QUANTITATIVE PHYSICAL HABITAT ASSESSMENT PROTOCOL FOR WADEABLE STREAM MONITORING SITES

I. PURPOSE

To describe the methods used by the Minnesota Pollution Control Agency's (MPCA) Biological Monitoring Program to collect physical habitat information at stream monitoring sites for the purpose of assessing water quality and developing biological criteria.

II. SCOPE/LIMITATIONS

This procedure applies in part to all integrated assessments of rivers and streams that are wadeable. An integrated assessment involves the collection of biological (fish and macroinvertebrate communities), physical habitat and chemical information to assess stream condition.

III. GENERAL INFORMATION

Sites may be selected for monitoring for a number of reasons including: 1) sites selected for condition monitoring as part of Intensive Watershed Monitoring (IWM), 2) sites randomly selected as part of the Environmental Monitoring and Assessment Program (EMAP), 3) sites selected for the development and calibration of biological criteria, and 4) sites selected for stressor identification. Although the reasons for monitoring a site vary, the physical habitat protocols outlined in this document apply to all wadeable stream monitoring sites unless otherwise noted. For our purposes, wadeable sites constitute those that are sampled for fish utilizing a backpack electrofisher or stream electrofisher (see SOP--"***Fish Community Sampling Protocol for Stream Monitoring Sites***"). At all sites, a qualitative habitat assessment is completed (see SOP—"***MPCA Stream Habitat Assessment (MSHA) Protocol for Stream Monitoring Sites***"). For stressor identification surveys, EMAP surveys and special investigations, the physical habitat assessment (described in this document) is also collected.

IV. REQUIREMENTS

A. Qualifications of crew leaders: The crew leader must be a professional aquatic biologist with a minimum of a Bachelor of Science degree in aquatic biology or closely related specialization. He or she must have a minimum of six months field experience in physical habitat sampling methodology. Field crew leaders should also possess excellent map reading skills and a demonstrated proficiency in the use of a GPS (Global Positioning System) receiver and orienteering compass.

B. Qualifications of field technicians/interns: A field technician/intern must have at least one year of college education and coursework in environmental and/or biological science.

C. General qualifications: All personnel conducting this procedure must have the ability to perform rigorous physical activity. It is often necessary to wade through streams and/or wetlands, canoe, or hike for long distances to reach a sampling site.

V. RESPONSIBILITIES

A. Field crew leader: Implement the procedures outlined in the action steps and ensure that the data generated meets the standards and objectives of the Biological Monitoring Program.

B. Technicians/interns: Implement the procedures outlined in the action steps, including maintenance and stocking of equipment, data collection and recording.

VI. QUALITY ASSURANCE AND QUALITY CONTROL

Compliance with this procedure will be maintained through annual internal reviews. Technical personnel will conduct periodic self-checks by comparing their results with other trained personnel. Calibration and maintenance of equipment will be conducted according to the guidelines specified in the manufacturer's manuals.

In addition to adhering to the specific requirements of this sampling protocol and any supplementary site specific procedures, the minimum QA/QC requirements for this activity are as follows:

A. Control of deviations: Deviation shall be sufficiently documented to allow repetition of the activity as performed.

B. QC samples: Ten percent of sites sampled in any given year are resampled as a means of determining sampling error and temporal variability.

C. Verification: The field crew leader will conduct periodic reviews of field personnel to ensure that technical personnel are following procedures in accordance with this SOP.

VII. TRAINING

A. All inexperienced personnel will receive instruction from a trainer designated by the program manager. Major revisions in this protocol require that all personnel be re-trained in the revised protocol by experienced personnel.

B. The field crew leader will provide instruction in the field and administer a field test to ensure personnel can execute this procedure.

