Madison Stream Team

Standard Operating Procedures (SOPs)

Updated June 17, 2014

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Contents

Introduction 3

Area Overview: 4

Sample Site Locations and Descriptions 5

Moores Creek 7

North Meadow Creek 8

O'Dell Creek 9

South Meadow Creek 10

West Fork of the Madison 11

Blaine Spring Creek 12

Jack Creek 13

..... 13

Methods 14

Example Site Visit Form 15

Recording Site Locations with GPS 16

YSI Field Care & Use Instructions 17

Photo-Point Field and Office Procedures 18

Turbidity Measurement with Secchi Tube 21

Pebble Count Instructions 22

Chlorophyll Rock Photos 23

Discharge Using the Marsh-McBirney FLO-Mate Meter 24

Sample Bottle Handling 27

Sample Collection 28

Packaging Samples for Shipment 29

Example Chain of Custody Form 30

Protocol for Cleaning and Disinfecting Field Equipment 31

Sampling Activity Checklist 32

MST Gear Checklist 33

Calendar for 2014 Samplings 34

Appendix A: YSI Care and Calibration Instructions 35

Appendix B: Blank Field Datasheets 39

Introduction

This document provides technical reference information for volunteers with the Madison Stream Team program. The Madison Stream Team is a volunteer water quality monitoring program in the Madison Watershed of southwest Montana. The program is relies on trained volunteers to assist with regular data collection events on 7 streams listed on the 303(d). The project was started in 2010, and is managed by the Madison Watershed Coordinator, Sunni Heikes-Knapton.

The techniques described herein relate to the collection of data with field equipment and the preparation of samples for analysis in lab settings. The document serves as a written format of the methods explained at the annual training events attended by project volunteers. Volunteers are encouraged to use this as a reference for the methods to be used and the approach taken during sampling events.

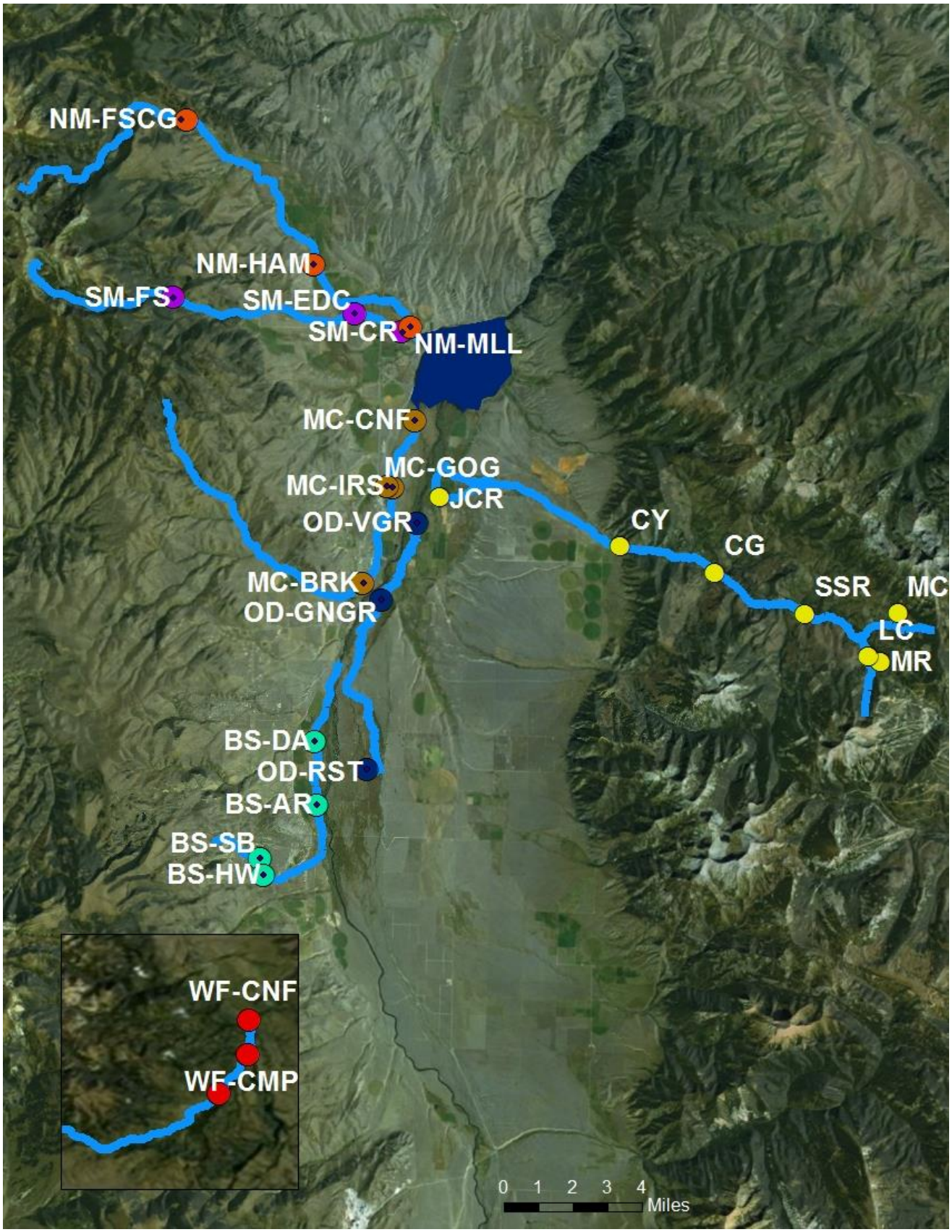
In addition to the sampling methods, the document also provides guidance on the protocol for a standard sampling day and a calendar outlining the parameters to be sampled during the 2014 sampling year. The structure of these events is established to assist volunteers in being efficient, accurate, and effective during site visits. This document does not include any of the Quality Assurance Quality Control components of the sampling, as those tasks are completed by support staff, and are covered in greater detail in the 2014 Sampling Analysis Plan.

Area Overview

Sampling stations have been selected throughout the reach of 7 streams; Jack, Blaine Spring Creek, Moore's Creek, O'Dell Creek, North and South Meadow Creeks, and the West Fork of the Madison. All sampling stations will remain the same as in past years with the exception of a change made to the SM-LKRD station which is being replaced with station, SM-CR. The following figures provide illustration of the site locations and the description of the sites.

Area Overview:

