Michigan Clean Water Corps

# MiCorps Volunteer Stream Monitoring Procedures

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Adapted from:
"Stream Crossing Watershed Survey Procedure, April 27, 2000"


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# MiCorps Volunteer Stream Monitoring Procedures

## A. OBJECTIVES

This set of stream monitoring forms is intended to be used as a quick screening tool to increase the amount of information available on the ecological quality of Michigan's streams and rivers, and the sources of degradation to the rivers. This document is designed to provide standardized assessment and data recording procedures that can be used by trained volunteers participating in the Michigan Clean Water Corps (MiCorps) Volunteer Stream Monitoring Program.

This stream monitoring procedure is designed to address several general objectives:

- Increase the information available on the ecological quality of Michigan rivers and the sources of pollutants, for use by DEQ staff, local communities and monitoring groups.
- Provide consistent data collection and management statewide.
- Serve as a screening tool to identify issues and the need for more thorough investigations.

## B. TRAINING

All MiCorps Volunteer Stream Monitoring Program leaders must have received basic training in the stream assessment methods described below from MiCorps staff. Trained program leaders are then qualified to train their program volunteers in these procedures.

## C. GENERAL CONCEPTS

The procedures and data forms provided below include two types of assessment: Stream Habitat Assessment and Macroinvertebrate Sampling.

The Stream Habitat Assessment is a visual assessment of stream conditions and watershed characteristics. The assessment should include approximately 300 feet of stream length. Only observations that are actually seen are to be recorded. No "educated guesses" are to be made about what should be there or is probably there. If something cannot be seen, it should not be recorded. The one exception is if a significant pollutant source or stream impact is known to be upstream of a particular site, a comment about its presence can be made in the comment section of the form.

The Macroinvertebrate Sampling procedure should be used in conjunction with the Stream Habitat Assessment because each approach provides a different piece of the stream condition puzzle. Because of their varying tolerances to physical and chemical conditions, macroinvertebrates indicate the ecological condition of the stream, while the habitat assessment provides clues to the causes of stream degradation.. Macroinvertebrate data used to calculate the MiCorps Stream Quality Index, which provides a straightforward summary of stream conditions and can be used to compare conditions between study sites.

## D. SURVEY DESIGN

### 1. Selecting Monitoring Sites

One of the basic questions in planning stream monitoring is the location of study sites: how many stream sites should be surveyed within a watershed to adequately characterize it, and where should they be located? That depends on a variety of factors including the heterogeneity of land use, soils, topography, hydrology, and other characteristics within the watershed. Consequently, this question can only be answered on a watershed-by-watershed basis.

A general DEQ guideline is to try to survey a minimum of 30% of the stream road-crossing sites within a watershed, with the sites distributed such that each subwatershed (and in turn their subwatersheds) are assessed to provide a representative depiction of conditions found throughout the watershed. At least one site should be surveyed in each tributary, with the location of this site being near the mouth of the tributary. The distribution of sampling stations within the watershed should also achieve adequate geographic coverage. Consider establishing stations upstream and downstream of suspected pollutant source areas, or major changes in land use, topography, soil types, water quality, and stream hydrology (flow volume, velocity or sinuosity). If the intent of monitoring is to meet additional, watershed-specific objectives, then additional data may be needed.

In all cases, the site should be representative of the area of stream surveyed, it should contain a diverse range of the available in-stream cover, and it should contain some gravel/cobble bottom substrates if possible. Remember that each study site should allow for the assessment of 300 feet of stream length.

### 2. Time of Year

The time of year in which monitoring is conducted is important. For comparisons of monitoring data from year to year, data should be collected during the same season(s) each year. Ideally, macroinvertebrate sampling should take place in spring and again in early fall. Different macroinvertebrate communities are likely to be encountered during these different seasons, and sampling twice a year will provide a more complete picture of the total stream community. Habitat Assessment should be done in early spring before leaf-out, or in the fall after streamside vegetation dies back, allowing visual assessments of stream characteristics. Stream habitat assessments should not be conducted when there is snow on the ground or ice on the water because important features may be hidden from view. Surveys conducted during or shortly after storm runoff events may help to identify sources of pollutants, but high water obscures bank conditions and increased stream turbidity may make assessment of instream conditions difficult. Furthermore, all sites within a single watershed should be surveyed as closely together in time as possible to facilitate relative data comparisons among stations surveyed under similar stream flow and seasonal conditions.

## E. INSTRUCTIONS FOR COMPLETING DATA SHEETS

1. Stream Habitat Assessment

### a. Photographs

*Taking Pictures*

Always take photos. Photographs are useful for interpretation of Stream Habitat Assessment data and for later comparisons among different sites. Site photos should show the bank conditions and some of the riparian corridor. Additional photos may be taken to highlight a particular item of concern in the stream or upland landscape. Be sure to document photos as they are taken, to simplify identification later.

### b. Site Identification Information

MiCorps Site ID#: A site ID# for each of your study sites will be assigned to you by MiCorps. If you do not know the MiCorps Site ID#, leave this space blank.

Stream Name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area and note also the local name if it is different. For tributary streams to major rivers, record the tributary stream name here, ***not*** the major river name. If the tributary is an unnamed tributary, record as "Unnamed Tributary to" followed by the name of the next named stream downstream. For example, a station on an unnamed tributary of Hogg Creek would be recorded as "Unnamed Tributary to Hogg Creek".