VIII. ACTION STEPS

A. Equipment list: Verify that all necessary items are present before commencement of this procedure (Table 1).

B. Data collection method: The location and length of the sampling reach is determined during site reconnaissance (see SOP--"***Reconnaissance Procedures for Initial Visit to Stream Monitoring Sites***"). Sampling is conducted during daylight hours within the summer index period of mid-June through mid-September. Sampling should occur when streams are at or near base-flow. Habitat assessments are collected after fish sampling so as not to disturb the fish community. At all sites, a qualitative habitat assessment is completed (see SOP—"***MPCA Stream Habitat Assessment (MSHA) Protocol for Stream Monitoring Sites***"). For stressor identification surveys, EMAP surveys and special investigations, the physical habitat assessment (described in this document) is also collected.

Habitat within a station is quantified utilizing the transect-point method (modified from: Simonson, T.D., Lyons, J., and Kanehl, P.D. 1994. Guidelines for Evaluating Fish Habitat in Wisconsin Streams. Gen. Tech. Rep. NC-164. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Experiment Station. 36 p.). Thirteen transects are established within the reach and four equally spaced points plus the thalweg are located along each transect. Measurements or visual estimates are made to characterize key components of the physical habitat structure important in influencing stream ecology. Key components include: channel morphology, substrate, cover, and riparian condition.

Two data sheets are required for the physical habitat assessment. One copy of the **Stream Features** form is needed for each site. One copy of the **Transect** form is needed for each of the thirteen transects (or only seven copies if forms are doubled-sided). Copies of these forms are attached. Guidelines for filling out each data sheet are described in the following pages.

C. Stream Features Data Sheet

This data sheet describes the length and location of the major morphological features within a sampling station (bends, pools, riffles, runs, log jams, islands, and beaver dams). The **Stream Features** data is collected in conjunction with the **Transect** data as you proceed from the downstream end to the upstream end of the station. The variables on this data sheet are as follows:

1) *Field Number* – A seven-digit code that uniquely identifies the station. The first two digits identify the year of sampling, the second two identify the major river basin, and the last three are numerically assigned in sequential order (example: 02UM001).

2) *Stream Name* – The name of the stream as shown on the most recent USGS 7.5" topographic map. Include all parts of the name (i.e. "North Branch", "Creek", "River", "Ditch", etc.).

3) *Date* – The date habitat sampling is conducted in month/day/year format (MM/DD/YY).

4) *Crew* – The personnel who collected the habitat data.

5) *Transect Number* (column) – Record the transect number you are measuring from for all Stream Features.

6) *Distance From Transect* (column) – The distance from the most recent transect of the station to the *stream feature*. Measure distances to the nearest tenth of a meter following the center of the stream channel. The first value is always "0" to indicate the *stream feature* at the beginning of the station.

7) *Stream Feature* (column) – Record the major morphological features encountered as you proceed upstream. If a cross-section of stream contains two or more channel morphology types (i.e. riffle, run, or pool) record the dominant type. Stream features recorded include:

   Riffles: Portions of the stream channel where water velocities are fast, water depths are relatively shallow, and substrates are typically coarse. Steeper stream gradient results in obvious surface turbulence. Areas of high gradient that are deep, fast, and turbulent are called **rapids**. Measurement is taken where riffle starts.

   Runs: Water velocities may be moderately fast to slow but the water surface typically appears smooth with little or no surface turbulence. Generally, runs are deeper than a riffle and shallower than a pool. Runs with very slow water velocities are sometimes called **glides**. For our purposes, if the channel type is not considered a riffle or pool it is defined as a run. Measurement is taken where run starts.

   Pools: Water is slow and generally deeper than a riffle or run. Water surface is smooth, no turbulence. A general rule that can be used to distinguish a pool is if two or more of the following conditions apply; the stream channel is wider, deeper, or slower than average. Measurement is taken where pool starts.

   Bends: Change in the direction of the stream channel of at least 60 degrees. Measurement is taken at middle of bend.

   Dry: There is no water present in the channel. Measurement is taken where stream become dry.

   Islands: Areas of land within the stream channel that is surrounded on all sides by water and is dry even when the stream is experiencing bank full flow. Areas with nearly all of the stream's flow on one side and just a trickle of water on the other are not considered islands. Islands usually contain woody vegetation (ex: Trees or Shrubs). **Bars**, channel features below the bank full flow level that are dry during base flow conditions, are not recorded.

