A Handbook for Mad River Watch Volunteers - 2026

Sampling Dates: (Sundays or Mondays)

June 7 or 8
June 21 or 22
July 5 or 6
July 19 or 20
August 2 or 3
August 16 or 17

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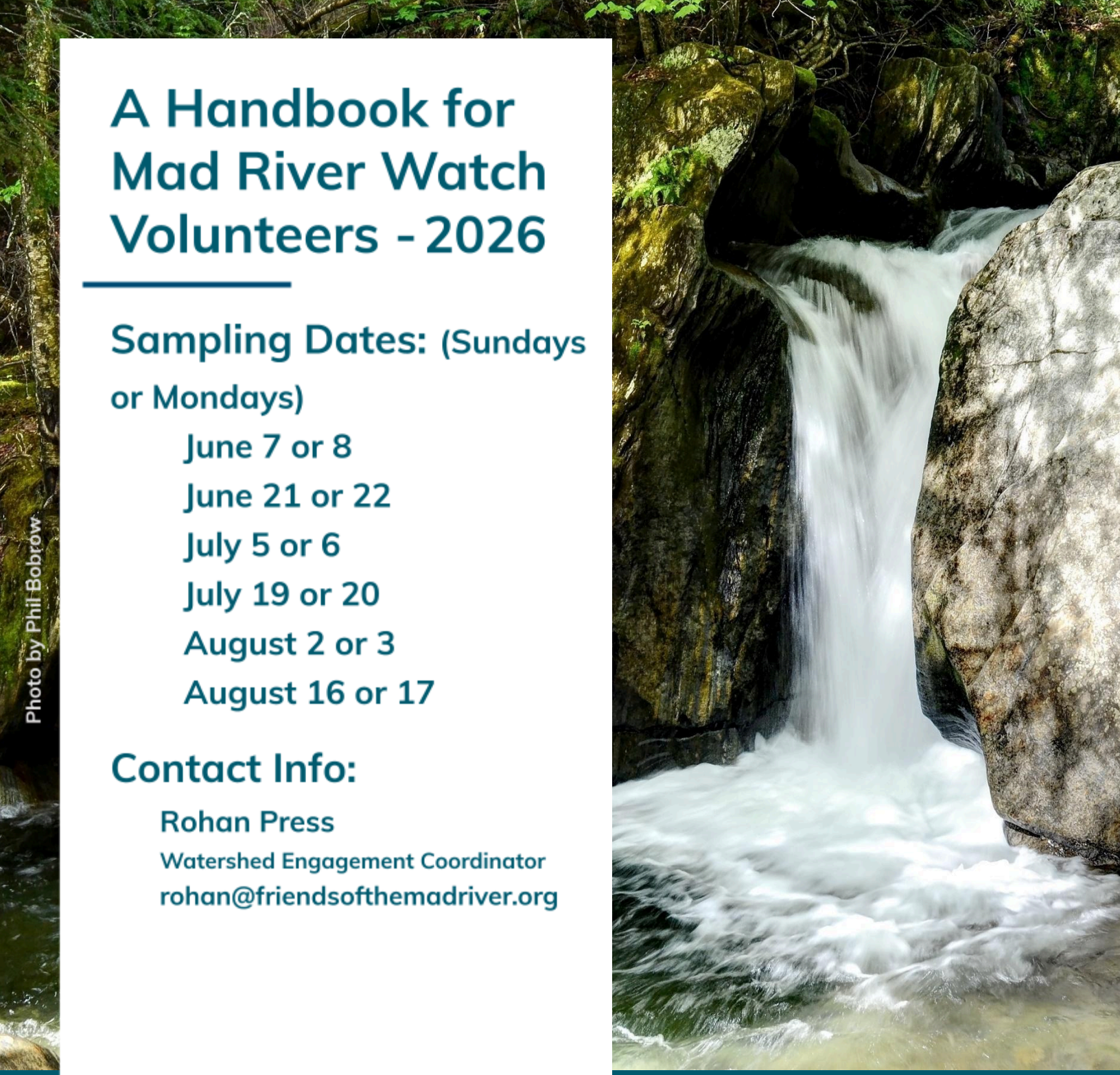

Photo by Phil Bobrow

FRIENDS OF THE MAD RIVER

HEALTHY LAND. CLEAN WATER. VIBRANT COMMUNITY.

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Welcome, Volunteers!

If you are reading this introduction, there is a good chance you are about to embark on a field season as a Mad River Watch (MRW) volunteer – thank you! If you're reading to simply learn more about the MRW program, we hope this handbook helps you, too.

Volunteers are the heart and soul of Mad River Watch and Friends of the Mad River's efforts to better understand the health of the watershed would not be possible without you. Mad River Watch volunteers spread out across the Mad River watershed as careful observers and caring stewards of our watershed. This handbook is meant to aid you as you record important data and help you tell the stories of your field sites.

These pages offer a starting point. Read on to explore a little of the history, the goals of the program for the coming years, and the details of a field day this summer.

