draining requirements more focused on closed drains – Green strips in road ROWs required to have 6” loam grass strips and be sloped toward the roadway – Shade trees every 100’ in green strip road ROWs where existing trees were not retained <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Open space draining requirements lean more heavily towards higher impact designs – Green strip grass requirements in Road ROW with no exception to native vegetation or other vegetation associated with LID features – Green strip slope requirements are not aligned with reducing stormwater runoff and promoting infiltration <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Explicitly recommend LID on lots, common open space, or Road ROW – Make exceptions for vegetation and slope requirements on road ROWs – Make exceptions for curbing requirements to allow sheet flow from sidewalks and road surfaces to flow to LID features

Factor	Regulation Source	Rating	Discussion
Permeable Paving	<i>Zoning By-Laws Section VIII C.1. b.; OSRP App. 4</i>	Conventional	<p><i>Current Design Standards:</i></p> <ul style="list-style-type: none"> – Requires bituminous asphalt for commercial parking lots <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – <i>OSRP recommends permeable materials for parking lots but contradicts existing Zoning By-law</i> <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – <i>Allow permeable pavement for all parking lots and driveways</i>
Stormwater Management O&M Plan	<i>LSRR 5.12.2.1.f; Article I Section 8</i>	Better	<p><i>Current Design Standards:</i></p> <ul style="list-style-type: none"> – Requires SWMPs to minimize the long-term operational maintenance of structural BMPs – Requires O&M plans for application of all stormwater BMP projects <p><i>Hinderances:</i></p> <ul style="list-style-type: none"> – Does not encourage the use of surficial bioretention/LID features <p><i>Recommendations:</i></p> <ul style="list-style-type: none"> – Encourage surficial bioretention and swales – Discourage closed systems with complicated O&M requirements

Green Infrastructure Analysis: Summary of Findings

This analysis will focus on whether current design standards and guidelines within Zoning By-Laws and LSRR allow the following types of Green Infrastructure:

- Green roofs,
- Infiltration Practices (rain gardens, curb extensions, planter gardens, porous and pervious pavement, etc.),
- And Water Harvesting Devices (rain barrels, cisterns, use of stormwater for non-potable uses)

Generally, Millis regulations and guidelines do not explicitly ban green roofs, infiltration practices, and water harvesting devices, but building requirements can hinder installation of green infrastructure.

Green Infrastructure	Regulation Source	Currently Allowable? (Y/N)	Discussion
Green Roofs	<i>Zoning By-Laws Section XV 4.c.4.e.; Section VI Table 3.2.a.; Section XIX 3.b.4.; SW Utility Credit Manual</i>	N	<p><i>What Allows Practice?</i></p> <ul style="list-style-type: none"> Commercial parcels in certain groundwater zones require roof runoff to be recharged on-site Does not explicitly ban green roofs <p><i>What Hinders Practice?</i></p> <ul style="list-style-type: none"> Residential roofs require gabled roofs which may hinder the installation of green roofs Commercial/Business developments in the village district are required to follow a “residential theme” SW Utility Credit Manual does not explicitly list green roofs as an option
Infiltration (rain gardens, Curb Extensions, Planter Gardens, porous and Pervious Pavement, etc.)	<i>LSRR 5.12.2; SW Utility Manual, Zoning By-Laws Section VIII C.1. b.; OSRP App. 4</i>	Y	<p><i>What Allows Practice?</i></p> <ul style="list-style-type: none"> LSRR allows gutters, inlets, culverts, catch basins, manholes, subsurface piping, surface channels, natural waterways, detention basins, detention basin recharge systems SW Utility Manual requirements are flexible and applied liberally for residents to receive credits towards Stormwater Utility fees OSRP encourages the use of porous paving <p><i>What Hinders Practice?</i></p> <ul style="list-style-type: none"> Pavement standards in LSRR and Zoning By-Law prohibit porous paving LSRR is mostly focused on conveying flow away as opposed to encouraging infiltration
Water Harvesting (Rain Barrels, Cisterns, use of Stormwater for non-potable Uses)	<i>LSRR 5.12.2.1; SW Utility Manual</i>	Y	<p><i>What Allows Practice?</i></p> <ul style="list-style-type: none"> SW Utility Manual requirements are flexible and applied liberally for residents to receive credits towards Stormwater Utility fees Nothing explicitly hindering gray water uses in Zoning By-Laws <p><i>What Hinders Practice?</i></p> <ul style="list-style-type: none"> LSRR focuses on treating SW on-site and flow-based stormwater management strategies rather than collecting or harvesting it

Proposed Implementation Schedule

It is recommended that some design guidelines and standards in the Zoning By-Laws and LSSR be modified to limit impervious area, encourage surficial infiltration, and allow green infrastructure. Topics are sorted by high priority, medium priority, and low priority level for each document.

Regulation	Topic	Implementation Date
LSSR	<i>High Priority:</i> <ul style="list-style-type: none"> Decrease Road Width requirements Make exceptions in curbing, landscaping requirements, and ROW slope to allow drainage to Roadside Swales from the road and the Change Paving Standards to allow permeable materials in applications like intersections, shoulders, alleyways, secondary roads, etc. Change Sidewalk requirements to allow the use of permeable materials 	May 2024 per Town meeting
	<i>Medium Priority:</i> <ul style="list-style-type: none"> Decrease Road ROW Width requirements depending on the road type Require hammerhead turnarounds for Dead-Ends/Cul-de-sacs, or bioretention islands Change Sidewalk placement to emphasize Change Street Location standards to minimize length, area of impact, and grading 	May 2024 per Town meeting
	<i>Low Priority:</i> <ul style="list-style-type: none"> Encourage surficial recharge and discourage closed/underground systems that require complicated O&M Plans Change Utilities standards to explicitly allow LID features to be installed between the sidewalk and road Explicitly allow one way loop streets and common driveways for single unit dwellings 	May 2024 per Town meeting
Zoning By-Law	<i>High Priority:</i> <ul style="list-style-type: none"> Allow permeable paving for driveways and parking lots Make exceptions for gabled roofs in residential neighborhoods 	May 2024 per Town meeting

Zoning By-Law	<p><i>Medium Priority:</i></p> <ul style="list-style-type: none"> • Set maximum parking limits • Modify parking lot island requirement to be geared towards bioretention instead of visual relief 	May 2024 per Town meeting
	<p><i>Low Priority:</i></p> <ul style="list-style-type: none"> • Limit commercial parking spot sizes and offer compact car spots • Explicitly require LID area in Parking lots, open spaces, and other commercial districts 	May 2024 per Town meeting
Article I	<ul style="list-style-type: none"> • Encourage surficial recharge and discourage closed/underground systems that require complicated O&M Plans 	May 2024 per Town meeting

Attachment 1: Street and Parking Lots Design Standards and Guidelines Analysis Tool

Factors	Conventional	Better	Best	Community's Zoning	Community's Subdivision Rules & Regulations	Community's Site Plan Review	Community's Stormwater/ LID Bylaw/ Regulations
GOAL: SMART DESIGNS THAT REDUCE OVERALL IMPERVIOUSNESS OF STRETS AND PARKING LOTS							
Street location	Numeric and geometric standards based primarily on vehicular travel and safety, with basic pedestrian requirements e.g. sidewalks	Flexibility in applying standards, to reduce area of impact, grading, avoid key natural features	OSRD design preferred by-right. Require locating streets to minimize grading and road length, avoid important natural features	(Not applicable)		(Not applicable)	(Not applicable)
Road width	Major and minor categories, 24-30'	Wide, medium, narrow categories. 22-24' max, plus 2' shoulders	Wide, medium, narrow, and alley categories. 20-24' widest for 2 travel lanes, 18-20' low traffic residential neighborhood, plus 2' shoulders. Allow alleys and other low traffic or secondary emergency access and all shoulders to use alternative, permeable materials.	(Not applicable)		(Not applicable)	(Not applicable)
Road ROW width	50-75', fully cleared and graded	40-50', some flexibility in extent of clearing	20-50' depending on road type				
Access Options	No common drives allowed, dead end allowed with limit on length and # of units	Allow dead end with limit on length and # of units. Allow common drives up to 2-3 units	Allow one way loop streets. Allow common drives up to 4 units, and alleys and rear-loading garages where suitable.	(Not applicable)		(Not applicable)	(Not applicable)
Dead Ends/Cul-de-sacs	120 ft or more minimum turnaround	Minimize end radii – 35 ft	Allow hammerhead turnaround	(Not applicable)		(Not applicable)	(Not applicable)
Cul-de-sacs	Full pavement standard	Encourage center landscaping with bioretention	Require center landscaping with bioretention	(Not applicable)		(Not applicable)	(Not applicable)
Curbing	Curbing required full length both sides of road	Allow curb breaks or curb flush with pavement to enable water to flow to vegetated LID features	Open drainage with roadside swales and no curbs preferred	(Not applicable)			
Roadside Swales	Allowed as an option	Preferred over closed drainage	Preferred, with criteria for proper design. Adoption of technical specifications and design templates for green infrastructure recommended	(Not applicable)			
Utilities	Off sets required contributing to wide road ROWs	Not specified, flexible	Allow under road, sidewalks or immediately adjacent to roads to enable placement of roadside swales.	(Not applicable)			(Not applicable)
Sidewalks	Concrete or bituminous	Some flexibility in material and design	Prefer permeable pavement or permeable pavers	(Not applicable)			(Not applicable)
Sidewalk location	Required both sides of road	Allow on only 1 side of road especially in low density neighborhoods	Prefer siting with land contours and for best pedestrian utility (e.g. connect with common areas and shared open spaces) – not necessarily immediately parallel to road.	(Not applicable)			(Not applicable)
Sidewalk drainage	Drains to road closed drainage system	Not addressed	Disconnect drainage from road system – e.g. adjacent green strips or within vegetated areas that can absorb sheet flow	(Not applicable)			(Not applicable)
GOAL 4: ADOPT GREEN INFRASTRUCTURE STORMWATER MANAGEMENT PROVISIONS							
Rooftop runoff	Prohibit directing clean roof runoff into closed municipal drainage systems.	Allow clean roof runoff to be directed to landscaped or naturally vegetated areas capable of absorbing without erosion, or infiltration	Require directing clean roof runoff to landscaped or naturally vegetated areas capable of absorbing, or infiltration	(Not applicable)			
Overall stormwater design; piping and surficial retention vs. LID	Conventional stormwater system design standards		LID design standard. Allow surficial ponding of retained runoff for up to 72 hours and credit for green roofs towards stormwater requirements	(Not applicable)			
Site Plan Requirements	LID may not be addressed	Encourage use of LID features in site design	Count bioretention and other vegetated LID features toward site landscaping/open space requirements.	(Not applicable)	(Not applicable)		
Allow easy siting of LID features (bioretention, swales, etc.)	Often not addressed, may require waivers from subdivision standards	Encouraged along road ROW	Allowed on lots, common open space, or road ROW, easement recorded. For commercial development, allow an increase in floor area ratio or other developmental incentives for green roofs				(Not applicable)