   Start Island: Measurement taken at Island's start.

   End Island: Measurement taken at Island's end.

   Log Jams: Woody material that is of sufficient size to appreciably alter the direction of flow or change the morphology within the stream channel. Measurement is taken at middle of log jam.

Beaver Dams: Structures constructed by beavers that span the entire stream channel and block flow. Beaver dams consist of sticks and mud, but will use the vegetation that is available to them. Measurement is taken at middle of beaver dam.
Bridge: Structure that provides a way for people and machinery to cross the width of the stream. Measurement is taken at middle of bridge.

Culvert: Artificial stream channel to move water through an obstacle such as a road or railroad. If the culvert is wadeable and sampleable, the recorded distance is the middle of the culvert.

Start Culvert: Used when a culvert is not wadeable or not sampleable. Start Culvert is measured to the point the culvert starts.

End Culvert: Used when a culvert is not wadeable or not sampleable. End Culvert is measured to the point the culvert ends.

Dam: Barrier constructed to contain the flow of water within a stream, and also prevents or impedes fish passage up or downstream. Measurement is taken to the middle of a dam.

Tributary: Stream or river that empties into a larger stream or river. Measurement is made to the middle of the tributary.

Drain Tile: Subsurface network of pipes to removing excess water from an area of land. Many tiles flow directly into a stream or river. Measurement is made to the middle of the drain tile entering the stream.

End of Reach: The upstream end of the sampling reach, marked with flagging. Measurement is taken at flag.

D. Transect Data Sheet

Record the data generated from each of the thirteen transects on this data sheet. One data sheet is needed for each transect. To determine the placement of each of the thirteen transects within the station divide the station length (determined during reconnaissance) by thirteen, this number is the *transect spacing* or distance between transects. The first transect is located one half of the transect spacing distance from the downstream end of the station. Each subsequent transect is then the distance of one transect spacing from the previous transect. All numbers are rounded to the nearest half meter.

For example, if the station length is 150 m, 150 ¸ 13 = 11.5 (equals the transect spacing). The first transect would then be located a distance of 6 m from the downstream end of the station, 11.5 ¸ 2 = 5.75 (equals 6 rounded to the nearest half meter). The second transect would then be located a distance of 17.5 m from the downstream end of the station, 6 + 11.5 = 17.5, and so forth for subsequent transects.

Each transect consists of several measurements or visual estimates, made within 0.3 m x 0.3 m quadrates at set intervals, or along the transect line perpendicular to the stream channel. The variables on this data sheet are as follows:

D.1. Location Information

1) *Field Number* – Same as for **Stream Features** data sheet.

2) *Stream Name* – Same as for **Stream Features** data sheet.

3) *Date* – Same as for **Stream Features** data sheet.

4) *Crew* – Same as for **Stream Features** data sheet.

5) *Transect Number* – The number (1-13) of the current transect as you proceed upstream. The downstream most transect is number one, the next transect upstream is two, and so on.

6) *Distance from Start* – The distance from the downstream end of the station to the current transect following the center of the stream channel, rounded to the nearest half meter.

7) *Stream Width* – The wetted width of the stream channel at the transect, measured to the nearest tenth of a meter. Exposed bars and boulders are included in the wetted width of the stream channel, but islands are not. Backwaters not in contact with the stream at the transect are also excluded. If a channel is split by an island(s), the wetted widths of each side channel should be combined so that a single number is recorded in *stream width*. In low gradient streams the wetted width is the defined portion of the stream channel, it does not include adjacent wetlands and areas of emergent vegetation.

8) *Channel Type* – Circle the predominant channel type at the transect. See the **Station Features** section for riffle, pool, and run definitions.

D.2. Transect Point Measurements: At each transect, measurements or visual estimates are made at five points along the transect. Variables quantified include: *water depth, depth of fines and water, embeddedness, substrate, percent algae, and percent macrophytes*. Four points are equally spaced across the stream channel and the fifth point is the thalweg, or deepest point along the transect line. Divide the *stream width* at the transect by five to determine the 1/5, 2/5, 3/5, and 4/5 locations across the wetted width of the stream channel. Measurements are made at each of these four locations moving from the right bank to the left bank along the transect. The right stream bank is on the right as you are facing downstream. For example, if the stream is 10 m wide, measurements are taken at the thalweg and along the transect at 2.0, 4.0, 6.0, and 8.0 m from the right bank. In some instances, the thalweg will occur at the same location as one of the four other points, in which case their measurement values will be the same.

