

Recommended list of items to take along:

Photocopies of topographic map of stream to be walked
Comfortable rubber boots or waders
Snag and thorn-proof clothing that is appropriate for the weather
Clip board with waterproof cover
Watershed walk data forms
Two pencils
Tape measure (30' preferable) or string marked in 1-meter increments
Meter stick
An orange or other float
Stopwatch
Camera and film in waterproof bag
Leather gloves
Whistle
First Aid Kit
Cell Phone

Monitoring Survey Tips

Please consider the following precautionary tips:

- Get the permission of landowners to cross any private land, posted or not. **Do Not Enter Areas Without Permission.** It is recommended that you use public access points (such as city/county/state parks and campgrounds).
- Only record what you see, not what you have previously seen. For example if you think fish are present but you can't see them, mark your sheet "no fish present."
- Always work with someone.
- Do not put yourself in danger to gather survey information.
- Be careful of ticks, poison oak, nettles, and insects. Bring repellent. Wear long pants and boots: windbreakers help to block nettles.
- Watch out for dogs.
- Do not drink the water -- it is unsafe.
- Do not walk on unstable banks; your footsteps could speed erosion.
- Be alert for spawning areas (redds) in the stream. Do not walk on them. They will look like a round or elliptical area of clean gravel about 1-3 feet long. During fall through spring, when redds are evident, try not to walk in the stream. In the summer, if you are careful, the streambed might be the easiest route for conducting your Watershed walk. Be aware that the streambed can be very slippery, uneven, and unpredictable.
- **Do not attempt to walk across streams that are swift and above the knee in depth. You can be swept away in an instant!**
- Be careful of streamside vegetation - disturb it as little as possible.
- **If for any reason you feel uncomfortable about the stream conditions or surroundings, please stop your Survey. You and your safety are much more valuable than the Survey!**

Instructions for Filling out Survey Data Sheets

Water Level

Look at where the vegetation starts. This is usually where the water level is during high flows after spring snow melt or after a heavy rain.

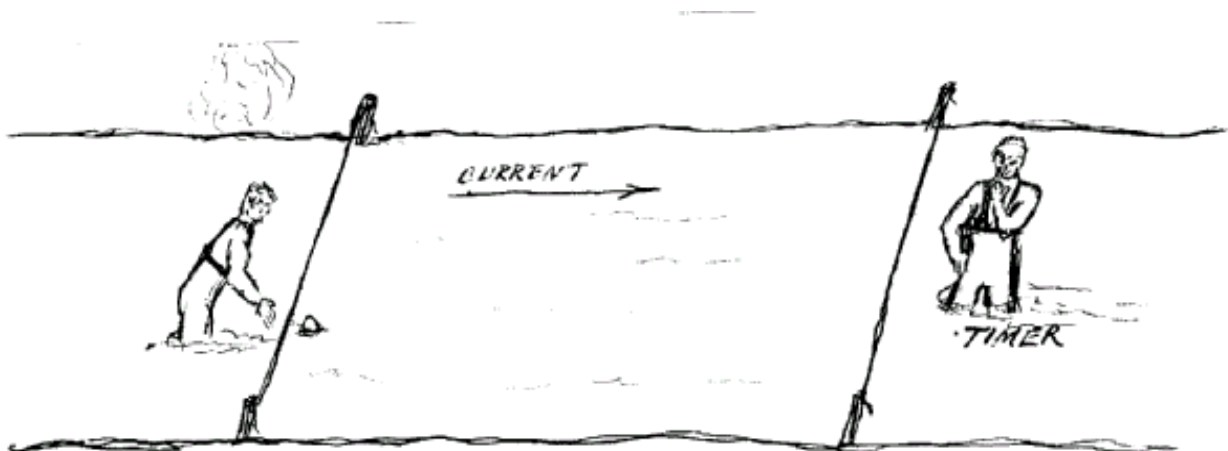
Velocity:

Use the stream velocity worksheet below to measure water velocity. You will need to get in the water, but do not complete this if the water looks like it's going too fast, or if it is higher than your knees.

Select a length of stream about 3 meters long that has a uniform flow pattern. Place stakes on each side of the stream at the beginning and end of the course. Tie a rope between the stakes on either side of the stream so that you have a distinct starting and finish line.



1. The partner with the stopwatch should stand where he or she can see the finish line. Using a tennis ball or an orange as a float, place it in the water at the starting line. Yell, "Go" when you let it go. Your partner should immediately turn on the stopwatch and then stop it when the float crosses the finish line. If your float is caught in an eddy or along the bank, start over.
2. Repeat this twice and record the time. Fill in the number sentences to find the average time and velocity.



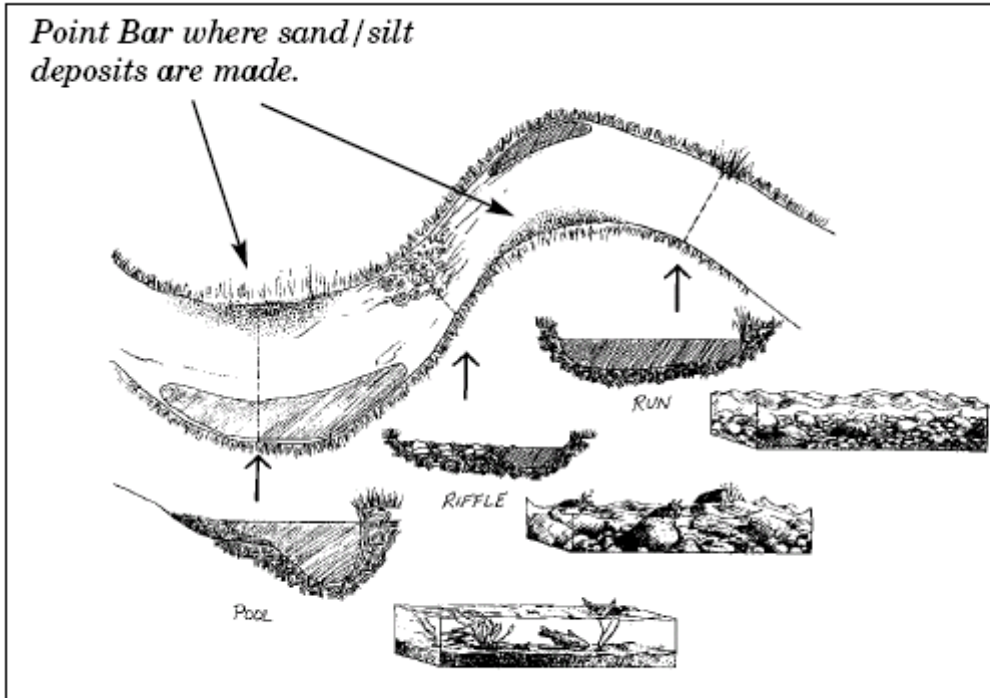
Instructions for Filling out Survey Data Sheets (continued)**Habitat Features: riffles, runs, pools, glides**

Diagram of a stream with a mixture of pools, riffles, and runs. Varying flows and depths create a variety of habitats for macroinvertebrates.

Substrate Size and Cobble Embeddedness:

This part of the survey looks at two important things that are part of the macroinvertebrate habitat: substrate size and cobble embeddedness.

- **Substrate** are the materials on the stream bottom. The sizes of stream bottom materials at a site are where macroinvertebrates live, and will determine what types of macroinvertebrates live there. For example, crayfish prefer to hide beneath large boulders and aquatic worms burrow in fine silt.
- **Cobbles**, the rocks between 2 and 10 inches in diameter, provide the best habitat for benthic macroinvertebrates. When cobbles on the stream bottom are covered up with silt and sand, they are **embedded**.
- The more cobbles are embedded, the less habitat is available to the macroinvertebrates that live in the spaces beneath the cobbles. Embeddedness also is bad for fish eggs and their survival.

Human Impacts and Land Uses:

Different land uses have different possible impacts on stream health. Examples follow in the chart.

CITIES AND TOWNS

- When rain runs off rooftops, roads and parking lots or any surface that water can not go through, it washes off the pollutants that may be on these surfaces, such as:
 - Salt and sand used on the roads in winter to melt the ice
 - Spilled gas, oil or antifreeze
 - Lead and other substances from car and truck exhaust
 - Chemicals in tar that can be washed away by water
- Air pollution from smoke stacks, cars and trucks and home chimneys settle out onto the land. This is washed into streams by the rain.
- Fertilizers, weed killers and pesticides, which are used on lawns and gardens, are washed into streams and ponds.
- Litter left by careless people will be washed or blown into the water. It will stay there until someone picks it up.
- Sewage pollution comes from septic systems that are not working correctly. It is the gray to black, bad smelling liquid which you may see flowing from lawns or trickling from a pipe into a gutter.

FARMS

- Soil washes into streams from plowed fields and from pastures that have too many animals eating too much of the grass. The grass and plants hold the dirt in place. Without the plants, the dirt can wash away.
- Pesticides and weed killers wash off the fields into the water.
- Fertilizers and animal manure can wash into the water.
- Thermal pollution occurs when the trees and brush are removed from along a stream's banks. The stream will no longer be in the shade, so the water heats up.

CONSTRUCTION AND MINING

- Any time dirt is dug up, as in mining or construction, erosion can occur. **Erosion** is when dirt is washed into a stream, pond or lake. Government laws require that man-made ponds be dug to hold the muddy water so that it does not drain into a natural body of water.
- There are chemicals called sulfides in coalmines and some other types of mines. When sulfide gets wet, it reacts to form an acid. This acid can pollute streams and ponds.

GARBAGE DUMPS AND LANDFILLS

- Water can become polluted when it trickles through garbage. Water polluted in this way is called **leachate**. Leachate may contain dangerous wastes, such as weed killer, pesticides, paint stripper, antifreeze or oil, which end up in landfills because there is no widely used way to remove them from trash.
- Soil erosion occurs when the soil is dug up to cover over the garbage heaps.

INDUSTRIES

- Air pollution comes from smoke stacks.
- Industries produce many dangerous wastes. They are supposed to get rid of these at special dumps. Unfortunately some dump their waste in other areas. These areas need to be cleaned up or the waste blocked from entering the waterways.

OIL STORAGE SITES

- Oil spills

School/Group _____ River/Stream _____
 Survey Site GPS _____ Survey Date & Time _____
 Name of person(s) completing survey _____

Weather: Today _____ **Temperature:** Air _____ °C
 Past 2 days _____ Water _____ °C

Water Appearance:

Turbidity substantially greater than natural conditions: Yes No

Oily film, grease globules, or unusual odor or color present Yes No

Algae or Weed Growth: Substantially greater than natural conditions: Yes No

Water Level: Compared to the height of the stream channel, the water level seems:
 high medium low

Stream Width & Depth: The stream is on average _____ meters wide and _____ meters deep

Average Depth of Bug Sampling Transect: (for riffle sites only) _____ meters

Average Velocity of Bug Sampling Transect: Average time it takes to flow 3 meters:

a) 3 m / _____ sec = v1 _____

b) 3 m / _____ sec = v2 _____

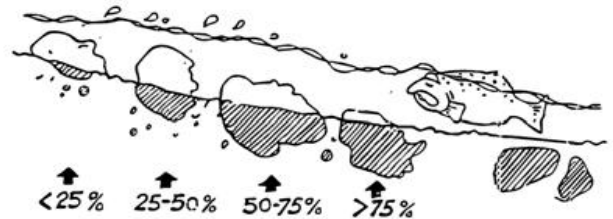
AVERAGE: _____ m/sec

Cobble Embeddedness: (for riffle sites only)

Look for a cobble in the riffle where organisms are being collected (but not one that has been disturbed by sampling). Reach down and feel the edge of the cobble where it emerges from the silt or sand. Keeping your fingers on that edge, pick up the cobble and estimate the percent that the cobble is embedded (see diagram below). Often there is a “bathtub ring” line on the cobble where the level of the silt or sand was. There are also often algae growing on the top surface of the cobble down to that line. Check the appropriate box in the “Cobble Embeddedness Table” below. Continue until you have sampled 10 cobbles.

Cobble Embeddedness Table

Cobble #	0-25%	25-50%	50-75%	75-100%
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				



Based on your results, estimate the average embeddedness of the site.

AVERAGE EMBEDDEDNESS %

Food Sources for Aquatic Organisms

Check the appropriate boxes below:

Type of Food Source	Present	Abundant	Sparse
Decaying leaves for decomposers			
Fine particles of organic matter for decomposers			
Algae growing on rocks for herbivores			
Invertebrates for predators			

Assessment Factors: Circle the box that best applies for each assessment factor.

Assessment Factor	Excellent	Good	Fair	Poor
Riffle Size	Well-developed riffle, as wide as stream & as long as 2x stream width	Riffle as wide as stream but riffle length < 2x stream width	Riffle not as wide as stream and length < 2x stream width	Riffles or run virtually nonexistent
Substrate Size	Cobble predominates; boulders, gravel common	Cobble less abundant; boulders and gravel common	Gravel, boulders or bedrock prevalent; some cobble	Large boulders and bedrock or sand & silt prevalent; cobble lacking
Shelter for Fish	Snags, submerged logs, undercut banks, or other stable habitat are found in over 50% of the site	Snags, submerged logs, undercut banks, or other stable habitat are found in 30-50% of the site	Snags, submerged logs, undercut banks, or other stable habitat are found in 10-30% of the site	Snags, submerged logs, undercut banks, or other stable habitat are found in < 10% of the site
Embeddedness (use results from "Cobble Embeddedness Table")	Rocks in stream <25% embedded; very little sand, silt, or mud	Rocks 25-50% embedded; can easily turn over rocks	Rocks 50-75% embedded and firmly stuck in sediments	Rocks >75% embedded; bottom mostly sand, silt, or mud
Flow Pattern (deep is > 2 ft)	All 4 patterns present: slow/deep, fast/shallow fast/deep, slow/shallow	Only 3 of 4 flow patterns present	Only 2 of 4 flow patterns present	Dominated by 1 flow pattern
Channel Alteration	Stream straightening, dredging, artificial embankments, dams or bridge abutments absent or minimal; stream with meandering pattern	Some stream straightening, dredging, artificial embankments, or dams present, usually near bridge abutments; no recent channel alteration	Artificial embankments present to some extent on both banks; and 40-80% of stream site straightened, dredged, or otherwise altered	Banks shored with gabion or cement; over 80% of the stream site straightened and disrupted
Stream bank cover and stability *	Banks stable; no evidence of erosion; bank covered by vegetation or rock	Moderately stable; small areas of erosion; most of bank covered by vegetation or rock	Largely unstable; almost half of bank has areas of erosion or is not covered by vegetation or rock	Unstable, eroded; < half of bank covered by vegetation or rock, or rock slumping into creek
Disruption of riparian bank coverage* (land bordering stream bank)	Mature trees and vegetation; most growing naturally; no disturbance by forestry, grazing, or mowing	Trees, woody plants, soft green plants dominate; some disruption but not affecting full plant growth potential	Obvious disruption; patches of bare soil, cultivated fields or closely cropped vegetation are the norm	Not much natural vegetation left or it has been removed to 3" or less in height
Width of riparian vegetation zone*	More than 35 yards wide; human activities have not impacted zone	Zone 12-35 yards wide; marginal impact from human activities	Zone 6-12 yards wide; impact from human activities evident	Zone <6 yards wide; lots of nearby human activities
Litter	No litter (metal or plastic) in area	Very little litter; accidentally dropped	Litter fairly common; purposely dropped	Lots of litter present; obviously dumped

*if the two banks are very different, assess the worse side

Human Impacts and Land Uses: (check boxes that are present)

- | | | | |
|---|--------------------------------------|--|--|
| <input type="checkbox"/> Stream channel altered | <input type="checkbox"/> Dam(s) | <input type="checkbox"/> Store(s) | <input type="checkbox"/> Road(s) |
| <input type="checkbox"/> Bridge abutments | <input type="checkbox"/> Farm(s) | <input type="checkbox"/> School(s) | <input type="checkbox"/> Industry |
| <input type="checkbox"/> Stream is culverted | <input type="checkbox"/> Recreation | <input type="checkbox"/> Parking lot(s) | <input type="checkbox"/> Logging |
| <input type="checkbox"/> Storm drain pipe(s) | <input type="checkbox"/> Golf course | <input type="checkbox"/> House(s) | <input type="checkbox"/> Mining |
| <input type="checkbox"/> Sewage treatment plant pipe(s) | <input type="checkbox"/> Garbage | <input type="checkbox"/> Lawn(s)/garden(s) | <input type="checkbox"/> Other (describe): |

Tier 2 Site Drawing:

Draw a “bird’s-eye” sketch of your 200’ long river segment up and downstream from your sampling site, recording:

1. Your sampling sites—include where you collected chemical and BMI samples, and measured velocity and cross section area.
2. Direction of water flow— indicate with arrows.
3. Location and orientation of any photos taken.
4. In-stream habitat—riffles, pools, runs, large woody debris, boulders, organic material, aquatic plants, overhanging vegetation, etc.
5. Streambanks—steep & gently sloping areas, naturally vegetated, bare, eroding, clear-cut, or mowed areas, artificially protected areas, etc.
6. Channel—wide & narrow areas, meanders, shaded & exposed areas, unnatural alterations, dams, culverts, etc.
7. Human land uses—roads, houses, driveways, parking lots, storm drain pipes, sewage pipes, factories, farms, livestock crossings, recreational use, logging, etc