Permeable paving	Often not addressed, may require waivers from subdivision standards	Allowed on private residential lots for parking, patios, etc.	Allowed for residential drives, parking stalls, spillover parking spaces, emergency access ways (with proper engineering support for emergency vehicles) Two track design allowed for driveways and secondary emergency access ways (where required).	(Not applicable)			
Stormwater management O&M plan	Typically only addressed if municipality has a stormwater or LID bylaw, or for areas subject to wetlands permitting	Required	Required, surficial bioretention and swales preferred. Closed/underground systems requiring specialized inspection and clean out discouraged.	(Not applicable)			
Construction Erosion and Sedimentation Plan required	Basic general requirements	Required, contents specified	Goes beyond minimum NPDES requirements, requires minimization of site disturbance	(Not applicable)			
GOAL 5: ENCOURAGE EFFICIENT PARKING							
Parking	Specific minimums set based on projected maximum use times	Encourage minimum # needed to serve routine use (e.g. 2/residential unit with any additional/visitors parking behind in driveway or on street.	Establish Maximum Parking spaces allowed. Do not require more than 2/residence. Allow tenants separate, optional lease agreements for parking.		(Not applicable)		(Not applicable)
Commercial Parking	Specific minimums set based on projected maximum use times adding all on-site uses together.	Some flexibility to reduce minimums based on street or other available nearby parking or transit.	Allowed shared parking for uses with different peak demand times. Provide model agreements/deed restrictions. Reduce parking requirements near transit. Limit parking stall size (9ftx18ft max), with up to 30% smaller for compact cars		(Not applicable)		(Not applicable)
LID in Parking Areas	Often not addressed, may require waivers e.g. for planting islands to drain down rather than built up surrounded by curbs	Allow LID/bioretention within parking areas.	Require landscaping within parking areas, as LID/bioretention, at a minimum of 10% of the interior area landscaped and a minimum of 25 square feet for island planting areas.	(Not applicable)			

APPENDIX G
Municipal Retrofit Opportunities Analysis



MEMORANDUM

TO: Jim McKay, Town of Millis
FROM: Peter Varga, Kleinfelder
DATE : 6/24/2022
SUBJECT: Municipal Retrofit Opportunities Analysis
CC: Kirsten Ryan & Adria Fichter, Kleinfelder

1 BACKGROUND

The following analysis was prepared for the Town of Millis to meet the requirements of the United States Environmental Protection Agency's (US EPA's) 2016 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4) in Massachusetts, hereafter referred to as the 2016 Permit or 'the Permit'. This document meets the Year-4 permit requirement of identifying a minimum of five (5) Town-owned properties that could potentially be modified or retrofitted with structural Best Management Practices (BMP) stormwater mitigation solutions.

2 BMP SUITABILITY ANALYSIS

Kleinfelder conducted a GIS-based screening analysis to identify Town owned parcels where the potential installation of structural stormwater BMPs could improve stormwater quality and reduce flooding impacts. The goal of this planning analysis is to identify five (5) parcels that have the potential to bring the highest value to the Town (in terms of stormwater volume reduction, community benefit, etc.). Ideal locations will be near areas that have the potential for high infiltration. These are areas with low slopes, well-draining soils, and adequate open space to install structural BMPs.

2.1 METHODOLOGY

In order to identify parcels with impervious area that have space and favorable site conditions for BMP implementation, the analysis utilized a ranking process that quantitatively evaluated where structural stormwater BMPs are most appropriate, based on these physical site characteristics:



- Hydrologic soil group (HSG)
- Slope
- Impervious area

Each parcel was processed through a workflow that assigned a ranking (good, fair, or poor) based on the physical characteristics derived from the GIS analysis (Figure 1). Highly permeable soils, and low slopes, are optimal (i.e. more cost effective) for structural BMP implementation and managing highly impervious parcels will offer the highest P reduction benefit. For HSG¹, and slope², the dominant category within in each parcel was assigned for a single parcel value. Impervious surface GIS data has been maintained for the town by Kleinfelder since the implementation of the Millis Stormwater Utility, which charges a stormwater fee to landowners based on the amount of impervious surface in a parcel. In order to determine a final, single, ranking per parcel based on these three physical site characteristics the following logic was applied:

- Poor = any parcel where any of the three factors is rated 'poor'
- Fair = any parcel where any two of the three factors are rated 'fair'
- Good = any parcel where any two of the three factors are rated 'good'
- Unknown = any parcel where data were insufficient to make a determination

¹ <https://www.mass.gov/info-details/massgis-data-soils-ssurgo-certified-nrcs>

² <https://www.mass.gov/info-details/massgis-data-elevation-topographic-data-2005>

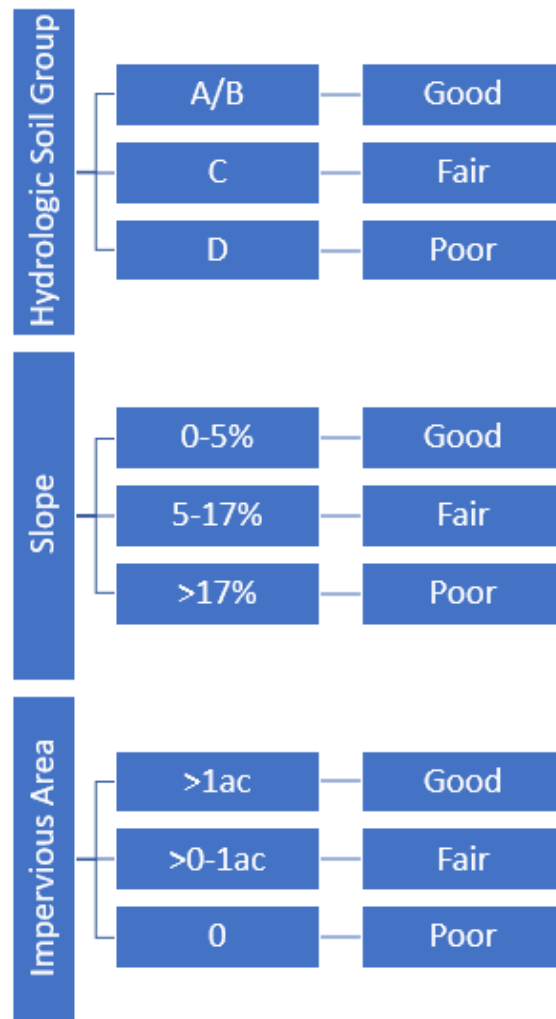


Figure 1. BMP suitability workflow.

In order to determine if there was sufficient open area for structural BMP implementation (300 sf³), the total area of impervious surface, wetlands⁴ and priority habitat⁵ were subtracted from total parcel area. Parcels that had less than 300 sf of remaining pervious area were removed from the analysis. This produced a suite of private and public parcels with favorable physical site conditions and sufficient available open space that could most readily be retrofitted to manage stormwater⁶.

³ Per the methodology of the Resilient Cambridge Plan
(<https://www.cambridgema.gov/Departments/CommunityDevelopment/ResilientCambridgePlan>)

⁴ <https://www.mass.gov/info-details/massgis-data-massdep-wetlands-2005>

⁵ <https://www.mass.gov/info-details/massgis-data-nhosp-priority-habitats-of-rare-species>

⁶ A full GIS process document is available from Kleinfelder upon request.



3 RESULTS

Kleinfelder ranked the 2,112 parcels with at least 300 sf of functional pervious area (i.e. not wetland or priority habitat) to determine the most feasible and optimal locations for future structural stormwater BMPs. This analysis represents 98% of non-right-of-way parcels in the Town. Figure 2 depicts all the Town parcels examined with their corresponding rating, while Table 1 includes those parcels deemed as “Good” or “Fair” by the analysis and considered suitable opportunities for BMP retrofits. Additionally, the parcels are ranked to provide a prioritization for the Town in choosing sites viable for BMP retrofits. Within the categorization of “Good” and “Fair” parcels, the amount of impervious area was prioritized in determining the ranking as this factor is the driving factor in terms of potential for mitigation.