1) *Water Depth* (**WD cm**)– The depth of the stream channel at each transect point. Measure the vertical distance of the water column from the streambed to the water surface to the nearest centimeter with a calibrated wading rod or meter stick. If the water depth is over 120 cm, record as >120 cm.

2) *Depth of Fines and Water (***+DoF cm***)* – The water depth plus the depth of fine sediments at each transect point. Fine sediments are those that are less than 2.0 mm in diameter and generally consist of sand, silt, clay, or detritus. Without using the weight of your body, push a wading rod into the sediment as far as possible, measure to the water surface to the nearest centimeter. This measurement is later converted to depth of fines by subtracting *water depth*.

3) *Embeddedness of Coarse Substrates* (**Emb %**)– The extent to which coarse substrates are surrounded by or covered with fine sediments. Coarse substrates consist of gravel, rubble/cobble, and boulders. If the dominant substrate within the quadrate is coarse, embeddedness should be visually estimated to the nearest 25%. Estimate the average percent embeddeness of coarse substrates within the 0.3 m x 0.3 m quadrate centered on the channel position. An embeddedness rating of 0% corresponds to very little or no fine sediments surrounding coarse substrates. Course substrate material completely surrounded and covered with sediment is considered 100% embedded. If the dominant substrate within a quadrate is anything other than gravel, rubble/cobble, or boulder then the column should be left null.

4) *Dominant Substrate* – The predominant substrate type within each quadrate. Visually estimate which substrate type is predominant within each quadrate and place a check mark in the appropriate column. If the stream bottom cannot be seen, use your hands and feet to determine the dominant substrate type. Choose from the following substrate types:

   Bedrock (Bed): A solid slab of rock, > 4000 mm in length (larger than a car).

   Boulder (Bou): Large rocks ranging from 250 mm to 4000 mm in diameter (basketball to car size).

   Rubble/Cobble (Rub): Rocks ranging in diameter from 64 mm to 250 mm (tennis ball to basketball).

   Gravel: Rocks varying in diameter from 2 mm to 64 mm (BB to tennis ball).

   Sand: Inorganic material that is visible as particles and feels gritty between the fingers. 0.06 mm to 2.0 mm in size.

Silt: Fine inorganic material that is typically dark brown in color. Feels greasy between fingers and does not retain its shape when compacted into a ball. A person's weight will not be supported if the stream bottom consists of silt.

Clay: Very fine inorganic material. Individual particles are not visible or are barely visible to the naked eye. Will support a person's weight and retains its shape when compacted.

Detritus (Detr): Decaying organic material such as macrophytes, leaves, finer woody debris, etc. that may appear similar to silt when very fine.

Other: Any substrate type not listed above, specify the type. Possibilities could include woody debris, culverts, tires, or mussel beds.

5) *Algae %* **(Alg %)** – Visually estimate the amount of algae within the quadrate, to the nearest 5 %. Algae can either be attached to the substrate in the form of a mat or crust; or filamentous algae, which forms dense mats of long, hair-like strands and is usually green in color.

6) Macrophytes % **(Mac %)** – Visually estimate the amount of aquatic vegetation within the quadrate, to the nearest 5 %. Aquatic macrophytes can be either submergent or emergent and are defined under *cover for fish.*

D.3. Cover and Land Use Characteristics

1) *Cover for Fish (%)* – The amount of cover or shelter available for fish along the transect. Visually estimate the percentage (nearest 5 %) occupied by each cover type along the transect within a 0.3 m band centered on the transect line. If a cover type is absent, enter a zero. In order to be considered cover, the water depth must be at least 10 cm where the cover type occurs. Cover for fish consists of objects or features dense enough to provide complete or partial shelter from the stream current or concealment from predators or prey.

Undercut Banks (UB): Stream banks where the stream channel has cut underneath the bank. The bank could overhang the water surface when water levels are low. The undercut bank must overhang (horizontally) the wetted stream channel a minimum of 15 cm and the bottom of the bank must be no more than 15 cm above the water level in order to be considered cover for fish.

Overhanging Vegetation (OV): Terrestrial vegetation overhanging the wetted stream channel that meets the same criteria for cover as undercut banks.

Woody Debris (WD): Logs, branches, or aggregations of smaller pieces of wood in contact with or submerged in water.

Boulders (BO): Large rocks as described under *Substrate.*

Submergent Macrophytes (SM): Vascular plants that have all of their biomass (except flowers) at or below the surface of the water. Examples include *Vallisneria*, *Elodea*, *Potamogeton*, *Nymphaea* and *Ceratophyllum.*

Emergent Macrophytes (EM): Vascular plants that typically have a significant portion of their biomass above the water surface. Examples include *Typha*, *Scirpus*, and *Zizania*.

Other Debris (OD): Additional objects that meet the criteria of cover, typically of human origin. Examples would include filamentous algae, culverts, docks, tires, discarded appliances, etc. Specify the type.

2) *Riparian Land Use* – The predominant land use within the riparian zone. For each bank, extending along the transect line, visually estimate the predominant land use within 30 m of the waters edge and place a check mark in the corresponding column. Repeat this same procedure for the riparian zone 30 – 100 m from the waters edge. Land use categories are as follows:

Cropland: Land that is cultivated with crops for forage or cover. Includes those areas under intensive cropping or rotation, or that are regularly mowed for hay.

Pasture: Land that is regularly grazed by livestock.

Barnyard: Land associated with farmsteads and the adjoining farmyard area. Includes grain storage facilities, barns, farmhouses, and feedlots (areas used to confine and feed high densities of livestock).

Developed: Land that has been modified (rural or urban) for commercial, industrial, or residential use. Includes commercial buildings/structures, parking lots, all roads, railroads, and power utilities. Also includes residential buildings, lawns, parks, golf courses, ball fields, etc. Specify the type in the space provided.

Exposed Rock: Natural areas of rock outcrops that lack appreciable soil development or vegetative cover.

Meadow: Land dominated by grasses and forbs with little woody vegetation, which is not subject to regular mowing or grazing.

Shrub: Land consisting primarily of woody vegetation less than 3 m in height. Typical shrubs include alder, dogwood, and willows.

Woodland: Land dominated by deciduous or coniferous tree species, generally taller than 3 m.

Wetland: Low-lying areas that are saturated or inundated with water frequently or for considerable periods of time on an annual basis. Wetlands include bogs, marshes, and swamps and contain vegetation adapted for life in saturated conditions.

Other: If a land use category other than one of those listed above is predominant, specify the type.

3) *Canopy/Shading* – A measure of overhead canopy cover that is shading the stream channel. A concave spherical crown densiometer is utilized for this measurement. The densiometer must be taped as shown in Figure 1 to limit the number of grid intersections to 17. Hold the densiometer at elbow level in front of you, making sure the instrument is level using the bubble level, count and record the number (0 to 17) of grid intersections that have vegetation covering them. If the reflection of a tree, branch, or leaf overlies any of the intersection points, that particular intersection is counted as having cover. Perform this measurement at the wetted edge of both the left bank (LB) and right bank (RB) facing the stream bank. In addition,.perform this measurement from the center of the stream channel along the transect line in each of four directions; facing upstream (CU), towards the left bank (CL), downstream (CD), and towards the right bank (CR).

4) *Riparian Buffer Width* – The amount of contiguous undisturbed land use within a 10 m buffer zone. For each bank, starting from the waters edge and extending out along the transect line 10 m, measure the width (nearest meter) of contiguous land that is considered undisturbed. Meadow, shrub, woodland, wetland, and exposed rock are considered undisturbed. If no undisturbed land uses are directly adjacent to the stream, then the riparian buffer width is 0 m. If more than 10 m is present, record it as >10 m.

