Massachusetts Department of Environmental Protection (MassDEP)

Division of Watershed Management (DWM)

Watershed Planning Program (WPP)

8 New Bond Street

Worcester, MA

CN 551.0

2021-2022 Chloride Project SAP

1. **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-) 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. It has also been shown to contribute to year-round elevated Cl- levels (Todd and Kaltenecker, 2012).

**1.2 Purpose:**

This plan involves collection of continuous conductivity data in order 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 November 2021 through October 2022. 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 separate YSI/Hydrolab multiprobe instruments. On three of the survey rounds, water samples will be collected for chloride (only) and analyzed by the WES lab.

**1.4 Data Analysis:**

Conductivity data will be analyzed using WPP’s chloride regression tool, which was previously verified, to estimate ambient chloride levels.

**1.5 Locations:**

This study will occur at locations in the Merrimack, Shawsheen, Parker and Ipswich Watersheds, in northeastern Massachusetts. The waterbodies and sampling locations in each watershed are identified in Table 2 and Appendix A.

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.

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:

1. Estimate chloride levels in-stream by collecting continuous conductivity data at multiple stations using HOBO U24 conductivity loggers during the period of November 2021 through October 2022. The data will then be used by applying the MA correlation between specific conductivity and chloride.
2. Analyze resulting data to determine if estimated concentrations exceed MA state surface water quality standards (EPA ambient criteria for chloride).
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.

1. **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 2022 monitoring season.

| **Table 1.** Project Roles and Responsibilities related to monitoring and data use | |
| --- | --- |
| **Project Personnel** | **Responsibility** |
| Project Oversight  -Matthew Reardon  -Richard Chase  -Arthur Johnson | Provide project guidance, review and approval of SAP. |
| Project Coordinators  -Peter Mitchell (Merrimack and Shawsheen Rivers Watersheds)  -Mason Saleeba (Ipswich River Watershed)  -Shervon De Leon (Parker River Watershed) | 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. |
| Water quality survey crews  -Peter Mitchell (lead)  -Mason Saleeba (lead)  -Shervon De Leon (lead)  -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.

1. **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), and the project-specific QAPP for Chloride Monitoring & Assessment (CN 539.0).

Onset HOBO U24 Conductivity (and Temperature) Loggers will be deployed at the selected water quality monitoring stations in the Massachusetts northeastern watersheds from November 2021 to October 2022. These deployments will be performed in order 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.

YSI/Hydrolab multiprobes will be used for QC purposes approximately every 3rd month between November 2021 and October 2021 at each of the stations. This quality control will be conducted primarily to collect data on temperature, depth, and specific conductivity. HOBO conductivity data will be transformed to specific conductance and then reviewed to compare to Hydrolab specific conductance data.

Water samples at each sampling location on three separate surveys for each watershed group will be collected in 250ml HDPE bottles using standard WPP sampling protocols as defined in the program QAPP. Samples will be 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 collected:

* Road salt use recorded by Massachusetts Department of Transportation and area towns to

estimate chloride loading

* Land use area (agriculture, developed, natural, wetland, and impervious cover) for each station
* Location of drinking water wells/intakes
* Weather statistics

**4.3 Data Analyses**

Conductivity data will be corrected to specific conductivity and used to estimate ambient chloride levels using the DWP’s chloride assessment tool, previously verified for this study and in accordance with Standard Operating Procedure CN 349.0. 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 (Table 2) and in Appendix A. 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. 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 2. Site details for the 2021-2022 Chloride Project

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Watershed** | **Town/City** | **Waterbody** | **Site ID** | **GPS Coordinates** | **AUID** | **Unique ID** | **Site selection rationale** | **Site Description** |
| Parker | Newburyport | Little River | LR01 | 42.794280, -70.890687 | MA91-11 | W3090 | D/S I-95 & drinking water well (DWW) | D/S Parker St. bridge |
| Byfield/  Newbury | Unnamed Parker River trib. | UTPR | 42.762024, -70.937165 |  | W3091 | Crosses & parallels I-95. D/S I-95, WMA & wetland | D/S #6 Wayside Ave, driveway |
| Byfield/  Newbury | Parker River | PR01 | 42.748957, -70.939865 | MA91-01 | W3092 | D/S I-95, U/S three DWWs | U/S Larkin Rd bridge |
| Byfield/  Newbury | Wheeler Brook | WB01 | 42.744504, -70.942288 |  | W3093 | U/S three DWWs. D/S urban area | Brook at end of Larkin and Parish Rd |
| Rowley | Mill River | MR01 | 42.739302, -70.899653 | MA91-08 | W3094 | ORW but still Cat 5. Data request from D&S Section (ADR) | Glen St. crossing |
| Rowley | Oak Pasture Brook | OakP | 42.723781, -70.878632 | MA91-10 | W3095 | D/S urban area | D/S Cross St. bridge |
| Rowley | Bachelor Brook | Bach1 | 42.706635, -70.908899 |  | W3096 | U/S DWW area. D/S Rte 1 & Rte 133. | D/S Rte 1/Newburyport Turnpike |
| Rowley | Mill River | MR02 | 42.693895, -70.956721 |  | W3097 | ORW but still Cat 5. D/S I-95 & U/S DWWs | D/S Label Rd crossing |
| Georgetown | Penn Brook | Penn1 | 42.729914, -70.987024 | MA91-16 | W3098 | D/S Rte 133, Rte 97 and Georgetown town center, ADR | D/S North St. crossing |
| Boxford | Parker River | PR02 | 42.722876, -71.030912 | MA91-01 | W3099 | U/S DWWs, HWC, Cat 2, D/S Rte 133 | D/S West St bridge |
| Ipswich | Wilmington | Maple Meadow Brook | MaMe | 42.55276, -71.15662 | MA92-04 | W3100 | Cat 5, D/S Wilmington town center, ADR | D/S Wildwood St. bridge |
| Reading | Ipswich River | IR01 | 42.55446, -71.12866 | MA92-06 | W3101 | D/S I-93, ADR, middle of DWW field | Reading Town Forest |
| North Reading | Martins Brook | MB01 | 42.57147, -71.10123 | MA92-08 | W0136 | Cat 5, Hx site. D/S DWWs, Rte 28 and town center | D/S Park St bridge |
| Topsfield | Fish Brook | Fish1 | 42.634808, -70.974772 | MA92-14 | W3102 | D/S I-95, Cat 5, Hx site | D/S River Rd bridge |
| Topsfield | Ipswich River | IR03 | 42.62576, -70.94984 | MA92-06 | W3103 | Cat 5, D/S I-95 & Middle School, ADR | D/S Salem Rd bridge |
| Topsfield | Howlett Brook | Howl1 | 42.65512, -70.91711 | MA92-17 | W0125 | D/S Rte 1, residential & commercial areas, Cat 5 | D/S Ipswich Rd crossing |
| Ipswich | Ipswich River | IR04 | 42.65874, -70.89051 | MA92-15 | W3104 | ADR, U/S two DWWs, Cat 5 | D/S Winthrop St. bridge |
| Ipswich | Miles River | Mile1 | 42.65837, -70.84333 | MA92-03 | W3105 | D/S Rte 1A, residential areas, Cat 5 | Rte 1A bridge |
| Shawsheen | Lawrence | Shawsheen River | Shaw1 | 42.70323, -71.14074 | MA83-19 | W0081 | D/S I-494, Rte 114, urban & residential areas, Cat 4a | Adjacent to Gateway Pub parking lot |
| Tewksbury | Strong Water Brook | SWB1 | 42.61227, -71.20936 | MA83-07 | W3106 | D/S I-495, DWW & residential areas, U/S DWW, Cat 4a | D/S East St. bridge |
| Burlington | Vine Brook | Vine1 | 42.486491, -71.211254 | MA83-06 | W3107 | D/S I-95 and Burlington Mall, U/S DWWs | Adjacent to Jos A. Bank parking lot |
| Bedford | Shawsheen River | Shaw2 | 42.493576, -71.256339 | MA83-01 | W0092 | D/S Hanscom AFB, I-95, Rte 4, mall, DWWs, urban and residential areas | D/S Page Rd. bridge |
| Bedford | Shawsheen River | Shaw3 | 42.47372, -71.256395 | MA83-08 | W0093 | D/S Hanscom AFB, residential & urban area | U/S Summer St. bridge |
| Merrimack | Andover | Fish Brook | Fish2 | 42.679895, -71.218312 | MA84A-40 | W1206 | D/S I-495/I-93 exchange. U/S DWWs | D/S River Rd. |
| Lowell | Black Brook | BLBR1 | 42.629681, -71.349309 | MA84A-17 | W1191 | D/S Rte 3, golf course & urban areas | U/S Westford St. bridge |
| Chelmsford | Cold Springs Brook | CSB1 | 42.62829, -71.37856 |  | W3108 | D/S Rte 4, U/S DWW field | D/S Richardson Rd |
| Tyngsborough | Lawrence Brook | Law1 | 42.67181, -71.41152 | MA84A-20 | W1189 | U/S & D/S DWW fields, D/S residential areas | D/S Sherburne Ave crossing |
| Westford | Stony Brook | Ston1 | 42.58439, -71.47898 | MA84B-03 | W3109 | U/S DWW field, D/S Rte 225 & Forge Village | U/S Town Farm Rd bridge |
| Littleton | Beaver Brook | BeBr1 | 42.52824, -71.51675 | MA84B-05 | W3110 | D/S I-495, Rte 2, Rte 111, residential and commercial area | D/S Porter Rd |

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**Appendix A**

Map

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Figure 1. Map showing Chloride 2021-2022 sites in the Parker River Watershed

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Figure 2. Map showing Chloride 2021-2022 sites in the Ipswich River Watershed

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Figure 3. Map showing Chloride 2021-2022 sites in the Merrimack River Watershed

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Figure 4. Map showing Chloride 2021-2022 sites in the Shawsheen River Watershed