In total, 12 sites were determined to be “Good” candidates for retrofit while an additional 14 were found to be “Fair”. The resulting inventory of parcels for retrofit exceeds the minimum five (5) required by the Permit and provides a number of options for the Town in planning BMP retrofits. Full results of the study, including a list of all parcels examined with their corresponding rating and site characteristics, is included in the attached *Phosphorus Control Plan: Best Management Practice Suitability Analysis (2021)* report.

3.1 INVENTORY OF TOP RETROFIT OPPORTUNITIES

Of the suitable sites determined in the analysis, the top five ranked sites will be used as the Town’s inventory of potential BMP retrofits to meet the Year-4 Permit requirements. These sites were found to have suitable soils for infiltration, slope for capturing runoff, and had the highest impervious area and therefore the highest potential impact for retrofit. The sites are as follows:

1. Parcel M_211794_879129: Millis Middle / High School

Public school building with large amount of impervious area from the school building, parking lots, and entrance roads (38% impervious, 4.86 acres). A significant amount of pervious area to the east of the parking lot has potential for BMP retrofits.

2. Parcel M_211730_879317: Clyde F. Brown Elementary School and fields

Public elementary school building with large amounts of impervious area from school building, tennis courts, playground, and entrance road (25% impervious, 3.50 acres). Also includes recreation fields and significant amounts of pervious area abutting the tennis courts and school building that could be used for BMP retrofits.



3. Parcel M_211547_879406: Clyde F. Brown Elementary School parking lot

Parking lot and entrance road adjacent to the Clyde F. Brown Elementary School, largely impervious area (71%, 2.35 acres) with open impervious space at the north end of the parcel that provides opportunity for capture of runoff from the parking lot.

4. Parcel M_211419_879504: Millis Public Library

Public library and parking lot along main street. The area is largely impervious (76%, 2.04 acres) but does have green space available for retrofit opportunities in the library courtyard and directly surrounding the parking lot.

5. Parcel M_211676_879539: Millis Town Hall

Impervious area made up of the town hall building and surrounding parking areas, totaling 1.73 acres of impervious cover (56% of parcel). The west side of the parcel contains a large impervious area running parallel to the parking lot with high potential for BMP retrofits.

A map of the five (5) prioritized parcels within the Town center is shown in Figure 2.

While parcel M_212399_880521 was ranked as the fifth best option for retrofits by the GIS analysis, the site was taken off the list because site stormwater runoff is already being managed through several structural BMPs. The parcel contains the Town's transfer station which, because it manages solid waste, is subject to a Stormwater Pollution Prevention Plan (SWPPP) under the Permit. The SWPPP was completed in 2020 and includes existing and recommended plans for managing on-site stormwater runoff.