5) *Bank Erosion* – The amount of the stream bank that is actively eroding. To be considered as erosion, the bank must be actively eroding through break down, soil sloughing, or false banks. False banks are natural banks that have been cut back, usually by livestock trampling. For each bank, along the transect line, use a wading rod or measuring tape to quantify the length (nearest 0.1 m) of bare soil. Measure the amount of exposed soil from the waters edge to the top of the stream bank, up to a maximum of 5 m. If there is no bare soil, record 0.

Table 1. Equipment List – This table identifies all equipment needed in the field in order to implement the sampling protocol as described.

Physical Habitat Sampling

Measuring tape (m) – for measuring distances

Wading rod – for measuring depths and short distances

Spherical crown densiometer (concave) – to measure canopy cover

Miscellaneous

Clipboard – to store forms and record data

Forms – for recording data

Pencil – for filling out forms

GPS – to locate and document sampling location (if necessary)

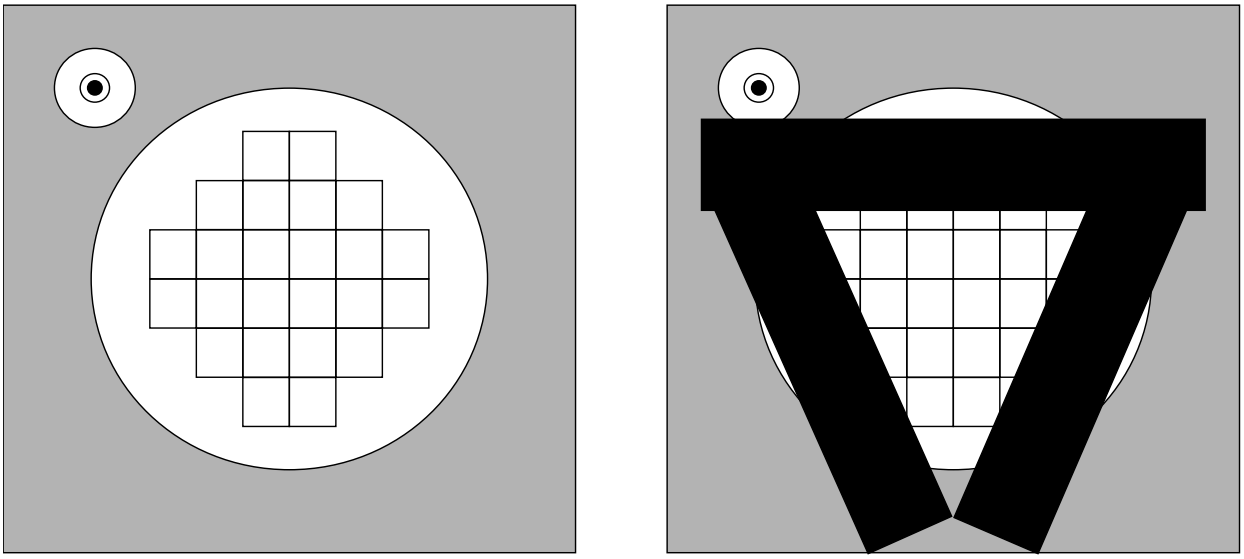

Figure 1. Illustration depicting how a spherical crown densiometer should be taped to limit the number of grid intersections to 17.

