

South Dakota Volunteer Water Quality Monitoring Program

Standard Operating Procedures for Volunteer Samplers



South Dakota Department of Agriculture and Natural
Resources

Watershed Protection Program

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Introduction

The intent of this document is to provide a step-by-step manual for volunteer water quality monitors participating in the volunteer monitoring program offered by the South Dakota Department of Agriculture and Natural Resources (SD DANR). Only the methods included in this document are approved by SD DANR for volunteer monitors. Methods not included in this document are not authorized by the External Party Quality Assurance Project Plan that addresses quality assurance and quality control for volunteer samplers. Any methods not included in this document must be approved by the SD DANR Volunteer Monitoring Coordinator.

Lake Sampling Methods

There are four lake sampling techniques authorized by SD DANR for volunteer collection. These include:

- Grab sampling where water is collected from a single location at the center of the lake.
- Shoreline *E. coli* sampling, which is collected at a designated station on the shoreline.
- Microcystin sampling, where the algal toxin microcystin is collected at a designated station on the shoreline.

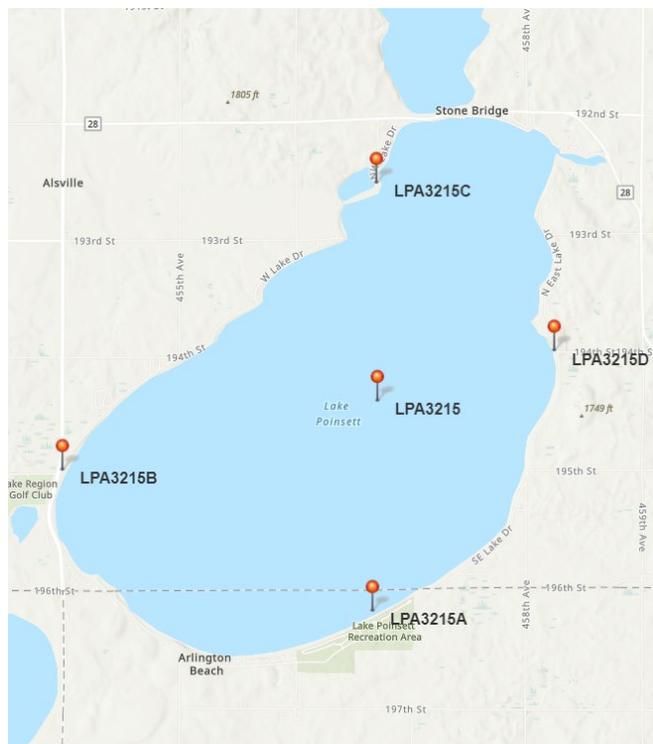


Figure 1. Lake station example.

Sampling Station Overview

Stations are locations where sampling and data collection activities occur. Your stations each have a unique Station ID that is not shared by any other station. The Station ID is printed on sample bottle labels and datasheets to notify the laboratory where each sample was collected. Sample results are associated with the Station ID in the SD DANR water quality database.

All Station IDs for volunteer monitoring stations begin with a 3 to 4 letter abbreviation of your group's name, if applicable. Mid-lake grab sampling stations begin with the group name abbreviation and then a 4-digit code unique to each lake. Lake shoreline stations for *E. coli* and microcystin sampling will have the abbreviation of the group name, then the 4-digit lake code, and finally a letter ranging from A-Z.

Stations will be customized to your water quality sampling project. For example, if your sampling plan calls for only shoreline bacteria sampling, you will not be provided with a mid-lake station for mid-lake grab sampling.

Table 1. Lake Station types, examples, and uses.

Station Type	Example	Sampling Uses	Location
Mid-Lake Station	LPA3215	Grab sampling, composite sample results associated with this station	Center of lake
Bacteria/Microcystin Stations	LPA3215A LPA3215B LPA3215C LPA3215D	Bacteria sampling, microcystin sampling	Swimming beach or boat ramp
Stream Station	XXX484ST	Stream sampling	Station on 484th Street

To accurately locate sampling stations when visiting a lake or stream, enter them in a GPS unit, mobile phone, or tablet with a mapping application such as Google Maps. Data layers for the Google Maps application containing station locations may be provided by the DANR volunteer monitoring coordinator upon request. These tools may not be necessary if you are familiar with the waterbody and sampling stations but are always useful for locating the mid-lake station on a lake.

One alternate method for locating the stations is to print satellite images with the station locations indicated on the map. This allows for using local landmarks to navigate to the stations. A second alternate method for locating stations is to view them on the DANR Water Quality Monitoring Access Portal (WQMAP) at <https://apps.sd.gov/NR92WQMAP/> and visually verify that you are at the appropriate location using landmarks. Latitude and longitude for each station is available on WQMAP by clicking on each station on the map or clicking the lake and selecting the Monitoring Data tab, which presents a list of all stations associated with that lake as well as their latitude and longitude.

Sample Bottle Overview

Table 2. Bottle types for volunteer samplers.

Image	Bottle	Size	Lab	Preservation	Rinse	Check Your Bottles
	A	500mL	Mid Continent Rapid City, SD	Ice	Yes	
	B	500mL	Mid Continent Rapid City, SD	1mL sulfuric acid, Ice	Yes, if not pre-preserved	
	C	125mL	Mid Continent Rapid City, SD	Sodium Thiosulfate, Ice	No	
	A	1-Liter Narrow Mouth Nalgene	Health Lab Pierre, SD	Ice	Yes	
	B	1-Liter Narrow Mouth Nalgene	Health Lab Pierre, SD	2mL sulfuric acid, Ice	Yes	
	B	250mL	Health Lab Pierre, SD	0.5mL sulfuric acid, Ice	No	
	C	250mL	Health Lab Pierre, SD	Ice	No	
	Chl-a	500ml, 1-liter, or 2-liter (always brown)	DANR Lab Pierre, SD	Ice	Yes	
	Microcystin	250mL	Midwest Laboratories	Ice	Yes	

A variety of sample bottles are needed for various water sampling methods. The laboratory the sample will be sent to must also be considered, as different labs use different bottle types. Check the bottle types in Table 2 that you will be using to make it easier to choose the correct bottle type for each sample.

If you are sending your samples to the SD Health Lab in Pierre and are sampling lakes for nutrients (total phosphorus, nitrate/nitrite, total ammonia as N, TKN), you will need to use the 1-liter narrow mouth Nalgene for your B-bottle.

If you have questions or concerns about choosing the correct bottle, contact the volunteer monitoring coordinator.