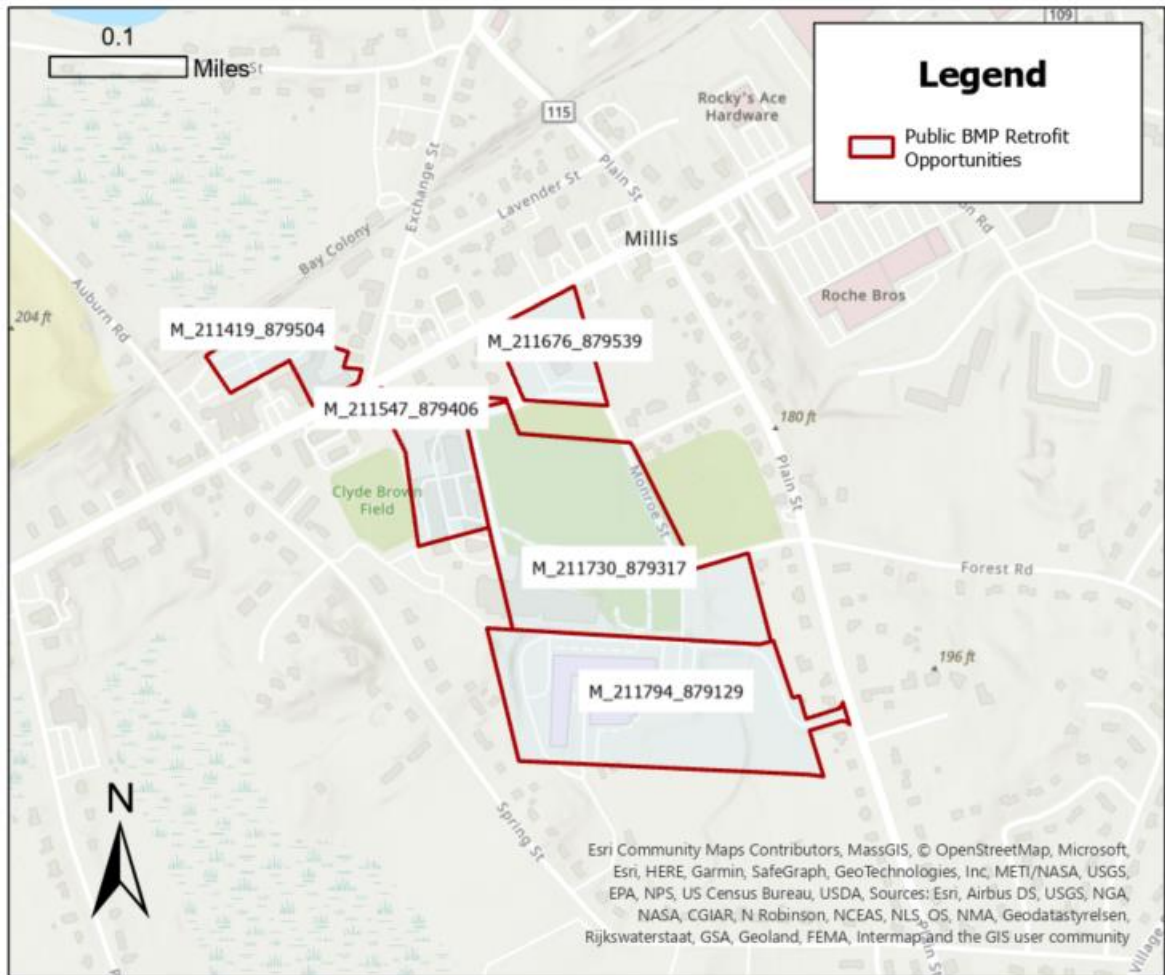


Figure 2: Prioritized Public Parcels for BMP Retrofits

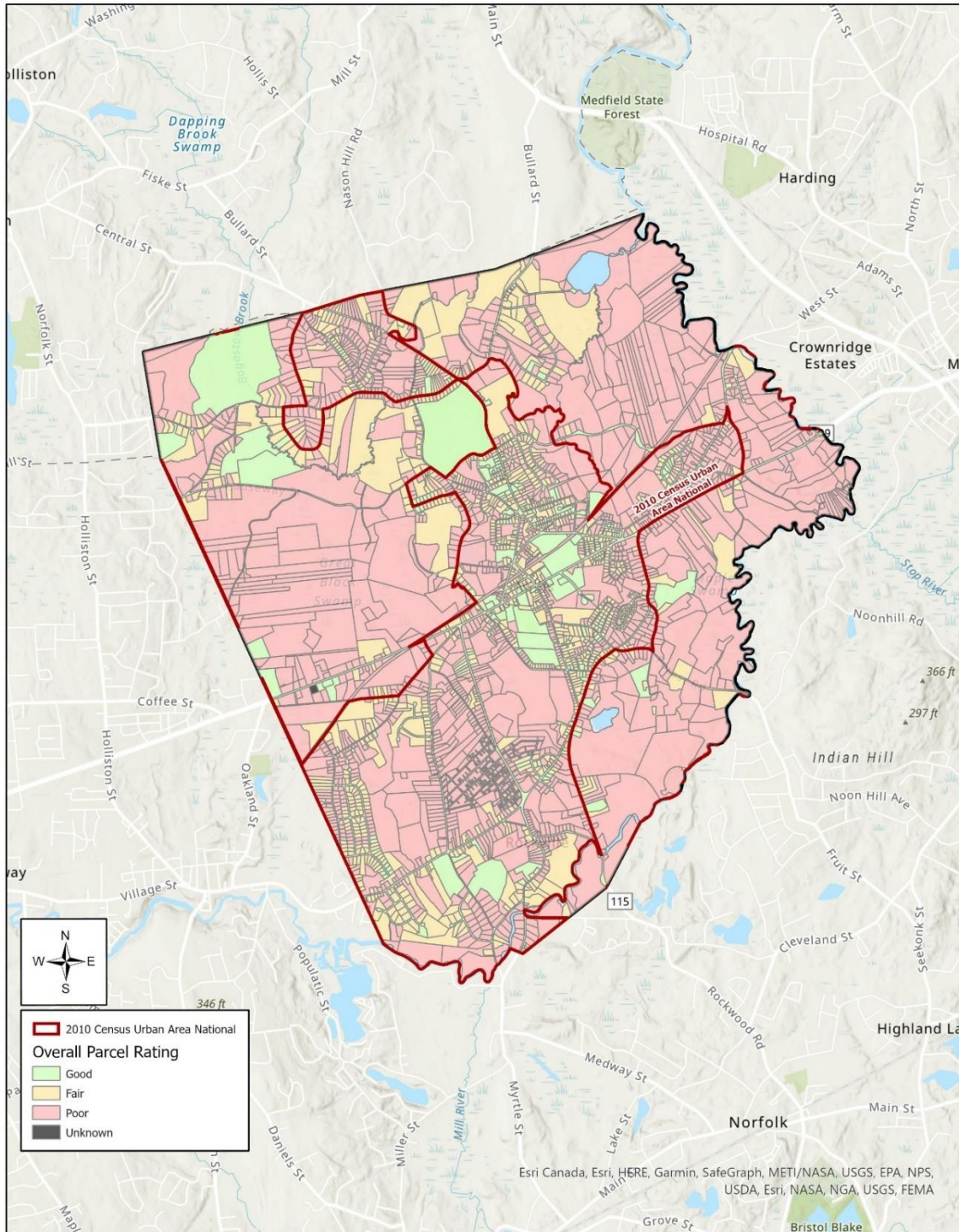


Figure 3: Parcel-Based BMP Suitability Analysis Results



Table 1: Inventory of Public Parcels Suitable for BMP Retrofits

Ranking	Parcel ID	Address	Parcel Size (ac)	Impervious Area (ac)	Overall Rating
1	M_211794_879129	245 PLAIN ST	12.89	4.86	Good
2	M_211730_879317	MAIN & SPRING ST	14.2	3.5	Good
3	M_211547_879406	7 PARK RD	3.3	2.35	Good
4	M_211419_879504	961 MAIN ST	2.68	2.04	Good
5	M_212399_880521	7 WATER ST	6.5	2	Good
6	M_211676_879539	900 MAIN ST	3.1	1.73	Good
7	M_211448_880635	310 EXCHANGE ST	3.2	1.44	Good
8	M_210983_881230	410 EXCHANGE ST	118	1.18	Good
9	M_211866_878976	SPRING ST	11.7	0.48	Good
10	M_211673_879653	885 MAIN ST	0.51	0.36	Good
11	M_211464_879386	972R MAIN ST	2.1	0.05	Good
12	M_210210_877038	INDEPENDENCE LN	0.8	0	Good
13	M_211274_879482	1003 MAIN ST	1.4	0.73	Fair
14	M_211487_879306	SPRING ST	1.26	0.53	Fair
15	M_211694_879460	MAIN ST	1.4	0.28	Fair
16	M_211654_879694	LAVENDER ST	0.35	0.21	Fair
17	M_211858_879375	PLAIN ST	3.3	0.12	Fair
18	M_211436_881490	EXCHANGE ST	36.17	0.08	Fair
19	M_211712_877223	185 PLEASANT ST	0.75	0.05	Fair
20	M_210395_876927	VILLAGE ST	5.1	0.04	Fair
21	M_209599_882044	WALNUT ST	2.41	0.02	Fair
22	M_211612_879999	MEMORIAL PARK	0.13	0.01	Fair
23	M_211259_877692	BOYLSTON AVE	0.12	0.01	Fair
24	M_211500_877542	MILLIS HGHTS	0.24	0.001	Fair
25	M_211268_877700	MILLIS HGHTS	0.12	0.001	Fair
26	M_211875_880351	IRVING ST	0.07	0.001	Fair

APPENDIX H
Scope of PCP and Baseline Assessment Memorandum



MEMORANDUM

TO: Jim McKay, Director, DPW, Town of Millis
FROM: Peter Varga, Kleinfelder
DATE : 6/22/2022
SUBJECT: Scope of PCP (PCP Area) and Baseline Assessment Memorandum
CC: Adria Fichter, Kirsten Ryan, Kleinfelder

1.1 BACKGROUND

The 2016 National Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts (“MS4 Permit” or “the Permit”) approved two nutrient TMDLs for the Charles River; one for the Lower Charles River Basin, published in 2007¹, and one for the Upper/Middle Charles River Basin, published in 2011². As an element of the Permit’s Water Quality Based Effluent Limits (WQBEL) provisions, communities within the Charles River watershed are obligated to address phosphorus impairments through the development and implementation of a Phosphorus Control Plan (PCP). Appendix F of the MS4 Permit describes specific requirements of the PCP, implementation of which is anticipated to achieve the TMDL-established targeted phosphorus reductions over a 20-year timeframe. PCP implementation includes structural and non-structural best management practices (BMPs) executed through programs, projects, and policies. The PCP must be fully implemented within 20 years of the Permit effective date (i.e., by 2038). The targeted phosphorus reductions are broken out into interim mandatory milestones, culminating in achievement of the allowable TMDL phosphorus loads for each municipality at the end of the 20-year schedule.

1.2 OVERVIEW OF PCP PHASE 1 MILESTONES

Permittees are currently in the Phase 1 of the PCP. Phase 1 spans for the first 10 years of the 20-year plan and has two subphases. The first subphase ranging from year one to year five (2018-2023) from the effective date of the permit is called the “Create Phase 1 Plan” which is the ongoing phase. The second subphase for the period from year 5 to year 10 (2023-2028) of the permit is called the “Implement Phase 1 Plan”. Phase 1 of the PCP must achieve the first 25% of each

¹ Massachusetts Department of Environmental Protection. 2007. *Final TMDL for Nutrients in the Lower Charles River Basin*. CN 301.1

² Massachusetts Department of Environmental Protection. 2011. *Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River Basin, Massachusetts*. CN 272.0



permittee's phosphorus load reduction requirement within 10 years (i.e., by June 30, 2028), with an interim milestone of achieving the first 20% of phosphorus load reduction by Year 8 (i.e., by June 30, 2026). This is accomplished by making sure various components of the PCP as detailed in Table 1-1 below are completed and reported to EPA by the stipulated deadline.

Table **Error! No text of specified style in document.**-1. Phase 1 Component Deadlines

Permit Year #	Year-End (June 30th)	PCP Component(s) Due
Year 1	2019	N/A
Year 2	2020	Legal Analysis
Year 3	2021	Funding Source Assessment
Year 4	2022	PCP Scope
Year 5	2023	Descriptions of the following Phase 1 items: <ul style="list-style-type: none"> - Nonstructural controls - Structural controls - O&M program for structural controls - Implementation schedule - Phase 1 cost estimate - Written Phase 1 PCP - Full implementation of nonstructural controls
Year 6	2024	Performance Evaluation
Year 7	2025	Performance Evaluation
Year 8	2026	Performance Evaluation & Implementation of structural controls to achieve 20% of target phosphorus reduction
Year 9	2027	Performance Evaluation
Year 10	2028	Performance Evaluation & Implementation of structural controls to achieve 25% of target phosphorus reduction

This memorandum summarizes the completion of a key PCP component by the Town of Millis during Year 4 of the NPDES permit which is to establish the scope of their designated PCP area within the Charles River Watershed Community. Additionally, this document also demonstrates the reassessment of the Baseline Phosphorus Loads and the corresponding Stormwater Phosphorus Reduction Requirement due to development since 2005 until 2016.

1.3 COMMUNITY CHARACTERIZATION

The Town of Millis is located in western Norfolk County, Massachusetts, along the Charles River. The town was formerly an industrial town, and is now primarily a suburban community with rural areas remaining on its outskirts. Millis is bordered by Medway on the west, Holliston and Sherborn on the north, Medfield on the east, and Norfolk on the south. Millis is 26 miles southwest of Boston,

32 miles east of Worcester, and 32 miles north of Providence RI. Major roadways include Rt. 109 which connects east and west to state Rt. 128 (I-95) and I-495. Route 115 is the major north-south route through town. The center of town is located near the intersection of Rt. 109 (Main St.) and Rt. 115 (Plain St.). The total land area of the town is 12.16 square miles, and the population, census, as of April 1, 2020, is 8,460³. Fig 1-1 below shows the 2005 land use cover for the Town of Millis.