STREAM FEATURES MPCA

Field Number**:** _____ Stream Name**:** _____

Date: _____ Crew: _____

Transect Spacing: _____ Total Length: _____

Transect Number	Distance from Transect	Stream Feature
0	0	

Transect Number	Distance from Transect	Stream Feature

Stream Feature	How to Measure and Description
Riffle	Measure to the **start** of the **Riffle** (look for two: narrow, shallow, fast flow)
Run	Measure to the **start** of the **Run** (average width, depth and flow)
Pool	Measure to the **start** of the **Pool** (look for two: wide, deep, slow flow)
Bend	Measure to the **middle** of the **Bend** (60* change in direction of the stream)
Dry	Measure to where the stream becomes **Dry**
Start Island	Measure to the **start** of an **Island** (islands have woody vegetation [trees/shrubs])
End Island	Measure to the **end** of an **Island** (islands have woody vegetation [trees/shrubs])
Log Jam	Measure to the **middle** of the **Log Jam** (alters the flow direction of the stream)
Beaver Dam	Measure to the **middle** of the **Beaver Dam** (covers entire stream width and blocks flow)
Bridge	Measure to the **middle** of a **Bridge**
Culvert	Measure to the **middle** of a **Culvert** if you can sample through it
Start Culvert	Measure to the **start** of a **Culvert** if you can not sample through it
End Culvert	Measure to the **end** of a **Culvert** if you can not sample through it
Dam	Measure to the **middle** of a man made **Dam**
Tributary	Measure to the **middle** of the **Tributary**
Drain Tile	Measure to the **middle** of the **Drain Tile**
End of Reach (EOR)	Measure to the upstream flag or **EOR**

Stream Width	Station Length	Transect Spacing	Transect 1
≤4	150	11.5	6
4.5	158	12	6
5	175	13.5	7
5.5	192	15	7.5
6	210	16	8
6.5	228	17.5	9
7	245	19	9.5
7.5	262	20	10
8	280	21.5	11
8.5	297	23	11.5
9	315	24	12
9.5	332	25.5	13
10	350	27	14
10.5	367	28	14
11	385	29.5	15
11.5	402	31	15
12	420	32.5	16
12.5	437	34	17
13	455	35	17.5
13.5	472	36	18
14	490	37.5	19
≥14.5	500	38.5	19.5

TRANSECT MPCA

Field Number:_____ Date (mm/dd/yy):_____ Crew:_____

Transect #_____ Distance from Start (m):_____

Stream Width(m):_____ Channel Type: Riffle Pool Run

	1/5	2/5	3/5	4/5	Deep
WD cm					
+DoFcm					
Emb %					
Bed					
Bou					
Rub					
Gravel					
Sand					
Silt					
Clay					
Detr					
Other					
Alg %					
Mac %					

Percent Cover for Fish:

_____ UB _____ SM

_____ OV _____ EM

_____ WD _____ OD

_____ Bo specify (other)_____

Riparian Land Use:

0 -- 30m	***L/R***	***30 -- 100m***
___/___	Cropland	___/___
___/___	Pasture	___/___
___/___	Barnyard	___/___
___/___	Developed	___/___ -specify:_____
___/___	Exposed Rock	___/___
___/___	Meadow	___/___
___/___	Shrubs	___/___
___/___	Woodland	___/___
___/___	Wetland	___/___
___/___	Other	___/___ -specify:_____

Canopy/Shading:

_____LB _____RB

_____Cup _____CL _____CDn _____CR

Riparian Buffer (m): _____LB _____RB

Bank Erosion (m): _____LB _____RB

Comments:

Transect #_____ Distance from Start (m):_____

Stream Width(m):_____ Channel Type: Riffle Pool Run

	1/5	2/5	3/5	4/5	Deep
WD cm					
+DoFcm					
Emb%					
Bed					
Bou					
Rub					
Gravel					
Sand					
Silt					
Clay					
Detr					
Other					
Alg %					
Mac %					

Percent Cover for Fish:

_____ UB _____ SM

_____ OV _____ EM

_____ WD _____ OD

_____ Bo specify (other)_____

Riparian Land Use:

0 -- 30m	***L/R***	***30 -- 100m***
___/___	Cropland	___/___
___/___	Pasture	___/___
___/___	Barnyard	___/___
___/___	Developed	___/___ -specify:_____
___/___	Exposed Rock	___/___
___/___	Meadow	___/___
___/___	Shrubs	___/___
___/___	Woodland	___/___
___/___	Wetland	___/___
___/___	Other	___/___ -specify:_____

Canopy/Shading:

_____LB _____RB

_____CUp _____CL _____CDn _____CR

Riparian Buffer (m): _____LB _____RB

Bank Erosion (m): _____LB _____RB

Comments: