**Sampling & Analysis Plan**

For the:

**2022 Monitoring Project**

**James and Unkety Brooks**

Massachusetts Department of Environmental Protection

Division of Watershed Management

Watershed Planning Program

8 New Bond Street

Worcester, MA 01606



CN 557.0

March 2022

**Title and Approval Page:**

A picture containing text, weapon, object

Description automatically generated\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_3/3/2022\_\_\_\_\_

Matthew Reardon, TMDL Program Manager

\_/s/Therese Beaudoin \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ Date: \_\_3/3/2022\_\_\_\_\_

Therese Beaudoin, MassDEP Field Coordinator

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ Date: \_ \_\_\_\_\_

Suzanne Flint, MassDEP QA Officer

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_

Tom Faber, EPA EMT Quality Assurance Officer

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_

Jack Paar, EPA LSASD Biology Laboratory Leader

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_

Dan Boudreau, EPA LSASD Chemistry Team Leader

**Sampling & Analysis Plan**

2022 Monitoring

James and Unkety Brooks

CN 557.0

March 2022



Massachusetts Department of Environmental Protection

Division of Watershed Management

Watershed Planning Program

8 New Bond Street

Worcester, MA

***NOTE: This sampling plan provides sampling locations, frequencies, analytes, etc. and is intended to augment WPP’s multi-year programmatic QAPP approved by EPA for 2020 through 2024. The contents mirror selected elements of WPP’s programmatic QAPP (i.e.,QA-R5 EPA Guidance; USEPA 2017a). See the most recent WPP Programmatic QAPP for relevant information not provided in this SAP (MassDEP 2020).***

Table of Contents

[Project Organization 4](#_Toc97542111)

[Project Definition and Background 4](#_Toc97542112)

[Project Description 6](#_Toc97542113)

[Sampling Process Design 6](#_Toc97542114)

[Non-Direct Measurements 10](#_Toc97542115)

[Bibliography 10](#_Toc97542116)

List of Tables

[Table 1 Project Roles and Responsibilities related to monitoring and data use 5](#_Toc97542117)

[Table 2 Sampling Dates for the 2022 James and Unkety Brooks Monitoring Season 6](#_Toc97542118)

[Table 3 Monitoring stations in James and Unkety Brooks 8](#_Toc97542119)

[Table 4 Sampling and Analytical Summary (USEPA 2020) 9](#_Toc97542120)

[Table 5 Project Schedule for James and Unkety Brooks Monitoring-2022 10](#_Toc97542121)

[Table 6 External data sources used for the 2022 James and Unkety Brooks monitoring 10](#_Toc97542122)

List of Figures

[Figure 1 Unkety Brook-Nashua River HUC-12 Watershed (USEPA 2020) 5](#_Toc97542123)

[Figure 2 Monitoring locations in James and Unkety Brooks (USEPA 2020) 7](#_Toc97542124)

# Project Organization

The National Water Quality Initiative (NWQI) was developed by the Natural Resources Conservation Service (NRCS) to address non-point sources of pollution associated with agriculture, within relatively small watersheds (Hydrologic Unit Code-12, or HUC-12), identified and prioritized by individual states (USEPA 2017b). MassDEP conducted a review of freshwater stream segments within the Massachusetts portion of the Merrimack watershed to identify high priority, HUC-12 watersheds for further monitoring and NPS protection/restoration actions (Reardon 2020). James Brook (segment MA81-20) in Groton and Ayer received a high priority score, based on its impairment by *E. coli* from unknown non-point sources, and its land use characteristics (relatively high percentage of agriculture and natural land uses, and low impervious cover). James Brook is located within the Unkety Brook-Nashua River HUC-12 watershed, as shown below in Figure 1 (USEPA 2021).

James and Unkety Brooks were included in the 2020 NWQI program, and monitoring was conducted by the USEPA; in 2021, monitoring was conducted by MassDEP, according to the procedures outlined in the most recent QAPP (MassDEP 2020). This Sampling and Analysis Plan (SAP) provides details for collecting samples for analyses i.e., nutrients, Total Suspended Solids (TSS), and bacteria (*E. coli*), and in situ parameters (e.g., temperature and conductivity) in 2022 in James and Unkety Brooks (see Figure 1 below). These data will provide us with the information needed to determine the effectiveness of NPS implementation actions in these watersheds. Given the desire to create a strong baseline of current conditions, an intensive sampling frequency was chosen. Specific descriptions of WPP staff roles and responsibilities for the project are detailed in Table 1.

# Project Definition and Background

The Unkety Brook-Nashua River HUC-12 watershed has a drainage area of approximately 58 square miles, most of which is located in Massachusetts; the remainder is in New Hampshire. The four sampling stations on James Brook are in Ayer and Groton, MA; the two stations on Unkety Brook are in Dunstable, MA.

The types of data that will be collected at each of the sites were selected to allow us to determine the effectiveness of NPS implementation actions in the James and Unkety Brook watersheds. These include:

* + - * Nutrients (total phosphorus, orthophosphate, total nitrogen, nitrate-nitrite as nitrogen, and ammonia as nitrogen)
* Other water quality parameters (total suspended solids)
* Instantaneous measurements (temperature, pH, dissolved oxygen, specific conductance, total dissolved solids)
* Continuous measurements (dissolved oxygen, temperature; 5 month duration)
* Aesthetics observations
* Bacteria levels (*E. coli*)

Figure 1 Unkety Brook-Nashua River HUC-12 Watershed (USEPA 2020)

Map

Description automatically generated

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

| **Project Personnel** | **Responsibility** |
| --- | --- |
| Project Coordinator  -Therese Beaudoin | Coordination with EPA, site reconnaissance, staff training in field procedures, and defining logistics for efficient monitoring and generation of useable data at assigned sites using the procedures contained in WPP SOPs. |
| Water quality survey crews  -WPP staff and seasonal employees | Sample and data collection at assigned sites using the sample collection techniques and probe use procedures contained in WPP SOPs. |

# Project Description

**Overview of 2022 monitoring activities in James and Unkety Brooks**

As stated above, the objective of this project is to collect water quality data during the late Spring, Summer and Fall of 2022 in James and Unkety Brooks, to support the NWQI goals of determining the effectiveness of NPS protection and restoration efforts in these areas of the Unkety Brook-Nashua River HUC-12 watershed.

# Sampling Process Design

Sampling will be conducted in James and Unkety Brooks on a biweekly basis from May 10 through October 25, 2022, as shown in Table 2. A total of 13 sampling events are currently scheduled.

Table 2 Sampling Dates for the 2022 James and Unkety Brooks Monitoring Season

| **2022 Sampling Dates\*, \*\*** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **May** | **June** | **July** | **August** | **September** | **October** |
| Tuesday, May 10+ | Tuesday, Jun 7+ | Wednesday, Jul 6+ | Tuesday, Aug 2+ | Tuesday, Sep 13 | Wednesday, Oct 12 |
| Tuesday, May 24 | Tuesday, Jun 21 | Tuesday, Jul-19 | Tuesday, Aug 16 | Tuesday, Sep 27+ | Tuesday, Oct 25+ |
|  |  |  | Tuesday, Aug 30+ |  |  |
| \*Final sampling dates will reflect the laboratory schedule and the availability of equipment. Dates may also be changed to reflect weather conditions and other factors.  \*\* Sampling activities are subject to COVID-19 restrictions and social-distancing precautions.  +Monitoring activities include attended probe measurements. | | | | | |

The locations sampled in 2020 and 2021, and to be sampled in 2022, were selected by MassDEP, and are based upon historical data and accessibility. These six sites are depicted in Figure 2, with further details in Table 3, and include, in order from upstream to downstream:

James Brook

* JB01, Broad Meadow Road, Groton, MA
* JB02, Old Ayer Road, north of Peabody Street, Groton, MA
* JB03 North of Old Ayer Road near Smith Road, Groton, MA
* JB04, Route 111/Park St, Ayer MA

Unkety Brook

* UNK01, Groton Street, Dunstable, MA
* UNK02, River Street, Dunstable, MA

Figure 2 Monitoring locations in James and Unkety Brooks (USEPA 2020)



Table 3 Monitoring stations in James and Unkety Brooks

| **Segment** | **River Name** | **Site ID** | **Unique ID** | **Latitude**  **(°N)** | **Longitude (°W)** | **Impaired 1° or 2° *E. coli*1** | **Impaired Aesthetics1** | **Impaired Aquatic Life1,2** | **Impaired Fish Consumption1** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MA81-20 | James Brook | JB01 | W3027 | 42.604515 | -71.573155 | Yes | No | No | NA |
| MA81-20 | James Brook | JB02 | W3028 | 42.597680 | -71.569377 | Yes | No | No | NA |
| MA81-20 | James Brook | JB03 | W3029 | 42.582071 | -71.571944 | Yes | No | No | NA |
| MA81-20 | James Brook | JB04 | W1000 | 42.581867 | -71.572088 | Yes | No | No | NA |
| MA81-81 | Unkety Brook | UNK01 | W3030 | 42.657451 | -71.523060 | No | No | NA | NA |
| MA81-81 | Unkety Brook | UNK02 | W1829 | 42.689621 | -71.547982 | No | No | NA | NA |
| 1As reported in *Massachusetts Year 2016 Integrated List of Waters* (MassDEP 2019).  2NA = Not Assessed | | | | | | | | | |

***Water Quality (Chemical and Physical)***

At each station, surface grab samples will be collected and analyzed for the parameters and methods outlined in Table 4; the Environmental Protection Agency (EPA) in Chelmsford, MA will conduct all analyses. The survey crew will preserve all samples before submitting them to the lab for processing and analyses. For each sampling date, a minimum of one duplicate and one blank sample per analyte will be tested for QC for each sampling crew (10% of the samples) for each parameter, as well as one filter blank for orthophosphate. For the first sampling date, and each subsequent date on which bottles are used from a different batch number, a bottle blank will be collected and analyzed for each parameter. All DWM field sampling SOPs will be followed in terms of sample collection. EPA laboratory methods and SOPs are outlined below (Table 4).

All samples will be stored on ice immediately following collection, and transported to the EPA laboratory within 6 hours, for analysis within 8 hours of collection.

In total, a minimum of approximately 433 samples bottles will be analyzed for the parameters listed in Table 4 below (6 sites, 13 visits per site, 33 total sample bottles per sampling event with 8 samples per parameter including 1 duplicate and one blank per visit, plus a filter blank for orthophosphate; and a minimum of one round of bottle blanks per parameter). There may also be additional samples if more than one round of bottle blanks is required. Note the samples for analysis of Total Nitrogen as N, Nitrate/Nitrite as N, Ammonia as N, and Total Phosphorus as P will originate from the same bottle.

Table 4 Sampling and Analytical Summary (USEPA 2020)

| **Parameter** | **# of Samples per Event** | **Name of Analytical Laboratory** | **Analytical Methods/SOP** | **Container** | **Preservation** | **Maximum Holding Time (from time of collection)** |
| --- | --- | --- | --- | --- | --- | --- |
| Total Suspended Solids | 8 | LSASD Chemistry  LSASD Chemistry | EIASOP-TSS-TDS-VRES6 | 1 Liter Precleaned HDPE | 1-6˚C | 7 days |
| Ortho Phosphate as P | 9 | EIASOP-INGTP11 | 1 120 ml Precleaned HDPE | 1-6 ˚C, Filter w/in 15 minutes | 48 hours |
| Total Nitrogen as N | 8 | LSBSOP-NO2-NO30 | 1 500 ml Precleaned HDPE | Ultrex Sulfuric Acid 1:1 pH<2 | 28 days |
| Nitrate/Nitrite as N | LSBSOP-NO2-NO30 |
| Ammonia as N | EIASOP-AMMO0 |
| Total Phosphorus as P | EIASOP-INGTP11 |
| E. coli (ECMM) | 8 | LSASD Biology | ECASOP-ENTEROLERT Rev 3 | 250 ml sterile | 1-6˚C | 8 hours |
| Total | 33 |  |  |  |  |  |
| Notes:   1. All bacteria samples must have headspace. 2. All sampling collection procedures will follow the appropriate DWM SOPs. 3. Deployed loggers will be checked to ensure constant submersion and the presence/absence of bio-fouling during each sampling event. 4. Orthophosphate samples will be filtered within 15 minutes of collection. 5. A filter blank will be collected on every sampling event to ensure no contamination occurs during the Ortho Phosphate filtering procedure. 6. A bottle blank will be collected on the first sampling date, and on each subsequent date in which bottles are used from a different batch. | | | | | | |

A dissolved oxygen/temperature probe will be deployed on a long-term basis from May through October at the downstream-most sites on both streams (JB04, UNK02) to evaluate these parameters. Onset temperature probes with out-of-water sensors will be used proactively to detect potential “dry” conditions. QC readings will be taken using a separate, “attended” multiprobe meter as specified in WPP’s unattended probe SOP (MassDEP, 2007), every two weeks. After retrieval of deployed probes and post-deployment calibration checks, QC checks on the data will be performed.

In addition, for each sampling event on which attended probes are used to conduct QC checks on the deployed probes, instantaneous measurements of temperature, dissolved oxygen, pH, total dissolved solids and specific conductance will be collected at all 6 sites. All stations were originally sited with GPS; photographs will be taken at each site during every sampling event. Field data and observations will be documented on MassDEP paper field sheets or as applicable electronic data capture.

Table 5 Project Schedule for James and Unkety Brooks Monitoring-2022

| **Task Proposed** | **Approx. Date of Initiation** | **Approx. Date of Completion** | **Attendees/Responsible Staff** |
| --- | --- | --- | --- |
| EPA- DEP Coordination | 2/1/2022 | 2/22/2022 | Conville, Gould, Beaudoin, Reardon, Nelson, Morgan, Faber, Dombroski |
| Laboratory Scoping Meeting | As needed | As needed | Bridges, Boudreau, Conville, Patel, Paar, Gould, Toompas, Faber |
| Water quality sampling surveys | 5/11/2022 | 10/25/2022 | Beaudoin and field crews |
| Data QA/QC review and validation | TBD (2022) | TBD (2023) | MassDEP Assessment and Data Section |
| WQ data review, analysis and preliminary reporting | 11/22/2022 | TBD | Beaudoin |

# Non-Direct Measurements

Table 6 contains a brief list of relevant external data sources that may be used in coordinating monitoring efforts or the interpretation of monitoring data. For example, rain data from NCDC could be used to determine if a sampling event occurred during wet or dry weather.

Table 6 External data sources used for the 2022 James and Unkety Brooks monitoring

|  |  |
| --- | --- |
| **Organization** | **Data** |
| National Climatic Data Center (NCDC)  <http://www.ncdc.noaa.gov/oa/ncdc.html> | Daily precipitation and temperature data weather stations within the project extent. |
| The Weather Underground  <http://www.wunderground.com/> | Daily precipitation and temperature data weather stations within the project extent. |

# Bibliography

MassDEP. 2007. *CN 4.41. Multi-Probe Sonde Deployments for Continuous Unattended Water Quality Data Collection. STANDARD OPERATING PROCEDURE.* Massachusetts Department of Environmental Protection. Worcester, MA.

MassDEP. 2019 [online]. *Massachusetts Year 2016 Integrated List of Waters.* Massachusetts Department of Environmental Protection. Worcester, MA. Available at <https://www.mass.gov/files/documents/2020/01/07/16ilwplist.pdf>

MassDEP. 2020 [online]. *Quality Assurance Program Plan. Surface Water Monitoring & Assessment. 2020-2024.* Massachusetts Department of Environmental Protection. Division of Watershed Management-Watershed Planning Program. October 2020. Available online at <https://www.mass.gov/guides/water-quality-monitoring-quality-management-program>

Reardon, M. 2020. *A Review of MassDEP segments in the Nashua, SuAsCo, Shawsheen and Merrimack River Watersheds*. Unpublished. Memo from Matthew Reardon, Massachusetts Department of Environmental Protection to Tom Akin, Natural Resources Conservation Service, and others. January 16, 2020. Worcester, Massachusetts.

USEPA. 2017a [online]. *EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans.* United States Environmental Protection Agency. Last updated June 21, 2017. Available at <https://www.epa.gov/quality/epa-qar-5-epa-requirements-quality-assurance-project-plans>

USEPA. 2017b [online]. *Nonpoint Source: National Water Quality Initiative. Polluted Runoff: Nonpoint Source Pollution.* United States Environmental Protection Agency. January 17, 2017. Available at <https://19january2017snapshot.epa.gov/nps/nonpoint-source-national-water-quality-initiative_.html>

USEPA. 2021. *NWQI Assessment for Unkety Brook-Nashua River Watershed Draft*. January 4, 2021.