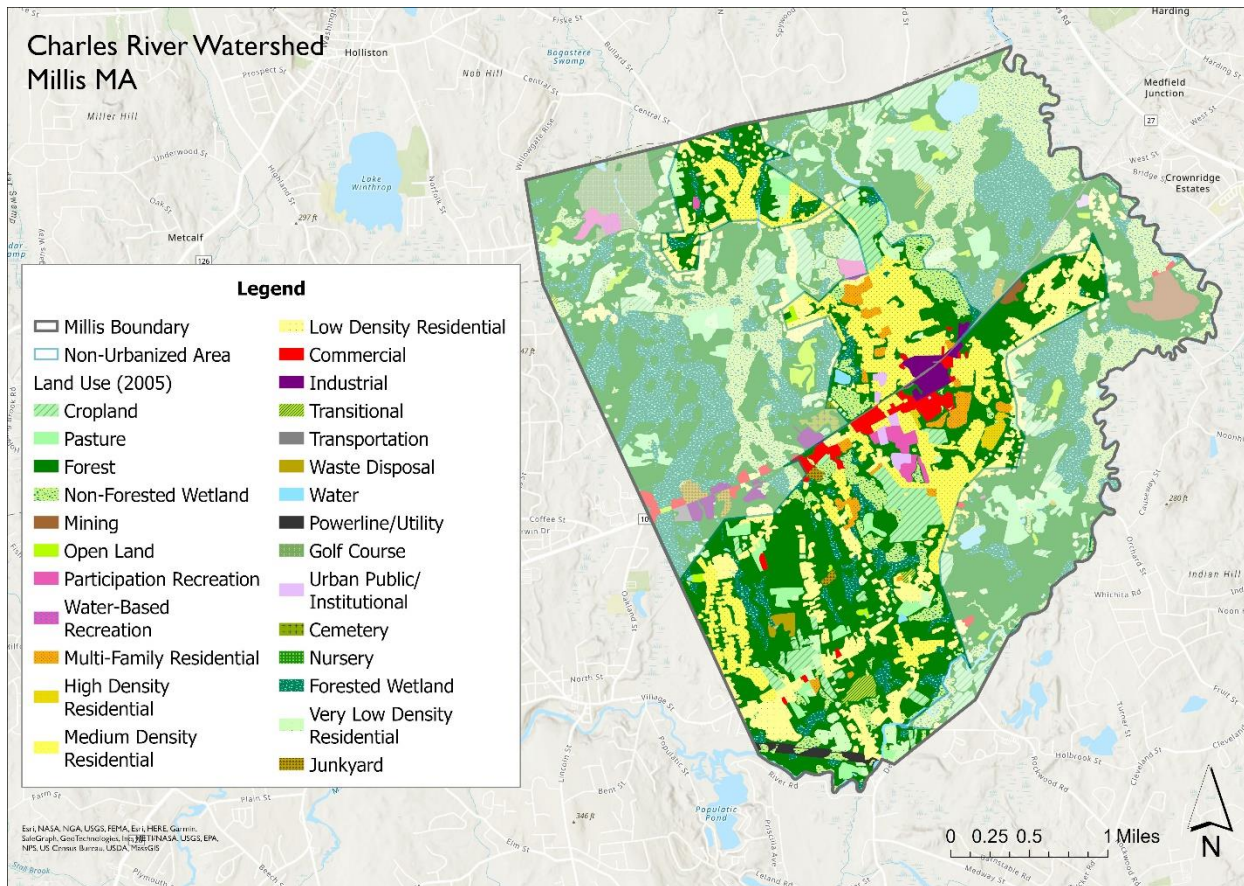


Figure 1-1: 2005 Land Use Cover for the Town of Millis

The Town of Millis is issued an NPDES permit (Permit ID # MAR041137) to discharge stormwater from its MS4 in accordance with the applicable terms and conditions of the MS4 General Permit, including all relevant and applicable Appendices.

The Town of Millis acknowledges that to meet the phosphorus reduction deadlines set forth in the MS4 Permit, significant preparation is required. In order to plan, allocate funds to, design, and construct structural controls to meet the Year 8 and Year 10 reduction deadlines, there is

³ QuickFacts Millis Town, Norfolk County, Massachusetts." U.S. Census Bureau, <https://www.census.gov/quickfacts/fact/table/millistownnorfolkcountymassachusetts/DIS010220>.



significant work to be completed during the initial years of PCP implementation. Some controls that rely on local bylaw or regulatory updates, or engaging landowners directly through incentives, may take even longer to implement. This is taken into account in the Phase 1 implementation schedule.

1.4 PCP LOAD REDUCTION TARGETS

The Town of Millis has the option to implement its PCP either within the entirety of the community that falls within the Charles River watershed, or just the MS4-regulated area otherwise called as the Urbanized Area of the community within the Charles River watershed.

Based on an assessment of factors relevant to the selection criteria, Millis will implement the PCP on the Urbanized Area and therefore be held to the Allowable Phosphorus Load reported in Table F-3 of Appendix F of the MS4 Permit. The Allowable Phosphorus Load reported in Table F-3 of Appendix F of the permit is highlighted in Table 1-3 below specifically for the Town of Millis along with the corresponding Year 8 and Year 10 reduction requirements.

Millis is opting to implement the PCP within the MS4-regulated (Urbanized) area because it is a smaller load and a smaller, more manageable area. We anticipate having the available space within this area to implement BMPs and to meet our MS4 Permit phosphorus reduction requirements. We do anticipate, however, that there will be improvements to stormwater management practices outside of this designated area as well due to the adoption of new stormwater policies and requirements that will be implemented at the municipal scale. We understand that these improvements will not count towards Millis's phosphorus reduction requirement.



Table 1-3. PCP Phase 1 Reduction Requirements

Condition	From Permit ¹
Baseline (2005) P-Load (lbs/yr)	1104.52
Allowable P-Load (lbs/yr)	661.39
Stormwater P-Load Reduction Requirement (lbs/yr)	440.92
Year 8 Milestone: 20% of Reduction (lbs/yr)	88.19
Year 10 Milestone: 25% of Reduction (lbs/yr)	110.23

1.5 INCREASES OR DECREASES TO BASELINE PHOSPHORUS LOAD SINCE 2005

The Baseline Phosphorus Load displayed in Table 1-3 above was calculated using land use data from 2005. Due to development in the Town of Millis, the current phosphorus load has changed, and a reassessment of the baseline load is warranted. An extensive GIS analysis comprising of the following steps was performed to update the Baseline Phosphorus Load with change in phosphorus export due to development from 2005 to 2016. The methodology used in the analysis was illustrated by the Charles River Watershed Association in their Workshop #1: All Abouts the Loads: Baseline Loads⁴.

- Open Source Information Downloads:
 - In order to assess the changes in land use and land cover, the 2016 Land Cover/Land Use ArcGIS layer file was downloaded from MassGIS⁵. Fig 1-2 below shows the 2016 Land Cover/Land Use within the Town of Millis. Phosphorus load exports were estimated for the land area of each landuse type presented in the 2016 Land Cover/Land Use dataset.

⁴ "Workshop 31: All about the Loads: Baseline Loads, Impact from EPA's RDA." Phosphorus Control Planning Support, Charles River Watershed Association, 10 May 2022, <https://www.crrwa.org/phosphorus-control-planning-support.html>.

⁵ "MassGIS Data: 2016 Land Cover/Land Use." Mass.gov, Commonwealth of Massachusetts, May 2019, <https://www.mass.gov/info-details/massgis-data-2016-land-coverland-use>.

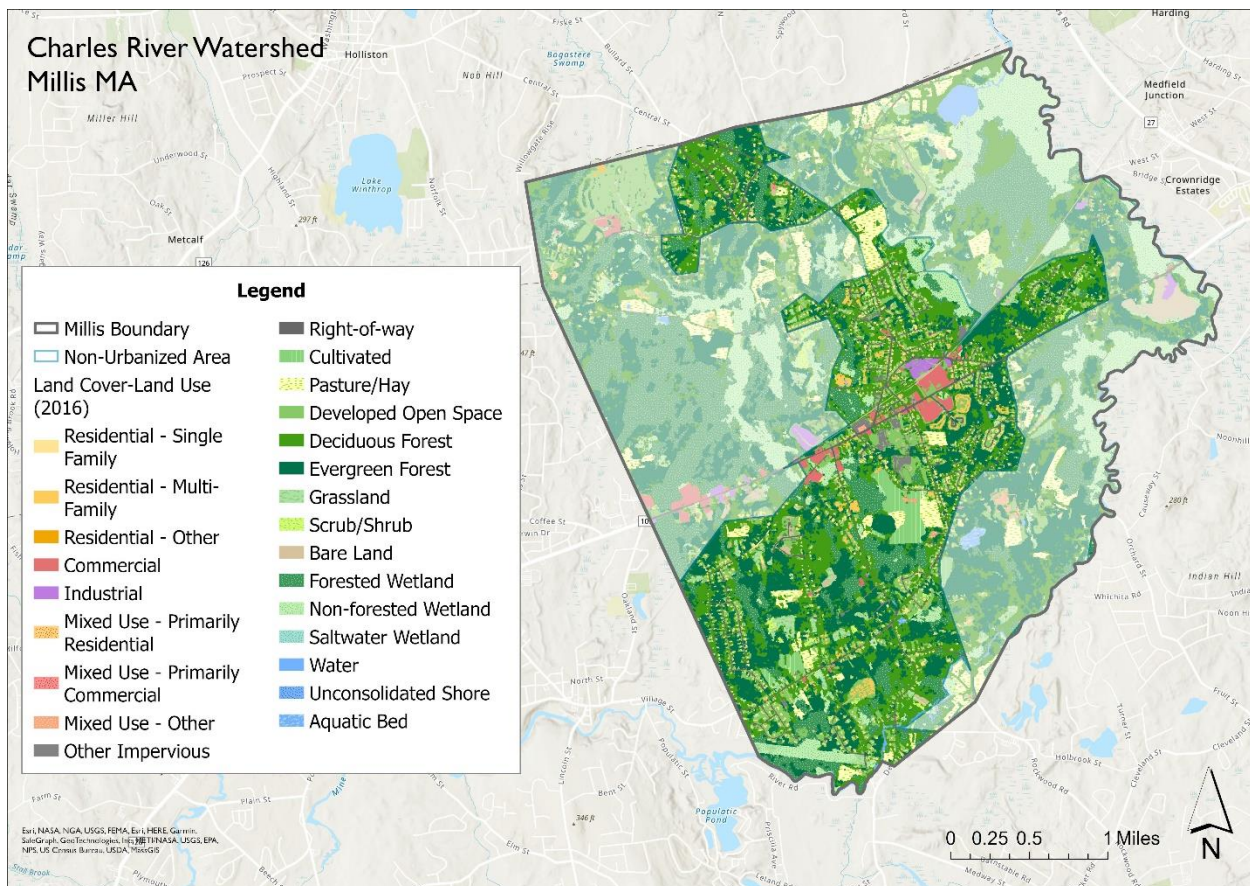


Figure 1-2: 2016 Land Cover/land use for the Town of Millis

- Massachusetts ‘Top-20’ SSURGO Soils Data Layer Created by NRCS in September 2020 was obtained to identify hydrologic soil group classifications for the pervious land areas within the PCP boundary⁶.
- Impervious Surface 2005 layer obtained from MassGIS was used to represent impervious surfaces within the Town of Millis. The impervious surfaces were produced using orthoimagery acquired in April 2005 by MassGIS and was last updated in August 2020⁷.
- The Urbanized Area boundary was used to represent the PCP area and to limit analysis of the land cover, soil groups and impervious surfaces to just the PCP area.