Location: This is often the name of the road from which you access the study site. It is very important to indicate whether the site is upstream or downstream of the road. If the same road crosses a single stream two or more times, it is sometimes desirable to record the road name relative to the nearest crossroads (e.g. "Green Road between Brown Road and Hill Road").

Date: Record the month, day and year.

Start Time: Record the time when the monitoring activity began. Use 24-hr time (e.g. 1:00 PM should be recorded as 1300).

Monitoring Team: Record the name and the phone number of the person completing the datasheet, as well as the names of other team members participating in the assessment.

Location Information:

- *Major Watershed*: Record the name of the major watershed where the study site is located (e.g., Grand River Watershed, St. Mary's River Watershed), and the corresponding HUC Code, if known.
- *County*: Record county name.
- *Township*: Record the township name.
- *Sec*: Record the township section number, town number, range number, and section ¼ ¼ designations (e.g. SW ¼ of the NW ¼ ).
- *Latitude and Longitude:* Record the latitude and longitude coordinates of the study site. Ideally, these coordinates will correspond to the midpoint of the stream study reach.
- *Coordinate Determination Method*: Check the method used to determine the latitude/longitude location coordinates. This could include a GPS unit, a topographic map, or a mapping website, like www.topozone.com.
- *Map Scale*: If a map is used to determine latitude/longitude coordinates, record the scale of measurement (e.g. 1:25,000) if known.
- Indicate whether the standard 300 feet of stream were assessed, or explain any deviation from this standard.

### c. Background Information

Storm Event Conditions Noted at Site: A stream "event" occurs when water runoff from a significant weather event, such as a major rainstorm or fast snowmelt, causes an increase in river flow. Note that high water flow conditions that are not related to storm events can exist (particularly in the spring). Also, rainstorms can occur that result in no increase in stream flow and therefore there is no stream event.

Circle the appropriate description of event conditions exhibited ***in the stream***. Event conditions are increased river flow above what would be considered typical or normal for the stream for the time of year. The surveyor needs to determine this based on the following:

- Their knowledge of recent weather conditions (e.g. how much it has rained recently).
- Visual stream observations (look for event related conditions such as a rising or recently elevated water level, water running off the land into the stream, fast stream water velocity, increased water turbidity, an increase in the amount of debris being carried by the stream, etc.).
- The surveyor's knowledge (or best guess) of what is typical flow for that (or a similar) stream, in that geographic area, for that season of the year.

None - No event conditions are evident. Stream flow conditions exist that are typical for the season of the year. Note that it is possible to have "high" flow conditions that are not due to a recent storm event.

| | | |
|---|---|---|
| Light | - | Stream exhibits increased turbidity from normal and/or the water level of the stream (stage height) is somewhat elevated above what would be considered typical for the season of the year. |
| Moderate | - | Stream stage height is elevated substantially above typical flow conditions for the stream, for that time of year. |
| Heavy | - | Bank full or flooding conditions exist. |

Days Since Rain: Circle the appropriate number of days that have passed since the last significant rain ended. This information is based on what you know about recent weather in the vicinity of the site. If you do not know, circle "unknown".

Water Temp: This is an optional data item. The person coordinating a particular watershed survey will determine if temperature measurements will be made. If measured, record the water temperature to the nearest degree fahrenheit or centigrade, making sure to include the scale units.

Water D.O.: This is an optional data item. The person coordinating a particular watershed survey will determine if dissolved oxygen (DO) measurements will be made. If measured, record the DO level in the river. If DO is measured, it is important that the water temperature be measured also.

Water pH: This is an optional data item. The person coordinating a particular watershed survey will determine if pH measurements will be made. If measured, record the pH of the stream to the nearest tenth.

Water Color: Circle the choice that best represents the color of the water.

Waterbody Type-upstream: Characterize the waterbody upstream of the study site and circle the appropriate category. The answer usually will be "stream", but not always. Impound=impoundment (dammed stream section/reservoir).

Waterbody Type-downstream: Characterize the waterbody downstream of the road crossing and circle the appropriate category.

Stream Width (ft): Circle the range that represents the average stream width in feet. Take width measurements of the stream at several points along the 300-foot assessment area, and indicate the average width here. These measurements are also useful in creating the Stream Site Sketch.

Avg. Stream Depth (ft): Circle the appropriate depth range in feet. Take depth measurements at several points within the 300-foot assessment area, and indicate the average depth here. This observation is for the average depth of the stream that is consistently observed. For example, if the stream is generally shallow (<1ft), but has a pool that is 3ft deep, circle the <1ft category since a pool is not representative of the average depth of <1ft observed over most of the stream.

Water Velocity (ft/sec): This is an optional data item. The person coordinating a particular watershed survey will determine if water velocity measurements will be made. If measured, record the approximate surface water velocity in feet per second, observed at the surface in the area of fastest river flow that is not impacted by a road crossing. One method is to observe how far downstream a floating object travels in one second (observe for 10 seconds and divide the distance by 10).

Stream Flow Type: Circle the category that best represents general flow volume in the stream. Describe the flow during the assessment in relation to the annual average flow. If a river flow is reduced in the summer, due to dry and hot conditions, circle "L" because it is below average, even though low flow may be typical for that stream in the summer.

| | | |
|---|---|---|
| Dry | = | No standing or flowing water, sediments may be wet. |
| Stagnant | = | Water present but not flowing, can be shallow or deep. |
| L (low) | = | Flowing water present, but flow volume would be considered to be below average for the stream. |
| M (medium) | = | Water flow is in average range for the stream. |
| H (high) | = | Water flow is above average for the stream. |

**d. Physical Appearance**

The following categories should be observed throughout the 300-foot assessment reach. If a category type (e.g. aquatic plants) is not present in the stream, circle "None". If a category type can be seen, in any amount, circle "present". If a category type is present in a large portion of the stream, circle "abundant".

Aquatic Plants: This category refers to aquatic macrophytes only, not terrestrial species. By definition, macrophytes are any plant species that can be readily seen without the use of optical magnification. However, the usage here is directed primarily toward aquatic vascular plants—plants with a vascular system that typically includes roots, stems and/or leaves. This includes duckweed, as it is a floating vascular plant. Certain large algae species that superficially look like vascular plants, such as Chara, can be recorded here as well. If the person conducting the survey is knowledgeable about aquatic plants, the particular type or species of plant(s) can be noted in the comment section at the end of the form. Floating, suspended, or filamentous algae species should be recorded in one of the algae categories and not here.

Floating Algae: The presence of suspended algae (single celled organisms that may or may not form colonies) or floating algae mats/bundles should be recorded here. This includes bluegreen algae mats/bundles, whether floating on the surface, suspended in the water column, or present at the bottom.

Filamentous Algae: Algae that appear in stringy or ropy strands, such as Cladophora. The strands may or may not be attached to other objects in the waterbody.

Bacterial Sheen/Slimes:
-Bacterial sheens occur as oily appearing sheens on the water surface, often with a silverish cast to them. The sheens are produced from bacterial decomposition activity, and occur most often in still water areas of lake edges and coves, as well as wetland areas. The sheen can be distinguished from petroleum products by breaking into

distinct platelets when poked with a stick or otherwise physically disturbed, whereas petroleum products remain viscous.
-Bacterial slimes are bacterial growths that are visible as a slimy-appearing coating of stream or lake substrates. They can be various colors, including black and orange.

Turbidity: Water appears cloudy—it is not transparent. Turbidity is caused by suspended particulates such as silt, sand, algae, or fine organic matter. Turbid water is opaque to varying degrees, preventing the observer from seeing very far into it. Note that water can have a color to it that is not turbidity, such as the brown transparent water often associated with swampy areas. If the water is slightly turbid, circle "present". If it is moderately turbid to very turbid, circle "abundant".

Oil Sheen: An oily appearing sheen on the water surface caused by petroleum products. A thin sheen will often have a rainbow of hues visible. The sheen can be distinguished from bacterial sheens by remaining viscous when poked with a stick or otherwise physically disturbed, whereas bacterial sheens break into distinct platelets.

Foam: Naturally occurring foam often looks like soap suds on the water surface and can be white, grayish or brownish. Foam is produced when water with dissolved organic material is aerated and can range in extent from individual bubbles to mats several feet high. Foam is typically produced in streams when water flows through rapids or past surface obstructions such as logs, sticks and rocks. Simple wave action can produce foam in lakes. This naturally occurring foam is quite common. Natural foam can be distinguished from soap suds by rubbing it between the fingers. If the suds disintegrate and leave only wet fingers or a gritty residue, the foam is natural. If the suds feel slippery and soapy, or smell perfumed, it is not natural foam.

Trash: Use this category to record the presence of general litter, such as paper, bottles, cans, etc., either in the waterbody or along the riparian banks. Use some reasonable discretion when completing this category. A single piece of gum wrapper on one bank would not be sufficient cause for checking "present".

**e. Substrate**

Substrate is the material that makes up the bottom of the stream. In general, good quality substrates (from an aquatic habitat perspective) contain a large amount of course aggregate material—such as gravels and cobbles—with a minimal amount of fine particles surrounding or covering the interstitial pore spaces. These stable materials provide the solid surfaces necessary for the colonization of attached algae and the development of diverse macroinvertebrate communities.

Using the particle size and composition guidance provided below, identify the percent areal extent of each substrate type present. The composition estimate should include the entire area of the stream bottom in the study site (typically, 300 feet of stream).. Sometimes it is not possible to determine the substrate type all the way across a river because it is too deep or the water is turbid. In these cases, assign the appropriate percentage amount to the "unknown" category.

| **Substrate Type** | | **Composition and Size** |
|---|---|---|
| Boulder | - | Rocks 10 inches in diameter or larger. |
| Gravel-Cobble | - | Rocks 1/12 inch to 10 inches in diameter. |
| Sand | - | Rocks 0.06 to 2 millimeters in diameter. |
| Silt-Muck-Detritus | - | Silt is usually clay, very fine sands, or organic soils, 0.004 to 0.06 millimeters in diameter. Muck is decomposing organic material of very fine diameter. Detritus is small particles of organic material such as pieces of leaves, sticks, and plants. |
| Hardpan-Bedrock | - | Solid surface. Hardpan is usually packed clay, <0.004 millimeters in diameter. Bedrock is a solid rock surface (the tops of buried boulders are not bedrock). |
| Artificial | - | Human made, such as concrete piers, sheet piling or rock riprap (that portion of shoreline erosion protection structures that extends below the water surface is considered substrate). |
| Unknown | - | The portion of the stream bottom for which a substrate type determination can not be made because the bottom can not be seen due to water depth or turbidity. |