Lake Grab Sampling

Equipment List

- Boat/motor or other watercraft
- Life jackets for all samplers
- Lake maps and/or GPS with station location
- Cooler(s) for holding and shipping samples
- Secchi disk
- Sulfuric acid for B bottle
- Pipettes for acid or acid vials
- Bottles (A, B, chlorophyll-a)
- Nitrile Gloves
- Ice
- Fine-tip Sharpie markers or pencils
- Preprinted labels and datasheets

For lake grab samples, Secchi disc measurements and water will be collected only at the mid-lake station located in the center of the lake (for example, YSC9702 in Figure 1).

Secchi Disc Measurement

1. Confirm that the lowering line is firmly attached to the Secchi disk.
2. Remove sunglasses and hat. Also, do not use view scopes or other visual aids. If wearing prescription sunglasses, temporarily replace them with regular clear lens prescription glasses.
3. Lower the Secchi disk over the shaded side of the boat until it disappears. Lower it one third of a meter and then slowly raise the disk until it just reappears. Move the disk up and down until the exact vanishing point is found.
4. Read the depth indicated on the lowering line or use a tape measure to measure the distance from the water surface to the Secchi disk at the disappearance depth. Record the disappearance depth on the SD DANR Field Data Collection Sheet (page 34).
5. Note any conditions that might affect the accuracy of the measurement in the field notes section of the datasheet.

Total Depth

Measure the total depth at the mid-lake station using a sonar, push pole, or any other reliable measuring device. Record the depth in meters at the mid-lake station on the field data collection sheet.

Lake Grab Sample Labeling and Datasheets

Bottle labeling

Note: It is good practice to label sample bottles before filling bottles and preserving samples.

1. Using waterproof labels and a waterproof pen or pencil (fine tip Sharpie recommended), fill out the empty fields on the labels for A, B, and chlorophyll- α bottles. If waterproof labels and pens/pencils are not available, apply packing tape over the top of the label to protect it from getting wet. In most cases when using pre-printed labels, most fields other than sampler initials, date, and time will be filled out. Other fields that may need to be filled include Station ID, Project, Source (the waterbody being sampled), Code or Agency Code (your unique billing ID

from the SD Health Lab), whether it is a surface, midwater, or bottom sample (always surface), and the sample bottle type (A, B or Chl A for the chlorophyll- α bottle).

- For the chlorophyll- α bottle, enter the volume of the sample that was put into the chlorophyll- α bottle. Typical volumes for chlorophyll- α sample bottles are 500 mL, 1000 mL, or 2000 mL, depending on the size of the bottle. Place the labels on their corresponding bottles.

Filling Out Datasheets

- Fill out the empty fields on the sample collection datasheets to match the values entered on the bottle labels for Agency Code, Sample Date, Time, Sampler, Source Water, Station ID, Project, and Project ID. Many of these fields may be filled out already if the volunteer monitoring coordinator provided pre-filled datasheets. Make sure the information on the datasheet matches the stations and source water you are collecting the sample from.
- Ensure that the box next to “Grab” is checked on the datasheet has a checkmark to indicate it is a grab sample.
- Write the result for the secchi disk measurement in the appropriate field on the datasheet.
- On the datasheet, review the boxes that are checked for each bottle for the parameters to be analyzed by the lab. Ensure they are correct for the parameters you intend to have analyzed.

SD DANR Water Quality Data						Rev 05/21
Agency Code	*					
Sample Date	*		Time	*	Samplers Print/Sign	*
Source Water	*			Station ID	*	
Site Location	*					
Project	*			Project ID	*	
* Type of Sample	<input type="checkbox"/> Replicate	<input type="checkbox"/> Grab	<input type="checkbox"/> Integrated Vertical	<input checked="" type="checkbox"/> Medium	<input type="checkbox"/> Water / Other	
	<input type="checkbox"/> Blank	<input type="checkbox"/> Composite	<input type="checkbox"/> Integrated Flow	<input checked="" type="checkbox"/> Relative Depth	<input type="checkbox"/> Surface	<input type="checkbox"/> Bottom
					<input type="checkbox"/> Midwater	
H2O Temp		C	Sample Depth		Ft	Field Comments
SPC		$\mu\text{mho/cm}$	Total Depth		Ft	
DO		mg/L	Width		Ft	
pH		SU	Gage Stage		Ft	
* Secchi		Meters	Discharge		CFS	

Figure 2. Sample collection datasheet fields that need to be filled in for lake grab samples.

Lake Grab Sample Collection

Note: It is good practice to label sample bottles before filling bottles and preserving samples. See the Bottle Labeling and Datasheets for Lake Grab Sampling section for instructions on bottle labeling.

- At the mid-lake station (Figure 1), remove the cap from the A bottle and rinse the bottle three times using lake water.
- With the A bottle inverted so the mouth is facing down, submerge the bottle to a depth of approximately 0.3 meters (1 foot). Tip the bottle so the mouth faces toward the surface and the bottle fills. Try not to let any scum from the water surface enter the bottle. Fill the A bottle to the shoulder, dumping out any excess, and cap the bottle. Place the A bottle in a cooler on ice.

3. Repeat the process in step 2 to fill the B bottle. Using a plastic pipette, add 2 mL of sulfuric acid (H_2SO_4) to the B bottle if using a 1 liter bottle. If using a 250 mL B bottle, add 0.5 mL H_2SO_4 . Cap the bottle. Invert the bottle several times to mix the contents and place the B bottle in the cooler under loose ice.
4. Perform the same process as in step 2 for the chlorophyll-a bottle. Place the chlorophyll-a bottle in a cooler under loose ice.

Quality Assurance/Quality Control Sample Collection for Lake Grab Sampling

Blank Sample Procedure

1. To submit a blank sample to the lab, triple rinse and fill bottles A, B, and chlorophyll- α with distilled or deionized water.
2. Using a plastic pipette, add 2 mL of sulfuric acid (H_2SO_4) to the B bottle if using a 1 liter bottle. If using a 250 mL B bottle, add 0.5 mL H_2SO_4 .
3. On the sample labels, indicate that the sample is a blank sample by checking the box or writing "BLANK" on the label.
4. Place the sample bottles in the cooler on ice.
5. Fill out a datasheet as you normally would with the date, time, station ID, and sampler. Check the box next to "Blank" to indicate it is a blank sample. You may use any real station ID for a blank sample. Do not make up a fake station ID for the blank sample.
6. Ship the blank sample to the South Dakota State Health Lab using the courier in the same manner as a regular sample would be shipped.