⁶ “MassGIS Data: Soils SSURGO-Certified NRCS.” Mass.gov, Commonwealth of Massachusetts, November 2021, <https://www.mass.gov/info-details/massgis-data-soils-ssurgo-certified-nrcs>.

⁷ “MassGIS Data: Impervious Surface.” Mass.gov, Commonwealth of Massachusetts, February 2007, <https://www.mass.gov/info-details/massgis-data-impervious-surface-2005>

- MassDOT roads layer file was used for the purposes of identifying and removing roadways owned by MassDOT and that do not fall under the jurisdiction of the MS4 permit from any GIS analysis⁸. It was however identified that all roadways included in the 2016 Land use/Land Cover dataset within the Urbanized Area of the Town of Millis were owned by the Town of Millis and therefore were included in the phosphorus load export calculations.
 - A layer file including Roads and Trails owned by the Department of Conservation and Recreation (DCR) was obtained from MassGIS⁹. DCR owned roads and trails, much similar to MassDOT properties do not fall under the jurisdiction of the EPA and must be eliminated from phosphorus load export calculations. The Roads and Trails layer file confirmed that there are no DCR owned properties within the designated PCP area for Millis.
- The 2016 Land Cover/Land Use data layer was clipped to the Urbanized Area boundary for the Town of Millis.
 - MassGIS Land Use Codes found in the 2016 dataset were reconciled with EPA's Land Use Groups for phosphorus load calculations tabulated in Table 1-3 in Attachment 1 of Appendix F of the MS4 permit. The following is a list of newly added Land Use categories in the 2016 Land Cover/Land Use layer file (as opposed to the categories in the 2005 land use layer). These categories were matched with corresponding Pollutant Loading Export Rate (PLER) categories instead obtained from a guidance document published by MassDEP called the *2016 Massachusetts Small MS4 Permit Pollutant Loading Export Rates applied to the 2016 Massachusetts land Use/Land Cover GIS Dataset*¹⁰.
 - Mixed use, other
 - Mixed use, primarily commercial
 - Mixed use, primarily residential
 - Residential – multi-family
 - Residential – single-family
 - Tax Exempt

⁸ "MassGIS Data: Massachusetts Department of Transportation (MassDOT) Roads." Mass.gov, Commonwealth of Massachusetts, May 2022, [MassGIS Data: Massachusetts Department of Transportation \(MassDOT\) Roads | Mass.gov](https://www.mass.gov/info-details/massgis-data-massachusetts-department-of-transportation-massdot-roads)

⁹ "MassGIS Data: Department of Conservation and Recreation Roads & Trails" Mass.gov, Commonwealth of Massachusetts, June 2015, <https://www.mass.gov/info-details/massgis-data-department-of-conservation-and-recreation-roads-trails>

¹⁰ 2016 Massachusetts Small MS4 Permit Pollutant Loading Export Rates Applied to the 2016 Massachusetts Land Use/Land Cover GIS Dataset. Mass.gov, <https://www.mass.gov/doc/2016-massachusetts-small-ms4-permit-pollutant-loading-export-rates/download>.

- Unknown

This guidance document was developed by MassDEP and EPA Region 1 to serve as a crossover between MassGIS's 2016 Land Cover/Land Use dataset and EPA's Land Use Groups that were solely developed based on landuse information identified in the 2005 dataset. MassDEP was consulted before utilizing this guidance document to assign corresponding Land Use categories to the above listed categories that are unique to the 2016 dataset. The final selection of EPA's Land Use Groups matched with each identified 2016 Land Use type within the PCP boundary of Millis can be found in Appendix A. These EPA Land Use Groups were appended to the 2016 Land Cover/Land Use layer clipped for the PCP area of Millis.

- The appended 2016 Land Cover/Land Use layer is now joined with the Massachusetts 'Top-20' SSURGO Soils Data Layer through "Union" operation on GIS.
- The resulting layer file is now intersected with the Impervious surface data layer. This intersection procedure generates an output data layer that includes the acreage of impervious surface area for each polygon. Each polygon in this final shapefile now has a designated EPA Land Use Group, a Hydrologic Soil Group (HSG) from the Soils data layer file and the acreage of pervious or impervious surface area within. The resulting master dataset from this shapefile is used for further calculations that is predominantly performed using Excel spreadsheet analysis.
- Two different types of impervious area, namely – Directly Connected Impervious Area (DCIA) and Disconnected Impervious Area (DIA), and pervious area within the PCP area were calculated for each EPA Land Use Group.
- Directly Connected Impervious Area (DCIA) is calculated based on the formula:
 - $\% \text{ Directly Connected Impervious Area} = A \times (\% \text{ Impervious Area}/100)^B$
 - Where A, B are coefficients that vary based on land use and are tabulated in Appendix A.
 - The Phosphorus loading export rate (PLER) that can be assigned to each Land Use Group is retrieved from Table 1-2 in Attachment 1 of Appendix F of the MS4 permit. The *2016 Massachusetts Small MS4 Permit Pollutant Loading Export Rates applied to the 2016 Massachusetts land Use/Land Cover GIS Dataset* provides an updated PLER for the "Highway" Land Use Group. This weighted average loading rate equals 1.95 lbs P/ac/yr and was applied to all Roads, Right of Ways and Highways that are owned by the permittee regardless of whether roadways are residential roads or highways. This is an increase from the 1.32 lbs/yr/ac pollutant loading export rate developed for the 2005 Land Use category for Highways, which only represented highway pollutant loadings. This updated loading rate was used in our estimations after consultation with MassDEP.

- Phosphorus load export from Directly Connected Impervious Area is Directly Connected Impervious Area multiplied by the corresponding Phosphorus Export Rate. The results of this analysis are tabulated in Appendix A.
- Pervious Area Phosphorus Load Export is calculated based on the following approach:
 - The pervious area polygons were filtered within the master dataset. The resulting dataset was categorized based on Land Use Groups and the corresponding acreage of different types of HSG A, B, C, D, A/D, B/D, C/D and Unknown, within each Phosphorus Land Use Group.
 - PLER that corresponds to the primary HSG were applied to all Dual HSG (A/D, B/D, C/D) assigned soils, as dictated by the *2016 Massachusetts Small MS4 Permit Pollutant Loading Export Rates applied to the 2016 Massachusetts land Use/Land Cover GIS Dataset* and confirmed by MassDEP. Therefore, soils classified as A/D, B/D and C/D were applied to the rates corresponding to HSG A, B and C respectively.
 - Any pervious areas that did not have a HSG assigned was applied the PLER corresponding to HSG C. The PLER for HSG C was revised from 0.29 to 0.21 lbs p/ac/yr as detailed in the *2016 Massachusetts Small MS4 Permit Pollutant Loading Export Rates applied to the 2016 Massachusetts land Use/Land Cover GIS Dataset*. The revised rate was used for our calculations.
 - The acreage of each HSG is multiplied by the PLER from Table 1-2 in Attachment 1 of Appendix F of the MS4 Permit in order to obtain phosphorus load export from pervious surfaces within the PCP area for Millis. The results of this analysis are tabulated in Appendix A.
- Disconnected Impervious Area Load Export is calculated based on the following approach:
 - Disconnected Impervious Area (IA) is calculated by subtracting the acreage of DCIA from total Impervious Area acreage for each Land use category.
 - A composite pervious area PLER is calculated for each Land Use category by dividing the sum of their corresponding Phosphorus Load exports by the overall pervious area across all HSGs.
 - Annual Disconnected Area Phosphorus Load is calculated by multiplying the acreage of Disconnected Impervious Area by the composite pervious area PLER for each Land Use category. The results of this analysis are tabulated in Appendix A.
- Now that we have calculated the annual phosphorus export from Directly Connected Impervious Area, Pervious Area and Disconnected Impervious Area, the total updated phosphorus load export from the Urbanized Area of Millis based on the 2016 Land Cover/Land Use dataset is the summation of phosphorus load exports from all three types

of surfaces. The total annual phosphorus load exports per Land Use Group are tabulated in Appendix A. Fig 1-3 below classifies the overall Urbanized Area of Millis by the estimated Phosphorus load export per acre per year.