### f. In-stream Cover

In-stream cover generally refers to habitat cover that is available to fish to: (1) protect them from predators, or (2) avoid certain stream conditions such as fast flow velocities or direct sunlight. Check all the instream cover types on the data form that are present in the stream reach for as far as can be seen—except, only check those cover types that are in areas of sufficient water depth (usually greater than 6 inches). Types of cover include the following:

| | | |
|---|---|---|
| Undercut Banks | - | Stream banks that overhang the stream because water has eroded some of the material beneath them. |
| Overhanging Veg | - | Terrestrial vegetation that extends out from shore over the surface of the stream within a foot or two of the water surface (includes trees, shrubs, grasses, etc.). This category also includes sweeping vegetation, which is terrestrial shoreline vegetation that extends into the water itself (such as low hanging branches on shrubs) and is therefore often “swept” in a downstream direction by the current . |
| Deep Pools | - | A depression or “hole” in the bottom of the stream where the water is substantially deeper than the average water depth of the stream. |

| | | |
|---|---|---|
| Boulders | - | Rocks 10 inches in diameter or larger. |
| Aquatic Plants | - | Aquatic macrophytes. |
| Logs/woody Debris | - | Logs, branches and roots. |

**g. Stream Morphology**

Riffle

Riffles are areas of naturally occurring, short, relatively shallow, zones of fast moving water, typically followed by a pool. The water surface is visibly broken (often by small standing waves) and the river bottom is normally made up of gravel, rubble and/or boulders. Riffles are not normally visible at high water and may be difficult to identify in large rivers. The size of, and distance between, riffles is related to stream size. In large mainstream reaches, such as the Manistee or Muskegon rivers, riffles may be present in the form of rapids.

| | | |
|---|---|---|
| Present | - | A riffle can be positively identified. |
| Abundant | - | A series of riffles and pools are visible. |

Pool

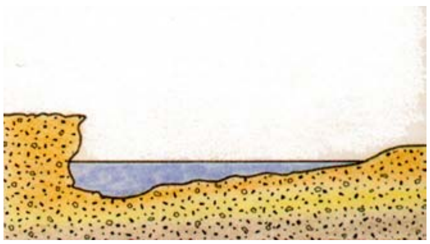
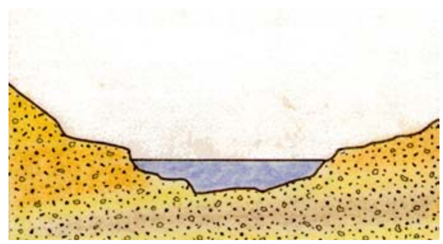
Pools are areas of relatively deep, slow moving water. The key word here is “relatively”. Water depth sufficient to classify an area as a pool can vary from around 8 inches in small streams, to several feet in wadable streams, to tens of feet in large rivers. Pools are often located on the outside bend of a river channel and downstream of a riffle zone or obstruction. The water surface of a pool is relatively flat and unbroken. The presence of pools in large rivers may be difficult to identify because of an increase in relative scale, and an often limited ability to see to the bottom of deep or turbid stream reaches.

| | | |
|---|---|---|
| Present | - | At least one pool can be identified. |
| Abundant | - | A series of pools in a riffle pool sequence are visible. |

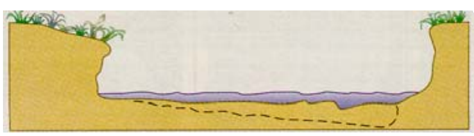
<u>Channel</u>

The channel condition, for the purposes of this assessment, is classified as Natural, Recovering, or Maintained.

**Natural Stream** - A natural stream has not been altered from its defined pattern, dimension and profile by artificial means, which includes straightening and widening. It is not necessarily stable, however. The stream has a non-uniform cross section with distinct pool and riffle sequences, although in large rivers the pool/riffle sequences may be difficult to identify. Mild to extreme meanders are often visible. The banks are vegetated and there are no signs of spoil piles or dikes along sides. The stream is not channelized or artificially controlled.

**Recovering** - A recovering stream is one that has been straightened or otherwise controlled, and is evolving back to a stable pattern, dimension and profile. The stream channel is relatively straight, or is overly wide with a channel within the wider channel. Meanders may be beginning to form as evidenced by bank erosion and pool formation. Pools and riffles should be forming but may be sparse. Point bars may be forming. Vegetation may be sparse or very young. Defined dikes or spoil piles along the stream bank can be identified.




**Maintained** - A maintained stream channel is one that is actively controlled through dredging, widening, straightening, or the formation of dikes along the stream channel. The stream channel is straight, wide and shallow at low flow, and has a uniform cross section. Bank vegetation is typically sparse or very young. Pools and Riffles are not existent or very sparse.

Designated Drain

If the surveyor knows whether or not the stream segment being assessed is a legally designated drain under the Michigan Drain Code, circle “Y” (yes) or “N” (no). If the surveyor does not know, circle the “?”.

Highest Water Mark

The highest water mark is the maximum height to which the stream water level rises at the site, as determined by the visible evidence present. This level is typically reached during floods or high flow conditions. The highest water mark is determined as the distance in feet **above the present water level** at the site. If the surveyor cannot visibly determine how far the stream rises at the site, circle the “?” on the form.

The highest water mark may be visible as discoloration on bridge pilings or abutments, stream debris (trash, leaves, weeds) left along the stream banks or in tree/shrub branches, ice scour marks on trees or streambanks, or muddy residues left in floodplains or on streamside vegetation.

Stream Cross Section

Draw a rough cross section of the stream profile. This should be just a general approximation. Do not spend more than a few seconds on this.

**h. Stream Corridor**

The questions in this section are used to characterize terrestrial land cover and land use in the vicinity of the stream, often referred to as the stream corridor.

Riparian Vegetative Width

The riparian vegetative width is the width of the streamside natural vegetation zone along the stream banks. The width is measured from the edge of the stream to the end of the contiguous block of natural vegetation. Natural vegetation is defined as including trees, shrubs, old fields, wetlands, or planted vegetative buffer strips (often used in agricultural areas and stormwater runoff control). Agricultural crop land and lawns are **not** considered natural vegetation for the purposes of this question. Circle the appropriate distance (in feet) that represents the **average, or most representative** (>50% of the lineal bank distance) width of the vegetation zone for each side of the river. Left and right banks are determined from the perspective of facing downstream.

Bank Erosion

Bank erosion may occur as a result of natural flow conditions, or may be caused by human activities. Determine the severity of erosion that has taken place and circle the appropriate category. Record the most severe magnitude of erosion observed on either bank.

| | | |
|---|---|---|
| 0 | - | The banks appear stable and there is no evidence of erosion. These banks have stable toes and sidewalls, are most likely well vegetated or structurally stabilized, and have no evidence of exposed tree roots or leaning trees due to eroded soil. They are not being altered by water flows, livestock access, or recreational access. |
| L | - | Low evidence of erosion. Streambanks are stable but are being lightly altered. <u>Less than 10%</u> of the streambank is receiving any kind of stress. Stress that is noted is very light. Less than 10% of the bank is sloughing, broken down, or actively eroding. |
| M | - | Moderate evidence of erosion. At least 75% of the streambank is in stable condition. <u>Between 10% and 25%</u> of the streambank is sloughing, broken down, or actively eroding. |
| H | - | High evidence of erosion. Less than 75% of the streambank is in stable condition. <u>Over 25%</u> of the streambank is sloughing, broken down, or actively eroding. Streambank sidewalls may have been scraped by machinery or scouring flows, banks may be slumped, bank toe may be severely undercut. Tree roots may be exposed or fallen/leaning trees may be present. |

<u>Streamside Land Cover</u>

Circle the letter of the dominant type of cover that exists at the streambank “edge” (within the first 20 feet or so of the stream edge) along the reach of river that can be seen from the road stream crossing.

| | | |
|---|---|---|
| Bare | - | Bare ground. No, or almost no, streamside vegetation. |
| Grass | - | Grasses, wildflowers, ferns, sedges (non-woody vegetation). |
| Shrub | - | Shrubs and small trees. Woody vegetation less than 15 feet high. |
| Trees | - | Trees (15 feet tall or higher). |

<u>Stream Canopy</u>

The stream canopy is the amount of leafy vegetation that extends out over a stream (at any height) and shades the water from direct sunlight. The average amount of stream canopy should be recorded as the amount of water shading that would be present *if the sun were directly over the stream.*

| | | |
|---|---|---|
| <25 | - | Less than 25% of the stream would be shaded. |
| 25-50 | - | 25-50% of the stream is shaded. |
| >50 | - | Over 50% of the stream is shaded. |

Adjacent Land Uses

Circle the appropriate left or right streambank (facing downstream) designation for all of the following land uses that are adjacent to the stream. Land use along the entire length of stream that can be seen from the road stream crossing should be evaluated. This might include land that is beyond the riparian corridor. “Adjacent” requires the use of some judgement on the part of the surveyor, but generally refers to any land that can be seen from the crossing and is reasonably close to the stream such that pollutants could run off it into the stream. For example, if a 20-acre corn field is near a stream but separated from it by a 10’ grass/shrub buffer strip, the “Rowcrop” category should be circled. If the same field were 100’ from the stream and the intervening distance was wooded, the “Forest” category should be circled.

| | | |
|---|---|---|
| Wetlands | - | Wetland vegetation is present. May or may not include standing water. Could include shrubs and trees. |
| Shrub or Old Field | - | Meadow or field that has not been recently cultivated or grazed. Often represented by tall grasses and shrubs. |
| Forest | - | Trees present in forested setting (includes small woodlots). Trees may be cultivated or natural. |
| Pasture | - | Field showing signs of being recently or actively grazed by livestock (vegetation is cropped close to the ground). |
| Crop Residue | - | An agricultural crop residue remains, after harvest and/or tillage, which covers 30% or more of the field surface. |
| Row crop | - | Agricultural cropland planted in rows and cultivated. |
| Res. Lawns, Parks | - | An expanse of maintained grass, often found in residential lawns and parks. |
| Impervious | - | Impervious surfaces (water can not penetrate them) are present near the water. Includes paved surfaces and roofs. |
| Disturbed Ground | - | Soil has been disturbed (plowed, cleared, bulldozed, excavated) for construction or agriculture. Vegetation is not present on disturbed ground but may be present in adjacent areas. |
| No Vegetation | - | Bare ground. No vegetation is present on the soil, but it is not disturbed ground. |

**i. Potential Sources**

The intent of this section is to evaluate the relative importance of potential sources in terms of pollutant contribution to the waterbody at a given site in the watershed. The evaluation assesses the potential for pollutant inputs at the site, **NOT pollutant impacts**, or the potential for pollutant impacts. Pollutant impacts, as indicated by visual manifestations, were evaluated previously on the first page of the data sheet.

Evaluating potential sources of pollutants to a waterbody is a three step process: identification of potential sources, evaluation of pathways for pollutants to get to the waterbody, and finally evaluation of the severity (magnitude) of this pollutant input or loading. The three steps of this process will result in scoring identified sources on the survey sheet as Slight, Moderate, or High Priority in terms of the severity or amount of their pollutant contribution to the waterbody at the site being surveyed.

(1) Source Identification

Visually evaluate the various land use/land change activities at the site for potential sources of pollution. Note all potential sources for the area that can be seen (choosing from among the list of sources on the data sheet). For example, is there evidence of soil disturbance at the site, or land uses such as residential lawns, agricultural fields, parking lots, urban areas, etc., near the waterbody? Use the source definitions provided to help identify what potential sources may exist. If it is known that a significant source exists upstream of the study site, such as a wastewater treatment plant, it may be important to note the presence of that source, but it should be recorded in the comments section since it was not visible at the site.

(2) Pollutant Pathway

Next, for each potential source that has been identified, evaluate how pollutants could get from the source to the water. An evaluation of likely pathways for pollutants to enter the waterbody provides information regarding the potential for the identified sources to contribute pollutants. The following provides a quick outline of some visual observations to consider in evaluating pollutant pathways. Pay particular attention to likely water runoff patterns at the site that may occur during rainfall or snowmelt events.

- Gully/rill erosion provides a direct pathway for pollutants to enter the stream in a concentrated flow when the land slopes toward the stream. Pollutants associated with eroding soils will vary depending on the type of land use activity.
- Tile/pipe discharges are potential direct pathways for pollutants.
- Bare soils near the edge of a waterbody provide a likely pathway for sediment to get to the waterbody.
- Maintained lawns to the edge of a waterbody provide a likely pathway for nutrients and pesticides to the waterbody.
- Land disturbance/use activities to the edge of a waterbody provide a likely pathway for various pollutants to the waterbody.
- Open areas of disturbed soils and/or bare soils devoid of vegetation provide a potential pathway for pollutants via wind erosion.
- Steep streambanks (steeper than a 2:1 slope) devoid of vegetation are likely pathways for sediment.
- No canopy over the waterbody is a pathway for dramatic thermal increase in water temperature during the day.
- Impervious surfaces (parking lots, roads, roof tops, etc.) provide a likely pathway for various pollutants, and may increase flows in the watershed causing flashiness.

- Culverts/bridges may not be aligned with the stream, or may be undersized, and could provide a likely pathway for flow to create streambank erosion both upstream and downstream of the culvert or bridge.

(3) Severity Ranking

Finally, for each source for which a pathway has been identified, evaluate how severe the pollutant loading is. Rank each source identified as Slight, Moderate or High severity for the contribution of pollutants, based on the magnitude or quantity of pollutants likely to be delivered to the stream. The surveyor must use their judgement on assigning a slight, moderate or high rating.

**The severity ranking is based only on *pollutant inputs* from the specific source *at the site*, not on visible stream impacts or impacts the pollutant may cause downstream.** The pollutant loads from the identified source(s) may or may not have an impact at the site.

Evaluation of the source, location and pathways can provide a reasonable assessment of the severity of the pollutant loading. The following provides a quick outline of some visual observations to consider in evaluating the severity of pollutant loading.

- Proximity to waterbody – generally the closer the use, or land disturbance activity, is to the waterbody, the greater the likelihood for pollutant delivery.
- Slope to waterbody – generally the steeper the slope/topography to the waterbody, the greater the likelihood of overland pollutant delivery.
- Conveyance to waterbody (ditch, pipe, etc.) – generally a conveyance from the use, or land disturbance activity, increases the likelihood of pollutant delivery.
- Imperviousness – impermeable surfaces reduce the amount of land area available for water infiltration and increase the potential for overland runoff. Additionally, if a watershed is greater than 10% impervious, it will start to show some systemic problems due to impacts from flow. If a watershed is greater than 25% impervious, the natural hydrology is generally heavily impaired.
- Intensity and type of use, or land disturbance activity – generally the more intensive the activity the greater the likelihood for the generation of pollutants. Certain activities may have specific types of pollutants associated with them.
- Size of erosion area – generally the larger the erosion area the greater the likelihood for sediment delivery.
- Soil type – clay is less permeable than sand, and therefore would create a greater potential for overland runoff of pollutants.
- Presence and type of vegetation – the greater the vegetative buffer around a waterbody, the better the filtration of pollutants from nearby land disturbance and use activities. Certain types of vegetative buffers work better than others and should be evaluated on a case-by-case basis.

## Potential Source Category Definitions:

| Source Category | Use this Source Category if … |
|---|---|
| **Crop Related Sources** | **… there is a reasonably clear pathway for pollutants to enter the waterbody from the farmed area. Possible pathways: farming to the edge of the drain, gully/rill erosion off field, tile discharge, wind erosion off field.** |
| **Grazing Related Sources** | **… there is clear evidence that grazing of animals near or in the waterbody has resulted in the degradation of streambanks or stream beds, sedimentation, nutrient enrichment, and/or potential bacterial contamination.** |
| **Intensive Animal Feeding Operations** | **… there is a reasonably clear pathway for pollutants to enter the waterbody from either runoff from the operation or land application of animal manure. Possible pathways: overland flow, tile discharge.** |
| **Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)** | **… there is clear evidence that transportation infrastructure is creating increased flow, runoff of pollutants, or erosion areas in or adjacent to the waterbody.** |
| **Channelization** | **… there is clear evidence that the natural river channel has been straightened to facilitate drainage.** |
| **Dredging** | **… there is clear evidence that a waterbody has been recently dredged. Evidence might include: spoil piles on side of waterbody, disturbed bottom, disturbed banks.** |
| **Removal of Riparian Vegetation** | **… there is clear evidence that vegetation along the waterbody has been recently removed (within the last few years).** |
| **Bank and Shoreline Erosion/ Modification/Destruction** | **… there is clear evidence that the banks or shoreline of a waterbody have been modified through either through human activities or natural erosion processes.** |
| **Flow Regulation/ Modification (Hydrology)** | **… there is reasonably clear evidence that flow modifications in the watershed have created unstable flows resulting in streambank erosion.** |
| **Upstream Impoundment** | **… there is reasonably clear evidence that an upstream impoundment has contributed to impacts on downstream sites. Impacts may be: nuisance algae, increased temperatures, streambank erosion from unstable flows.** |
| **<u>Construction:</u>Highway/Road /Bridge/Culvert** | **… there is clear evidence that on going or recent construction of transportation infrastructure is contributing pollutants to the waterbody.** |
| **<u>Construction:</u> Land Development** | **… there is clear evidence that on going or recent land development is contributing pollutants to the waterbody.** |
| **Urban Runoff (Residential/ Urban NPS)** | **… there is a reasonably clear pathway for pollutants to enter the waterbody from an urban/residential area. Possible pathways: gully/rill erosion, pipe/storm sewer discharge, wind erosion, runoff from lawns or impervious surfaces.** |
| **Land Disposal** | **… there is a reasonably clear pathway for pollutants to enter the waterbody from an area where waste materials (trash, septage, hazardous waste, etc.) have been either land applied or dumped. Possible pathways: gully/rill erosion, pipe discharge, wind erosion, or direct runoff.** |

| Source Category | Use this Source Category if … |
|---|---|
| **On-site Wastewater Systems (e.g. septic systems)** | **… there is reasonably clear evidence of nutrient enrichment and/or sewage odor is present, and there is reason to believe the area is unsewered.** |
| **Silviculture (Forestry NPS)** | **… there is a reasonably clear pathway for pollutants to enter the waterbody from the forest management area. Possible pathways: logging to the edge of the waterbody, gully/rill erosion off site, pumped drainage, erosion from logging roads, wind erosion off site.** |
| **Resource Extraction (Mining NPS)** | **… there is a reasonably clear pathway for pollutants to enter the waterbody from the mined area. Possible pathways: gully/rill erosion off site, pumped drainage, runoff from mine tailings, wind erosion off site.** |
| **Recreational/Tourism Activities (general)** | **… you are unable to clearly identify the recreational source as related to a golf course, or recreational boating activity. Foot traffic causing erosion would fall into this category.** |
| **Golf Courses** | **… there is a reasonably clear pathway for pollutants to enter the waterbody from the golf course area. Possible pathways: overland runoff, gully/rill erosion off course, tile discharge, wind erosion off course.** |
| **Marinas/Recr. Boating (water releases)** | **… if you can reasonably determine that releases of pollutants to a waterbody such as septage or oil/gasoline are due to recreational boating activities.** |
| **Marinas/Recr. Boating (streambank erosion)** | **… you can reasonably determine that streambank erosion is due to wake from recreational boating activities.** |
| **Debris in Water** | **… debris in the water either is discharging a potential pollutant, or is causing in stream impacts due to modifications of flow. Possible examples: Leaking barrel, Refrigerator, Tires, etc. This does not include general litter (e.g. paper products).** |
| **Industrial Point Source** | **… there is reasonably clear evidence that an upstream industrial point source has contributed pollutants.** |
| **Municipal Point Source** | **… there is reasonably clear evidence that an upstream municipal point source has contributed pollutants.** |
| **Natural Sources** | **… there is reasonably clear evidence that natural sources are contributing pollutants. Possible examples: streambank erosion, pollen, foam, etc.** |
| **Source(s) Unknown** | **… if you see an impact but are unable to clearly identify any likely sources.** |

Additional Comments:

Any observations about the site that were not covered elsewhere on the survey form should be recorded in this section. If certain survey responses require clarification or elaboration, those should be described here as well. The comment section can also be used to add detail to the site characterization, such as listing the types of aquatic plants or algae present, if known.

In addition, any unique conditions or issues that arose or were observed during the assessment process should be noted here.

Finish Time: Record the time that the assessment was completed.

Completeness: A volunteer team member *other than the person who filled out the data sheets* must check the data sheet for completeness before the team leaves the site. This verification of completeness should be noted at the bottom of each page.

**j. Site Sketch**

A site sketch should be made of the 300-foot study site each time the stream habitat is assessed. Draw a bird's eye view of the study site. Include enough detail that someone unfamiliar with the site could easily find the site again. It is important to include a north arrow, the direction of water flow, and notable stream, upland, and location features in the sketch.

2. Stream Macroinvertebrate Monitoring

**a. Streamside Procedures**

Stream Location Information:

MiCorps Site ID#: A site ID# for each of your study sites will be assigned to you by MiCorps. If you do not know the MiCorps Site ID#, leave this space blank.

Stream Name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area. For tributary streams to major rivers, record the tributary stream name here, ***not*** the major river name. If the tributary is an unnamed tributary, record as "Unnamed Tributary to" followed by the name of the next named stream downstream. For example, a station on an unnamed tributary of Hogg Creek would be recorded as "Unnamed Tributary to Hogg Creek".

Location: This is often the name of the road from which you access the study site. It is very important to indicate whether the site is upstream or downstream of the road. If the same road crosses a single stream two or more times, it is sometimes desirable to record the road name relative to the nearest crossroads (e.g. "Green Road between Brown Road and Hill Road").

Date: Record the month, day and year.

Collection Start Time: Record the time when macroinvertebrate sampling begins. Use 24-hr time (e.g. 1:00 PM should be recorded as 1300).

- *Major Watershed*: Record the name of the major watershed where the study site is located (e.g., Grand River Watershed, St. Mary's River Watershed), and the corresponding HUC Code, if known.
- *Latitude and Longitude:* Record the latitude and longitude coordinates of the study site. Ideally, these coordinates will correspond to the midpoint of the stream study reach. Sources for these coordinates include a GPS unit, a topographic map, or digital maps, such as www.topozone.com.

Monitoring Team: Record the name of the person completing the datasheet, the person doing the actual in-stream macroinvertebrate collecting, as well as other team members participating in the assessment.

Stream Conditions:

Average Water Depth : This value can be taken from the Stream Habitat Assessment datasheet, if completed at the same time. Otherwise, to measure average water depth (ft), three measurements should be made at random points along the representative reach length being surveyed, and these values averaged for a mean depth.

Siltation: Some siltation along stream margins is normal. However, silt that settles on gravel, cobble, and woody debris in the main stream channel can have a negative impact on the benthic invertebrates that colonize these substrates and also can affect fish reproduction. Note on the data form whether there is obvious siltation on the dominant substrate types in the main stream channel.

Embeddedness: Embeddedness refers to the extent to which gravel, cobble, or boulders are surrounded or covered by fine material (such as silt or sand). The more the substrate is embedded, the less its surface area is exposed to the water and available for colonization by invertebrates. Record the appropriate level of embeddedness observed in the stream reach. This is measured as the percentage of an **individual** substrate piece, such as a rock, that is covered on average.

Fish or Wildlife: During the macroinvertebrate survey, volunteers should take note of any fish or wildlife (frogs, turtles, ducks, etc.) that may be visible in or near the stream and document any observations on the survey form.

Note if any crayfish or large clams, that would not fit in the sample jar, were found at the site but not collected. Many freshwater clams are rare or endangered, and should not be disturbed. Remember, however, to include these organisms in the Stream Quality Score on the second page of the data sheet.

<u>Macroinvertebrate Collection:</u>

The sampling effort expended to collect benthic macroinvertebrates at each site should be sufficient to ensure that all types of benthic invertebrate habitats are sampled in the stream reach. This generally will be about 30 minutes of total sampling time per station. Macroinvertebrate samples should be collected from all available habitats within the stream reach using a dip net with a one millimeter (mm) mesh, a kick screen made from doweling and window screening, or by hand picking. Habitat types can include riffles, pools, cobbles, aquatic plants, runs, stream margins, leaf packs, undercut banks, overhanging vegetation, and submerged wood. Habitat and substrate types from which macroinvertebrates were collected (or collections were attempted) should be recorded on the form; include as many as possible.

Collecting should begin at the downstream end of the stream reach and work upstream.

All organisms collected should be placed into a bucket or tray. The composite sample should be rinsed and all large pieces of debris removed. The remaining sample contents should be emptied into enamel or plastic pan(s) with a light-colored bottom. The team of volunteers should then sort through the collection and place the macroinvertebrates into jar(s) of 70% ethanol preservative for later identification. Volunteers should be shown how to pick through the tray, and to inspect rocks and other debris, emphasizing hidden locations under bark and in caddisfly cases. Be sure that every jar has a label written in pencil and placed inside the jar. It is recommended that all individuals collected be placed in the sample jar. However, in cases where there are VERY large numbers of clearly identical organisms, no more than approximately 15 individuals need to be included in the collection.

** *While macroinvertebrates collected from the stream can be identified to order in the field by experienced collectors, the collected organisms must still be preserved in labeled sample jars and retained by the volunteer monitoring program for verification purposes. See "Macroinvertebrate Monitoring: Is It Good for the Stream?" in the MiCorps Monitor, Issue 2 (April 2006) for more information (www.micorps.net/newsletter.html)* **

**b. Macroinvertebrate Identification and Stream Quality Assessment**

The organisms in the collection should be identified to order or sub-order, as indicated, using taxonomic keys. The abundance of each taxon in the stream study site should be estimated and recorded on the survey form (R=Rare [1-10 organisms], C=Common [11 or more organisms]).

The total stream quality score should be calculated as indicated on the survey form. This score is then used to rank the site as excellent, good, fair, or poor.

Identification Confidence: The name(s) of those determining the identification of organisms in the sample should be recorded, as well as a numerical rating of confidence in the identifications.

For more information, or to view the latest version of this procedure and MiCorps data sheets, visit the MiCorps website at www.micorps.net.