Replicate Sample Procedure

1. To submit a replicate sample, triple rinse and fill bottles A, B, and chlorophyll- α with lake water as you are filling the bottles for the regular sample. Place the A and chlorophyll- α bottle under loose ice in the cooler.
2. Using a plastic pipette, add 2 mL of sulfuric acid (H_2SO_4) to the B bottle if using a 1 liter bottle. If using a 250 mL B bottle, add 0.5 mL H_2SO_4 . Place the B bottle under loose ice in the cooler.
3. On the sample labels, indicate that the samples are replicate samples by checking the box or, if there is not a box to indicate a replicate sample, write "REPLICATE" on the label.
4. Fill out a datasheet as you normally would with the date, time, station ID, and sampler. Enter the exact same time on the replicate datasheet that you entered on the regular sample datasheet. Do not enter a time that is slightly different from the normal sample time.
5. On the replicate sample datasheet, check the box next to "Replicate" to indicate it is a replicate sample.
6. Ship the replicate sample to the South Dakota State Health Lab using the courier in the same manner as a regular sample would be shipped.

Lake E. coli Sampling

E. coli is a bacterial indicator that shows if there is contamination from fecal matter originating with warm-blooded animals. Lake E. coli samples are collected at stations located along a lake's shoreline to determine if there is a risk to people engaging in water recreation.

Equipment List

- Lake maps and/or GPS with station location

- Cooler(s) for holding and shipping samples
- Waders/hip boots/rubber boots (If needed)
- C bottle
- Nitrile Gloves
- Ice
- Fine-tip Sharpie markers or pencils
- Preprinted labels and datasheets

Tutorial video: <https://youtu.be/DNn5ZoYkoDo>

Note: The C bottle is either a 100 mL clear bottle or a 250 mL white bottle that should not be rinsed before sample collection.

Lake Bacteria Sample Collection

1. Put on a pair of nitrile or latex gloves and proceed to the designated bacteria collection station (Figure 1).
2. Do not rinse the C bottle (100 mL or 250 mL bottle).
3. In water at least 0.3 meters (1 foot) deep, invert the C bottle so the bottle mouth is facing down and submerge the bottle in the water approximately halfway to the lake bottom. Avoid collecting surface scum or sediment from the lake bed.
4. While holding the bottle underwater, tip upright so the bottle fills. Remove the bottle from the water and screw on the cap.
5. Fill out the label on the C bottle for date, time, and sampler's initials and place it in a cooler under loose ice.
6. On the lake bacteria datasheet, enter the date, time, and sampler's initials.
7. Ship the bacteria sample using the health lab courier on the day of collection. The sample must arrive at the Health Lab within 24 hours of collection.

Blank Sample Collection for Lake Bacteria

1. Wearing nitrile or latex gloves, without rinsing, fill the C bottle to the shoulder using distilled or deionized water.
2. Fill out the label on the C bottle for date, time, and sampler's initials.
3. On the sample labels, indicate that the sample is a blank sample by checking the box or writing "BLANK" on the label.
4. Place the sample bottle in the cooler on ice.
5. On the lake bacteria datasheet, enter the date, time, and sampler's initials.
6. Check the box on the datasheet to indicate it is a blank sample.
7. Ship the blank sample using the Health Lab courier as you would with a normal bacteria sample.

Replicate Sample Collection for Lake Bacteria

1. Without rinsing the bottle, fill the replicate C bottle at the same time using the same technique as the C bottle for the regular sample.
2. On the sample label, indicate that the samples are replicate samples by checking the box or writing "REPLICATE" on the label.
3. Fill out the label on the C bottle for date, time, and sampler's initials and place it in a cooler under loose ice.

4. Fill out a datasheet as you normally would with the date, time, station ID, and sampler. Enter the exact same time on the replicate datasheet that you entered on the regular sample datasheet. Do not enter a time that is slightly different from the normal sample time.
5. On the replicate sample datasheet, check the box next to “Replicate” to indicate it is a replicate sample.
6. Ship the blank sample using the Health Lab courier as you would with a normal bacteria sample.

Microcystin Sampling

Microcystin is a cyanotoxin that is produced by cyanobacteria, also known as blue-green algae. Microcystin causes illness for humans and potentially death for animals if ingested. Microcystin samples are collected on a routine basis at pre-determined locations along lake shorelines to determine if there is a risk to people, pets, wildlife, and livestock.

Equipment List

- Lake maps and/or GPS with station location
- Cooler(s) for holding and shipping samples
- Bottles (microcystin)
- Nitrile Gloves and/or elbow length dishwashing gloves
- Rubber boots, hip boots, or waders
- Ice
- Fine-tip Sharpie markers or pencils
- FedEx shipping labels

Microcystin Collection

1. Put on nitrile gloves, or any other type of glove that will prevent water that is potentially containing cyanotoxins from touching your skin.
2. Once at the station, remove the cap from the microcystin bottle and rinse the bottle three times using lake water.
3. At the station in water approximately 0.3 meters (1 foot) deep, submerge the microcystin bottle so half the bottle’s mouth is submerged. Fill the bottle to the volume line indicating 125 mL.
4. Write the date, time, station ID, and sampler’s initials on the bottle label.
5. Cap the bottle and place it in a cooler under loose ice until reaching your home or office. Ship the sample the same day it is collected.
6. To ship the microcystin sample, pack it and any other microcystin samples collected that day in a small cooler with a Ziploc bag filled with ice. Tape the cooler shut.
7. Ship the cooler via FedEx to Midwest Laboratories using the pre-printed FedEx shipping labels provided to you. You may contact FedEx to schedule a pickup for the cooler by calling 1 800 463-3339 and say “schedule a pickup.”

Microcystin Quality Assurance/Quality Control Sampling

Blank Microcystin Sample Collection

1. With distilled or deionized water, fill the microcystin bottle to the volume line indicating 125 mL.
2. Write the date, time, station ID, and sampler’s initials on the bottle label.
3. Write “BLANK” on the microcystin bottle label.

4. Cap the bottle and place it in a cooler under loose ice until reaching your home or office. Ship the sample the same day it is collected.
5. To ship the microcystin sample, pack it and any other microcystin samples collected that day in a small cooler with a Ziploc bag filled with ice. Tape the cooler shut.
6. Ship the cooler via FedEx to Midwest Laboratories using the pre-printed FedEx shipping labels provided to you. You may contact FedEx to schedule a pickup for the cooler by calling 1 800 463-3339 and say “schedule a pickup.”

Replicate Microcystin Sample Collection

1. Put on nitrile gloves, or any other type of glove that will prevent water that is potentially containing cyanotoxins from touching your skin.
2. Collect the replicate microcystin sample at the same time and location as a regular microcystin sample is collected.
3. At the station in water approximately 0.3 meters (1 foot) deep, submerge the microcystin bottle so half the bottle’s mouth is submerged. Fill the bottle to the volume line indicating 125 mL.
4. Write the date, time, station ID, and sampler’s initials on the bottle label.
5. Write “REPLICATE” on the microcystin bottle label.
6. Cap the bottle and place it in a cooler under loose ice until reaching your home or office. Ship the sample the same day it is collected.
7. To ship the microcystin sample, pack it and any other microcystin samples collected that day in a small cooler with a Ziploc bag filled with ice. Tape the cooler shut.
8. Ship the cooler via FedEx to Midwest Laboratories using the pre-printed FedEx shipping labels provided to you. You may contact FedEx to schedule a pickup for the cooler by calling 1 800 463-3339 and say “schedule a pickup.”