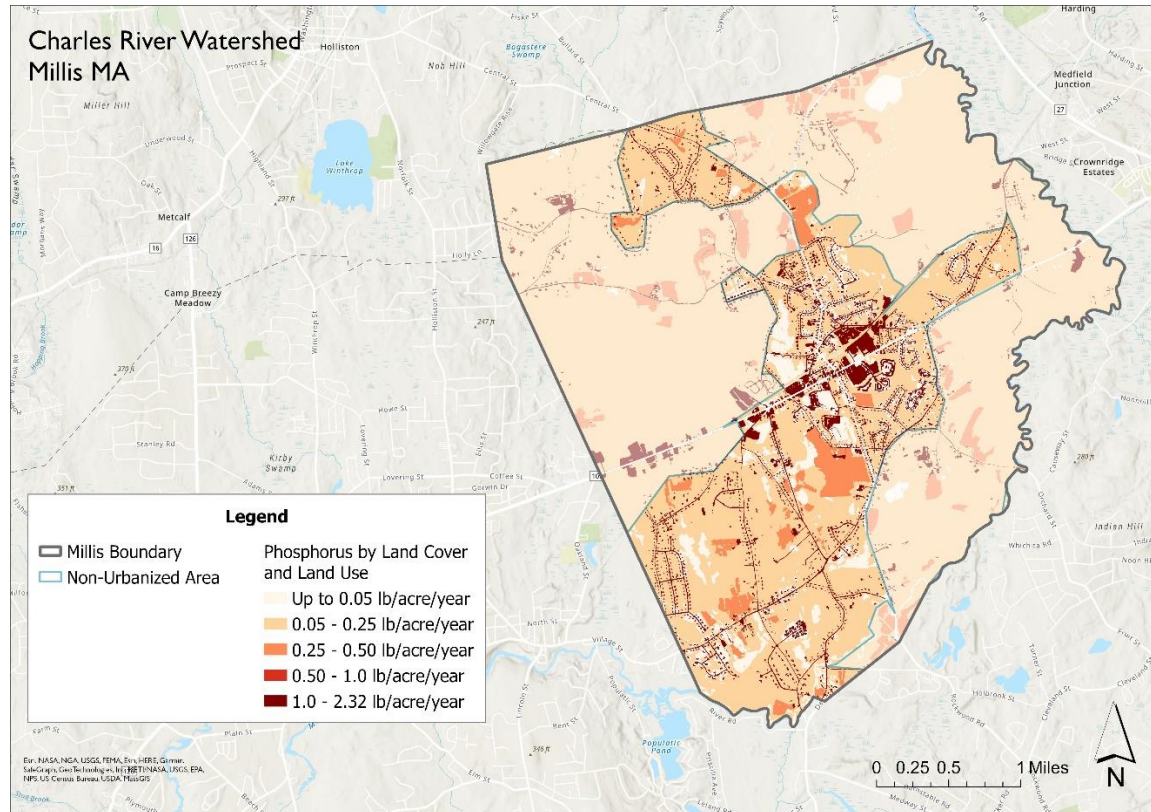


Figure 1-3: Phosphorus load export within the PCP area

- If the updated phosphorus load from the above calculations is calculated to be lesser than the 2005 baseline load, then there is lesser phosphorus exported to the Charles River watershed. This constitutes a reduction in the Stormwater Phosphorus Load Reduction Requirement. If the updated phosphorus load from the above calculations is calculated to be higher than the 2005 baseline load, then this will result in an increase in the Stormwater Phosphorus Load Reduction Requirement.
- Current phosphorus load due to development since 2005 amounted to 705.10 lb/yr. Table 1-4 below shows how the new reduction requirements impacts the Year 8 and Year 10 milestones that the Town should meet.

Table 1-4: Phosphorus Loads Reflecting 2016 Conditions

Condition	Value
Baseline (2005) P-Load (lbs/yr)	1104.52
Allowable P-Load (lbs/yr)	661.39
Stormwater P-Load Reduction Requirement(lbs/yr)	440.92
Changes in P-Load Since 2005 (P-dec lbs/yr)	399.42
Current (2016) P-Load (lbs/yr)	705.10
Current (2016) Stormwater P-Load Reduction Requirement (lbs/yr)	43.71
Year 8 Milestone: 20% of Reduction (lbs/yr)	8.74
Year 10 Milestone: 25% of Reduction (lbs/yr)	10.93

The above analysis indicates a reduction in the annual phosphorus load compared to the existing baseline load as we predict it is due to a large difference in impervious surface data between 2005 and 2016 Land Cover/Land use datasets. To support this theory, a direct comparison of just the impervious area in the 2016 data and the 2005 land use data layers was performed. The 2016 data has a minimum mapping unit of 1/10th acre while the 2005 data has a minimum mapping unit of 1 acre (sometimes less). According to the 2005 documentation of how the separate impervious area class was created, "...The buffered and labeled impervious and labeled pervious data were combined through a second buffer using ESRI's ArcGIS®. This buffer incorporated natural classes into urban class delineations, e.g., lawns (pervious segment) into residential (buffered and labeled impervious). It allowed impervious features of certain classes to grow into pervious areas of specific classes. This buffer was allowed to grow a specified distance beyond the edge of the first buffer. The buffer distance and class hierarchy were specified in an automated model." The coarse resolution and growth of some impervious classes beyond their actual bounds might explain why total P estimated based on 2005 data are so much higher than the estimates based on the 2016 data, where the bounds of impervious area are much more precisely delineated.

The current phosphorus load as calculated using the 2016 Land cover/land Use dataset is reduced by 399.42 lbs/yr from the Baseline Load of 1104.5 lbs/yr. to 705.1 lbs/yr. The Town of Millis will be planning and implementing a series of structural and non-structural BMPs, updating regulatory mechanisms as necessary to aid with achieving these goals, evaluating funding mechanisms and costs, and developing its O&M and recordkeeping programs to ensure functionality of all installed BMPs and enforce continued compliance. Additionally, as land use, development, and impervious cover continue to change, this information will be updated, ensuring that the Town of Millis is on track to still achieve the required 20% and 25% reduction milestones by Years 8 and 10.

Town of Millis PCP Scope and Baseline Assessment Memo - Appendix A

2016 Land Use Categories vs. EPA's Loading Use Groups

Town Survey Land Use	PLUG
Crop Land	Agriculture
Pasture (active)	Agriculture
Forest	Forest
Wetland	Forest
Mining	Industrial
Open Land Includes inactive pasture	Open Land
Participation Recreation	Open Land
Spectator Recreation	Open Land
Water Based Recreation	Open Land
Multi-Family Residential	High Density Residential
High Density Residential	High Density Residential
Medium Density Residential	Medium Density Residential
Low Density Residential	Low Density Residential
Saltwater Wetland	Water
Commercial	Commercial
Industrial	Industrial
Urban Open	Open Land
Transportation	Highway
Waste disposal	Industrial
Water	Water
Cranberry Bog	Agriculture
Powerline	Open Land
Saltwater Sandy Beach	Open Land
Golf Course	Agriculture
Marina	Commercial
Urban Public	Commercial
Cemetery	Open Land
Orchard	Forest
Nursery	Agriculture
Forested Wetland	Forest
Very Low Density residential	Low Density Residential
Junkyards	Industrial
Brush Land/Successional	Forest
Right-of-way	Highway
Mixed use, other	Commercial
Mixed use, primarily residential	High Density Residential
Mixed use, primarily commercial	Commercial
Residential - multi-Family	High Density Residential
Residential - single family	Medium Density Residential
Tax exempt	Commercial
Unknown	Open Land

Sutherland Coefficients

PLUG	A	B
Commercial	0.4	1.2
Industrial	0.4	1.2
Multi-Family	0.4	1.2
High Density Residential	0.4	1.2
Medium Density Residential	0.1	1.5
Low Density Residential	0.1	1.5
Highway	0.1	1.5
Forest	0.01	2
Open Land	0.1	1.5
Agriculture	0.01	2

Phosphorus Load Export from Directly Connected Impervious Area (DCIA)

Phosphorus Land Use Group	Total Area (ac)	Impervious Area (ac)	Percent Impervious	Sutherland Coefficients		Percent DCIA (%)	Directly Connected Impervious Area (ac)	P Loading Export Rate (lb/ac/yr)	P Export Load (lb/yr)
				A	B				
Commercial	301.03	79.39	26.37%	0.4	1.2	20.30%	61.10	1.78	108.76
Industrial	15.65	12.33	78.73%	0.4	1.2	75.41%	11.81	1.78	21.01
High Density Residential	300.56	47.16	15.69%	0.4	1.2	10.88%	32.71	2.32	75.90
Medium Density Residential	1586.70	137.18	8.65%	0.1	1.5	2.54%	40.33	1.96	79.06
Low Density Residential	0.00	0.00	0.00%	0.1	1.5	0.00%	0.00	1.52	0.00
Highway	262.30	148.53	56.63%	0.1	1.5	42.61%	111.77	1.95	217.95
Forest	34.94	0.06	0.17%	0.01	2	0.00%	0.00	1.52	0.00
Open Land	652.26	23.74	3.64%	0.1	1.5	0.69%	4.53	1.52	6.89
Agriculture	33.07	0.25	0.77%	0.01	2	0.01%	0.00	1.52	0.00
Total	3186.51	448.63	14.08%			8.23%	262.26		509.57

Phosphorus Load Export from Pervious Area

Phosphorus Land Use Group	Hydrologic Soil Group - Total Area (acres)				P Loading Export Rate (lb/ac/yr)				Phosphorus Load (lb/yr)				Total
	A	B	C	D	A	B	C	D	A	B	C	D	
Commercial	142.91	58.50	15.82	4.40	0.03	0.12	0.21	0.37	4.29	7.02	3.32	1.63	16.26
Industrial	0.39	0.00	2.90	0.04	0.03	0.12	0.21	0.37	0.01	0.00	0.61	0.01	0.63
High Density Residential	145.11	69.09	31.79	7.42	0.03	0.12	0.21	0.37	4.35	8.29	6.68	2.74	22.06
Medium Density Residential	605.97	510.58	301.91	31.06	0.03	0.12	0.21	0.37	18.18	61.27	63.40	11.49	154.34
Low Density Residential	0.00	0.00	0.00	0.00	0.03	0.12	0.21	0.37	0.00	0.00	0.00	0.00	0.00
Highway	47.33	29.47	32.36	4.61	0.03	0.12	0.21	0.37	1.42	3.54	6.80	1.71	13.46
Forest	14.02	5.61	15.25	0.00	0.13	0.13	0.13	0.13	1.82	0.73	1.98	0.00	4.53
Open Land	249.99	165.02	189.13	24.38	0.03	0.12	0.21	0.37	7.50	19.80	39.72	9.02	76.04
Agriculture	19.91	9.08	3.83	0.00	0.45	0.45	0.45	0.45	8.96	4.09	1.72	0.00	14.77
Total	1225.64	847.34	592.99	71.90					46.53	104.73	124.23	26.60	302.10