Madison Stream Team Sampling Locations

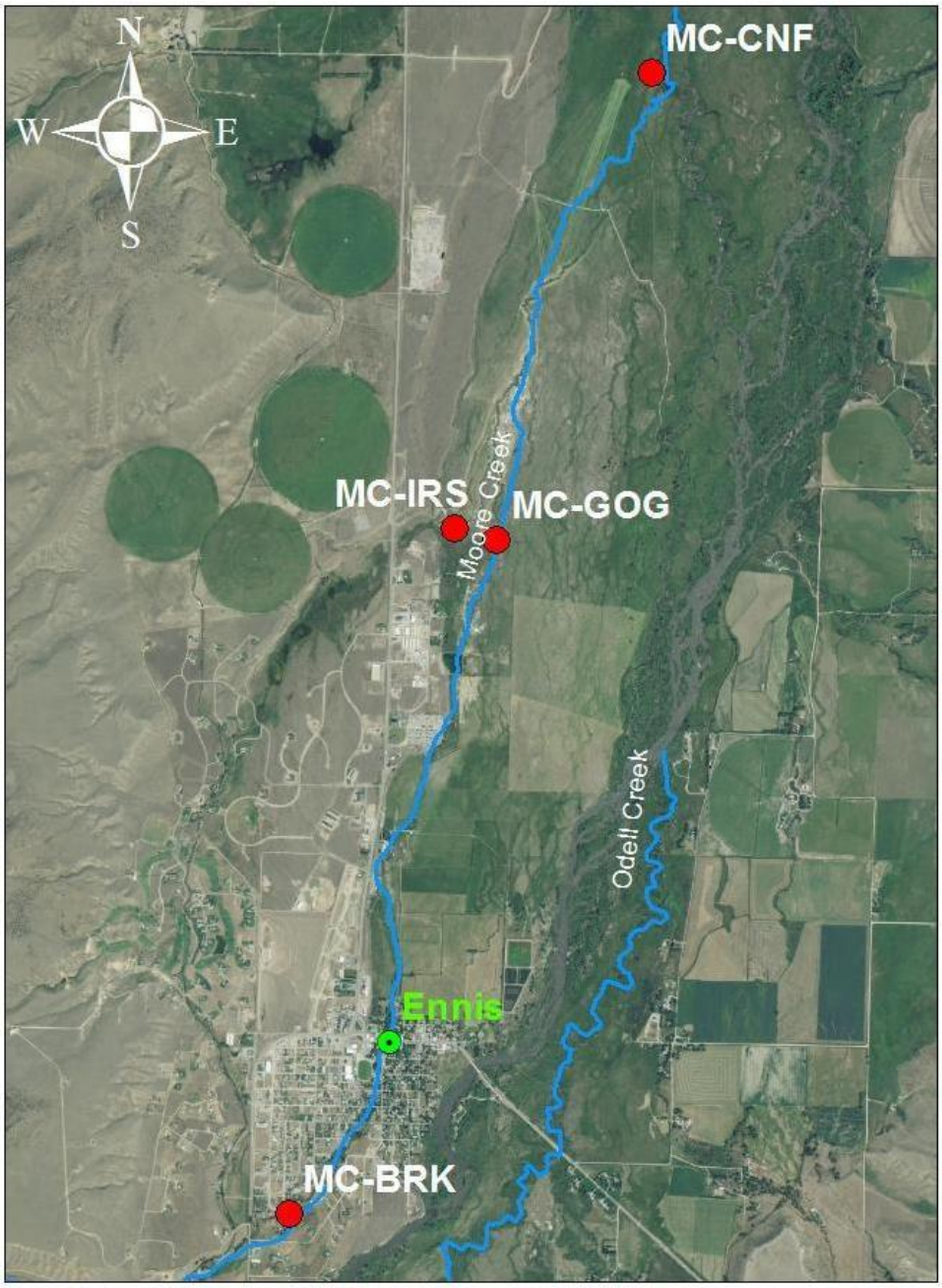


Sample Site Locations and Descriptions

Site ID	Site Name	Latitude	Longitude	Description
MC-BRK	Moore upper	45.33858	-111.737733	Southeast boundary of Bricker (BRK) property.
MC-GOG	Moore middle	45.3787	-111.721883	Southern boundary of Valley Garden property at fence line of Goggins (GOG) property
MC-CNF	Moore lower	45.40683	-111.709983	Upstream of confluence (CNF) with Fletcher Channel of Madison River
MC-IRS	Moore UT	45.37932	-111.7254	Unnamed Tributary (UT) to Moore Creek flows consisting of spring and irrigation return flows, irrigation spring(IRS)
NM-FSCG	North Meadow upper	45.52977	-111.85362	At USFS primitive campground (FSCG) near FS Road 6360.
NM-HAM	North Meadow middle	45.47078	-111.7723	Approx. 200' upstream of bridge on Hamilton (HAM) Ranch
NM-MLL	North Meadow lower	45.4461	-111.713883	Near confluence with Ennis Lake, south of Meadow Lake Lodge (MLL) main house
OD-RST	O'Dell upper	45.26057	-111.7324	Directly above steel bridge on Granger Ranch. Restoration Area (RST)
OD-GNGR	O'Dell middle	45.33178	-111.726917	1 mile in from highway 287 on ranch access road, on Granger Ranch (GNGR)
OD-VGR	O'Dell lower	45.3639	-111.706967	Near southern boundary of FWP land on Valley Garden Ranch (VGR) Fishing Access Site.
SM-FS	South Meadow upper	45.45512	-111.855	Near USFS (FS) campground, 100'upstream of bridge.
SM-EDC	South Meadow middle	45.45097	-111.747217	200' upstream of bridge on Endecott (EDC) Ranch.
SM-CR	South Meadow lower	45.444024	-111.719069	Near confluence with North Meadow Creek, 40' upstream of culvert inlet on county road, Lake Road (CR).
WF-FSRD	West Fork of Madison River upper	44.80307	-111.6168	Approx. 7.5 miles from highway 287, forest service road (FSRD)
WF-CMP	West Fork of Madison River middle	44.84862	-111.582833	Adjacent to Smith Lake outflow campground (CMP).
WF-CNF	West Fork of Madison River lower	44.8884	-111.581717	Approx. 200' upstream of confluence (CNF) adjacent to USFS access road.
BS-SB	Spring Box	45.222236	-111.794206	Inside Spring Box (creek source) on Ennis National Fish Hatchery grounds
BS-HW	Hatchery Weir	45.21515	-111.79153	Just south of Hatchery Buildings. Stream will have already passed through hatchery
BS-AR	Alton Ranch, middle	45.24539	-111.76152	Just downstream of culvert crossing Blaine Spring Creek on Alton Ranch
BS-DA	Dok Arvanites, lower	45.27176	-111.76354	Property boundary for Dok Arvanites' land

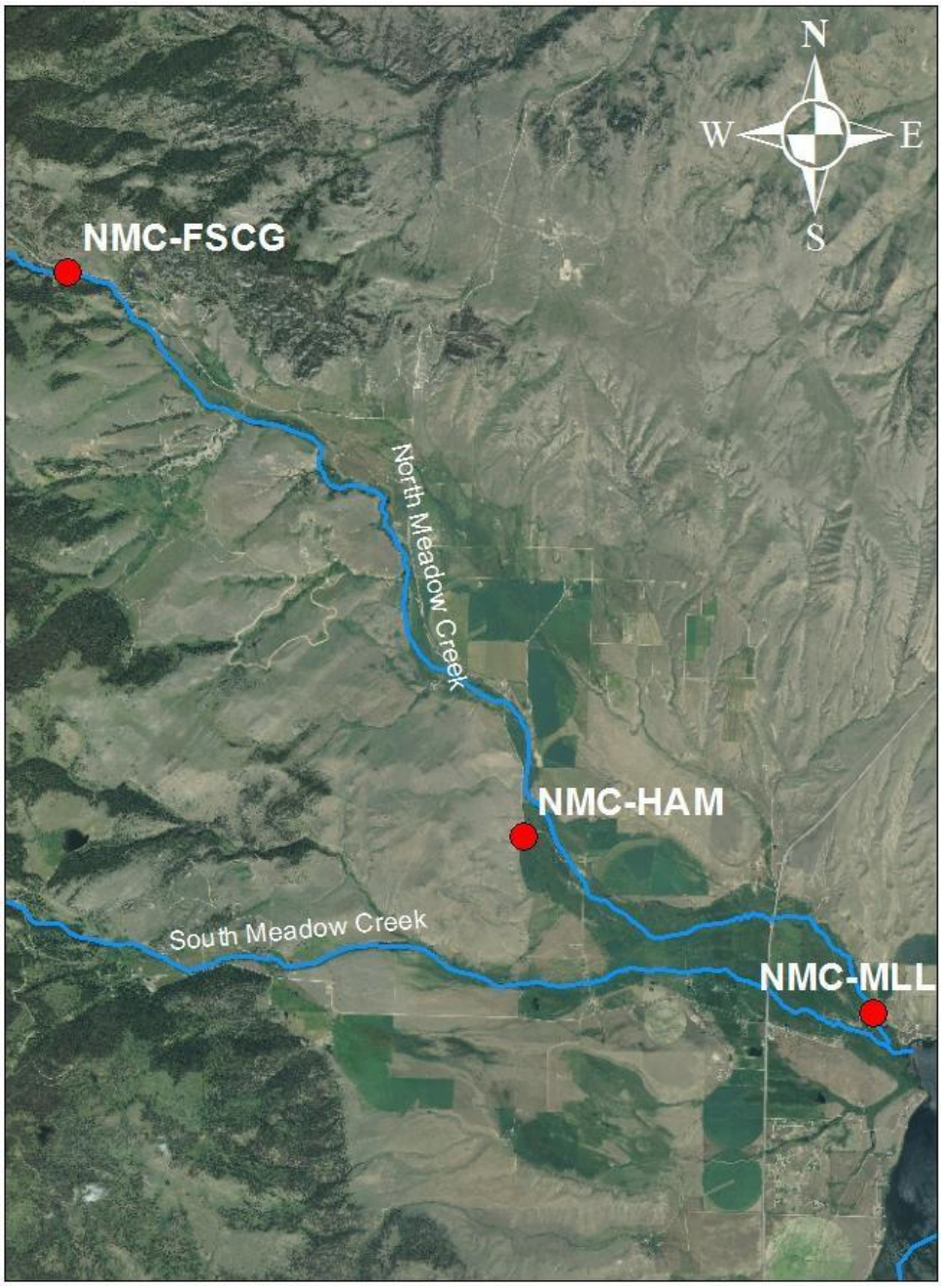
Site ID	Site Name	Latitude	Longitude	Description
JC-JCR	Jack Creek Ranch	45.37519	-111.69392	Less than 1 mile upstream from confluence with Madison River
JC-CY	Canyon	45.35646	-111.58602	Directly upstream from former USGS gaging station.
JC-CG	Campground	45.34662	-111.5295	Directly upstream from end of public access section of Jack Creek Road.
JC-SSR	South Side Road	45.33051	-111.47578	Downstream of private ownership, upstream of South Fork of Jack Creek.
JC-MC	Moonlight Creek	45.33169	-111.42036	Reference site located above Jack Creek road.
JC-MR	Madison Road	45.31098	-111.43022	Located within private ownership, off of golf course access road.
JC-LC	Lone Creek	45.31318	-111.43758	Located within private ownership, directly below base of chairlift.

Moores Creek



Site ID	Site Name	Rationale for site selection
MC-BRK	Moore upper	Stream relatively unaffected by urban influence, ease of access. Interested landowner.
MC-GOG	Moore middle	Near upstream boundary of restoration project on Moore Creek. Interested landowner.
MC-CNF	Moore lower	Near downstream boundary of restoration project on Moore Creek. Interested landowner.
MC- IRS	Moore UT	Tributary to Moore Creek with irrigation return flow. Flows potentially affected by urban influence. Interested landowner.

North Meadow Creek



Site ID	Site Name	Rationale for site selection
NM-FSCG	North Meadow upper	Ease of access from USFS road, ideal cross section. This site was replaced in 2011
NM-HAM	North Meadow middle	Upstream from Historic sampling location from 1999 sampling report. Interested landowner.
NM-MLL	North Meadow lower	Upstream from Historic sampling location from 1999 sampling report. Ease of access.

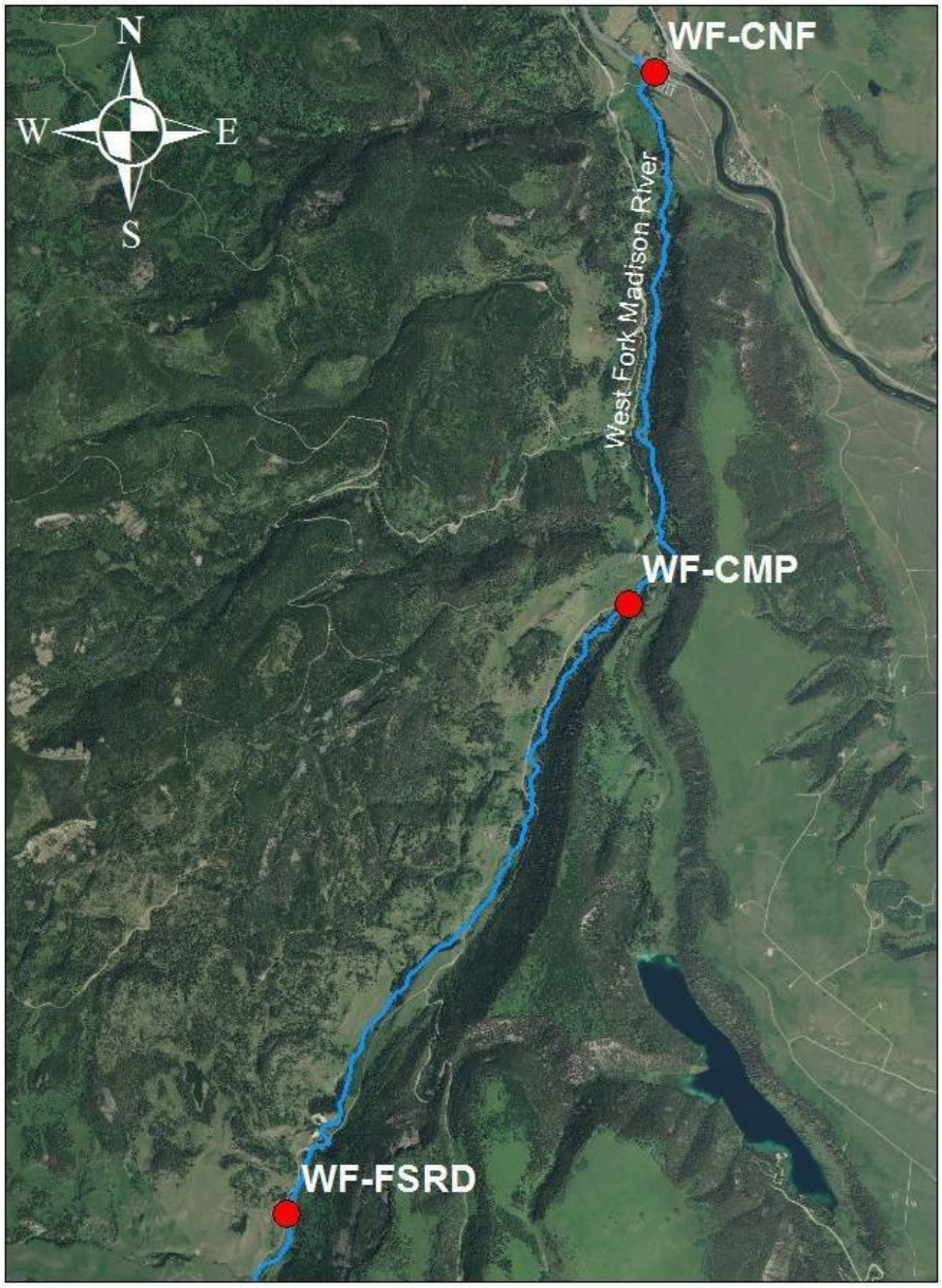
O'Dell Creek

Site ID	Site Name	Rationale for site selection
OD-RST	O'Dell upper	Within boundary of restoration area on O'Dell Creek.
OD-GNGR	O'Dell middle	Downstream of restoration area on O'Dell Creek. Location of ongoing temperature monitoring affiliated with the O'Dell Creek project.
OD-VGR	O'Dell lower	Near confluence with Madison River, ease of access on public land.

South Meadow Creek

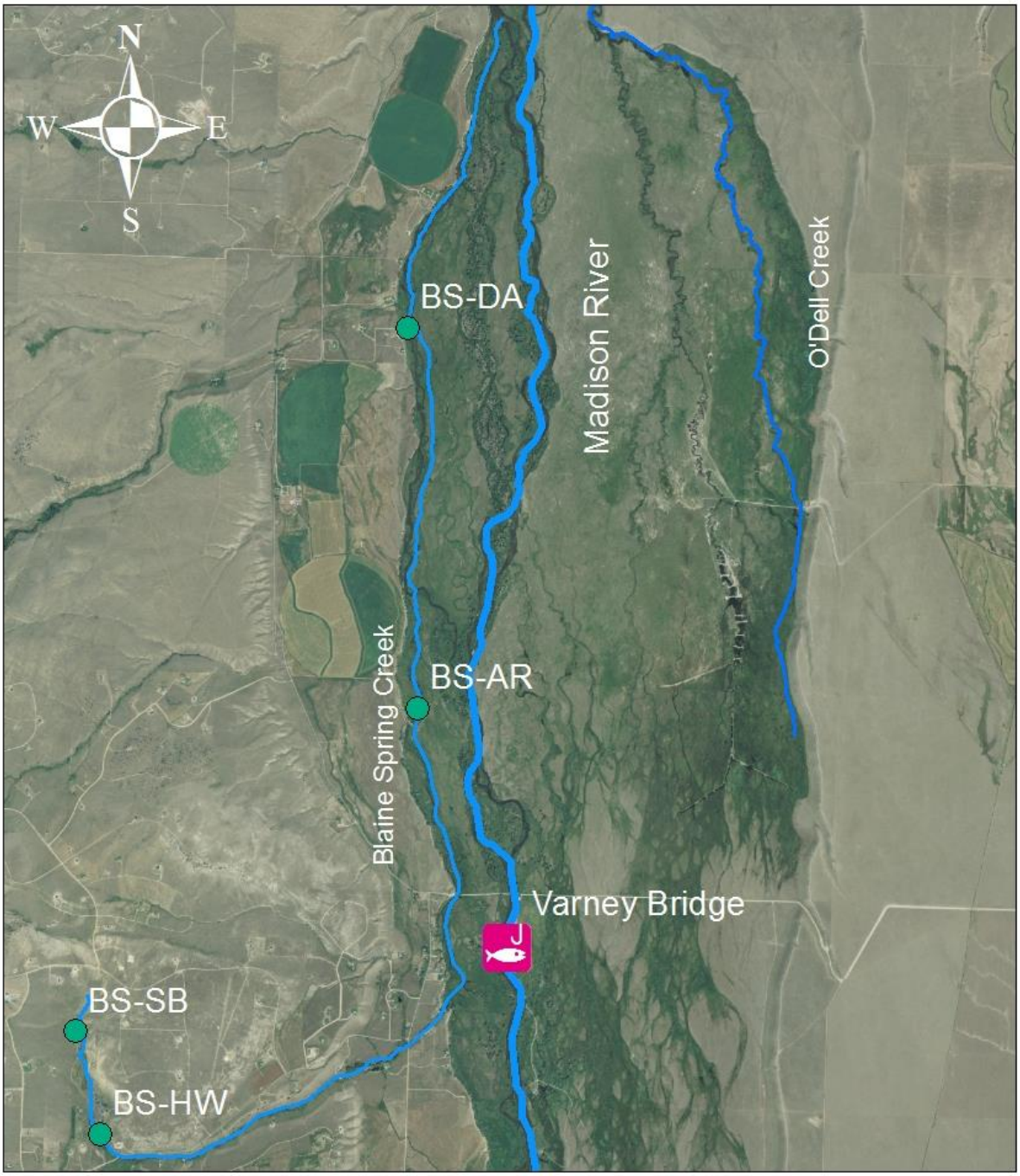
Site ID	Site Name	Rationale for site selection
SM-FS	South Meadow upper	Historic sampling location from 1999 sampling report. Ease of access on public land.
SM-EDC	South Meadow middle	Within reach of South Meadow Creek Water Efficiency project, interested landowner.
SM-CR	South Meadow lower	Near historic sampling location from 1999 sampling report. Moved upstream from historic site in 2014 due to unreliable flow data at previous location.

West Fork of the Madison



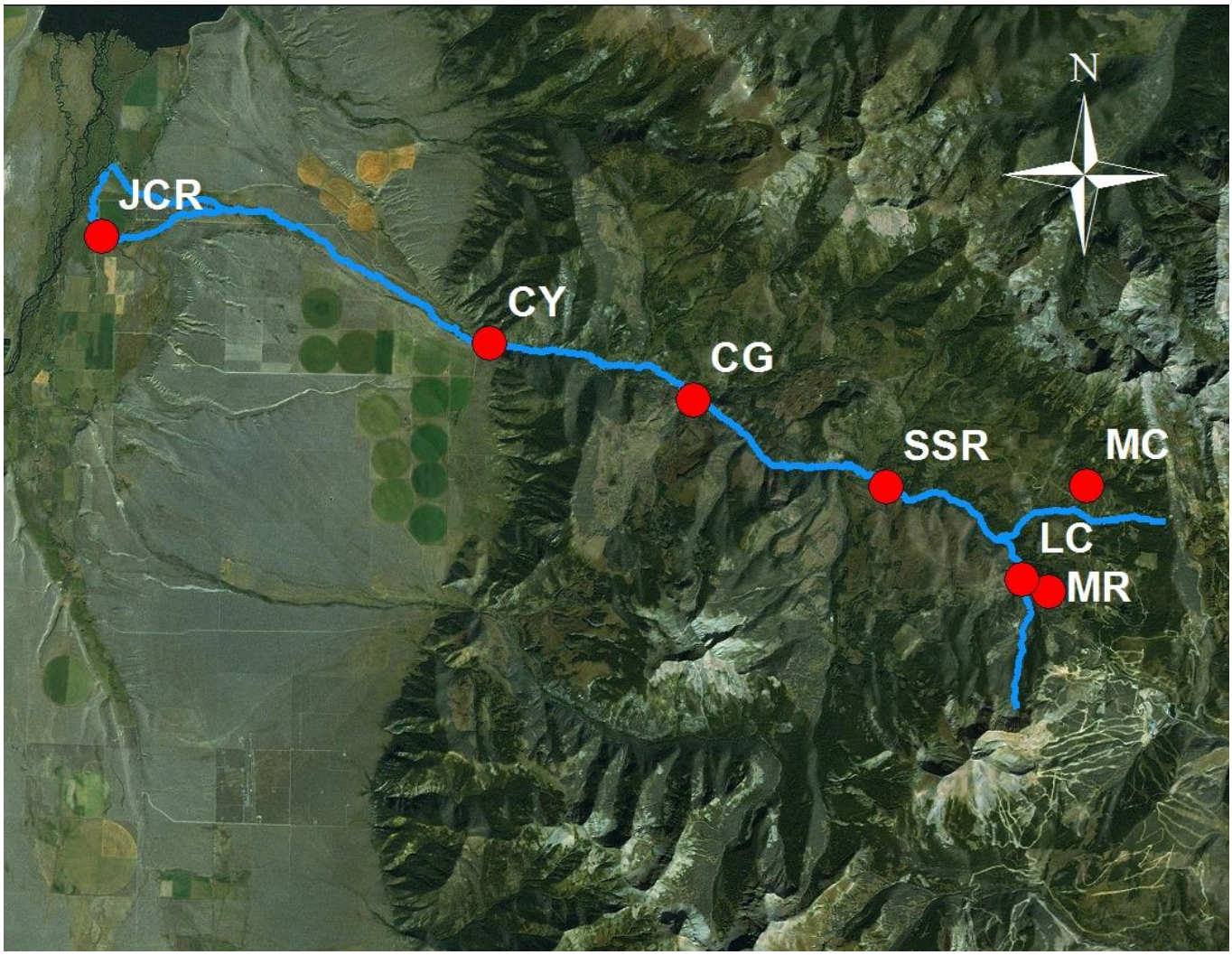
Site ID	Site Name	Rationale for site selection
WF-FSRD	West Fork of Madison River upper	Ease of access from adjacent USFS road, ideal cross section.
WF-CMP	West Fork of Madison River middle	Near accessible campground site, public land, ideal cross section.
WF-CNF	West Fork of Madison River lower	Near confluence with Madison River, ease of access on public land.

Blaine Spring Creek



Site ID	Site Name	Rationale for site selection
BS-SB	Spring Box	Spring source of creek
BS-HW	Hatchery Weir	Located just downstream of hatchery
BS-AR	Alton Ranch, middle	Land use change
BS-DA	Dok Arvanites, lower	Near confluence with Madison River

Jack Creek



Site ID	Site Name	Rationale for site selection
JC-JCR	Jack Creek Ranch	Examine effect of lower watershed land uses and spatial trends throughout upper portions of watershed.
JC-CY	Canyon	Examine effect of adjacent land use and infrastructure, and compare data with historic flow data from USGS gaging station.
JC-CG	Campground	Examine potential effect of upper watershed land uses
JC-SSR	South Side Road	Examine potential effect of upper watershed land uses.
JC-MC	Moonlight Creek	Tributary with no present anthropogenic activities in basin, considered headwaters system, accessible by Jack Creek Road.
JC-LC	Lone Creek	Examine potential effect of upper watershed land uses
JC-MR	Madison Road	Examine potential effect of upper watershed land uses

Methods

The following sections cover proper protocols for the field methods of data collection. Each method is associated with a metric or parameter that is referenced in the Site Visit Form, and includes tasks completed with field equipment, or in preparation of laboratory analysis of a sample. All protocols should be followed as instructed, to ensure accuracy of the data collections.

The field tasks include:

- Recording Site Locations with GPS
- YSI Field Care & Use Instructions
- Riparian Condition Photos
- Turbidity Measurement with Secchi Tube
- Pebble Count Instructions
- Chlorophyll Rock Photos
- Discharge Measurement
- Sample Bottle Handling
- Sample Collection

Additional tasks include:

- Cleaning and Disinfection of field equipment

All forms that are associated with data collection and analysis can be found in the following sections. Methods and forms associated with the QAQC are described in the Sampling Analysis Plan (SAP).

