

Standard Operating Procedure #9:

Physical Habitat Assessment

Version 1.0

In Monitoring Protocol for Wadeable Streams of the Great Lakes Network

Prepared by

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Revision History Log

The following table lists all edits and amendments to this document since the original publication date. Information entered in the log must be complete and concise. Users of this standard operating procedure will promptly notify the project manager and/or the Great Lakes Network (GLKN) data manager about recommended and required changes. The project manager must review and incorporate all changes, complete the revision history log, and change the date and version number on the title page and in the header of the document file. For complete instructions, please refer to Procedure for Revising the Protocol, SOP #16.

Previous Version #	Revision Date	Author (with title and affiliation)	Location in Document and Concise Description of Revision	Reason for Change	New Version #
Add rows as needed for each change or set of changes tied to an updated version number					

Acknowledgements

This standard operating procedure (SOP) is based in large part on the Wisconsin Department of Natural Resources protocol for evaluating habitat of wadeable streams (WDNR 2002), with some portions used *verbatim*.

9.0 Introduction

Physical habitat characteristics play an important role in the biotic diversity of streams. Factors such as large woody debris, substrate type, channel dimensions, presence of macrophytes, and riparian vegetation influence presence and abundance of biota. Habitat measurement allows us to determine if amount of available habitat or quality is changing. Stream channel connectivity to riparian and floodplain zones is an important factor in overall stream corridor function. Monitoring of instream and riparian habitat allows us to determine if stream and floodplain connectivity is changing due to factors such as decreased discharge or floodplain development.

Physical habitat measurements are useful for interpreting results of biotic monitoring (macroinvertebrates, periphyton, fish, etc.) and may help identify emerging issues within the stream or watershed. This standard operating procedure (SOP) describes procedures for collecting data on habitat features within stream and riparian areas. The procedures in this SOP are designed to provide guidance to a crew of two or more people to collect stream habitat data quickly and efficiently.

Each sampling reach will be mapped to quantify proportions of different habitat features. Examples of habitat features include (but are not limited to) pools, riffles, runs, islands, beaver dams, and logjams. More detailed data will be collected along 11 equally spaced transects, established perpendicular to stream flow.

9.1 Equipment and Supplies

The equipment and supplies required for habitat sampling consist of:

- GPS, preloaded with coordinates for each transect, extra batteries
- One ≥ 100 m tape with 0.1 m resolution
- Two ≥ 30 m tape with 0.01 m resolution
- Two or more meter sticks with ≤ 0.01 m resolution
- 0.3×0.3 m square quadrat (constructed out of half-inch PVC pipe)
- Five (5) brightly painted stones (to mark quadrat placement)
- Forest densitometer
- Clipboard
- Data sheets on waterproof paper (see Appendices for blank data sheets)
- Pencils or waterproof pen

- Digital camera, fully charged
- Waders
- Raingear
- Park radio or cellular/satellite phone, fully charged
- First aid kit
- Appropriate maps for navigating to the field site
- Field trip itinerary
- Calculator (optional)
- Flagging tape/stakes for temporary markers (be sure to pick them up before you leave!)
- Viewing bucket (optional, may be helpful on deeper streams)

9.2 Suggested Sequence of Events

The general sequence of events should be as follows:

1. Prepare sample bottles and labels in advance.
2. Review checklist of field gear.
3. Prepare new data sheets for each monitoring station, printed on waterproof paper. Separate data sheets are needed for a) mapping and measuring habitat features; b) habitat sampling along transects; c) station summary, including water quality; d) flow; e) macroinvertebrate collection; and f) periphyton collection.
4. Conduct daily calibration of appropriate meters and probes.
5. Inspect motorized vehicles/boats at the beginning of every field day, including all safety and directional lights, oil, gasoline, and air pressure levels of tires.
6. Travel to monitoring site. Refer to description of monitoring station location, directions, and photos to verify correct location. Verify coordinates on GPS unit.
7. Measure water quality variables with a multiprobe and transparency with a transparency tube downstream of first transect per SOP #6; record measurements on data sheet.
8. Obtain mean stream width to calculate $40 \times \text{MSW}$ to find sample reach Length, as needed.

9. Moving from downstream to up, conduct physical habitat assessment instream and in the riparian area along transects, Map and measure habitat features as you go. Also as you move upstream, select three riffles or other appropriate habitats for collecting macroinvertebrate and periphyton samples (per SOPs #7 and #8).
10. Collect and preserve macroinvertebrate and periphyton samples, per SOPs #7 and #8, respectively.
11. Measure water quality variables with a multiprobe and transparency with a transparency tube upstream of last transect per SOP #6; record measurements on data sheet.
12. Measure flow along a cross section of the stream (per SOP #10) at an appropriate place within the sampling reach; record measurements on data sheet.
13. Download data from continuous logging devices, replace batteries or logging devices if necessary, and re-deploy.
14. Record stage reading.
15. Verify that all data sheets are completely filled out, and initial them.
16. If sampling more than one monitoring station in a day, go back to step 6, ensuring that equipment has first been decontaminated for invasive species per SOP #5.
17. Return to office or park laboratory.
18. Clean and decontaminate sampling equipment (SOP #5) and perform calibration checks, as detailed in SOP #6.
19. Download field data and check against hard copy field data sheets as soon as feasible.
20. Enter all data into NPSTORET at the end of the season.
21. This SOP contains details on mapping and measuring habitat features and conducting physical habitat assessments instream and in the riparian area.

9.3 Measuring and Mapping Habitat Features

The purpose of measuring and mapping habitat features is to provide a visual representation of the instream habitat as it appears on a given visit. Especially important are habitat features such as bends, pools, runs, riffles, islands, log jams, and dams (built by both beavers and humans).

Instream habitat mapping will take place following collection of chemical/physical data at the downstream end of the reach. Mapping falls in this place in the sequence because it is used to select three riffles with similar substrate composition for macroinvertebrate and periphyton sampling, or if riffles are absent, to select appropriate habitats for the sampling. Mapping will begin at the downstream end of the reach and will be conducted walking upstream, being careful to minimize habitat disturbance. The length of each feature will be measured, as will the distance between features.

9.3.1 Habitat Feature Definitions

Typically, habitat features will fall into the following categories:

- **Bend:** A curve in the channel in which the stream changes direction by ≥ 60 degrees.
- **Riffle:** An area of the stream characterized by shallow depths, higher than average velocities and turbulence visible at the water surface of the stream. Deep, fast riffles in larger streams are called rapids. In high flow conditions, some riffles may be characterized as runs (see below for description).
- **Run:** Area with average depths and little or no surface turbulence. During extreme low water, some runs may become riffles.
- **Pool:** Area of the stream with deeper than average maximum depths, with no obvious surface turbulence or broken water. Water velocities are always slow, and sometimes upstream direction of flow is evident (eddies). The longitudinal profile of the streambed in a pool is often bowl shaped.
- **Island:** Area of land within the stream channel that is surrounded on both sides by a large portion of the stream's flow. Areas resembling islands with significant stream flow on only one side, and little or no stream flow on the other are not considered islands. Islands contain soil and/or multiple rocks. A single boulder in a stream is not considered an island, but exposed sand, gravel, or rock bars are.
- **Dam:** Structures created intentionally by either humans or beavers. Dams typically stretch across the whole stream and block the flow. Usually there is a noticeable drop in the surface elevation of the stream at the dam.
- **Log Jam:** A group of three or more large (>0.2 m diameter) logs intermingled in the stream channel and partially or totally submerged. Log jams have a noticeable impact on flow patterns and sedimentation. When large and dense enough, log jams may act as a dam.

9.3.2 Measure Habitat Features

The downstream end of the sampling reach may begin in the middle of a habitat feature or at the start of the feature. Indicate on the datasheet the habitat feature in which the sampling reach begins, and whether it is the beginning of the feature or not. Measure upstream to the beginning of the next habitat feature and record the distance to the nearest 1 m. Continue upstream, measuring the distance from the beginning of one habitat feature to the beginning of the next habitat feature, and record the measurements on the data sheet. Only include measurements to bends if they are $\geq 60^\circ$. Standing in the thalweg, determine the angle of the bend by using a compass to find the azimuth of the channel upstream of the bend and downstream of the bend. The angle is calculated by subtracting the upstream azimuth from the downstream. Record the angle on the data sheet.

Include the following information on the habitat feature measurement form (Appendix A):

- **Park:** The appropriate four digit park code (e.g., 'ISRO' for Isle Royale National Park).
- **Stream Name:** The name found on USGS quadrangle maps.
- **Site Code:** The designated code for the site being sampled.
- **Date:** The date (MM/DD/YYYY) that sampling was conducted
- **Personnel:** The first and last names of the crew members.
- **Distance Measurements (m):** The distance of all features measured from the downstream end of the station, to the downstream end of the next feature upstream, rounded to the nearest 1 m. All features, except bends, will be measured to their downstream end. Bends are to be measured to the middle of the bend. All measurements should be made following the center of the channel.
- **Stream Habitat Feature:** Record the stream habitat features encountered while moving upstream from the downstream end of the station. Features include bends, riffles, runs, pools, islands, dams, and logjams, as defined above.
- **Distance Summary:** To fill out the Distance Summary portion of the data sheet, use the information from the "Start of Feature" and "End of Feature" and calculate the values for the "Distance from Start" columns. These can be calculated later in the office using a computer or calculator. Indicate on the form whether the summary measurements have been calculated or estimated. Determine and record the following:
 - **Distance between bends (m):** The distance from the middle of one bend to the middle of the next one upstream. Measure only bends that are more acute than 60° (measure the angle of the bankfull channel). Do not measure from/to bends that are outside the stream reach. Measure from the start of the stream reach to the middle of the first bend. For the nth-Upstream, measure from the most upstream bend in the reach to the upstream end of the reach.

- Distance between riffles (m): Distance between riffles is measured from the upstream end of one riffle to the downstream end of the next, always working upstream. The actual length of each riffle is not included in this distance.
- Length (m) of individual riffles, pools, and runs: The length of each pool, riffle, and run within the sample reach. These lengths are obtained by subtracting the distance from the start of the next feature upstream from the start of each riffle, pool, or run listed in the stream feature column.

Features Summary: On the back of the habitat measurement form, summarize the number of each feature type, the total length of each feature type, and the percent of the sampling reach containing each type of feature. Check the appropriate box to indicate whether the summary is an estimate or whether it was calculated.

9.3.3 Sketch a Site Map

Construct a sketch of the entire sampling reach using the measurements recorded. It may be easier to sketch as you walk back to the downstream end of the reach, referring to the measurements as you see and walk through the habitats again. Include the habitat features by name (e.g., run, riffle, logjam, etc.) and at least some of the habitat measurements. Indicate the direction of flow with an arrow. Take an electronic photo of each major in-stream habitat type; record the photo information on the datasheet so that photos can be named properly later in the office.

The maps will be scanned electronically, and will become part of the permanent file.

9.4 Habitat Sampling Along Transects

While following the above procedure for measuring and mapping, habitat data should be collected at transects. The length of the sampling reach, determined during site establishment, is 40 times the mean stream width (MSW) (SOP #4). Eleven equally spaced transects are located within the sampling reach. The first transect (T1) is located at the downstream end of the reach and the last transect (T11) is located at the upstream end of the reach. Spacing between transects is determined by dividing the length of the sampling reach by 10 (Figure 1). Most small streams with relatively homogeneous habitats will be adequately sampled by 11 transects. Transect sampling will occur from downstream to upstream, and typically from the left side of the stream to the right, facing upstream. All transects are oriented perpendicular to the flow of water. Four equally-spaced transect points are placed along the transect line and habitat measurements are made within 0.3 m × 0.3 m quadrats centered on each point.

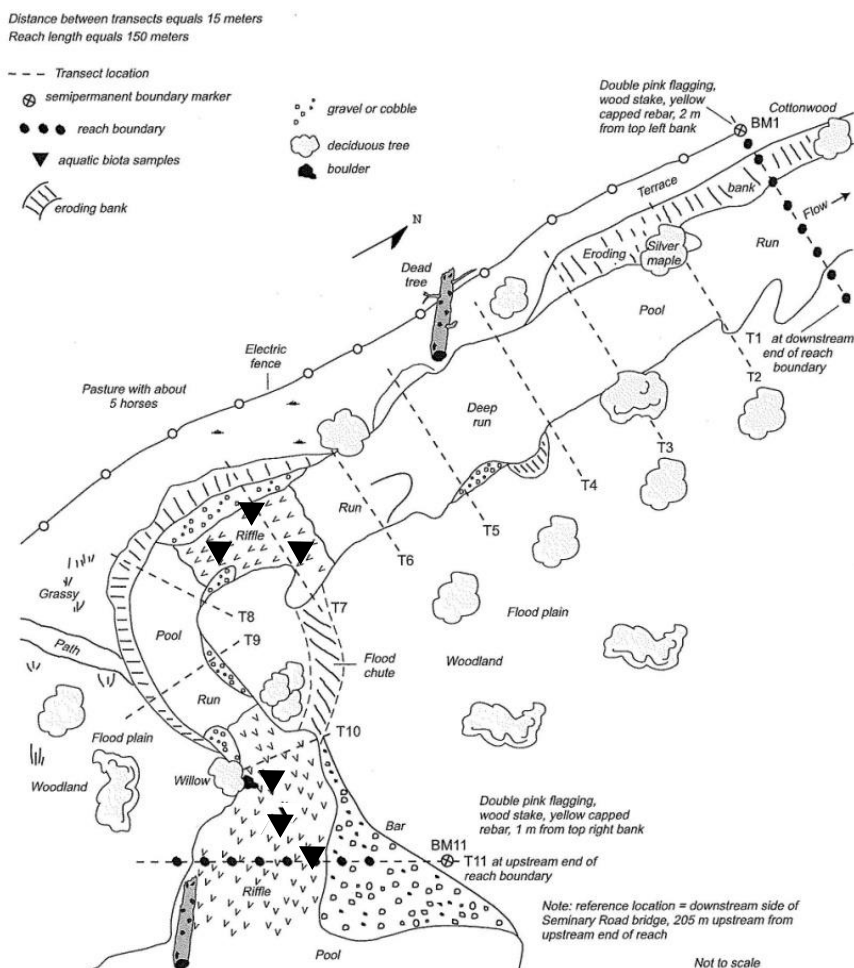


Figure 1. Schematic of sampling reach showing transect placement. From Fitzpatrick et al. (1998).

9.4.1 Transect Data

Use a separate transect data sheet (Appendix C) for each transect and record the following:

- **Park:** The appropriate four digit park code (e.g., 'ISRO' for Isle Royale National Park).
- **Stream Name:** The name found on USGS quadrangle maps.
- **Site Code:** The designated code for the site being sampled.
- **Date:** The date (MM/DD/YYYY) that sampling was conducted
- **Personnel:** The first and last names of the crew members.
- **Transect Number** (transects are numbered sequentially, starting with transect one [T1], from downstream to upstream)
- **Habitat Type** (Pool, Riffle, or Run)

- Wetted Stream Width
- Thalweg Depth (the depth of the flowing stream at its deepest point)
- Bankfull Width (optional measurement; distance from one side of the stream to the other, measured from the point at which the stream can reach its highest point but not overtop the bank and spill onto the floodplain)
- Bankfull Depth (optional measurement; distance [height] from the top of the bank to the stream bottom at the thalweg, measured from the point at which the stream can reach its highest point, but not overtop the bank and spill onto the floodplain)
- Average overhead canopy cover. Use a forest densitometer held at elbow level and take measurements from the thalweg facing upstream, downstream, towards the left bank, and towards the right bank. Record all four measurements; compute and record the average. See Appendix B for details on using a forest densitometer.

In order to determine where to place the quadrats along each transect line, measure the wetted width of the stream to the nearest 0.1 m using a tape ≥ 30 m long. Wetted width is the portion of the stream channel that is holding water on the day that the stream is visited. Stretch the tape across the stream and hold it as taut as possible; do not let the tape drag in the current. Record the wetted width measurement on the transect data sheet. Divide the wetted width measurement by five to determine the spacing between the transect points and the distance from the banks. Center the quadrats over each point. Quadrats are numbered 1 through 4, from left bank to right bank while facing upstream.

9.4.2 Quadrat Data

Within each quadrat, working from left bank to right bank, measure and record the following information:

- Depth of water plus depth of fine sediment to the nearest 0.5 cm, measured at the center of quadrat with a meter stick. Do not force the meter stick, rather push it lightly into the substrate.
- Depth of water to the nearest 0.5 cm, measured at the center of quadrat with a meter stick.
- Percent embeddedness (visual estimate within entire quadrat). Embeddedness is the degree to which coarse gravel and rubble/cobble are surrounded by/covered by sand, silt, or other fine substrates (<2 mm in diameter; see Figure 2 for an illustration of embeddedness). Estimate the average embeddedness to the nearest 25% as described in Table 1. Embeddedness cannot be measured unless coarse mineral substrate materials are present. If embeddedness cannot be measured, enter “NA” on the habitat data sheet to distinguish those sites lacking coarse substrate from those that have coarse substrate but embeddedness equals zero).
- Substrate type (visual estimate within entire quadrat). Estimate to the nearest 10% each substrate type present as defined in Table 2; the total will equal 100%.

- Percent cover by algae (visual estimate within entire quadrat). Estimate to the nearest 10%, making separate estimates for filamentous green algae and periphyton.
- Percent cover by macrophytes (visual estimate within entire quadrat). Estimate to the nearest 10%; indicate species, or collect a sample for identification later. (Percent algae and macrophytes are not a part of the substrate habitat estimates that are to total to 100%)

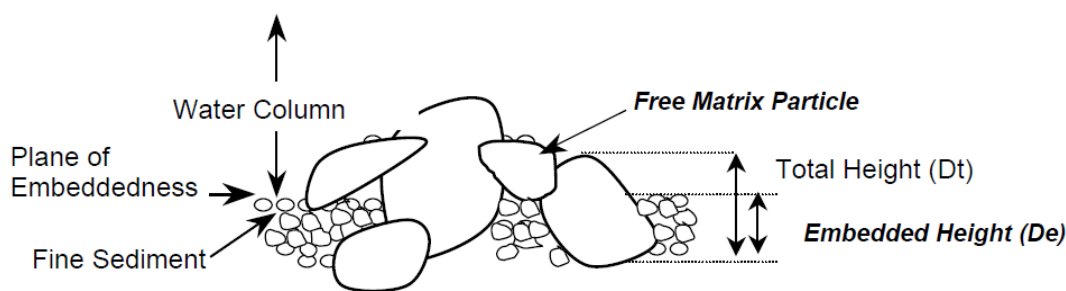


Figure 2. Illustration of embeddedness. From Sylte and Fischenich (2002).

Table 1. Descriptions to assist in assigning % embeddedness values.

Description of Relationship Between Rocks and Sediment	% Embeddedness
Completely covered by fine sediments	100%
Completely surrounded by and half covered by fine sediments	75%
Surrounded by fine sediments, rock tops clean of sediment	50%
Rocks half surrounded by, rock tops clean of sediment	25%
No fine sediments covering or surrounding rocks	0%

Table 2. Substrate categories, separated by size and description (WIDNR 2002).

Substrate Category	Size Range and Description
Bedrock	Solid, uniform rock slab
Boulder	261 mm – 4.1 m; Large rocks
Rubble/cobble	65 – 260 mm; Medium rocks
Gravel	2 – 64 mm, Small rocks
Sand	0.062 – 1.9 mm; Inorganic material smaller than gravel, beach material
Silt	0.004 – 0.061 mm; Fine inorganic material, usually brown in color, does not support a person's weight on the stream bottom
Clay	0.00024 – 0.0005 mm; Fine inorganic material, dark brown or gray, feels gummy and sticky to the touch, retains shape when compacted, fully or partially supports a person's weight on the stream bottom, slippery underfoot.
Detritus	Various sizes; partially decayed organic matter, leaves, sticks, other dead plants

9.4.3 Bank Erosion

Bank erosion can occur when exposed soil on the stream banks is inundated by water or exposed to wind. To quantify bank erosion, measure the length (nearest 0.1 m) of contiguous bare soil at the ends of each transect line. Measurements should be made parallel to the stream, within 1 m of the stream edges. The stream edge is defined as the edge of the wetted stream channel under ‘normal’ flow conditions. If the flow is above or below normal, estimate where the wetted stream channel edge would be under normal flow conditions. Record the measurement for each bank separately. Exposed rock or patches of vegetation are included in the measurement of bank erosion if they are <0.5 m in length. If no contiguous bare soil occurs, record ‘0’. Depositional areas, for example, silt and sand along stream margins, are not considered bank erosion.

In addition to the measurements of contiguous bare soil, visually estimate the percent (to the nearest 10%) of the line from the crest of the bank to the wetted stream edge that consists of bare soil. If the bank crest is not easily discernable, estimate the bank erosion within 5 m of the stream edge. It may help to measure the length of the entire bank (from stream edge to the crest of the bank), if easily discernible, and then divide into the length of bare soil to obtain the percent bank erosion.

9.4.4 Riparian Corridor

Riparian land use is the amount of a particular category of land use present on each bank, 5 m inland from the wetted banks during normal flow conditions. Land uses fall into two main categories: disturbed and undisturbed. Disturbed land uses are unnatural, human-related uses, while undisturbed land uses are characterized by relatively unaltered natural vegetation and soils.

Extend the transect line 5 m into the riparian area of both banks. Visually estimate the land use categories (Table 3) along the transect line to the nearest 10% for each bank separately. The sum of each estimate must equal 100%. The land use must be at least 1 m wide in order to be included. If a category listed on the sheet is not present along the transect, enter a zero for that category. If a category that is not listed on the sheet is present, specify the identity of that category and list the percentage next to “Other”.

Table 3. Riparian land use categories and descriptions.

Land Use Category	Description
<i>Disturbed Land Uses</i>	
Cropland	Land that is plowed and planted with crops on a yearly basis or is regularly mowed for hay.
Pasture	Land that is regularly grazed by livestock.
Barnyard	Land that is used to confine and feed high densities of livestock. Also known as feedlots, this land often contains little vegetation and large volumes of manure and mud. Usually associated with farmsteads.
Developed	(Commercial/Residential/Urban): Includes lands that have been modified for human use, such as residences, buildings used for commerce or industry, all roads (paved and unimproved), railroads, paths > 2 m wide, parking lots, and yards, parks, playgrounds, golf courses, ball fields.

Table 3 (continued). Riparian land use categories and descriptions.

Land Use Category	Description
<i>Undisturbed Land Uses</i>	
Meadow	Land dominated by grasses and forbs with few woody plants, which is not subject to regular mowing or grazing by livestock.
Shrub	Land dominated by small (< 3m high) woody plants, such as alder, willow, hazel, nine-bark, or tree saplings.
Forested	Land dominated by trees (either coniferous or deciduous), most of which are taller than 3m.
Wetland	Low-lying land that is covered with standing water for much of the year.
Exposed Rock	Land covered by exposed bedrock outcrops, boulders, riprap, gabions, or other natural materials along the banks.

Slumping or cut banks, with eroding soil and little vegetation, are not considered a separate category but are included with the land use found at the top of the bank. For example, an eroding, bare bank in an otherwise wooded area would be included as “Forested” land use, while a severely eroding bank in a pasture would be included as “Pasture” land use. If a cut bank with a narrow band (1 m wide) of undisturbed land use (e.g., Meadow) at the top of the bank is followed by a disturbed land use (e.g., Pasture), the cut bank is included as “Meadow”.

In addition to visually estimating the land use categories in the riparian zone, measure (to the nearest meter) the width of contiguous undisturbed land uses (Table 3) from the streams edge out 10 m along the transect-line, following the contours of the land, for each bank. If no undisturbed land uses are directly adjacent to the stream, then the riparian buffer width is 0 m; if undisturbed land uses are present from the stream edge to a point >10 m, then the riparian buffer width is recorded as >10 m.

9.4.5 Photograph the Left and Right Banks

While standing in the thalweg of the stream, take photographs of both banks in line with the transect. Indicate that photos were taken on the data sheet. When naming photos, adhere to the following naming convention: park code_stream name and site #_transect # and left/right bank_YYYYMMDD (e.g., PIRO_Miners01_T9_LB_20120729).

9.5 Estimate Abundance of Other Biota

After all habitat sampling has been completed, estimate and record the abundance of various biota (sponges, filamentous algae, fish, macrophytes, etc.) observed during the entire sampling event on the station summary form (Appendix B and SOP #6). Use the qualitative ranks of 0 = absent or not observed through 4 = dominant, as described on the data sheet.

9.6 Quality Assurance/Quality Control

Approximately 10% of all measurements and visual estimates (e.g., % cover, % embeddedness) will be replicated independently by the second crew member. Disparities >10% will be discussed and rectified in the field.

Sampling crews will be trained prior to the field season. Visual estimates of % cover (e.g., substrate type, algal cover) will be calibrated against a viewing bucket with a grid. Estimates of % embeddedness will be calibrated against measurements with a metric ruler.

Prior to departure from the sampling site, check to be sure all data forms have been filled out completely.

After sampling is completed at a site, rinse all equipment and gear, especially brushes and scraping tools. Inspect to be sure no organisms or debris remains. Follow decontamination procedures described in SOP #5 before using the equipment at a new site.

9.7 Literature Cited

- Fitzpatrick, F. A., I. R. Waite, P. J. D'Arconte, M. R. Meador, M. A. Maupin, and M. E. Gurtz. 1998. Revised methods for characterizing stream habitat in the National Water-Quality Assessment Program. United States Geological Survey Water Resources Investigation Report 98-4052. Available at: <http://pubs.usgs.gov/wri/wri984052/>.
- Sylte, T., and C. Fischenich. 2002. Techniques for measuring substrate embeddedness. ERDC TN-EMRRP-SR-36. Available at: <http://el.erd.usace.army.mil/elpubs/pdf/sr36.pdf> (accessed 13 November 2012).
- WIDNR (Wisconsin Department of Natural Resources). 2002. Guidelines for evaluating habitat of wadeable streams. Bureau of Fisheries Management and Habitat Protection. Monitoring and Data Assessment Section. Madison, Wisconsin.

Note: Left bank / right bank facing upstream

Park Code _____	Stream Name _____	Site Code _____
Date (DDMMYYYY) _____		
Personnel _____		

Distance Measurements			
Start of Feature (m)	End of Feature (m)	Distance from Start (m)	Stream Feature (Bend, Riffle, Pool, Run, Logjam) incl. angle (°) of

continued on back

☐ estimated ☐ measured (check one)		
Distance Summary		
Distance b/w Bends (m)	Distance b/w Riffles (m)	
Meas. from center of bend	Meas. from upstream end of one riffle to downstream end of next	
Downstr – 1st _____	Downstr – 1st _____	
1 st – 2 nd _____	1 st – 2 nd _____	
2 nd – 3 rd _____	2 nd – 3 rd _____	
3 rd – 4 th _____	3 rd – 4 th _____	
4 th – 5 th _____	4 th – 5 th _____	
5 th – 6 th _____	5 th – 6 th _____	
6 th – 7 th _____	6 th – 7 th _____	
7 th – 8 th _____	7 th – 8 th _____	
8 th – 9 th _____	8 th – 9 th _____	
9 th – 10 th _____	9 th – 10 th _____	
10 th – 11 th _____	10 th – 11 th _____	
11 th – Upstr _____	11 th – Upstr _____	
Sum _____	Sum _____	
Mean _____	Mean _____	
Length (m) of individual riffles, pools, runs		
1 st Riffle _____	1 st Pool _____	1 st Run _____
2 nd Riffle _____	2 nd Pool _____	2 nd Run _____
3 rd Riffle _____	3 rd Pool _____	3 rd Run _____
4 th Riffle _____	4 th Pool _____	4 th Run _____
5 th Riffle _____	5 th Pool _____	5 th Run _____
6 th Riffle _____	6 th Pool _____	6 th Run _____
7 th Riffle _____	7 th Pool _____	7 th Run _____
8 th Riffle _____	8 th Pool _____	8 th Run _____
9 th Riffle _____	9 th Pool _____	9 th Run _____
10 th Riffle _____	10 th Pool _____	10 th Run _____
11 th Riffle _____	11 th Pool _____	11 th Run _____
12 th Riffle _____	12 th Pool _____	12 th Run _____
Sum _____	Sum _____	Sum _____
Mean _____	Mean _____	Mean _____

[illegible]

Appendix B. Station Summary Form

Note: Left bank / right bank facing upstream.

Park Code _____		Stream Name _____		Site Code _____	
Date (DDMMYYYY) _____					
Personnel _____				# Photos taken (describe on back) _____	
GPS coordinates — Downstream starting point (circle one):					
				Lat/Long	UTM
NAD (circle one): 83 27					
Downstream Water Characteristics Time _____					
Water Level (circle one): Average Above Average Below Average					
Water Clarity (circle one): Clear Turbid Tannin-stained					
Air Temperature (°C) _____ Transparency (cm) _____					
Depth (m)	Temp (°C)	DO (mg/L)	DO (%)	pH	EC25 (µS/cm)
GPS coordinates — Upstream ending point (circle one):					
				Lat/Long	UTM
NAD (circle one): 83 27					
Field Observations Indicate estimated abundance throughout site					
0 = Absent/Not Observed		1 = Rare (1–3 organisms)		2 = Common (3–9 organisms)	
3 = Abundant (>10 organisms)		4 = Dominant (>50 organisms)			
Sponges	0	1	2	3	4
Hydrozoa	0	1	2	3	4
Bryozoans	0	1	2	3	4
Leeches	0	1	2	3	4
Fish	0	1	2	3	4
Macrophytes	0	1	2	3	4
Crayfish	0	1	2	3	4
Snails	0	1	2	3	4
Clams	0	1	2	3	4
Filamentous algae	0	1	2	3	4
Periphyton	0	1	2	3	4
Other _____	0	1	2	3	4

Use back side to describe photos taken (e.g., #1 – from downstream end of station looking upstream)