Stream Sampling Methods

Stream sampling is conducted at stations located on streams or rivers. Grab sampling is used to collect samples from streams, meaning you simply need to fill the bottles with water from the stream. In a stream that is shallow, you may wade into the middle of the stream to collect the sample. Be sure to face upstream and avoid clouds of sediment created by your footsteps when collecting the sample. You may also collect the water along either shoreline by reaching out into the flowing water and filling the sample bottles. If it is not possible to get to the stream due to safety or access reasons, you may use a Van Dorn sampler to collect the sample from a bridge (page 21).

Equipment List

- Cooler(s) for holding and shipping samples
- Distilled/deionized Water
- Sulfuric acid for B bottle
- Pipettes for acid
- Bottles (A,C – some groups may collect the B bottle for nutrients)
- Nitrile Gloves
- Ice (enough to cover samples)
- Waders/hip boots/rubber boots (If needed)
- Labels and datasheets
- Fine-tip Sharpie markers or pencils

Supplemental Equipment

- Van Dorn Sampler

Bottle Labeling and Datasheets for Stream Sampling

Bottle Labeling Procedure

At the vehicle, using a waterproof pen (fine tip Sharpie only) or pencil, fill out the empty fields on the labels for bottle A, B, and C. If waterproof labels and pens/pencils are not available, apply packing tape over the top of the label to protect it from getting wet. In most cases when using pre-printed labels, most fields other than Station ID, sampler initials, date, and time will be filled out. Other fields that may need to be filled out include Project, Source (the waterbody being sampled), Code or Agency Code (your unique billing ID from the SD Health Lab), whether it is a surface, midwater, or bottom sample (usually surface), and the sample bottle type (A, B, or C). All samples will be marked as “Grab” samples.

Filling Out Datasheets

Agency Code *		SD DANR Water Quality Data			Rev 05/21
Sample Date *	Time *	Samplers Print/Sign *			
Source Water *	Station ID *				
Site Location *					
Project *				Project ID *	
* Type of Sample	<input type="checkbox"/> Replicate	<input type="checkbox"/> Grab	<input type="checkbox"/> Integrated Vertical	* Medium	<input type="checkbox"/> Water / Other
	<input type="checkbox"/> Blank	<input type="checkbox"/> Composite	<input type="checkbox"/> Integrated Flow	* Relative Depth	<input type="checkbox"/> Surface <input type="checkbox"/> Bottom <input type="checkbox"/> Midwater

1. Fill out empty fields on the SD DANR Water Quality Datasheet to match the values entered on the bottle labels for Agency Code, Sample Date, Time, Sampler, Source Water, Station ID, Project, and Project ID.
2. Review the boxes that are checked for each bottle for the parameters to be analyzed by the lab to ensure that they are correct.

C Bottle Collection Procedure

Tutorial video for A, B and C bottle collection: <https://youtu.be/XtrFUBOC7LU>

Note: The C bottle should be collected before the A and B bottles to avoid sample contamination.

Note: The C bottle is a sterile bottle and should never be rinsed with distilled or sample site water.

1. Put on nitrile or latex gloves.
2. Remove lid and position the open end of the bottle towards the flow.
3. Plunge the bottle down into the water (0.5 foot – 1 foot) to avoid introducing surface scum.
4. Fill the bottle to the 250 mL or 100 mL mark, whichever is appropriate for the bottle size. If too much water enters the bottle, pour out a small amount (~5 mL).
5. Write down the time of collection for the C bottle on the datasheet.
6. Place the C bottle in a cooler with loose ice, making sure most of the sample bottle is in contact with ice.

A Bottle Collection Procedure

1. Rinse the A bottle with stream water 3 times.
2. Position the open end of the bottle towards the flow.
3. Lower bottle into the stream so the bottle mouth is fully submerged and allow the bottle to fill up to the shoulder.
4. Place the A bottle in a cooler on loose ice, making sure most of the sample bottle is in contact with ice.

B Bottle Collection Procedure

1. Rinse bottle with stream water 3 times.
2. Position the open end of the bottle towards the flow.
3. Lower bottle into the stream (0.5 foot – 1 foot) and allow the bottle to fill up to the shoulder.
4. Using a plastic pipette, add 2 mL of sulfuric acid (H_2SO_4) to the B bottle if using a 1 liter bottle. If using a 250 mL B bottle, add 0.5 mL H_2SO_4 .
5. Place the cap on the bottle. Invert the bottle several times to mix the contents and place the B bottle in the cooler under loose ice.
6. Place the B bottle in a cooler on loose ice, making sure most of the sample bottle is in contact with ice.

Stream Sampling Using a Van Dorn Sampler

Tutorial video: <https://youtu.be/fQLsJZN633Q>

If it is not safe to access the water to collect a sample at a stream site or conditions prevent direct physical access to the water, a Van Dorn sampler may be used. The Van Dorn sampler allows a field sampler to collect water by lowering the device into the water, then sending a heavy weight down the rope that closes the ends of the tube, in turn capturing water from the stream.

1. Open the plungers, attach plunger clips to the trip mechanism and lower the Van Dorn into the water and rinse three times.
2. Lower the Van Dorn sampler back into the water and hold just below the surface.
3. Release the messenger down the rope to trip sampler and close the plungers.
4. Pull the Van Dorn sampler back up from the water.
5. Open the drain valve on either end and fill bottles A, B, and C.