Example Site Visit Form

Site Visit Form- Madison Watershed

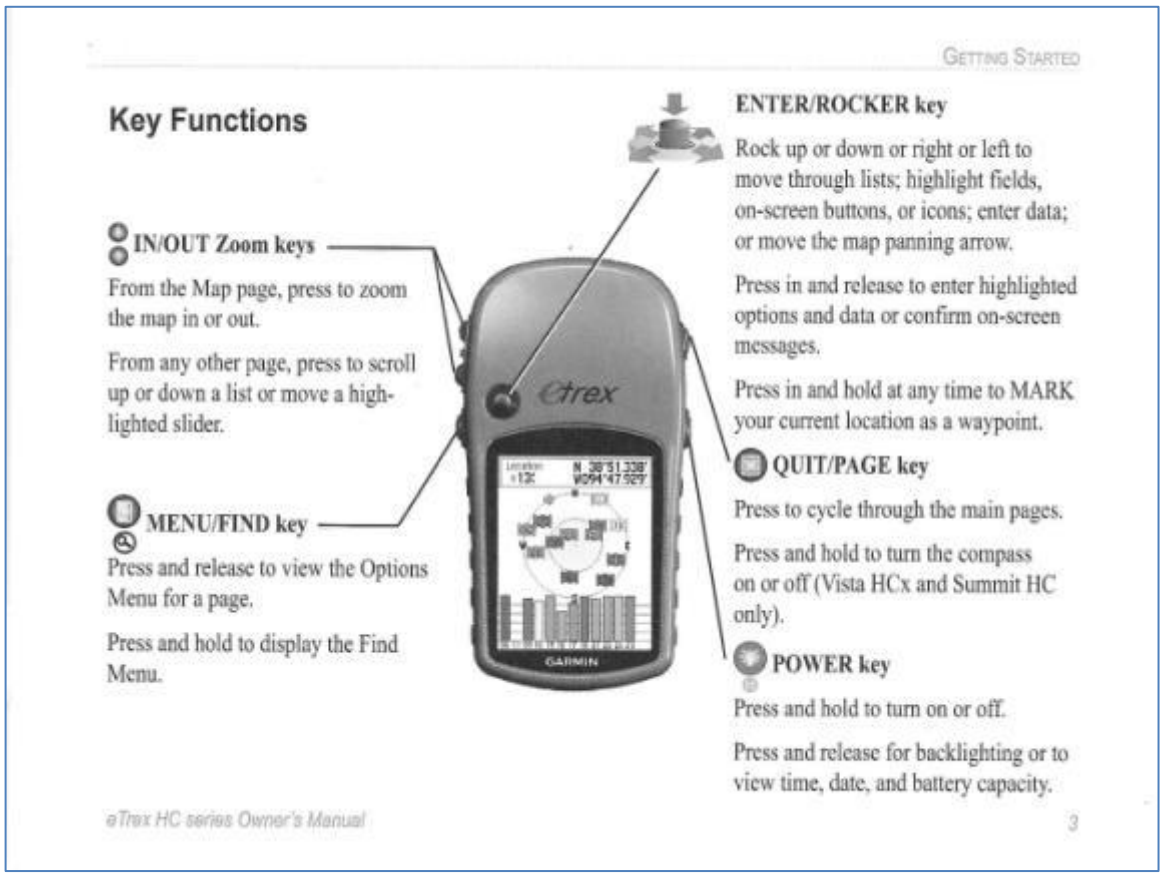
(Updated June 2014)

Date:	M. Time:	Team Members:				
Waterbody:		Station ID:				
Site Description:						
Latitude:		Longitude:			Elevation:	ft
Lab Samples						
Sample ID = Year-Month-Day-SiteID- Sample Type Letter						
Sample Type Letter: *R = Regular Sample* *D = Duplicate Sample* *B = Blank Sample*						
Example: 20130610-MCIRS-A						
Total Persulfate Nitrogen – 250 ml White Lid		Total N and Total P – 250 ml Yellow Lid				
Regular:		Regular:			Preserved □	
Duplicate:		Duplicate:			Preserved □	
Blank:		Blank:			Preserved □	
Field Parameters						
Air Temp (°C)		Turbidity (cm)	1st reading	2nd reading	3rd reading	Average of 3
Water Temp (°C)						
Specific Conductivity (µs/cm[c])		Visual Turbidity	□ Clear	□ Slight	□ Turbid	□ Opaque
Elec. Conductivity (µs/cm)		Cloud Cover	□ <5%	□ 5-25%	□ 25-75%	□ 75-100%
Dissolved Oxygen (%)		Current Precipitation	□ None	□ Light	□ Moderate	□ Heavy
Dissolved O (mg/L)		Past Precip (24 hrs)	□ None	□ Light	□ Moderate	□ Heavy
pH		Datalogger Download	□ Completed		□ Not completed	
Pebble Count						
Particle count	> 2 mm:	%	< 2 mm:		%	
Photo Log						
JPEG Number(s)	*Description*				*Photo Point Notes*	
	1st white board photo					
	Looking across stream					
	Chlorophyll rock photo					
	***Upstream** Riparian Condition Photo Point*					
	***Downstream** Riparian Condition Photo Point*					
	Other:					
	Last white board photo					
Flow						
Flow Method	□ Float	□ Meter	Measured Flow		cfs	
Field Notes						
Site Visit Form Reviewed and Checked by						
Hours in Field		*Mileage*				

Recording Site Locations with GPS

Lat/Long and Elevation

Using the Garmin E-Trex GPS to take a waypoint:



Key functions for Garmin ETrex GPS unit.

1. Use power key to turn device on.
2. Press and hold the rocker key until the Mark Waypoint page appears. The latitude, longitude, and elevation data can be found on this screen. Latitude and Longitudes should be in decimal degrees. Elevation should be recorded in feet.
3. Record these values on the site visit form.
4. If a lat/long is obtained by another method, the datum and method must be recorded in the Site Visit Comments.

YSI Field Care & Use Instructions

1. Plug sensor cable into YSI device.
2. Replace transport cup with probe sensor guard
3. Press the green power button on the YSI device
4. Place probe into the stream. Be sure to select a location where the water is moving and circulating.
5. Allow up to 10 minutes for readings to equilibrate
6. Record measurements and remove device from the stream.
7. Turn off device.
8. Replace the sensor guard with the transportation cup and store device. Be sure to leave about a half inch of tap water in the transport cup.

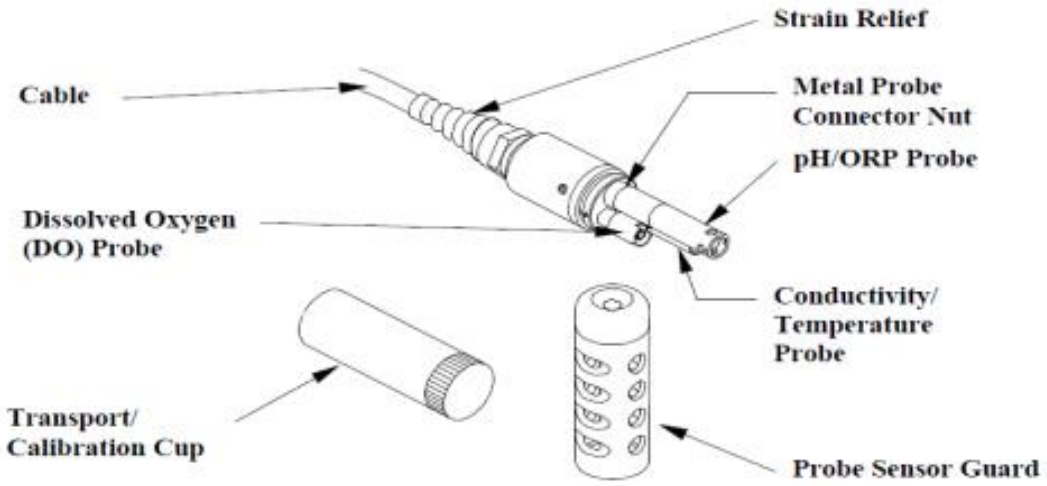
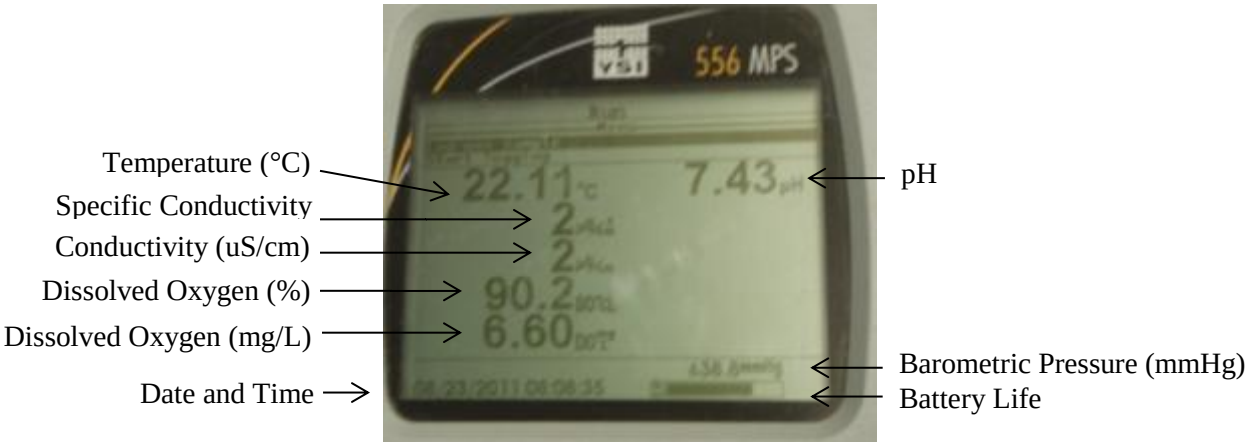


Figure 3.1 Probe Module

Probe Module from the YSI 556 Manual



Screen Shot of YSI 556 Interface

Photo-Point Field and Office Procedures

Considerations When Taking Photographs

It is critical that photo-point photographs are an exact replicate of previous photos. This will require the use of the *MST Photo Point Guide* document for each location which includes directions to the site and instructions for locating and repeating photos. The first thing you need to do is locate the position that the photograph is to be taken from. The second thing you need to do is identify the features in the photo that let you know you are repeating it exactly. In addition to photo-point photographs, supplementary photographs can be taken at the photographer's discretion to document interesting conditions at the site. Artistic expression is encouraged as some photos may be used on websites and in slide shows. Season and weather conditions should be considered when scheduling monitoring events especially if there are implications for site accessibility. Scheduling events to capture different stream flow levels and seasonal changes in vegetation can be advantageous. The camera should not be zoomed in unless specifically directed in the *MST Photo Point Guide*.

Equipment Needed

Required:

- Camera and backup camera
- MST Photo Point Guide
- Wipe off sheet
- Dry erase marker
- Rag to erase white board
- Topographic and/or road map
- Compass
- Timepiece
- Extra batteries for camera (if applicable)
- Photo-log data sheets

Optional:

- Aerial photos if available
- GPS unit (if applicable)
- Staff gauge (for scale on landscape shots)
- Ruler (for scale on close up views of streams and vegetation)
- Steel fence posts for dedicating fixed photo points in the absence of available fixed landmarks

Field Procedures

Once at a monitoring site, the following step should be performed:

1. First, take a photograph of a wipe off sheet that displays the information about the site. The wipe off sheet should be photographed before any site photos are taken and again after all photos are taken at the site to facilitate data management. Information on the white board should include stream name, site ID, date, photographer name, and start time.
2. Ensure that the date and time in the camera are set correctly. If they are not correct and you cannot figure out how to reset them; make a note of the incorrect time on the datasheet.
3. Confirm photographer location with either existing marker (steel fence post), GPS, or by referencing the description contained within the station location guide.
4. Locate the definitive features for the given photo-point and correctly align the feature within the camera's view using a compass
5. Take a photograph. Be sure not to zoom in.
6. With digital cameras, confirm photograph is as close to a complete duplication as possible to the original photograph.
    a. Pay particular attention to the corners of the old photo. Does your photo have the same features in each corner?

b. Does your photo look like it is too close or too far away? If so, move accordingly.
c. Is the horizon the same?

7. Record the appropriate information (metadata) on the datasheet
8. Once all photos have been taken, update the wipe off sheet with the end time and the number of photos taken and photograph the board (example below). A photo of the wipe off sheet should be the first and last photograph taken at each site.

Madison Stream Team Site Photos

Date:
Site:
Photographer(s):
Start Time:
End Time:
Number of Photos taken:

The photos of the wipe off sheet should be included in the number of photos taken at each site as indicated on the wipe off sheet. In the example above, three photos would have been taken at the site and two of the wipe off sheet, totaling to 5 photos taken.

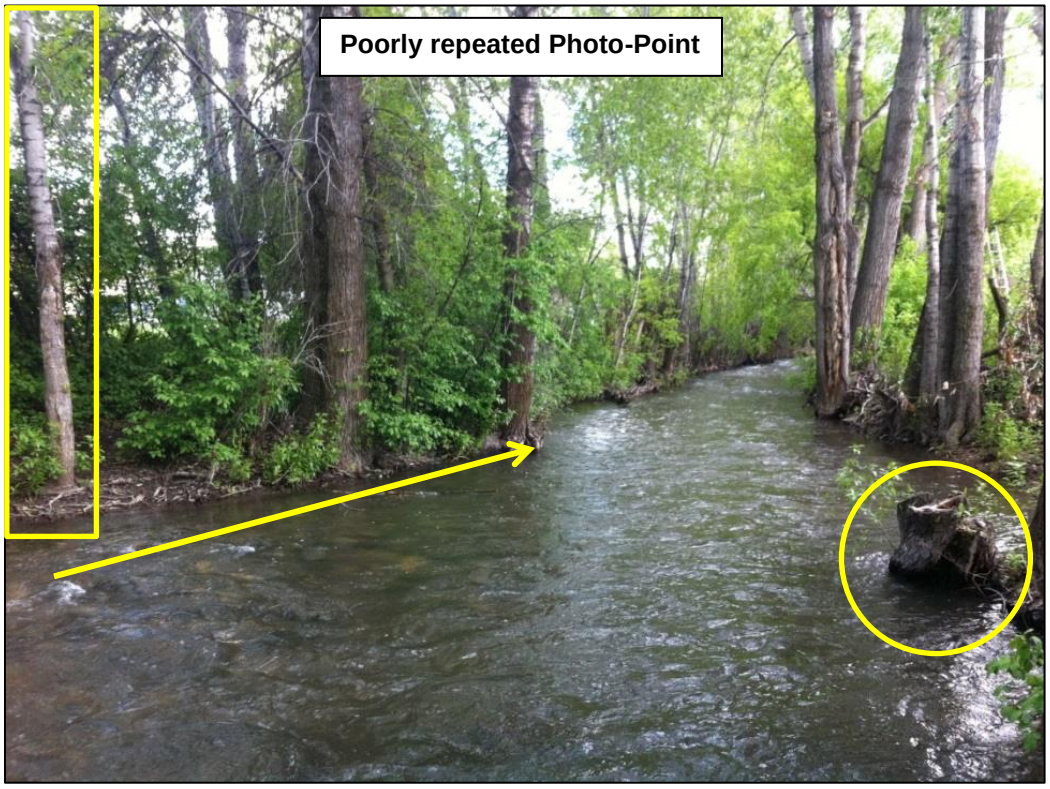
Delivery of Photos to the Project Manager

It is critical that photos are transferred off of the camera shortly after they are collected and that they are backed up in at least 2 locations. The details of photo management plan need to be written for the specific project and included in the SOPs.

File and Data Management

Data management will be simplified by taking photographs that contain the site information both before and after photo-points and supplementary photos are taken. This will result in the photos for a given site being sandwiched between the site information when uploaded in the computer. Having a very specific system for file management is critical but the details of that system are up to the project manager. Using the white board for site information documentation alleviates the need to change the file name of the individual photos which will save a lot of time. It is still very important to keep photographs organized however. One recommended photo storage system is to have a folder for the project and a folder for each site. All photos through time can be stored in a single folder (assuming the whiteboard approach is used correctly). This will allow for photos to be sorted by date taken and easily viewed in chronological order.


Original Photo-Point


Poorly repeated Photo-Point

Turbidity Measurement with Secchi Tube

1. Turbidity measurements should be taken as quickly as possible to get the measurement before particles settle out and make the sample less turbid.
2. The secchi tube should be filled with water from the active portion of flow, making sure there is no upstream disturbance taking place.
3. The tube should be filled all the way to the zero line near the top which may require adding additional water from the stream with a bucket.
4. Measurements are taken by standing over the secchi tube and looking straight down the tube.
5. Stand with your back to the sun so the tube is in your shadow and remove sunglasses before taking a reading.
6. Lower the secchi disk in the tube until it disappears. Pinch the cord against the tube to hold it in place and look through the side of the tube to determine the depth of the disk in the tube.

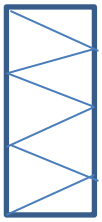
7. If the disk is visible at the bottom of the tube, the reading is recorded as greater than the depth of the tube. This means the water is too clear to measure with this tube.
8. Record the measurements (in centimeters) on the datasheet.
9. Repeats steps 2 through 7 twice more, record each reading on the datasheet, and calculate the average of the 3 readings.

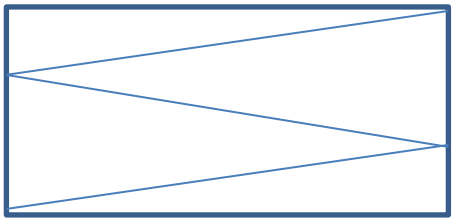
Pebble Count Instructions

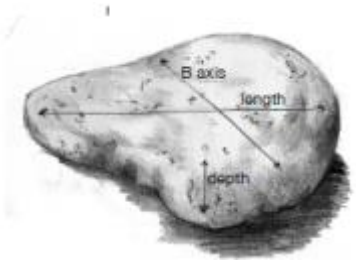
The sampling points are determined by paced transects across the channel from wetted edge to wetted edge of channel using the "zig-zag" method (including the top, middle and bottom of the riffle). A minimum of 400 particles must be observed and recorded. (If time only allows for collection of 100 particles, the pebble count data will still be useful for a basic assessment of the reach but will not provide a large enough sample size for MDEQ to thoroughly assess sediment impairment).

1. Start at one end of the downstream cross-section. Without looking directly at the substrate, step forward. Reach down and pick-up the FIRST PARTICLE at the end of your foot touched by your finger. DO NOT LOOK while you are selecting the substrate to ensure a random sample is collected.

- In narrow streams you should walk heel to toe to space your collections across the stream. In wider streams with a longer riffle, you can take larger steps to space your steps so that you will spread out the collection of 100 samples in the riffle. Try to walk so you cover the length of the riffle during sampling. The number of times you cross the stream will depend on the width and length of the riffle, you can record how many times you crossed the stream in the "Riffle description" location on the pebble count datasheet.







2. Measure the intermediate diameter of the particle (B axis)
3. Note whether each particle is greater than or less than 2 mm across its B axis. Use the provided washer as the 2mm size indicator
4. Call out "less than 2mm "or" greater than 2mm" to your team partner who is recording the data. Use the Dot/Slash system to record pebble counts.

- If you pick up multiple pieces of sand, that is considered one particle. If you pick up organic matter or anything other than stream bed material then it is not counted in the tally.

5. Continue zig-zagging up the riffle until 100 particles have been measured. If you reach 100 particles while in the middle of a stream crossing, continue collecting particles until you reach the edge of the stream. Tally the two size categories outlined on the data form. Calculate the cumulative percent total for each class size and record on the data sheet.

Chlorophyll Rock Photos

Ten random rocks need to be collected for nuisance algae (chlorophyll) photos. These should be collected in the same riffle where pebble counts are conducted. A zig-zag pattern similar to pebble count transects (see pebble count protocol for details) can be used to randomly select 10 rocks for the photo.

1. Start at one bank to make a zig zag pattern back and forth across the channel. Reach down at your toe after each step and pick up the first rock you touch. If the rock is larger than a golf ball, collect it for the photo (hand it to a partner to place it on the bank). If the rock is smaller than a golf ball, discard it and continue. Continue the process zig zagging across the channel until you have collected 10 rocks.

2. Place rock right side up (as it was in channel) on the white plastic bag

3. Place the chlorophyll photo form in the picture (see picture below) with the sample site name, the date and time, so the time and location of the photo can easily be identified.

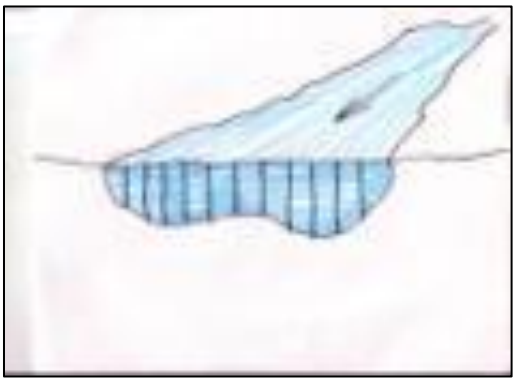
4. Take a picture and confirm that is properly displays algae growth

5. Record the photo number(s) from the camera on the field visit sheet. The description should say that the photo was for chlorophyll and should describe the location of the riffle where the rocks were collected.

Discharge Using the Marsh-McBirney FLO-Mate Meter

Equipment and Supplies

- 100' reel-type tape measure
- 2 tent stakes (hammer optional if needed)
- FLO-Mate unit
- Measuring rod



1. Locate a reach of stream that is not being immediately disrupted by obstacles upstream (boulders, logs, etc.) and generally reflects the flow characteristics of the stream at the site.
2. Stretch a tape measure across the channel to establish the cross-section. This should be perpendicular to the channel.
3. Measure the wetted width of the channel by looking at where the tape intersects the left and right edges and subtracting the smaller number from the larger. Measurements should be made in tenths of a foot for ease of math. Record this wetted width on the data sheet.
4. Divide the wetted width into 20 even intervals for depth measurement. You can round to the nearest number that will make the math easier (maybe to the nearest quarter foot).
5. Start at one wetted edge of the channel, and record the tape measurement at that location with a zero depth. Continue measuring depths across the channel at your determined interval. You should finish on the opposite wetted edge with a zero measurement and should have at least 20 depth measurements.

➢ Depths and velocity are measured at each interval along the cross section using the measuring rod and FLO-Mate. Instructions for its operation are below:

Operation of FLO-Mate

The FLO-Mate is a portable flow meter designed to measure stream velocity in the field. The unit works by taking instantaneous velocity measurements and averaging them over a set period of time. When you receive the unit, the necessary specifications and calibrations will already be set. Stream Team members will use the FLO-Mate to measure stream velocity over the established cross section. The sensor of the unit is attached to a measuring rod that accurately places the sensor at the proper depth within the stream for accurate collection. The rod also measures stream depth. The procedures for using the meter with the measuring rod are shown below, followed by the procedures for operating the meter.

Sensor Mounting

Mounting instructions are as follows:

1. Insert the mounting shaft into the hole at the back of the sensor.
2. The thumbscrew needs to be seated in the groove, so make sure the shaft is completely inserted into the hole.
3. Hand tighten the thumbscrew.

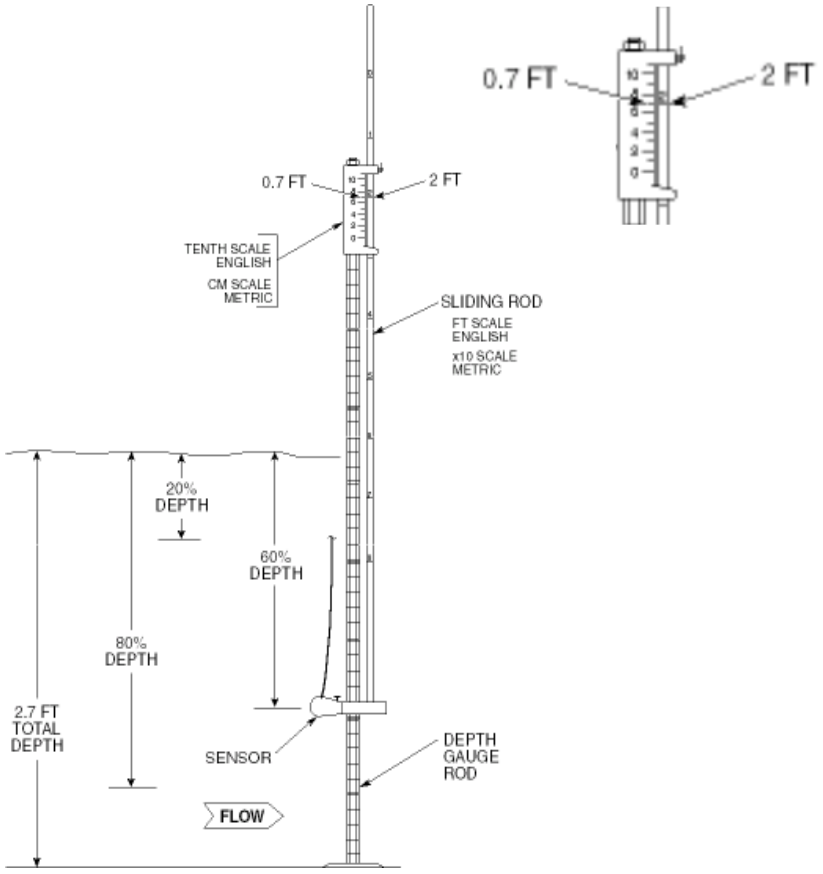
[CAUTION]

Do not over tighten the thumbscrew on the sensor. Excessive force on the thumbscrew could damage the sensor.

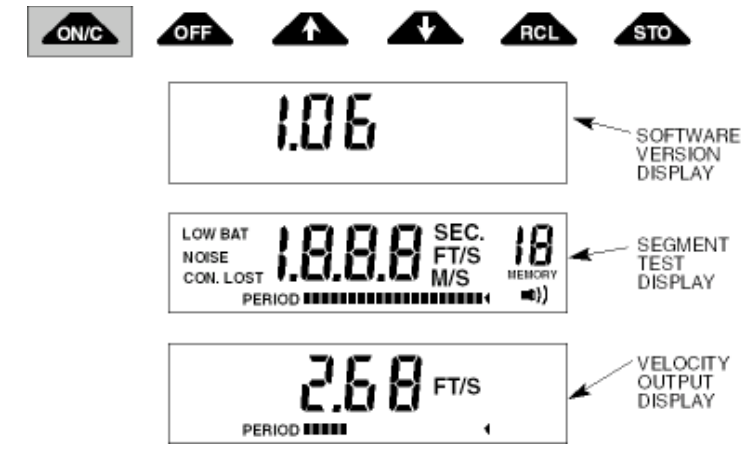
Using the Measuring Rod

Because stream velocities differ at various depths within the channel, an accepted method for determining mean velocities of flows is to measure the velocity at 60% of the depth (from the top) and use this as the mean.

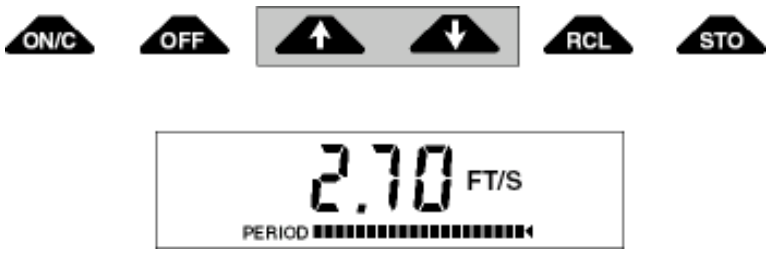
1. Set the rod at the first interval determined by the stream width measurement. Note the height of the water at the depth gauge rod. Each single mark represents 0.10 foot, each double mark represents 0.50 foot, and each triple mark represents 1.00 foot.
2. Line up the foot scale on the sliding rod with the tenth scale on the top of the depth gauge rod. If, for example, the total depth of the water is 2.7 feet, then line up the 2 on the foot scale with the 7 on the tenth scale.



3. Turn the meter on.
4. The first set of screens you see appear below. The velocity output display will resume measuring average velocity for a 30 second period.



5. Clear the display by hitting the ON/C button once.
6. The unit display will begin averaging by showing the horizontal time bar under the velocity output. The time bar provides an indication as to the amount of time left until the display is updated.
7. At the end of the averaging period, record the value indicated in the "velocity" column on the field form.



Sample Bottle Handling

1. All samples (including quality control samples) should be labeled with a permanent marker before being filled and then covered with clear packing tape so that the labeled information does not smear. Labels should include:
    a. Company Name (Client): Madison Conservation District = MCD
    b. Date and time (military time)
    c. Sample ID (includes year, month, day, site ID, and letter indicating sample type)
        i. Sample ID = Year-Month-Day-SiteID-Sample Type Letter
        ii. Sample Type Letter
            - R = Regular Sample
            - D = Duplicate Sample
            - B = Blank Sample

Sample ID Examples:

A **regular sample** collected at the Moore Creek Upper site on August 15, 2014 would be labeled:

- 20140815-MCBRK-R

A **duplicate** at the same place and time as above:

- 20140815-MCBRK-D

A **blank** at the same place and time as above:

- 20140815-MCBRK-B

Note: For simplicity and brevity for sample bottle labels, these IDs do not include the MST portion of the site IDs which will be added before uploading the data to databases.

Sample Collection

Non-Filtered Sample:

1. Samples will be collected in a well-mixed portion of each stream.

2. Bottles and lids shall be rinsed three times with stream water prior to sampling. During sampling, the sample bottle opening should face upstream and should be drawn through the water column once, carefully avoiding disturbance of bottom sediments.

3. One set of quality control (QC) samples consisting of blanks and duplicates will be collected for approximately every 10 stream samples collected.
    a. Field blanks will be provided by the laboratory and labeled according to the labeling methods. A duplicate sample is a second stream sample collected at the same time in the same way that the regular stream sample is collected.
    b. Duplicate and blank samples will be collected at a random location for each event.
4. Blank and duplicate samples are handled and delivered to the lab in the same manner that regular samples are handled.

5. Any preservative necessary should be added to samples in the field. Sulfuric acid (H_2SO_4) (yellow vials and bottle caps) is typically added to samples for nutrient analysis.

6. After adding preservative, mark the lid of the preserved bottle with an "X" by sharpie marker to indicate that preservative has been added.

Packaging Samples for Shipment

1. Samples need to be kept on ice or in a refrigerator until shipping.
2. Samples should be shipped as quickly after collection as possible but need to be shipped on a Monday or Tuesday and not later than Wednesday. Next day delivery is ideal, but if outside temperatures aren't too high, two day delivery would work too. Samples need to be shipped so they do not arrive on a weekend.
3. Samples should be packaged immediately before shipping to avoid unnecessary loss of ice before shipping.
4. Organize all samples on a table, grouped by site, in the order they were collected.
5. Check that all sample labels are completely filled out.
6. Fill out the chain of custody for the testing laboratory. This includes listing all of the sample IDs and sampling times. See the completed example on the following page.
7. Place a large trash bag inside the cooler. This bag will hold all of the samples and be tied off at the end to prevent any liquids from leaking from the cooler.
8. Place sample bottles in the ziplock bags (they may have come from the lab in bags initially which can be used). Samples preserved with nitric acid (red caps) should be bagged together separately. This is because nitrogen in the form of acid was added to these bottles and we don't want them to contaminate the nutrient samples if they were to leak.
9. Fill a minimum of 2 gallon ziplock bags with ice purchased from a store or ice from your freezer (whichever is more convenient) to include with the samples. The volume of ice should be at least equal to that of the samples.
10. Place all of the samples and the bagged ice inside the trash bag, inside the cooler and tie off the top of the trash bag.
11. Tear off the pink sheet on the completed chain of custody to give to project manager. Place the other COC completed sheets inside a ziplock bag and tape it to the top of the cooler.
12. Close the cooler and tape it closed. Sign and stick the custody seal on the cooler. Peel the tracking sticker on the UPS prepaid sticker and place it on the pink sheet. Deliver the cooler to the shipping center immediately.
13. Timely delivery of samples is critical so the ice doesn't melt. Especially if temperatures are hot, samples need to reach the lab quickly to avoid overheating.

ENERGY LABORATORIES

Chain of Custody and Analytical Request Record

Page 1 of 2

PLEASE PRINT (Provide as much information as possible.)

Company Name:	Project Name, PWS, Permit, Etc.	Sample Origin	EPA/State Compliance:
Madison Conservation District	Madison Stream Team	State: MT	Yes ☐ No ☐
Report Mail Address:	**Contact Name:** Phone/Fax:	**Email:**	**Sampler: (Please Print)**
PO Box 606 Ennis, MT 59729	Sunni Heikes-Knapton	mwc@3rivers.net	
Invoice Address:	**Invoice Contact & Phone:**	**Purchase Order:**	**Quote/Bottle Order:**
11	11		

Special Report/Formats:

☐ DW
☐ POTW/WWTP
☐ State: _____
☐ Other: _____
☒ EDD/EDT (Electronic Data) Format: MT EQuIS
☐ LEVEL IV
☐ NELAC

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids
Vegetation Bioassay Other
DW - Drinking Water

ANALYSIS REQUESTED

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Dissolved Aluminum	Metals (full suite)	Nutrients (N+N, TP)	SEE ATTACHED
1 20120710-NMMLL-DA-A	7/10/12	9:40	3W	X			
2 20120710-NMFSCG-DA-A	7/10/12	12:45	3W	X			
3 20120710-NMMLL-DA-B	7/10/12	9:45	3W	X			
4 20120710-NMHAM-DA-A	7/10/12	11:10	3W	X			
5 20120710-NMMLL-M-A	7/10/12	9:35	3W		X		
6 20120710-NMHAM-M-A	7/10/12	11:07	3W		X		
7 20120710-NMFSCG-M-A	7/10/12	12:45	3W		X		
8 20120710-NMMLL-M-B	7/10/12	9:45	3W		X		
9 20120710-NMFSCG-N-A	7/10/12	12:45	3W			X	
10 20120710-NMMLL-N-B	7/10/12	9:40	3W			X	

Standard Turnaround (TAT) → RUSH

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments:

Shipped by:
Cooler ID(s):
Receipt Temp ____ °C
On Ice: Y N
Custody Seal On Bottle Y N, On Cooler Y N
Intact Y N
Signature Match Y N

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
William Robertson	7/12/12	William Robertson			
Relinquished by (print):	Date/Time:	Signature:	Received by (print):	Date/Time:	Signature:
			Received by Laboratory:	Date/Time:	Signature:

Sample Disposal: Return to Client: _____ Lab Disposal: _____

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.
Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

Protocol for Cleaning and Disinfecting Field Equipment

Overview: To ensure field workers do not transport aquatic invasive species form one site location to another, the following protocol from Montana Fish Wildlife and Parks will be followed before leaving each site:

This cleaning and disinfection protocol should be followed to ensure that field workers are not transferring aquatic nuisance species into new sites. Particular attention should be paid to cleaning and disinfecting equipment after working in areas known to be infested with an aquatic nuisance species. However, all equipment should be thoroughly cleaned before using it in a different location.

Waders, nets and all other field equipment used in the water:

- Separate all individual components such as insoles, socks, booties, ankle guards and laces. Wash all components separately.
- Remove all sediment, vegetation and aquatic animals from all equipment. Pay particular attention to the soles of waders.
- Disinfect all equipment in a 20% commercial bleach solution for 10 minutes or a 5% bleach solution for 1 hour.
- If chlorine disinfection is not used, an alternative is to ensure all equipment is thoroughly cleaned with hot water such as in a bucket or bathtub and allowed to soak for sufficient time to allow components to reach water temperature, and allowed to dry completely for as long as possible between visits to different sites.
- Do not transfer any water, vegetation or animals between sites.
- Always work from upstream to downstream.

Sampling Activity Checklist

This activity Checklist is to be completed for each sampling event and kept on file.

Stream Name, Date_____

Event Planning (to be performed by the field technician or project manager (indicated by *) at least 1 week prior to event)

Date, Initial	Task	Date, Initial	Task
	Coordinate sampling date with volunteers*		**Order sample bottles (1 for each site, 1 extra set, and as needed for QAQC)**
	Coordinate sampling date with landowners*		**Ensure number and type of bottles is correct**
	Verify volunteers have signed release forms		**Print Data Sheets on Rite in Rain paper, ensure all equipment is available.**

Pre Field Activity (to be performed by the field technician 1 day prior to event)

Date, Initial	Task	Date, Initial	Task
	Remind volunteers of event, time, location		**Calibrate YSI meter**
	Remind landowners of sampling event		**Label Sample containers with site name, date**
	Purchase Ice for sample cooler		**Check battery power on all equipment**

Field Activity (to be performed by volunteers and supervised by field technician at the site)

Date, Initial	Task	Date, Initial	Task
	Deploy YSI Meter		**Take nuisance algae photos***
	Begin filling out field visit form		**Take site photos, other photos**
	Finish labeling bottle with date, time		**Measure Discharge**
	Collect Water Samples		**Check that all forms are complete**
	Collect YSI Meter measurements		**Check that all gear is accounted for**
	Conduct Pebble Count*		**Tally volunteer miles and hours**

*dependent on schedule

Post Field Activity (to be performed at office by technician or project manager, as needed)

Date, Initial	Task	Date, Initial	Task
	Unload gear, dry any wet equipment		**Download photos into electronic file**
	Fill out chain of custody report		**Transfer electronic data to file**
	Ship samples (never on a Friday or Saturday)		**Send email to all volunteers confirming event, provide photo, summary of data**
	Enter data from field forms,		**Save lab results into data file**
	Put field forms in project folder		**Complete QAQC matrix, upload data into EQUIS**

MST Gear Checklist

Data Sheets

1. Site visit form
2. Discharge form
3. Pebble count form
4. Chlorophyll photo sheet, dry erase marker
5. Site Photo sheet

Equipment for data collection

1. YSI multi parameter meter or handheld meters
2. Tap water for YSI storage
3. Clipboard
4. Calculator
5. Air Thermometer
6. Batteries (4 C for YSI, 2 AA for GPS, 2 D for FLO Mate)
7. Camera
8. Garmin eTrex GPS Unit
9. Turbidity Tube
10. Bucket to fill tube
11. 2mm washer for pebble count
12. White garbage bag

Collecting Samples for Lab Analysis

1. Cooler from lab
2. Chain of Custody form (COC)
3. One set of sample bottles for each site and for any blank and duplicate QC samples
4. Sample Preservative (nitric/sulfuric acid)
5. Plastic gloves
6. Safety glasses
7. Ice
8. Packing tape for labels
9. Sharpie marker

Discharge

1. 100 foot tape measure
2. Bank pins (2)
3. Measuring rod
4. FLO-Mate Meter
5. Field Laptop with ominlog software, cables
6. Siphon

General Equipment

1. First aid kit
2. Bear spray
3. Duct tape
4. Multi-tool
5. Life Jacket

Personal Items

1. Cell Phone
2. Sun screen
3. Waders
4. Bug spray
5. Lunch
6. Water

Calendar for 2014 Samplings

Sampling events should be planned for early in the week, to allow sufficient time for the lab to analyze the samples shipped to them. Preferred days are Sunday, Monday, Tuesday and Wednesday. The minimum number of days that should pass between sampling events is 22 days, with 30 days being preferred. Field assistance is available and preferred for all events, to provide additional support and to ensure sample collection and submission is completed accurately. Contact our office to arrange for equipment and to coordinate field assistance.

Site visit tasks schedule

Stream	*July*	*August*	*September*
O'Dell	*Discharge, Field meter, T Tube, Pebble Count, Nutrients, QAQC*	*Discharge, Field meter, T Tube, Rock Chlorophyll Photo, Nutrients*	*Discharge, Field meter, T Tube, Nutrients*
Blaine Spring Creek	*Discharge, Field meter, T Tube, Pebble Count, Nutrients, QAQC*	*Discharge, Field meter, T Tube, Rock Chlorophyll Photo, Nutrients*	*Discharge, Field meter, T Tube, Nutrients*
West Fork	*Discharge, Field meter, T Tube, Pebble Count, Nutrients, QAQC*	*Discharge, Field meter, T Tube, Rock Chlorophyll Photo, Nutrients*	*Discharge, Field meter, T Tube, Nutrients*
South Meadow	*Discharge, Field meter, T Tube, Pebble Count, Nutrients, QAQC*	*Discharge, Field meter, T Tube, Rock Chlorophyll, Nutrients*	*Discharge, Field meter, T Tube, Nutrients*
North Meadow	*Discharge, Field meter, T Tube, Pebble Count, Nutrients, QAQC*	*Discharge, Field meter, T Tube, Rock Chlorophyll Photo, Nutrients*	*Discharge, Field meter, T Tube, Nutrients*
Moore's Creek	*Discharge, Field meter, T Tube, Pebble Count, Nutrients, QAQC*	*Discharge, Field meter, T Tube, Rock Chlorophyll Photo, Nutrients*	*Discharge, Field meter, T Tube, Nutrients, Arsenic*
Jack Creek	*Discharge, Field meter, T Tube, Pebble Count, Nutrients, QAQC*	*Discharge, Field meter, T Tube, Rock Chlorophyll photo, Nutrients*	*Discharge, Field meter, T Tube, Nutrients*

Appendix A: YSI Care and Calibration Instructions

Adapted from a QAPP for the Gallatin Volunteer Monitoring Program written by Tammy Crone

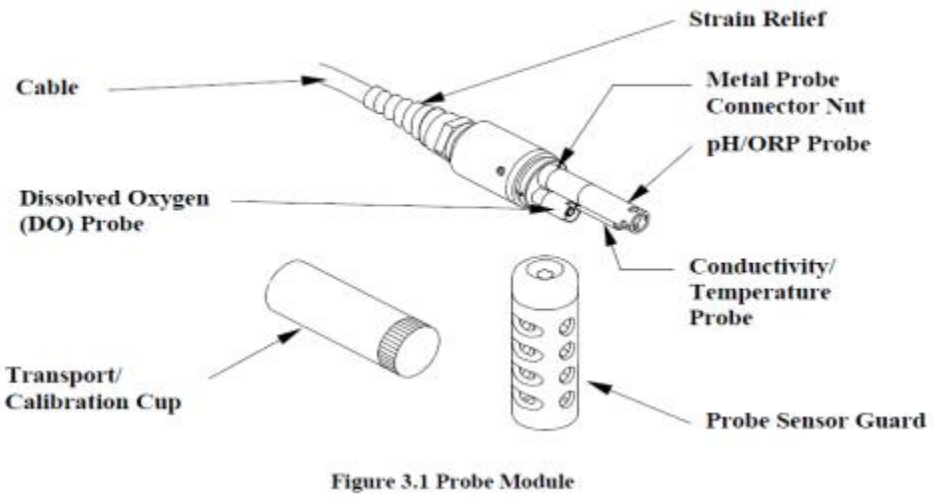


Figure 1: Probe Module from the YSI 556 Manual

Figure 2: Screen Shot of YSI 556 Interface

YSI 556 CARE

- Before calibrating the YSI, check the condition of all of the probes
  - The pH glass bulb at the end of the probe should be clear. If it is starting to get cloudy or if you notice the pH taking a long time (> 5min) to calibrate then consider replacing the pH probe
  - Inspect the membrane on the dissolved oxygen probe. The membrane should be clear and not cloudy/dirty or scratched. There should not be bubbles under the membrane.
  - Check all probes to make sure they are free of sediment or buildup that may have accumulated since the last time it was used.

CALIBRATION TIPS & HINTS

- Calibration solutions should ideally be stored at room temperature and calibration should be performed at room temperature.
- The transport/calibration cup that comes with the probe serves as a calibration chamber for all calibrations and minimizes the volume of calibration solutions required.
- Ensure all sensors are immersed in the calibration solution. Many of the calibrations factor in readings from other sensors (e.g., temperature sensor). The top vent hole of the conductivity sensor must also be immersed during some calibrations.
- Make sure to loosen the seal of the transport/calibration cup prior to the DO calibration to allow pressure equilibration.
- For maximum accuracy, use a small amount of previously used calibration solution to pre-rinse the probe (Figure 1).
- Put some deionized (DI) water at ambient temperature to rinse the probe between calibration solutions.
- Have several clean, absorbent paper towels or Kim-wipes available to dry the probe between rinses and calibration solutions. Shake excess rinse water off the probe. Dry off the outside of the probe and sensor guard. (Making sure the probe module is dry reduces carry-over contamination of calibration solutions and increases the accuracy of the calibration.

Figure 1. Bottles of solution for each calibration solution for

PROBE INSPECTION

- Ensure the o-ring is installed in the o-ring groove of the transport/calibration cup and that the bottom cap is securely tightened. **NOTE:** Do not overtighten!
- Remove the probe sensor guard, if installed.
- Remove the o-ring, if installed, from the probe and inspect for defects. Replace with extra o-ring if defects found.

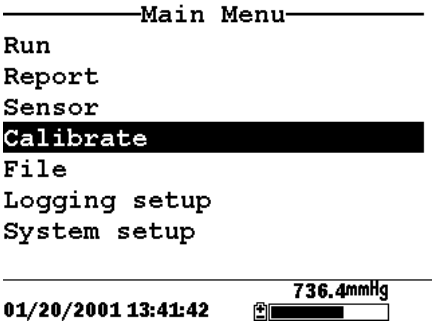


Figure 2. Main Menu Screen

PROBE STORAGE

- Store the probe with about half an inch of tap water in the storage cup.

ACCESSING THE CALIBRATION SCREEN

1. Press the **On/Off** key to display the **Run** screen.
2. Press the **Escape** key to display the main menu screen (figure 2).
3. Use the arrow keys to highlight **Calibrate** (figure 3).
4. Press **Enter** key. **Calibrate** screen is displayed. Conductivity will automatically be highlighted on this screen.

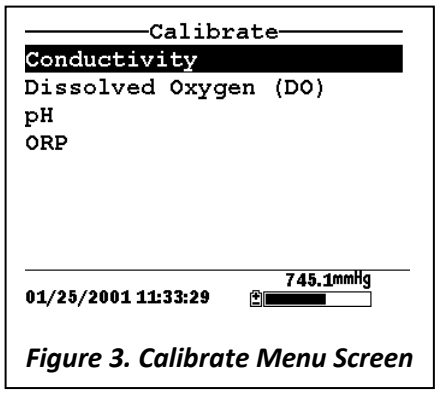


Figure 3. Calibrate Menu Screen

CONDUCTIVITY CALIBRATION

Picture 1

Picture 2

1. Go to **Calibrate screen** as described above.
2. Highlight **Conductivity** and press **Enter**. The Conductivity Calibration Screen is displayed.
3. **Specific Conductance** parameter will automatically be highlighted. Press **Enter**
4. Remove the clear plastic **transport/calibration cup (picture 1)**.
5. Pre-rinse the conductivity sensor with a little bit of the **1413 standard conductivity calibration solution** and then discard into a waste jar.
6. Pour enough new **1413 standard** into the **transport/calibration cup** to entirely cover all 3 sensors including the vent hole on the conductivity sensor (~55ml). Tap the probe gently to remove air bubbles. **(picture 2)**
7. Use the keypad to enter the **calibration value** of the standard that is being used. The **1413 uS/cm Standard Solution** should be entered as**: 1.413** (the 1.413 value may automatically be displayed)
8. Press **Enter**. The **Cond Calibration Menu** Screen will be displayed.

   Note: *the YSI is set-up for "temperature compensation". Always use the value for the calibration standard at* ***25°C****.*
9. Allow at least one minute for **instrument temperature** to stabilize. The current values of enabled sensors will appear on the screen and will change with time as they stabilize.
10. Observe the reading under **Specific Conductivity (uS/cm^{C})**. When the reading shows no significant change for ~**30 seconds**, then record the **"Temp of Standard"** and record the **Specific Conductivity (uS/cm^{C})** value on the calibration log sheet under **"Reading Before Cal"** then press **Enter** key.

    If the meter displays a warning similar to "Value out of range, accept anyway?" Do **NOT** accept the value. Recalibrate and try again
11. Record the **"Set to" values** in the **YSI Calibration Log** (which should be 1413 uS/cm^{C})
12. Remember to record the **"Expiration Date"** of the solution too
13. Press **Enter** key again, screen will indicate calibration has been accepted.
14. Record the new Specific Conductivity (uS/cm^{C}) value under **"Reading After Cal"** on the calibration log sheet
15. Press **Enter** key again, to return to the **Conductivity Calibration Selection Screen**.
16. Press **Escape** to return to the **Calibrate Menu Screen**.
17. **Rinse** the probe and sensors with **DI water**

DISSOLVED OXYGEN CALIBRATION in % SATURATION

1. In the **Calibration Screen**, use the **arrow keys** to highlight **DO 2 mil PE (Blue)**.
2. Press **Enter** key. The **DO %** will automatically be highlighted.
3. Press **Enter** key again. The **Enter Baro mmHG screen** will be displayed and the BP will automatically appear because the meter has an internal barometer
4. Record the **Barometric Pressure** on the calibration log sheet
5. Pour approximately 1/8 inch of water (indicated by arrow 2) in bottom of **transport/calibration cup**. ***Do Not** immerse any of the sensors in the water.

Picture 3

6. Screw the **transport/calibration cup** onto the probe using only 1 or 2 threads, so it is just hanging on (arrow 1).
7. Press **Enter** key. The **DOsat Calibration Menu Screen** will be displayed.
8. Allow 10 minutes for the **DO probe** to stabilize (and for the temperature to stabilize).
9. When the **DO %** reading is stable for 30 seconds, record the **DO%** and **DO mg/L** values in the calibration log.
10. Press **Enter** key to accept the reading.
    If the meter displays a warning "Value out of range, accept anyway?" Do **NOT** accept the value, recalibrate and try again
11. **Record** the new **DO% and DO mg/L** values in the **YSI Calibration Log**
12. Press **Enter** key again. This returns you to the **DO Calibration Menu Screen**.
13. Press **Escape** key, to return to the **Calibrate Menu Screen**.

pH CALIBRATION

Picture 4

1. In the **Calibration Screen**, use the **arrow keys** to highlight **pH**.
2. Press **Enter** key. The pH Calibration Screen will be displayed.
3. Use arrow keys to highlight **2-point** option to calibrate the pH sensor.
4. Press the **Enter** key, the **pH Entry Screen** will be displayed.
5. Enter value of pH standard being used - **NOTE:** Always calibrate in **7 buffer** first.
6. Rinse the **pH sensor** with little bit of the **7.00 buffer** and discard.
7. Pour ~35 ml 7.00 buffer into the **transport/calibration cup** make sure there are no air bubbles in the solution **(picture 4)**.
8. Use the keypad to enter the **calibration value** of the **pH standard** being used.
9. Press **Enter**. The **pH Calibration Screen** will be displayed.
10. Allow 1 minute for temperature to stabilize. Observe pH reading. If no significant change in 30 seconds, then record the current pH value under **"Reading Before Cal"** and the Temperature of the standard under **"Temp of Standard"**
11. Press **Enter** key. The screen will indicate **calibration accepted.**
12. ***If the meter displays a warning similar to "Value out of range, accept anyway?" Do **NOT** accept the value. Recalibrate and try again***
13. Record the **"Set to"** value on the Calibration Log and record the new pH reading under **"Reading After Cal"**
14. Pour used solution into a waste container and rinse the probes with DI water.
15. Press **Enter** key to return to **pH Calibration Screen**, continue with the **second point** of calibration for **pH 10.00** (**repeat steps 5-13).**
16. Press **Enter** to return to the **pH Calibration Screen**. Press **Escape** twice to return to the data logging menu.
17. **Rinse** the probe and sensors with **DI water**

Appendix B: Blank Field Datasheets

Blank data sheets to be used in the field can be found on the subsequent pages.

Site Visit Form- Madison Watershed

(Updated June 2014)

Date:	M. Time:	Team Members:	
Waterbody:		Station ID:	
Site Description:			
Latitude:		Longitude:	Elevation: ft

Lab Samples

Sample ID = Year-Month-Day-SiteID- Sample Type Letter

Sample Type Letter:
R = Regular Sample
D = Duplicate Sample
B = Blank Sample

Example: 20130610-MCIRS-A			
Total Persulfate Nitrogen – 250 ml White Lid		Total N and Total P – 250 ml Yellow Lid	
Regular:		Regular:	Preserved □
Duplicate:		Duplicate:	Preserved □
Blank:		Blank:	Preserved □

Field Parameters

Air Temp (°C)		Turbidity (cm)	1st reading	2nd reading	3rd reading	Average of 3
Water Temp (°C)						
Specific Conductivity (µs/cm[c])		Visual Turbidity	□ Clear	□ Slight	□ Turbid	□ Opaque
Elec. Conductivity (µs/cm)		Cloud Cover	□ <5%	□ 5-25%	□ 25-75%	□ 75-100%
Dissolved Oxygen (%)		Current Precipitation	□ None	□ Light	□ Moderate	□ Heavy
Dissolved O (mg/L)		Past Precip (24 hrs)	□ None	□ Light	□ Moderate	□ Heavy
pH		Datalogger Download	□ Completed		□ Not completed	

Pebble Count

Particle count	> 2 mm: %	< 2 mm: %

Photo Log

JPEG Number(s)	*Description*	*Photo Point Notes*
	1st white board photo	
	Looking across stream	
	Chlorophyll rock photo	
	***Upstream** Riparian Condition Photo Point*	
	***Downstream** Riparian Condition Photo Point*	
	Other:	
	Last white board photo	

Flow

Flow Method	□ Float	□ Meter	Measured Flow cfs

Field Notes

Site Visit Form Reviewed and Checked by	
Hours in Field	*Mileage*

Form Updated 6/4/14

PEBBLE COUNT DATA SHEET

Date:	Station ID:	Equipment used:
Team Member(s):		

Less than 2 mm

10 = 

Total Count < 2mm = _____

% Total < 2mm = _____

Greater than 2 mm

Total Count > 2mm = _____

% Total > 2mm = _____

Total samples collected (total count <2mm + total count >2mm) = _____

Notes about riffle location and sampling within riffle:

(Ex: Riffle is 50 ft upstream from culvert where regular sampling occurs. Large distinct cottonwood on river right of bottom of riffle. See pictures. Riffle is ~ 50 ft long and 8 ft wide. Sample location started downstream and moved in zig zag formation upstream)

Madison Stream Team

Chlorophyll Photo

Date:

Stream:

Site:

Madison Stream Team Site Photos

Date:

Site:

Photographer(s):

Start Time:

End Time:

Number of Photos taken:

Discharge Measurement Form
For use with FLO Mate

Date	Time	Station ID
Team Members		

Left edge of water:	Right edge of water:	Wetted stream width:
Wetted width divided by 20:	Interval for distance:	

For each station, record distance on tape in tenths of feet, depth on rod in tenths of feet, and velocity in ft/s. First and last measurements must be at water's edge with a depth of zero.

Station	Distance	Depth	Velocity
1 R or L		0	0
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Station	Distance	Depth	Velocity
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			