Phosphorus Load Export from Disconnected Impervious Area (DIA)

Phosphorus Land Use Group	Total Area (ac)	Impervious Area (ac)	Directly Connected Impervious Area (ac)	Disconnected	Pervious Area								Composite Pervious Area Phosphorus Export Loading	Annual Disconnected Phosphorus Load (lb/yr)
					Hydrologic Soil Group - Area (ac)				Phosphorus Load (lb/yr)					
					A	B	C	D	A	B	C	D		
Commercial	0.00	79.39	61.10	18.29	142.91	58.50	15.82	4.40	4.29	7.02	3.32	1.63	0.07	1.34
Industrial	Total Area (ac)	12.33	11.81	0.52	0.39	0.00	2.90	0.04	0.01	0.00	0.61	0.01	0.19	0.10
High Density Residential	301.03	47.16	32.71	14.44	145.11	69.09	31.79	7.42	4.35	8.29	6.68	2.74	0.09	1.26
Medium Density Residential	15.65	137.18	40.33	96.84	605.97	510.58	301.91	31.06	18.18	61.27	63.40	11.49	0.11	10.31
Low Density Residential	300.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Highway	1586.70	148.53	111.77	36.76	47.33	29.47	32.36	4.61	1.42	3.54	6.80	1.71	0.12	4.35
Forest	0.00	0.06	0.00	0.06	14.02	5.61	15.25	0.00	1.82	0.73	1.98	0.00	0.13	0.01
Open Land	262.30	23.74	4.53	19.21	249.99	165.02	189.13	24.38	7.50	19.80	39.72	9.02	0.12	2.32
Agriculture	34.94	0.25	0.00	0.25	19.91	9.08	3.83	0.00	8.96	4.09	1.72	0.00	0.45	0.11
Total	2501.18	448.63	262.26	186.38	1225.64	847.34	592.99	71.90	46.53	104.73	124.23	26.60		19.80

Total Annual Phosphorus Load Export

Phosphorus Land Use Group	Annual Phosphorus Export (lb/yr)			Total (lb/yr)
	Directly Connected Impervious Area	Pervious Area	Disconnected Impervious Area	
Commercial	108.76	16.26	1.34	126.37
Industrial	21.01	0.63	0.10	21.75
High Density Residential	75.90	22.06	1.26	99.22
Medium Density Residential	79.06	154.34	10.31	243.71
Low Density Residential	0.00	0.00	0.00	0.00
Highway	217.95	13.46	4.35	235.75
Forest	0.00	4.53	0.01	4.54
Open Land	6.89	76.04	2.32	85.25
Agriculture	0.00	14.77	0.11	14.88
Total	400.80	285.84	18.46	705.10

APPENDIX I
Public Education and Outreach Memorandum



MEMORANDUM

TO: Jim McKay, Town of Millis
FROM: Peter Varga, Kleinfelder
DATE : June 21, 2022
SUBJECT: MS4 - Public Education and Outreach
CC: Kirsten Ryan, Peter Varga, Adria Fichter

The purpose of this memorandum is to deliver the Public Education and Outreach requirements for the Town of Millis to comply with their year-4 General Municipal Separated Sanitary Sewer System (MS4) Permit. Part 2.3.2 of Permit requires MS4 communities to provide an educational program to deliver awareness, change the behavior, and increase knowledge to reduce pollutants from entering the stormwater systems.

Section 2.3.2.d of the permit sets educational/messaging standards and best management practices (BMPs) for each target audience category: residential, business/commercial/Institutions, developers/constructors, and industries. The list of standards is provided in Table 1. To provide educational resources that comply with the permit requirements, this task lists a number of resources to account for the relevant BMPs in their category. The summary table in this memorandum provides a comprehensive list of resource materials with the appropriate messaging given the target audience.

The document list at the end of this memorandum catalogues the specific educational resources that are provided separately as part of this task for compliance with year 4 requirements and the associated BMPs that they address.

Category	BMP Number	Description	Notes
Residents	1	Effects of Outdoor Activities such as lawn care on water quality	Focus to minimize use of pesticides, herbicides, and fertilizers.
	2	Benefits of appropriate on-site infiltration of stormwater	
	3	Effects of automotive work and car washing on water quality	
	4	Proper disposal of swimming pool water	
	5	Proper management of pet waste	
	6	Maintenance of Septic systems	If the small MS4 area has areas serviced by septic systems the permittee shall consider information pertaining to maintenance of septic systems as part of its education program.
Business/ Commercial/ Institutional Program	1	Proper lawn maintenance	
	2	Benefits of appropriate on-site infiltration of stormwater	
	3	Building maintenance	Consider proper disposal: use of detergents.
	4	Use of salt or other de-icing and anti-icing materials	Minimize their use.
	5	Proper storage of salt or other de-icing and anti-icing materials	Cover/prevent runoff to storm system and contamination to ground water.
	6	Proper storage of materials	Emphasizing pollution prevention.
	7	Proper management of waste materials and dumpers	Cover and pollution prevention
	8	Proper management of parking lot surfaces	Importance of Sweeping
	9	Proper car care activities	Washing of vehicles and maintenance
	10	Proper disposal of swimming pool water by entities such as motels, hotels, and health and country clubs.	Discharges must be dechlorinated and otherwise free from pollutants.
Developers and Construction	1	Proper sediment and erosion control management practices	
	2	Information about Low Impact Development(LID) principles and technologies	
	3	Information about EPA's construction general permit(CGP)	
Industrial Program	1	Equipment inspection and maintenance	
	2	Proper storage of industrial materials	Emphasize pollution prevention.
	3	Proper management and disposal of wastes	
	4	Proper management of dumpsters	
	5	Minimization of salt or other de-icing/anti-icing materials	
	6	Proper storage of salt or other deicing/anti-icing materials	Cover/prevent runoff to storm system and ground water contamination.
	7	Benefits of appropriate on-site infiltration of stormwater runoff from areas with low exposure to industrial materials such as roofs or employee parking	
	8	Proper maintenance of parking lot surfaces	Importance of Sweeping
	9	Requirements for coverage under EPA's Multi-Sector General Permit	

Table 1: Best Management Practice List

**Residential:***The Solution to Stormwater Pollution.pdf*

- 1.) Effects of Outdoor Activities such as lawn care on water quality
 - a.) use of pesticides, herbicides, and fertilizers
- 2.) Benefits of appropriate on-site infiltration of stormwater
- 3.) Effects of automotive work and car washing on water quality
- 4.) Proper disposal of swimming pool water
- 5.) Proper management of pet waste

New Homebuyer's Guide to Septic Systems.pdf

Brochure addresses maintenance of septic systems

- 1.) If the small MS4 area has areas serviced by septic systems, the permittee shall consider information pertaining to maintenance of septic systems as part of its education program.

Business/Commercial/Institution Program*Commerical-landscaping-pollution-prevention-fact-sheet.pdf*

- 1.) Proper lawn maintenance
- 2.) Benefits of appropriate on-site infiltration of stormwater

<https://www.keepitcleanpartnership.org/learn/household-waste/>

- 3.) Building maintenance

Stormwater_business_pamphlet.pdf

- 4.) Use of salt or other de-icing and anti-icing materials
- 5.) Proper storage of salt or other de-icing and anti-icing materials

<https://www.youtube.com/watch?v=UTqYjbq0FZM&t=147s>

- 6.) Proper storage of materials
- 7.) Proper management of waste materials and dumpers

<https://www.youtube.com/watch?v=9o58vSqbwr8>

- 8.) Proper management of parking lot surfaces

Industrial_commercial_businesses.pdf

7.) Proper management of waste materials and dumpers (already covered)

- 9.) Proper car care activities

Pool-construction-maint.pdf

10. Proper disposal of swimming pool water by entities such as motels, hotels, and health and country clubs.



Developers and Construction

https://www.youtube.com/watch?v=Kdm-Z-_AGnU

- 1.) Proper sediment and erosion control management practices

Builder-lid.pdf

- 2.) Information about Low Impact Development(LID) principles and technologies

Sw_cgp_brochure.pdf

- 3.) Information about EPA's construction general permit(CGP)

Industrial Program

Heavy-Equipment-Yard-BMPs.pdf

- 1.) Equipment inspection and maintenance
- 2.) Proper storage of industrial materials
- 3.) Proper management and disposal of wastes
- 4.) Proper management of dumpsters

Ms4-industrial-bmps.doc

- 5.) Minimization of salt or other de-icing/anti-icing materials
- 6.) Proper storage of salt or other deicing/anti-icing materials

<https://weatherbuild.co/2017/03/27/5-benefits-stormwater-runoff-management-construction/>

- 7.) Benefits of appropriate on-site infiltration of stormwater runoff from areas with low exposure to industrial materials

<https://www.youtube.com/watch?v=9o58vSqbwr8>

- 8.) Proper maintenance of parking lot surfaces

<https://www.epa.gov/npdes/stormwater-discharges-industrial-activities-epas-2021-msgp>

- 9.) Requirements for coverage under EPA's Multi-Sector General Permit