


=Massachusetts Department of Environmental Protection (MassDEP)  
Division of Watershed Management (DWM)  
Watershed Planning Program (WPP)  
8 New Bond Street  
Worcester, MA

**2024-2025 Chloride Project SAP**  
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## List of Revisions

Revision Date	Revision	Pages #s	CN/ (Old CN if applicable)	Initials
8/11/2025	All	1-8	603.0	PM

## Overview

### 1.1 Background:

Sodium chloride (NaCl) is applied to roadways in winter as a deicer. Mattson and Godfrey (1994) found that road salt is the major source of salt loading to Massachusetts streams. Chloride (Cl<sup>-</sup>) levels have also been correlated with impervious surfaces and urbanization (Wallace and Biastoch, 2016). Chloride is a recognized contaminant with potential to impair waterbodies and impact biological communities (Delaune, Nesich, Goos, and Relyea, 2021). It has also been shown to contribute to year-round elevated Cl<sup>-</sup> levels (Todd and Kaltenecker, 2012).

### 1.2 Purpose:

This plan involves collection of continuous conductivity data and discrete surface water samples to estimate chloride levels using DEP's conductivity-chloride regression at the selected stream locations in the watershed. This collection will take place starting in October 2024 through November 2025. Estimated chloride data will help assess how seasonal road salt (NaCl) applications may affect surface water quality. This study will collect continuous conductivity data for (1) application of the MA correlation between specific conductivity and chloride; and (2) analysis of data for comparison to EPA ambient criteria for acute and chronic toxicity.

### 1.3 Sampling & Analysis:

Continuous conductivity data will be collected using HOBO U24 freshwater data loggers. Attended, discrete quality control (QC) readings will be taken at each visit using an Orion Portable Conductivity Meter. On five of the survey rounds, water samples will be collected for chloride (only) and analyzed by the Wall Experiment Station (WES) laboratory.

### 1.4 Data Analysis:

Conductivity data will be analyzed using WPP's chloride regression tool, which was previously verified, to estimate ambient chloride levels. Chloride concentrations from the discrete water samples shall be used to strengthen the chloride regression formula.

### 1.5 Locations:

This study will occur at locations in the Taunton, Ten Mile, French and Quinebaug Watersheds. The waterbodies and sampling locations in each watershed are identified in Table 2A and Table 2B.

The study will focus on waterbodies based on their proximity to major roadways, routes, intersections, and/or estimated high salt deposit areas, as well as proximity to drinking water wells. See Appendix B for individual land use characteristics.

## 1. Project Definition and Background

### 2.1 Project Goals and Objectives

The data collected in this study will help the Massachusetts Department of Environmental Protection (MassDEP) - Division of Watershed Management (DWM), Watershed Planning Program, (WPP) identify potential impacts of road salt on freshwater bodies. From this study, WPP can better understand how road salt, urbanization, and/or other factors affect chloride concentrations of adjacent waterbodies, aquatic biotic health, and drinking water supplies. The results of this study have the potential to influence MassDEP water quality alert levels for chloride and provide baseline data for potential future development of Total Maximum Daily Loads (TMDLs). The sampling objectives for this study are:

- Objective 1.** Estimate chloride levels in-stream by collecting continuous conductivity data at multiple stations using HOBO U24 conductivity loggers during the period of October 2024 through October 2025. The data will then be used by applying the MA correlation between specific conductivity and chloride.
- Objective 2.** Analyze resulting data to determine if estimated concentrations exceed MA state surface water quality standards (EPA ambient criteria for chloride).
- Objective 3.** Collect water samples for chloride measurement. Measured amounts of chloride in water samples will be compared to simultaneously specific conductance measures to continue to evaluate and improve the MA correlation between specific conductance and chloride.

## 2. Project Personnel and Responsibilities

### 3.1 Project Personnel

Specific descriptions of WPP staff roles and responsibilities for this monitoring project are detailed in Table 1. The WPP fulltime Chloride Project staff will be augmented by the seasonal employees from May through September to ensure that enough personnel are available to carry out field surveys throughout the height of the 2025 monitoring season.

**Table 1.** Project Roles and Responsibilities related to monitoring and data use

Project Personnel	Responsibility
<u>Project Oversight</u> - Matthew Reardon - Richard Chase - Shervon De Leon	Provide project guidance, review and approval of SAP.
<u>Project Coordinators</u> - Shervon De Leon - Mason Saleeba - Peter Mitchell	Responsible for site reconnaissance, obtaining landowner access permission, defining logistics for efficient monitoring and generation of useable data at assigned sites using the procedures contained in WPP SOPs.
<u>Water quality survey crews</u> - Peter Mitchell - Mason Saleeba - Shervon De Leon - WPP staff and seasonal employees	Responsible for the collection of samples and data at assigned sites using the sample collection techniques and probe use procedures contained in WPP SOPs.

For each field monitoring survey event, the staff member serving as the survey crew leader (at a minimum) will have met the following qualifications:

- Familiarity with this SAP and all applicable SOPs for that survey
- Completion of a multiprobe sampling/grab sampling/QC training segment
- Prior field experience with survey equipment and with similar monitoring surveys
- Be physically able to access the sites, carry equipment and samples, and perform the sampling.

Survey crew leaders will be accompanied by one or more additional crew members for each survey. All field survey crew personnel and WES/WPP lab personnel will be trained in the proper application of standard operating procedures (SOPs).

Dr. Oscar Pancorbo, Director of MassDEP's Wall Experiment Station (WES), and/or his designees, will coordinate with the WPP regarding sample delivery, analyses, and reporting. WES has been selected to perform chloride analysis.

## 3. Surface Water Quality Monitoring

### 4.1 Standard Operating Procedures

This SAP will be implemented consistent with DWM's EPA-approved programmatic Quality Assurance Program Plan (QAPP) for surface water monitoring in 2020/2024 (CN 520.1).

Onset HOBO U24 Conductivity (and Temperature) Loggers will be deployed at the selected water quality monitoring stations in the Massachusetts watersheds from October 2024 to October 2025. These deployments will be performed to collect continuous conductivity and temperature readings at fixed, 30-minute, recording intervals. The HOBO units will be used in accordance with the Watershed Planning Program's *Standard Operating Procedure for Continuous Conductivity Monitoring* (CN 349.0) and the manufacturer's instructions. The loggers' sensor faces will be cleaned before each intermittent data collection shuttle-technology download. After retrieval of deployed multiprobes, post-deployment calibration and QC checks on the data will be performed. At deployment and prior to retrieval of multiprobes, as well as at various times during the deployment, QC readings will be taken using a separate meter as specified in WPP's unattended probe SOPs.

A YSI EX01 Multi-probe (Yellow Springs, Inc.) will be used in accordance with MassDEP SOP CN: 004.26 for QC purposes approximately every 3rd month between October 2024 and October 2025 at each of the stations. This quality control will be conducted primarily to collect data on temperature and specific conductivity. HOBO conductivity data will be transformed to specific conductance and then reviewed to compare to YSI EX01 specific conductance data.

Water samples will be collected at each sampling location on the five separate surveys for each watershed group in 250ml HDPE bottles, using standard WPP sampling protocols as defined in the program QAPP. Samples will be preserved and delivered to the WES lab for analysis using method SM 4500-Cl E, within 14 days of receipt.

#### **4.2 Non-Direct Measurements**

To better interpret data from the study, the following information will also be collated:

- Road salt use recorded by Massachusetts Department of Transportation and Municipalities
- Forest cover, impervious cover, urban cover, and road miles per watershed area within each watershed.
- Location of drinking water wells/intakes and surface water supply zones
- Daily air temperature and precipitation observations

#### **4.3 Data Analyses**

Conductivity data will be corrected to specific conductivity and used to estimate ambient chloride levels using the WPP's chloride assessment tool, previously verified for this study and in accordance with Standard Operating Procedure CN 004.42. Once available, final data will be summarized in a Technical Memorandum (project-specific or bundled into a larger report).

#### **4.4 Design Rationale and Sampling Locations**

Specific sampling locations are shown below, in Tables 2A and 2B. In general, sites were selected to be representative of typical urban and suburban conditions including percentage impervious cover, impact from roadways and parking lots. In certain cases, a site may have been selected based on indications of historically high levels of chloride or due to site proximity to a suspected high salt loading area or salt storage area, or a drinking water well or withdrawal point. On occasion, recent or concurrent WPP monitoring projects may yield non-continuous conductivity measures resulting in sites of interest to the Chloride Project. These sites may then be included into the Chloride Project for further investigation. Concurrent and contemporary WPP projects may also include biological and chemical measures that may enhance the Chloride Project. Year round safe and easy access to sites were taken into consideration during site selection. Of the sites proposed, none lie in any AUs that are currently impaired for aquatic life use due to chloride. One site is typically chosen per AU, but if the WPP Assessment requests data for multiple sites in an AU, then that request will be fulfilled.

**Table 2A - 2024-2025 Chloride Project Site details for Group 1 – Taunton and Ten Mile**

Basin	Order	Stream	AUID	Unique ID	Site ID	Lat	Lon	Site Description	Site Selection Rationale
Taunton	1	Millers Neck Brook	MA62-82	W3423	MNECK	41.8420	-70.8643	[Walnut Street, Middleborough]	Receives surface runoff from Route 495
Taunton	2	Nemasket River	MA62-25	W0314	NMASK	41.8718	-70.9146	[Old Bridge Street bridge, Lakeville/Middleborough]	Receives runoff from 495 and Middleborough
Taunton	3	Taunton River	MA62-01	W3424	TRGAGE	41.9339	-70.9567	[Titicut Street bridge, Bridgewater]	There is a gage here, and flow data is vital for modelling chloride loading.
Taunton	4	Mill River	MA62-29	W2915	MILL	41.8996	-71.0899	[Spring Street, Taunton (within mixing zone of storm drain outfall on northern shore)]	Receives runoff from Taunton
Taunton	5	Three Mile River	MA62-56	W3425	3MILE	41.8644	-71.1219	[Approximately 700 feet downstream from Warner Boulevard, Dighton]	Receives runoff from Route 44 and Taunton
Taunton	6	Segreganset River	MA62-53	W3426	SEGRE	41.8404	-71.1430	[Proximate to USGS gaging station # 01109070, Center Street, Dighton]	USGS gage here for loading determination
Taunton	7	Wading River	MA62-61	W0858	WADEGAGE	41.9471	-71.1769	[Route 140, Norton]	USGS gage here for loading determination
Taunton	8	Canoe River	MA62-66	W3427	CANOE	41.9772	-71.1438	[Plain Street, Norton]	Receives runoff from Route 495 interchange
Ten Mile	9	Rumford River	MA62-63	W3428	RUM	41.9960	-71.2105	[South Main Street (Route 140), Mansfield]	Receives runoff from Route 495 interchange and Mansfield
Ten Mile	10	Wading River	MA62-47	W0819	WADE	42.0188	-71.2667	[West Street, Mansfield]	Receives run off from Route 95

**Table 2B - 2024-2025 Chloride Project Site details for Group 2 – Ten Mile, French, and Quinebaug**

Basin	Order	Stream	AUID	Unique ID	Site ID	Lat	Lon	Site Description	Site Selection Rationale
Ten Mile	1	Sevenmile River	MA52-08	W0183	7MILE	41.9013	-71.3434	[County Street, Attleboro]	Receives runoff from Route 95 and Route 1A interchange
Ten Mile	2	Speedway Brook	MA52-05	W1517	SPEED	41.9287	-71.2803	[Dexter Street, Attleboro]	Receives runoff from Attleboro
Ten Mile	3	Ten Mile River	MA52-03	W0172	10MILE	41.9374	-71.2903	[Olive Street, Attleboro]	Receives runoff from Attleboro
Ten Mile	4	Bungay River	MA52-06	W2294	BUNG	41.9501	-71.2897	[North Main Street (Route 152), Attleboro]	Receives runoff from Attleboro and Route 95
Ten Mile	5	Scotts Brook	MA52-09	W1931	SCOTT	41.9775	-71.3339	[near footbridge approximately 160 feet downstream from South Washington Street, North Attleborough]	Receives runoff from North Attleboro
French	6	French River	MA42-05	W0072	FRENCH	42.0431	-71.8874	[Brandon Road (Dudley)/ Hill Street (Webster), upstream of the Webster-Dudley WWTP discharge, Webster]	Receives runoff from Webster
French	7	Unnamed Tributary (Lowes Bk.)	MA42-19	W1175	LOW	42.1033	-71.8669	[Main Street (Route 12) crossing of unnamed French River tributary locally known as Lowes Brook, Oxford]	Receives runoff from Route 395

Quinebaug	8	Quinebaug River	MA41-02	W3429	QUIN	42.0770	-72.0269	[Mechanic Street bridge, Southbridge]	Receives runoff from Southbridge
Quinebaug	9	Cady Brook	MA41-06	W0064	CADY	42.1407	-71.9967	[east of Route 169 approximately 230 feet downstream/south of Charlton WWTP discharge, Charlton (near wooden footbridge)]	Receives runoff from Routes 90 and 20
French	10	Town Meadow Brook	MA42-02	W0078	TMB	42.2324	-71.9204	[Pine Street, Leicester]	Receives relatively little residential runoff

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