Please review this package before your first sampling date and get ready for a great season! Thank you for your dedication in support of a healthy watershed.

Ira Shadis,
Executive Director

Mad River Watch 2026

In 2026, we are continuing to pursue the goals of improving the usefulness of the data we collect to more directly inform stewardship action; tracking changes in the watershed over time; providing more opportunities for volunteers to meaningfully engage with the intangible beauty and peace that comes when we spend time along the river; and sharing what we all learn with the community in new ways.

The last few years of the Mad River Watch program have highlighted the central role our volunteers play. Your efforts in the field have taught us lessons about the tools and methods we use and have laid the groundwork for the next 30+ years monitoring the health of the river and surrounding watershed. This year, we are continuing the third full field season using Survey123. We've also re-enrolled in the LaRosa partnership and will be collecting samples at 6 sites along the main stem of the Mad. Samples will be analyzed for total nitrogen, total phosphorus, and chloride. Over the course of the summer, we will also be installing leave-in probes at some sites that will provide continuous measurements of water temperature, conductivity, and dissolved oxygen.

This year, volunteers will visit their field sites eight times (as opposed to six times in previous years) through the course of the summer. You will collect data and make careful observations—and you will have opportunities to deepen your connection to your field sites. We will continue to explore the incorporation of additional apps, field methods, and learning as opportunities arise throughout the summer. We encourage volunteers to explore the app iNaturalist to help build out our body of wildlife observations.

Thank you, and bon voyage!

I. An Introduction to Mad River Watch

About Friends of the Mad River

Friends of the Mad River (Friends) is a member-supported, nonprofit organization, founded in 1990. FMR is dedicated to stewarding the Mad River Valley's healthy land and clean water for our community and for future generations. We build diverse partnerships of neighbors, businesses, towns, and other organizations to restore and enhance the watershed's valued resources. Together, we learn about the health of the land and water; conserve our natural resources; and celebrate this special place. Our work is grounded in sound science, inclusive education and engagement, and thoughtful action.

A Long Running Program

Since 1985, Friends' Mad River Watch program has been connecting volunteers with the Mad River and its tributaries. The work of volunteers has helped identify important projects, like failing and unmaintained septic systems in Warren that led to a wastewater treatment system for the village. The program has also raised awareness around the connections between land use and water quality as well as generated information about long-term trends in the river. For an overview of Mad River Watch's history in celebration of Friends' 30th anniversary, see the August 1st, 2020 edition of the *Valley Reporter*.

Program Goals

The Mad River Watch program is built around several key goals. We hope to:

- offer volunteers meaningful opportunities to contribute to our collective understanding of the state of the Mad River watershed as well as a breadth of opportunities to connect to the natural world;
- track changes in the river over time;
- gather data and observations that allow us to respond to emerging environmental concerns and more effectively collaborate with conservation partners;
- foster stewardship and care of our healthy land and clean water; and
- make valuable contributions to the evolving story of this special watershed community.

The Basics of Your Volunteer Work

Mad River Watch is a field-based program where volunteers like you play a vital role in monitoring the health of our watershed. You will be our eyes and ears across the watershed, getting to know your site(s) through both broad and focused observations. You will collect key

data that serve as indicators of pollutants, healthy or stressed river ecosystems, and emerging opportunities for restoration and addressing environmental concerns. You will master the tools of the trade as you record your findings using the Mad River Watch mobile data app along with a good, old-fashioned notebook. Whether you consider yourself a scientist, artist, naturalist, explorer, environmentalist, or just (perhaps most important of all) someone who loves our river and its valley, you will also be a voice helping us tell the stories of this watershed.

Where? This is a field-based program. We have chosen sites across the watershed that are important from a scientific and observational perspective. At the beginning of each season, we work to match you with one or more sites that you may already love or will grow to love. These sites are under your observation and care for the summer.

When? There are 8 field days throughout the summer season. Your field days fall on either a Sunday or Monday, meaning you will either volunteer consistently on 8 Mondays or 8 Sundays. You will choose which at the beginning of the season. Field visits should be in the morning so we can compare data across the watershed.

How? We know that some sites require a bit of dexterity to reach, and at others, the site conditions may change and require you to adapt or for us to adjust site assignments. Please come prepared for changing weather conditions. The mobile device app we use for data collection requires that you bring either an iOS or Android device, though we can provide one if this requirement may limit or prevent your participation.

A Note on Rainy Field Days –

It might help to know that sampling during the first few hours of a rain (assuming you are safe!) can offer great water quality information because it enables us to better understand non-point source (stormwater) pollution that washes into the water!

What We Pay Attention to & Why

In 1972, the Clean Water Act was passed with the goal to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.” It is in this spirit that the Mad River Watch program seeks to learn more about the Mad River and its tributaries. In addition to these fundamental categories - physical, chemical, and biological - we are also interested in learning more about the way we care for and connect with the watershed around us.

Everything we do begins with careful observations. This is your most important task. When you get to your site, we encourage you to deeply observe the place before doing anything else – just observe. Note any changes from the last time you visited, blooming flowers, signs of

usage, smells, sounds, and anything else that speaks to you. Once you have a sense of the big picture, it's time to focus our attention on a few key areas.

Physical

Temperature
Stream temperature influences everything else. It influences bacteria levels and drives all biological activity, determines the speed of geochemical reactions, and increases the pace of plant and algae growth. Native aquatic life thrives within certain temperature ranges. Knowing the water temperature is a critical element of all our other monitoring work.

Flow
Streamflow provides a sense of how much water is moving through the system at any one time. When streamflow is high, lots of water is moving across the land as 'stormwater runoff,' picking up sediment and pollutants before depositing it in the streams and river. When streamflow is low, we are getting a picture of the watershed during 'baseflow,' without the influence of stormwater or pollutants from runoff. The flow values set a critical context for understanding almost all the other values we measure.

Erosion & Deposition
Rivers are dynamic systems and some degree of erosion and deposition of soil and sediment is normal and good for the integrity of the river ecosystem, especially for river systems like the Mad that have been heavily impacted by historic land uses and are now adjusting back to equilibrium. However, major storms, human impact, and changes to the landscape can increase erosion to the point where sediment can act as a pollutant and degrade water quality and wildlife habitat. Excess erosion can also lead to increased transportation of other pollutants, like phosphorus, that can have negative impacts downstream.

Conductivity (a proxy for salinity)
The presence of salts and other minerals in the water affects the way it conducts electricity. Road salt applications across cold regions of the country are linked to increased salinization of freshwater resources, with increasing trends of sodium and chloride. Having this data will enable us to begin to understand how and when components of road salt are moving into the Mad River so we can begin to work on reducing those sources in our effort to protect water quality.

Chemical

pH
pH is a measure of the acidity and alkalinity of a solution. The pH scale ranges from 0 to 14 with lower values indicating more acidic conditions and higher values more alkaline. A pH of 7 indicates neutrality which is another way of saying it has a balanced number of hydrogen (H+) and hydroxide (OH-) ions. The pH of natural water bodies is influenced by the bedrock and soils through which it flows.

Human inputs in the form of runoff and pollution can also alter pH. Changes in pH can be initiated by pollution and those changes can fundamentally alter a water body's chemistry by changing the biological availability and form of nutrients (such as nitrogen and phosphorus) and metals (like lead, copper, and iron).

The most significant and widely impactful cause of acidification of Vermont streams is from acid rain caused by coal-burning power plants and factories in the Midwest. pH is easy to measure and can be used as an early indicator of chemical changes in a water body when collected over time. Friends of the Mad River's historical pH data has tracked the increase in pH as power plants cleaned up their emissions in the early 2000s.

Biological

Wildlife
Our wild neighbors can tell us a lot about the health of the river and the surrounding land if we are willing to listen. Through observation of animal tracks, signs, and presence, we can start to get an understanding of who else visits our field sites regularly. Over time, these populations might change because of a number of factors, from habitat loss (or restoration!) to climate change. Tracking these changes can help inform and prioritize wildlife conservation projects across the Mad River Valley.

Riparian Buffer
The stretch of woody plants that runs along the river's edge is a riparian buffer. Without those buffers, the river is exposed to direct runoff of water and pollutants from the land, more intense erosion along the banks, greater vulnerability to invasive species, and warmer and less oxygenated water. When those buffers are present, they help resolve those issues and provide rich habitat for wildlife. Buffers tend to change slowly over time, although human impact can change them in an afternoon. Our monitoring efforts track changes in these buffers over years and help us identify areas where restoration projects (like invasive species removal and tree plantings) should be prioritized.

Invasive Species
Opposite riparian buffers, many invasive and nuisance species degrade ecosystems by interrupting or competing with the species that provide habitat and ecosystem services. Some species, like Japanese knotweed or honeysuckle, are well established in the Mad River Valley. Keeping an eye on their spread is important and tracking populations can help us adapt as management plans change. Other invasive species have not yet been spotted here, but a changing climate and more human impact increases the chance that they spread to the Mad River Valley.

Benthic Macroinvertebrates
Like wildlife more generally, benthic macroinvertebrates can serve as an indicator for the ecological health of the river. These small, aquatic, "bottom-dwelling" animals have limited mobility, meaning they are likely to be exposed to whatever is in the water near them, and changes in the health and population of individual species occur in predictable ways. Altogether, getting to know these communities of very small wildlife can give us a very big picture of the health of the river.

Stewardship

Human Impact
By tracking the human use and impact at your field site, you help us develop and prioritize more comprehensive plans that bring others across the community together towards shared stewardship goals, including important partners such as local towns and conservation commissions, for example.

Trash
Measuring the volume of trash at your field site can help us plan volunteer stewardship activities and river cleanup events. Identifying the type of trash can help us understand where it is coming from and look upstream to find ways to keep it out of the water in the first place.

Stewardship Activities
The people that live in the Mad River Valley are part of our local ecosystem and the actions we take as stewards reflect the kind of neighbor we are to both the humans and the wildlife that call this place home. Tracking the work we do as stewards allows us to tell a more complete story about the value and impact of the Mad River Watch program.

Connection to Place

Telling the Mad River Story

The story we tell together about the state of the Mad River watershed would not be complete without an exploration of what it really means for us to connect with nature and the river at a personal level. As a Mad River Watch volunteer, we invite you to share what you discover and how it makes you feel – revel in the small natural wonders, investigate your curiosities, sing out the beauty of your field site, inspire others with ideas for restoration, or even shout out your concerns.

A Note on Notetaking –

Notes are the backbone of all scientific endeavors. At the end of the week, the year, and/or the decade, when we are analyzing the data and a pattern emerges or we notice a data point that doesn't seem to fit, we will look back to your notes from the days that those data were collected to find clues. Your observations are important and can help us explain what we see in the data. For instance, if there are lots of ducks at a site on a particular day – record it. That may explain elevated turbidity in the stream.

II. A Day in the Field as a MRW Volunteer

Getting Ready

1. **Review Site Profiles** – Ensure you know the location and access for your sampling sites.

2. **Gather Materials** – Check to make sure you have the materials required for each site. You should have all the sampling materials in-hand before each field day. Be sure to charge your phone or tablet and make sure you've downloaded Survey123 and have the most up-to-date version of the survey. Bring water and a snack.

3. **Check the Weather** – Check the weather (for your sites) and dress appropriately. Please heed any hazard warnings – your safety is more important than gathering data.

Your Field Day

After getting ready and finding your way to your site, it is time to start your field work. Open the Survey123 app and follow the directions outlined here and you will be on your way to recording excellent data and observations! The description below is meant to provide an overview of your time in the field. The **Survey123 Field Guide** includes the most detailed explanation of each step.

1. **Take in the Big Picture** – Take it all in, look around. Take note of the date/time, weather, air temperature, and your surroundings. Record your observations in the Survey123 app. Take pictures of the stream and streambanks to capture a 360° perspective of the site (Survey123 stores the pics). Capture pictures of anything else that you think is notable, or even ordinary (it might become notable)!

2. **Observe Physical Characteristics** - Observe the movement and color of the water and enter the flow and color category in the app. At the start and end of the season make note of any erosion or deposition. Some sites will have installed staff gauges to measure stream height. Optionally, get more detailed measurements of the flow by measuring depth, width, and velocity. (Appendices: A. Flow Description Guide, B. Float Method: Optional Flow Activity)

3. **Measure Water Quality** – Using the correct water sampling technique, collect water from the stream. Measure conductivity, temperature, and pH. Record results in Survey123 app. (Appendix C. How to Collect a Water Sample) **Optional App:** HydroColor

4. **Observe Biological Characteristics** - Continue to zoom in and get to know your site. Take note of wildlife presence or sign and vegetation. Record observations in Survey123 app. At the start and end of the season, or when relevant changes or discoveries are made, record information about the riparian buffer and the presence of invasive species. Optionally, get out your nets and ID guides and record information about benthic macroinvertebrates at your site. (Appendices: D. What is a Riparian Buffer, E.1-2 Benthic Macroinvertebrates, F. Invasive Plant Resource Guide) **Optional Apps**: iNaturalist, Seek, and Merlin

5. **Stewardship –** What is the impact of humans on your field site? Did you notice trash? What kinds? How much is there? Measure and record in the Survey123 app. Then get out those gloves and take some action! Is there more work than you can do alone? Let us know and we can organize a volunteer river cleanup at the site.

6. **Reflect –** Take a minute (or 30) to think about the stories your site offers. What has changed since your last visit? What inspires you? What challenges you? What are you curious about? How would you describe what happens at this site to someone that is not a MRW volunteer? Using your Field Journal (see **Appendix G. Welcome to Your Field Journal)** and/or other tools available to make an entry, draw a picture, write a poem, sing a song, make a list – the sky is the limit. Connecting with these sites is important and how you do it is up to you!

7. **Check In with the MRW Coordinator –** After you have visited your last field site for the day, please return to the Wait House in Waitsfield (4061 Main St) and meet with the Mad River Watch Coordinator to resupply, ask questions, and share any observations. This will also be an opportunity for us to photograph or scan any artwork or handwritten notes you may have created. The MRW Coordinator will be on hand Sunday and Monday from 8 am until 11:00am.

Record-Keeping Tools

Several tools will help you collect observations, record data, and be creative:

- **Survey123 –** To streamline and simplify the staff's role in processing your field data, we use a digital data collection app called Survey123. This tool provides a powerful way to track (with great accuracy) your sampling time, location, photographs, and notes that are easily shareable with Friends of the Mad River (Appendix H. Survey123 Guide).

- **Field Journal** – Each field kit comes with an old-school paper notebook that you are invited to use for writing, drawing, collecting a leaf or other small wonder, making charts, or whatever else the site inspires you to record. These notebooks will tie sites together from year to year with a record of important observations and personal connections. See Appendix C.

- **Online Form** – You will also be provided with a link to an online form if you would like to type up your notes or submit other digital content after your site visit. This is also a place where you are welcome to provide feedback about the program.

- **Additional Apps** – There will often be opportunities to use and field test additional apps. We encourage volunteers to use Merlin and iNaturalist (Seek). If you are interested in exploring these apps, let us know!

- **Extra Goodies** – You are also more than welcome to bring your own writing or artistic supplies, field guides, binoculars, or whatever else can help you better understand your field site. If there is something or information you don't have but would like, let us know and we will work with you to find the resources to make it happen.

Sharing your Learning – with Friends & the MRV Community

The stories, art, and data you share with us all come together to paint a broader picture of the health of the watershed and what a healthy watershed means to Friends and the Mad River Valley community. The connections you make with your site are an essential part of this process and they offer a starting point for deepening the connection between this community and the watershed that bounds it. Each week that volunteers are in the field, we will be sharing updates about your findings through the *Valley Reporter*, on our website (friendsofthemadriver.org) and through our social media channels.

This program is strongest when our volunteers provide feedback. Each week you connect with the MRW Coordinator and/or use the same Online Form for submitting observations to provide us updates on how things are going out in the field.

III. Safety

While every effort has been made to assure that water sampling locations are safely accessible, collecting water samples requires certain precautions and safety measures:

- Be aware of your own physical limitations and the difficulty collecting water at certain locations under certain conditions.

- Listen to your instincts and to weather reports. Please don't attempt to collect a sample if you feel the least bit of risk. High flows can turn even the most placid water into a raging torrent. Never wade in swift or high water. Do not wade if depth is greater than knee-deep. Do not monitor if the stream is at flood stage.

- Assume that you may get wet and wear appropriate clothing and footwear that has traction but can also get wet.

IV. Appendices

Appendix A. Flow Description Guide

The Flow Description Guide can be found at friendsofthemadriver.org/mrwvolunteers.

Appendix B. Float Method: Optional Flow Activity

Measuring Flow - The Float Method

The float method uses a neutrally buoyant object that moves with the water to provide a tried and true estimate of the flow of water at your field site. The method is best used with two or more people.

Materials Needed

- Survey123 Data App
- Tape Measure
- Yard Stick
- Stopwatch (most cell phones have this function)
- Float (an orange is a great, highly visible choice!)
- Waders (or a willingness to get in the water)

Before you start

We are calculating discharge by collecting information about the volume of water in a given section of the stream and then measuring the speed at which the 'float' moves with the water. This method is ideal for more uniform and straighter sections of the stream. It is not going to work in all situations (and that is OK!). This optional activity can help us compare discharge at your site to discharge that is recorded at the USGS Gage in Moretown and build an understanding of where water is coming from in the watershed

Instructions

1) Measure the length of the stream section you have chosen for your flow measurement and record it in the Survey123 App. Try to select a section of the stream that is fairly uniform and straight. Aim for a section that is greater than 10 ft, mark the start and end of your section.
2) Measure the width of the stream at the start and end of your section. The tape measure should be perpendicular to stream flow and just above the surface of the water. The first person holds the "0" point on the tape measure even with one wetted edge. A second person on the opposite bank holds the tape measure level, taut, and even with the other wetted edge. Record each measurement in the Survey123 App.
3) Along each width measurement, use the yardstick to take measurements of depth at 4 equally spaced intervals.
4) Method
    a) Person #1 wades in the stream at the upstream starting line, float in hand. Person #2 wades in the stream at the downstream finish line. Person #3, if available, stands on

the bank next to the finish line, stopwatch and clipboard in hand. If you have only 2 people, the one at the finish line holds the stopwatch.

b) Person #1 drops the float on the surface, **upstream** from the starting line. As the float passes the starting line, person #1 says "go" and person #2 starts the stopwatch.
c) When the float crosses the finish line, person #2 stops the stopwatch, catches the float, and records the time.
d) Discard any trials in which the float gets caught in debris, rocks or eddies.

1) In the Survey123 App, record the time in seconds that it took for the float to travel the measured distance.
2) Repeat steps 4 to 6 (x2) and record in Survey123. Vary the start location of the float if possible to account for different conditions in the average velocity measurement.
3) Take a photo of the stretch measured.

After you have taken these measurements and entered them into Survey123 we can calculate the flow. If you want to check it yourself in the field follow these steps:

1) **Calculate the average velocity**: Divide the length of your section by the average float time value. Your result is the average surface velocity.

2) **Calculate corrected average velocity**: Because the velocity of a stream varies from the surface to the bottom, with the surface tending to be faster, you will need to adjust your result to reflect the overall average velocity of the stream. Multiply your average surface velocity by 0.8 - The adjusted value is called the corrected average velocity.

3) **Calculate Average Cross Sectional Area**: Take the average of your width measurements and multiply that by the average of your depth measurements. Note* the measurements used to calculate the average of your depth measurement should also include two zero entries to account for the edges of the stream.

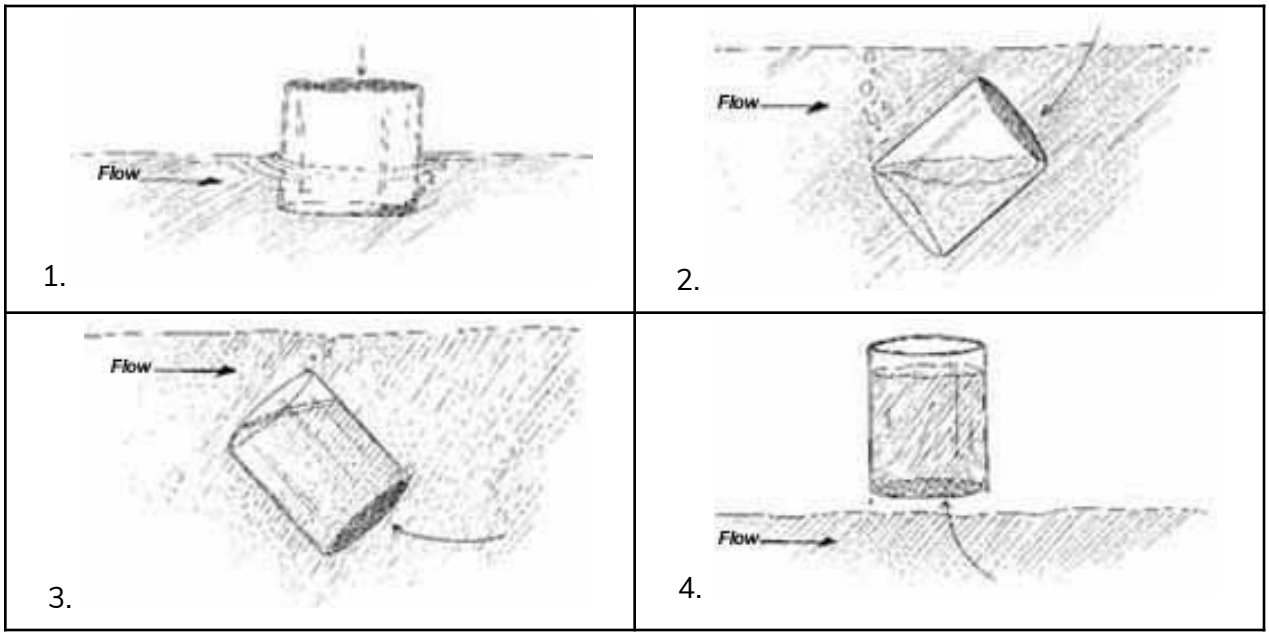
4) **Flow (cubic feet per second)**=Corrected average velocity*Average Cross Sectional Area

These instructions were adapted from the NatureMapping Foundation.

Appendix C. How to Collect a Water Sample

- Samples should be **taken toward the centers of streams or in the current** when possible, avoiding sampling water near the bank, or in stagnant pools.
- When wading to a sample site, **try not to disturb the stream bottom**. If the bottom is disturbed, prevent any bottom sediment from being sampled.

- Samplers should always stand **facing upstream** (see figure on right).
- Fingers should always be on the outside & near the bottom of the large sample container to avoid contamination. **Do not touch inside the bottle or cap.**
- **Open sample container just before sampling**. Open containers should be placed upside down over water, and water should be sampled in a "U" shape against the flow of water, away from the body (see figure below). This process should be done at a swift pace (without disturbing the site) to allow for the most representative sample.

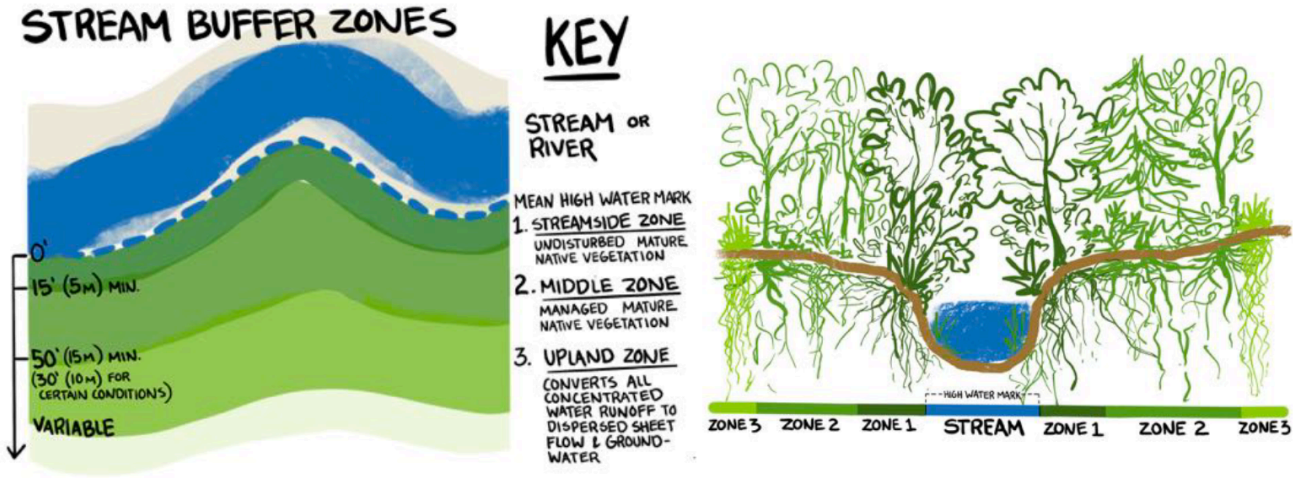


- Samples should be **taken at a depth of at least 8 – 12 inches**, or mid-way between the surface and bottom if a stream is shallow.

Appendix D. What is a Riparian Buffer?

Riparian Buffers are made of the plants, fungi, animals, and bacteria, the whole web of life, along the edge of the river. This complex weave of biological and physical properties helps determine how the river moves, what lives in it, and the impact it receives from water running off the land. In general, a healthy riparian buffer is identified by the presence of woody native trees and shrubs. It's the root systems of these plants that stabilize the soil and it is the shade they offer that cools and stabilizes the water temperature of the river. These plants also provide habitat for animals and as the buffers grow in width, the diversity of life found in the buffer grows as well.

As a Mad River Watch Volunteer, you have a front row seat to the riparian buffer show. By describing the width and character of the buffer, you can help us understand what kind of impact to expect on the Mad or its tributaries. In areas where the buffer is thin, you can also help us identify opportunities for restoration. Where invasive species are well established, you can help us understand if the next generation of native plants has any chance of survival. And where invasive species have just arrived, you can help us prioritize active management to slow their advance. As you get to know the many species that make up the riparian buffer, and that call it home, you will be able to tell a more complete story about the value of protecting the entire river corridor.



(Vermont Streamwise Program)

Riparian areas can be defined as a zone of interaction and influence between aquatic and terrestrial ecosystems along streams, rivers, lakes, wetlands and other waterbodies (RSTC 2007). These areas perform important ecological functions which link aquatic and terrestrial ecosystems and thereby support unique habitats, natural communities and high biological diversity (RSTC 2007, ANR 2005).

Verry (2000) further offers the following functional definition for riparian areas: “Riparian areas are three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the watercourse at a variable width.”

(Vermont Fish and Wildlife, 2015)

(Intervale Conservation Nursery, 2020)

What is a River Corridor?

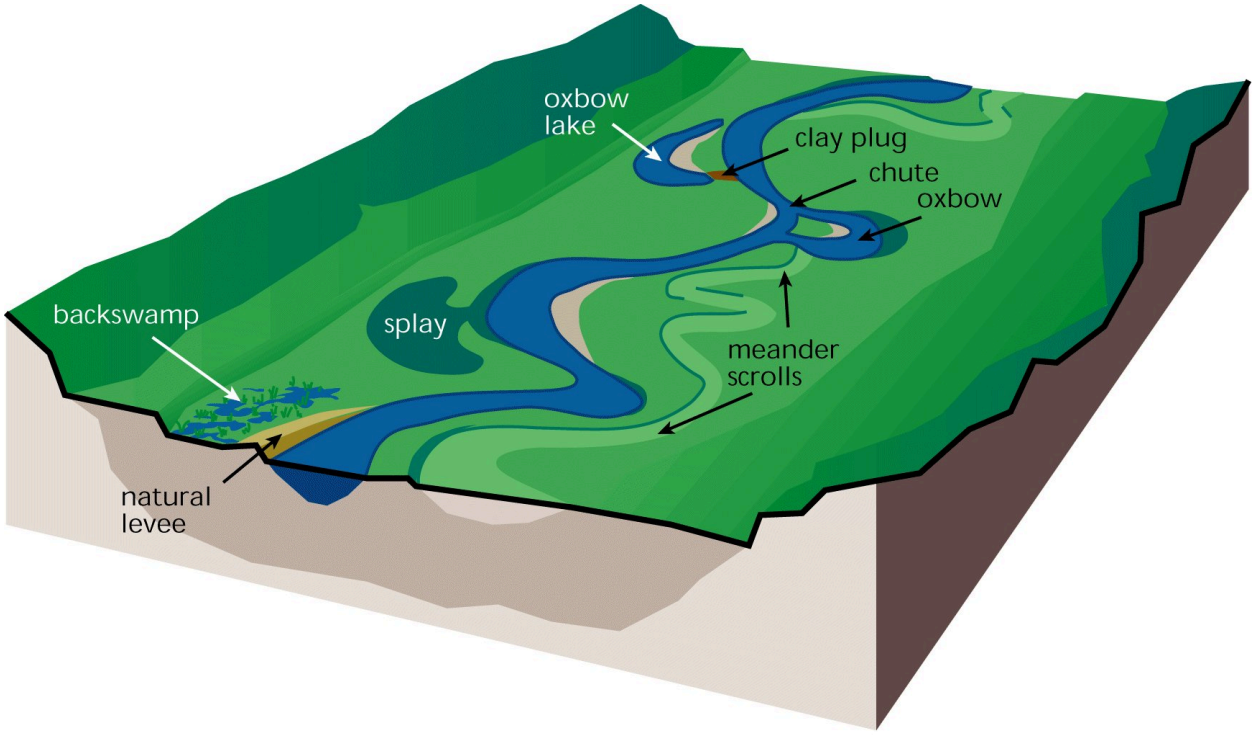


Fig. 1.21 -- Landforms and deposits of a floodplain. Topographic features on the floodplain caused by meandering streams.
In Stream Corridor Restoration: Principles, Processes, and Practices (10/98).
Interagency Stream Restoration Working Group (15 federal agencies)(FISRWG).

"River Corridor" means the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition. (Flood Ready Vermont, 2022)

Appendix E. Benthic Macroinvertebrates

The Benthic Macroinvertebrate Key can be found at friendsofthemadriver.org/mrwvolunteers.

How to Collect Benthic Macroinvertebrate Samples - Adapted from the Vermont Agency of Natural Resources Department of Environmental Conservation Watershed Management Division Field Methods Guide 2022

Materials Needed

- Glass Containers
- Kick Nets
- Small Nets
- ID Guidebook or Dichotomous Key

Before You Start

Benthic (meaning "bottom-dwelling") macroinvertebrates are small aquatic animals and the aquatic larval stages of insects. They include dragonfly and stonefly larvae, snails, worms, and beetles. They lack a backbone, are visible without the aid of a microscope and are found in and around water bodies during some period of their lives. Benthic macroinvertebrates are often found attached to rocks, vegetation, logs and sticks or burrowed into the bottom sand and sediments (EPA, 2020). Sampling benthic macroinvertebrates requires you to get your feet wet (or wear some very tall boots). Most of the time, sampling will be done in areas of the stream or river containing riffles. Some species can be found in deeper, slower moving water - often attached to woody debris.

Riffle Kick Net Samples

Riffle kick-net samples are used to represent the macroinvertebrate community of riffle habitats within a stream reach. Riffles are hard-bottom areas of the stream characterized by shallow depths (< 1 m) and fast, turbulent water (> 0.2 feet per second). Due to their high productivity, riffles are the best stream habitat for providing comparable data over time and across stream reaches.

Procedure:

1. Place the kicknet (large net) on the stream bottom in a representative riffle location with the long edge perpendicular to the flow. A representative location has similar characteristics to the overall riffle habitat present in the reach. Make sure water is flowing freely through the net and move substrate immediately downstream of the net if necessary to improve flow. Avoid artificial riffle habitat such as riprap.
2. Collect each sample from an estimated 45 cm x 45 cm (0.20 m2) square area immediately upstream of the net. Move all large coarse gravel and cobble substrates to the mouth of

the net and rub clean of attached organisms. Discard cleaned substrate to the side of the sample area. Portions of larger cobbles and small boulders in the 0.20 m2 area that are immobile are left in place and rubbed clean of organisms with the net positioned to capture the organisms. On rare occasions in very small streams, the riffle may not have sufficient width to collect a representative sample. In this case, the net may be rotated so that the narrow edge is perpendicular to flow. Collect the composite from an estimated 23 cm (one width) x 92 cm (four widths) rectangular area immediately upstream of the net. This will also approximate a 0.20 m2 subsample area.

3. Disturb all remaining small substrate by hand to a depth of 5–10 cm and allow disturbed organic matter to flow into the net.
4. This entire riffle kick-net procedure should last a minimum of 30 seconds per area sampled but should continue until all substrates within the area have sufficiently been cleaned and disturbed.
5. After the samples have been collected into the kick-net, large pieces of organic matter (i.e. leaves and sticks) and substrate within the net can be carefully rinsed and rubbed clean of organisms and discarded. Transfer the contents of the net into a cleared-sided container. Any remaining organisms attached to the net should be removed by hand and placed in the container.
6. After completing sample collection, the sampler should refer to the dichotomous key provided to identify individual organisms. Examples of each organism should be photographed and recorded along with the total number of each organism type in the Survey123 app.

Appendix F. Invasive Plant Resources

Information on invasive species in Vermont can be found at https://www.vtinvasives.org/

Appendix G. Welcome to Your Field Journal

The Welcome to Your Field Journal Guide can be found at friendsofthemadriver.org/mrwvolunteers.

Appendix H. Guide to Survey123 for Mad River Watch

The 2023 Guide to Survey123 for Mad River Watch can be found at friendsofthemadriver.org/mrwvolunteers.

Appendix I. La Rosa Partnership Guidance

LPP Flow Observation Survey123 Form Link

- **Survey123 App tutorial**

- Survey123 WebForm tutorial

Flow Observation Guidelines

- Example photos
- CoCoRaHS precipitation dataset

Partner Guide