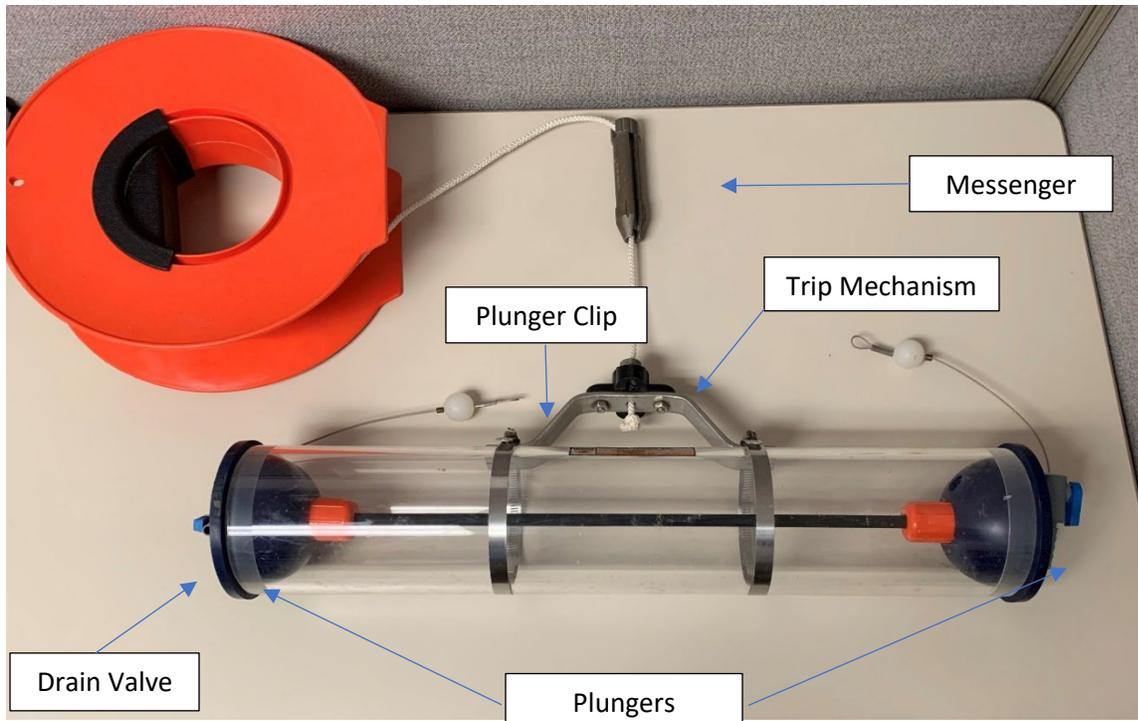


Figure 4. Van Dorn sampler.

Quality Assurance/Quality Control Sample Collection for Stream Sampling

Blank Sample Collection Procedure

Tutorial video: https://youtu.be/BAhUF1wNx_A

1. To submit a blank sample to the lab, triple rinse and fill bottles A and B with distilled or deionized water.
2. Using a plastic pipette, add 2 mL of sulfuric acid (H_2SO_4) to the B bottle if using a 1 liter bottle. If using a 250 mL B bottle, add 0.5 mL H_2SO_4 .
3. Without rinsing, fill the C bottle with distilled or deionized water.
4. Place the sample bottles in the cooler under loose ice.
5. On the sample labels, indicate that the samples are blank samples by checking the box to indicate a blank sample or writing "BLANK" on the label.
6. Fill out a datasheet as you normally would with the date, time, Station ID, and sampler. Check the box next to "Blank" to indicate it is a blank sample.
7. Ship the blank sample the same as a regular sample would be shipped.

Replicate Sample Collection Procedure

Tutorial video: <https://youtu.be/P9VVYgSygh0>

1. Without rinsing the bottle, fill the replicate C bottle at the same time while using the same technique as the C bottle for the regular sample.
2. Triple rinse and fill replicate bottles A and B with water from the stream at the same time you are filling the A and B bottles for the regular sample.

3. Preserve the replicate B bottle with 2 mL of sulfuric acid (H₂SO₄) like you would with a regular sample (if using a 250 mL B bottle, add 0.5 mL H₂SO₄).
4. On the sample labels, indicate that the samples are replicate samples by checking the box or writing “REPLICATE” on the label.
5. Place the replicate sample bottles in a cooler under loose ice.
6. Fill out a datasheet as you normally would with the date, time, Station ID, and sampler. Enter the exact same time on the replicate sample datasheet that you entered on the regular sample datasheet.
7. On the replicate sample datasheet, check the box next to “Replicate” to indicate it is a replicate sample.
8. Ship the replicate sample along with the regular sample.

Sample Care, Shipping, and Packaging

South Dakota State Health Lab

Sample Shipping

Tutorial video: https://youtu.be/KIS_9eUpCBI

Sample shipping will primarily be conducted using the South Dakota Health Laboratory courier system, which is conducted by Sameday Express. The courier has scheduled pick-up locations and times throughout eastern South Dakota. Scheduled pick-up locations and times are shown in Table 2. If the courier system is unavailable in your region or does not fit your needs, samples may also be Priority shipped via the US Postal Service. Contact the Volunteer Monitoring Coordinator for information about shipping the samples with the US Postal Service.

Table 3. Courier pickup locations and times in eastern South Dakota.

City	Address/Location	Address	Courier Departure Time
Webster	SD Game Fish & Parks office	603 E 8th Ave, Webster, SD 57274	5:00 PM
Watertown	DANR field office	2001 9th Avenue SW, Suite 500	4:00 PM
Aberdeen	St. Luke's Hospital	305 S State St, Aberdeen, SD 57401	3:30 PM
Huron	Huron Regional Hospital - lab entrance on east side	172 4th St SE, Huron, SD 57350	5:00 PM
Brookings	Brookings Regional Hospital	300 22nd Ave S, Brookings, SD 57006	4:00 PM
Mitchell	Queen of Peace Hospital	1900 Grassland Drive, Mitchell, SD 57301	8:00 PM
Yankton	Sacred Heart Hospital	501 Summit St, Yankton, SD 57078	3:30 PM
Sioux Falls	SF Airport Business Aviation	43 N John Orr Drive, Sioux Falls, SD 57104	7:00 PM

If you are not able to reach a scheduled pick-up location, or if it isn't sensible to use one of the scheduled pick-up locations, you can call Sameday Express to schedule a pick-up nearly anywhere in South Dakota by calling **605-366-3299**. Be sure to call early in the morning to schedule your pick-up to allow the courier ample time to coordinate.

Samples collected in western South Dakota outside of the Rapid City area can also be delivered to the South Dakota Health Laboratory using Sameday Express. There are no set pick-up locations in western South Dakota, so arrangements must be made prior to sample collection by calling **605-366-3299**.

Sample Care and Packaging

All samples should be held and shipped in a hard-sided cooler with enough loose ice to cover all sample bottles. Samples must be kept at a temperature of $<4^{\circ}\text{C}$. Datasheets should be sealed in a 1 gallon zip-seal bag and taped to the inside of the cooler lid. Take precautions to ensure the datasheets do not get wet.

Note: Ice in the sample cooler should be removed from the bag it came in and spread over the top of the sample bottles. If ice is left in the bag, the sample bottles will not reach a temperature of $<4^{\circ}\text{C}$.

The cooler should be taped shut with packing tape. Make sure the cooler drain plug is closed. A shipping label with the South Dakota State Health Laboratory's address (below) should be taped on the lid of the cooler in such a manner that it will not come off during shipping.

South Dakota State Health Laboratory
615 E. 4th Street
Pierre, SD 57501

The cooler should also be labeled with the cooler owner's organization name, phone number, and address so the cooler can be returned to the owner. Write this information on the cooler with a Sharpie or attach a label with this information to the cooler.

Note: The health lab will ship your coolers back to you with empty sample bottles.

Mid Continent Testing Labs

Samples collected in the Rapid City area will be sent to Mid Continent Testing labs for analysis and must be delivered in person. Samples should be transported by the sampler in a cooler under ice with accompanying datasheets to **2381 South Plaza Drive, Rapid City, SD 57709**.

Midwest Laboratories

Microcystin samples will be shipping to Midwest Laboratories in Omaha, NE for analysis. FedEx will be used for shipping. To ship microcystin samples, pack them in the small cooler provided by Midwest Laboratories with a Ziploc bag of ice. Tape the cooler lid shut using packing tape. Schedule a pickup with FedEx by calling 1 800 463-3339. When prompted, say "schedule a pickup." The cooler will then be picked up by FedEx.

Sample Holding Times

Table 4. Sample holding times, preservation, and bottle type information.

Bottle	Size & Material	Preservative	Parameters	Holding Time
A	1,000 mL HDPE or 250 mL HDPE	Cool to 4°C	Alkalinity, total solids, TSS, volatile solids, TDS, BOD, CBOD, CO ₃ , Hardness, K, lab pH, lab conductivity, nitrate, chloride, fluoride, HCO ₃ , SO ₄	48 hours
B	1,000 mL HDPE or 250 mL HDPE	2 mL H ₂ SO ₄ pH <2 Cool to 4°C	Ammonia, Nitrate+Nitrite, TKN, Total P, COD	28 days
C	100 mL or 250 mL sterilized HDPE	Na ₂ SO ₃ if chlorinated Cool to 4°C	Fecal coliform, <i>E. coli</i> , total coliform, enterococci, fecal PFG	24 hours
Chlorophyll-a	500, 1,000, or 2,000 mL brown HDPE bottle	Cool to 4°C	Chlorophyll-a	48 hours (unfiltered) 28 days (filtered)
Microcystin	250 mL rectangular HDPE	Cool to 4°C	Microcystin	14 days at 4°C, 1 year if frozen

Laboratory Services

The South Dakota State Health Lab will be the primary laboratory service for volunteer samplers. The health lab courier service allows free transport of samples on the day of collection. However, crews operating in the Rapid City/Black Hills area may use Mid Continent Testing Labs in Rapid City because of its proximity to the region and an existing working relationship with SD DANR. All sample collection, processing, and holding procedures outlined in the preceding sections apply to samples sent to Mid Continent Testing Labs, as well as the SD State Health Lab.

When using the State Health Lab, sample results are electronically delivered to the SD DANR water quality database. This results in less time between sample collection and the public display of results on the SD DANR Water Quality Monitoring Access Portal. Results from samples sent to the State Health Lab will typically be available for review and approval by the volunteer monitoring coordinator within 1 week. Results from samples sent to Mid Continent Testing will typically be available for review and approval within 1 month because data must be requested from the lab and manually uploaded to the SD DANR water quality database. Using the SD State Health Lab results in less turn-around time between sample collection and public reporting.

Microcystin samples are analyzed by Midwest Laboratories in Omaha, NE. Midwest Laboratories is the closest and most cost effective laboratory that analyzed microcystin samples. Microcystin samples will be shipped to Midwest Laboratories on the day of sample collection.

Benthic Macroinvertebrate Sampling

The purpose of sampling benthic macroinvertebrates is to quantify the benthic community, evaluate community structure, stream condition, and correlate density with nutrient loading. This requires sampling a certain length of a stream to get a representative picture of the ecological community. A length of 30 times the average wetted width is necessary to characterize the benthic community in the reach. This procedure is designed to give a general overview; subsamples will be composited to eliminate the patchiness of invertebrate populations typically found in streams.

Study Index Period

The establishment of a study index period, or the period of time over the course of a year when sampling will be conducted, is necessary to standardize the time of the year when macroinvertebrate samples are collected. The focus on the growing season months allows samples to be comparable and targets the macroinvertebrate community at a time of greatest diversity. The study index period for macroinvertebrates ranges from June 1 to September 30 of any given year.

Sampling During or After Rain Events

Avoid sampling during high flow rainstorm events. Use your best professional judgement to determine if the stream has risen above baseflow during this recent rain event. It is often unsafe to be in the water during such times. In addition, biological and chemical conditions during such episodes are often quite different from those during baseflow. On the other hand, sampling cannot be restricted to only strict baseflow conditions. It would be next to impossible to define “strict baseflow” with any certainty at an unstudied site. Such a restriction would also greatly shorten the index period when sampling activities can be conducted. Thus, some compromise is necessary regarding whether to sample a given stream because of storm events. To a great extent, this decision is based on the judgment of the field sampler. Some guidelines to help make this decision are presented below. The major indicator of the influence of storm events will be the condition of the stream itself. If you decide a site is unduly influenced by a storm event, do not sample the site that day.

- If it is running at bank full discharge or the water seems much more turbid than typical for the class of stream do not sample it that day.
- Do not sample that day if it is unsafe to be in the water.
- Keep an eye on the weather reports and rainfall patterns. Do not sample a stream during periods of prolonged heavy rains.
- If the stream seems to be close to normal summer flows, and does not seem to be unduly influenced by storm events, sample it even if it has recently rained or is raining.

Equipment List

- Landowner permission, if necessary
- D-frame macroinvertebrate net with 500 μm mesh
- GPS, mapping application, or paper maps
- Flags for marking transects
- Laser rangefinder or long tape measure
- Nalgene wide mouth sample bottle, 1 liter (no more than 3 per site)
- 95% ethyl alcohol (for sample preservation)

- Sieve bucket with 500 μm mesh
- 5 gallon pail
- Funnel with large bore spout
- Spoon or scoop for transferring sample

Laying Out the Sampling Reach

Sampling reach: the length of stream that will be sampled for macroinvertebrates.

Transect: an imaginary line crossing the stream at which macroinvertebrates will be collected. There will be 11 transects at each site.

$\text{Sampling reach} = \text{average stream width} \times 30$

$\text{Distance between transects} = \text{sampling reach} / 10$

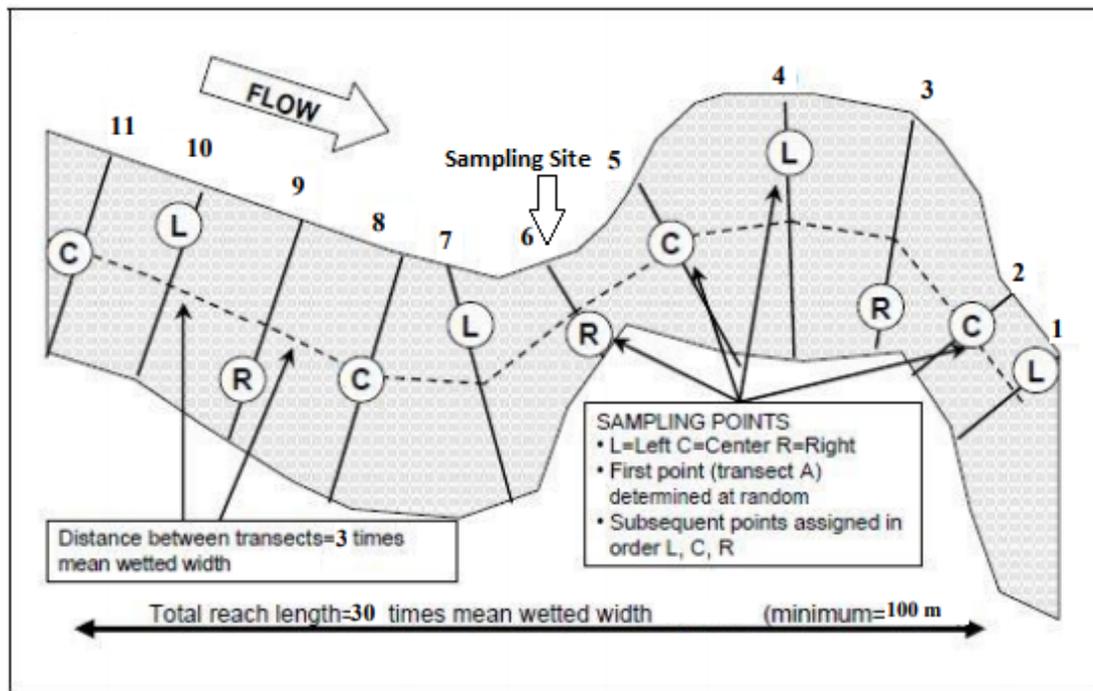


Figure 5. Sampling reach layout for collecting macroinvertebrates.

1. Locate the site using a GPS, mapping application such as Google Maps, or a paper map. The site location will be at the center of the sampling reach (transect 6). Place a surveyor's flag on the stream bank where it is easily visible from within the stream to mark transect 6.
2. Use a laser range finder, tape measure, or stadia rod to determine the wetted width of the channel at 5 places of "typical" width within approximately 5 channel widths upstream and downstream from transect 6. Average the five readings together and round to the nearest 1 m.
3. Multiply the average wetted width by 30 to determine the sampling reach length.
4. If the average width is <4 m, use 100 m as a minimum reach length. If the average width is >100 m, use 4 km as a maximum reach length.

5. Divide the sampling reach length by 10. The resulting value is the distance between each transect.
6. Starting at the site location, use a range finder or long tape to measure a distance upstream the next transect using the value you calculated in step 5. Place a surveyor's flag on the bank or shoreline that is visible from within the stream for transect 7. Be careful to measure all of the bends of the river/stream; do not artificially straighten out the line of measurement. Enter the channel to make measurements only when necessary to avoid disturbing the stream channel prior to sampling activities.
7. Continue to transect 8 and set a flag at the appropriate distance. Continue measuring upstream and placing flags at each transect until you reach transect 11.
8. Return to transect 6 and flag transects 1-5 on the downstream side of the site using the transect spacing calculated in step 5.

Collecting Macroinvertebrates

Collect a benthic macroinvertebrate composite sample using a D-frame net with 500 μm mesh openings. Take individual samples from the sampling stations at the 11 transects equally distributed along the sampling reach. Multiple habitats will be encountered and sampled using this approach. Habitats will include various types of bottom substrate as well as woody debris, macrophytes, and leaf packs. Composite all sample material from all 11 sampling locations and field preserve with ~95% ethanol.

Note: If a sampling point is in water that is too deep or unsafe to wade, select an alternate sampling point on the transect at random.

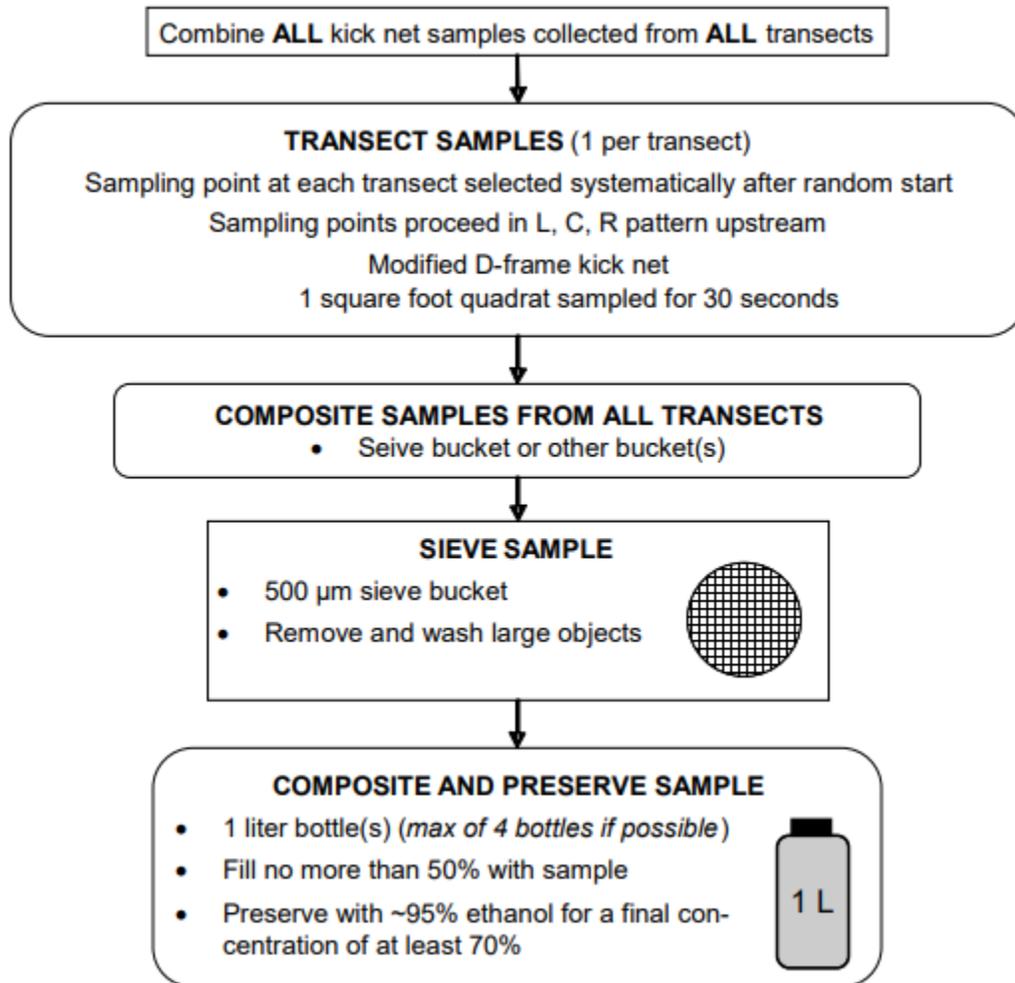


Figure 6. Sampling design for collecting benthic macroinvertebrates.

Sample Collection Procedure

1. At each transect, beginning with transect 1, randomly locate the first sampling station (Left, Center, or Right as you face downstream) as 25%, 50%, and 75% of the wetted width, respectively. If you cannot collect a sample at the designated point because of deep water or unsafe conditions, relocate to another random point on the same transect. If there is no location along the transect that is safe to sample, skip that transect.
2. Determine if there is sufficient current in the area at the sampling station to fully extend the net. If so, classify the habitat as “riffle/run” and proceed to Step 3. If not, use the sampling procedure described for “pool/glide” habitats starting at Step 9.
3. With the net opening facing upstream, quickly position the net securely on the stream bottom to eliminate gaps under the frame. Avoid large rocks that prevent the net from seating properly on the stream bottom. *Note: If there is too little water to collect the sample with the D-net, randomly pick up 10 rocks from the riffle and pick and wash the organisms off them into a bucket which is half full of water.*
4. Holding the net in position on the substrate, visually define an area upstream of the net opening that is about 1 square foot. This is called a quadrat.

5. Check the quadrat for heavy organisms, such as mussels and snails. Remove these organisms by hand and place them into the net. Pick up loose rocks or other larger substrate particles in the quadrat. Use your hands to dislodge organisms and wash them into the net. Scrub all rocks that are golf ball sized or larger and which are at least halfway into the quadrat. After scrubbing, place the substrate particles outside of the quadrat.
6. Hold the D-net securely in position. Starting at the upstream end of the quadrat, vigorously kick the remaining finer substrate within the quadrat for 30 seconds.
7. Pull the net up out of the water. Immerse the net in the stream several times to remove fine sediments and to concentrate organisms at the end of the net. Avoid having any water or material enter the mouth of the net during this operation.
8. Go to Step 13.
9. Visually define a quadrat that is one net width wide and long at the sampling point. The area within this quadrat is 1 square foot.
10. Check the quadrat for heavy organisms, such as mussels and snails. Remove these organisms by hand and place them into the net. Pick up loose rocks or other larger substrate particles in the quadrat. Use your hands to dislodge organisms and wash them into the net. Scrub all rocks that are golf ball sized or larger and which are at least halfway into the quadrat. After scrubbing, place the substrate particles outside of the quadrat.
11. Vigorously kick the remaining finer substrate within the quadrat with your feet while dragging the net repeatedly through the disturbed area just above the bottom. Keep moving the net all the time so that the organisms trapped in the net will not escape. Continue kicking the substrate and moving the net for 30 seconds. *Note: If there is too little water to use the kick net, stir up the substrate with your gloved hands and use a sieve with 500 μm mesh size to collect the organisms from the water in the same way the net is used in larger pools.*
12. After 30 seconds, remove the net from the water with a quick upstream motion to wash the organisms to the bottom of the net.
13. Invert the net into a sieve bucket and transfer the sample. Remove as much gravel as possible so that the organisms do not get damaged. Inspect the net for any residual organisms clinging to the net and deposit them into the bucket. Use forceps if necessary, to remove organisms from the net. Carefully inspect any large objects (such as rocks, sticks, and leaves) in the bucket and wash any organisms found off the objects and into the bucket before discarding the object. Remove as much detritus as possible without losing organisms.
14. Thoroughly rinse the net before proceeding to the next sampling station. Proceed upstream to the next transect and repeat steps 1 - 13. Make sure to follow the left, center, right pattern to determine which area along the transect to collect the sample (Figure 6). Combine all kick net samples from riffle/run and pool/glide habitats into the bucket.

Sample Processing

Use a 500 μm mesh sieve bucket placed inside a larger bucket full of site water while sampling to carry the composite sample as you travel around the site. Once the composite sample from all stations is sieved and reduced in volume, store in a 1 L wide-mouth bottle and preserve with 95% ethanol. Do not fill bottles more than $\frac{1}{2}$ full of material. Multiple bottles may be required if detritus is heavy. Try to use no more than 3 bottles per site.

Sample Labeling

With a fine tip sharpie, enter the station, date, bottle number out of total number of bottles, the number of transects sampled out of 11, and your name on the Volunteer Monitoring Benthic Macroinvertebrate label. Place a label on each sample bottle.

Note: It is vital that you label each bottle and enter the bottle number out of the total number of bottles on each label in the case a bottle is lost or gets mixed with other sample bottles.

Sample Holding and Shipping

Store the samples at room temperature and out of direct sunlight. Before shipping samples, wrap bottle lids with electrical tape. Ship samples to **SD DANR at 523 E Capitol, Pierre, SD 57501** with attention to Paul Lorenzen.

Appendix

SD DANR Water Quality Sample Labels

Project: **Volunteer Monitoring**

Source:

Code: **5665**

Initials

Station:

Date

Time

Surface

Bottom

Midwater

A - 1 Liter HDPE

Preservative: None

SD DANR Biological Labels for Chlorophyll-a Samples

Project: WQMap	Date
Source:	Time
Station:	Initials
Program: WP	Comp mL
<input checked="" type="checkbox"/> Surface <input type="checkbox"/> Bottom <input type="checkbox"/> Midwater	Filtered mL
<input type="checkbox"/> Algae <input type="checkbox"/> Composite <input type="checkbox"/> Periphyton	Surface Area
<input type="checkbox"/> MacroInv <input type="checkbox"/> Grab <input type="checkbox"/> Zooplank	
<input type="checkbox"/> AFD <input type="checkbox"/> Replicate <input type="checkbox"/> Art Sub	
<input checked="" type="checkbox"/> Chl A <input type="checkbox"/> Blank <input type="checkbox"/> Nat Sub	

SD DANR Biological Labels for Benthic Macroinvertebrate Samples

SD Volunteer Monitoring

Benthic Macroinvertebrate Sample

Station:

Date:

Bottles: _____ of _____

Transects: _____ of 11

Sampler: