MPCA STREAM CONDITION AND STRESSOR IDENTIFICATION (SCSI) PROTOCOL FOR STREAM MONITORING SITES

I. PURPOSE

To describe the methods used by the Minnesota Pollution Control Agency's (MPCA) Biological Monitoring Program to collect documentation of general stream and riparian condition. This documentation will accompany the Minnesota Stream Habitat Assessments (MSHA) and assist in providing evidence of stressors and causal mechanisms that may be visible at time of sampling to better inform the Stressor Identification process.

II. SCOPE/LIMITATIONS

This procedure applies to all river and stream monitoring sites for which Phase I stream assessments are being conducted to assess stream health using fish and macroinvertebrate communities and water quality. This procedure may also be applied during the Phase II Stressor Identification process as needed.

III. GENERAL INFORMATION

Sites are selected for stream biological assessment for various reasons, 1) EMAP random sampling, 2) intensive watershed surveys, 3) sites selected for the development and calibration of biological criteria, and 4) special investigations of suspected sources of pollution. Although the reasons for assessment vary, this protocol is intended to support the benefits of the intensive watershed surveys.

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. The field crew leader will

conduct periodic reviews of field personnel to ensure that procedures are being followed 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 a form, pencil, and camera, are present before commencement of this procedure.

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***"). Unless otherwise instructed, observations recorded should be limited to the sampling reach. 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. ***The Stream Condition and Stressor Identification Worksheet*** is completed immediately after fish sampling in order to provide the evaluator a perspective of the quality of fish habitat, general stream channel condition, and potential stressors.

C. MPCA Stream Condition and Stressor Identification Worksheet

This worksheet documents instream, riparian, and adjacent land use characteristics that may influence water chemistry, biology, physical channel structure, and habitat quality within and occasionally upstream of the sampled reach.

Stream conditions and potential stressors are recorded based on a presence/absence based observation method. The following documents were consulted during development of the SCSI worksheet: Stream Visual Assessment Protocol (USDA-NRCS 1998. Technical Report 99-1. National Water and Climate Center, Portland, Oregon) and Remote Sensing and Field Surveys Techniques for Conducting Watershed and Reach Level Assessments (Vermont Agency of Natural Resources 2004. Stream Geomorphic Assessment Program, Waterbury, Vermont), and the Qualitative Habitat Evaluation Index (Ohio EPA, 2007).

Observations are recorded on the **MPCA Stream Condition and Stressor Identification Worksheet**. A copy is attached and guidelines for filling out this data sheet are described in the following pages.

C.1. Stream Documentation –

1) *Field Number* – A seven-digit code that uniquely identifies the station. The first two digits identify the year the sampling station was established, 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. South Branch Wild Rice River).

3) *Date* – The date the worksheet was completed in month/day/year format (MM/DD/YY).

4) *Person Scoring* - The personnel completing the SCSI worksheet.

C.2. General Reach Condition

1) *Photographs of reach segments (frame #)* - In the first photograph, identify the site by writing the field number on a piece of paper held within the picture frame (just for tracking purposes, these do not get stored on the x:drive). Next ,take two pictures (one facing downstream and one facing upstream) at each of the

following three locations: the downstream end (DD, DU), the mid-point (MD, MU), and the upstream (UD, UU) end of the station. Finally, locate a position on the landscape from which to take a wide view (WV) of the floodplain/riparian zone and/or land use adjacent to the stream (e.g., from road or bridge). Record the order the photos were taken or the frame numbers of each image to assist in identifying the pictures after downloading (see *Downloading and Storing Images* on the last page of the SOP for examples).

2) *Comments - stream condition/SID images* – Use this space to record any general comments of overall stream condition as well as additional descriptions of Stressor ID images taken. Place an "*" next to the description if you would like to incorporate comments to the *Photo Form* in *StmBioMon.mdb*.

C.3a. Riparian Condition – Indicating the riparian condition from 0-15 and 15-30 m for both banks above and below the X point. A percentage of the land that is undisturbed, rounded to the nearest 10% will be recorded in the appropriate column for Left Bank (LB) and Right Bank (RB) from 0-15 meters and 15-30 meters. Include comments on the type of disturbance observed.

C 3b. Row Crop Agriculture – First, indicate (Yes, No) if row-cop agriculture is planted w/in or adjacent to the minimum buffer width (MBW) used for shoreland rules [natural streams (NA) = 50 ft from high water mark, channelized streams (OC) = 16.5ft from top of bank]. Next, indicate the percentage of row crop within the minimum buffer width by stream type for each stream bank. The percentage will be based on the percentage of the land that is actively engaged in row crop agriculture. Round to the nearest 10% and record the value in the appropriate column for Left Bank (LB) and Right Bank (RB).

C.4. Stream Condition and Stressor Identification Checklist – Use this area to record any noteworthy observations of potential stress related conditions by using the *SCSI checklist*. In each of the sub categories there is an empty box to add any addition issues seen. Each of these components is described below:

A. Checklist for Stream Condition/ Hydrologic Influences – Check if present. Check when photo taken or label S1, S2, etc. Include additional comments/descriptions of images (if needed) in section 2B on form.

1) Substrate Quality – Observations of the quality of the substrate in the riffles, runs and pools.

Run/Riffle Substrate Suitable for Lithophilic Spawners: Presence of Gravel and/or Cobble substrate with 25% or less embeddedness with sustained flow.

Excess Sedimentation in Riffles: Newly deposited or shifting sediments in the Riffles. May be seen as high embeddedness where coarse substrates are present.

Excess Sedimentation in Runs: Newly deposited or shifting sediments in the Runs. May be seen as high embeddedness where coarse substrate is present.

Excess Sedimentation in Pools: Newly deposited or shifting sediments in pools. May be seen as high embeddedness where coarse substrates are present. Bottom can be difficult to walk on as feet may sink into unconsolidated fine sediment.

2) Wetlands/Groundwater – Presence of wetlands, or wetland attributes at or upstream of a site:

Draining/Downstream of a Wetland: Stream is immediately downstream of a wetland. Problem sites may have a very large wetland area upstream of site.

Channel through Wetland: Single channel going through a wetland. Likely a straight line channelized site because of dredging years ago. Banks are normally made up of wetland plants like cat tails and sedges, and do not have solid banks.

Wetland Riparian: Riparian area around stream is not a solid bank. These areas normally have a natural channel and are low areas of cattails, grass with hummocks or small shrubs and brush.

Springs/Groundwater Seeps: Upwelling of cold groundwater can be felt along stream bottom or at toe of banks. Oxidized iron and iron utilizing bacteria may be visible (rust or red colored flock). Fine sediments may be soft or in suspension where upwellings occur.

3) Hydrologic influences – Observations of physical indicators of natural flow paths or human-induced alterations to normal stream flow patterns or pathways. Potential items likely to be encountered are described:

   Draintiles: Tile outflow pipes visible along stream bank.

   Storm Water Culverts: Large culverts (>60 cm diameter) visible along stream reach; water generally collected from roadways, parking lots or residential streets.

   Center Pivot Irrigation: Center Pivot Irrigation units are visible along the riparian zone or upland of the stream reach.

   Irrigation Pumps in Stream: Submersible pumps in the stream that are used to irrigate the surrounding land. Likely in residential areas next to streams.

4) Blockages to fish passage – natural, animal or man-made impediments that prevent large fish from traveling easily between sections of the reach. These may be observed within reach or downstream of the reach that is being sampled. The following are examples of conditions that may impede fish passage:

   Perched Culvert: Bridge culverts that have an artificial waterfall >15 cm vertical drop or interrupted break in water flow.

   Dam Upstream of Site: Any dam that will block fish passage within a mile upstream of site.

   Dam Downstream of Site: Any dam that will block fish passage within a mile downstream of site.

   Natural Grade Controls/ Waterfalls/ Shallow Riffles: Any natural waterfall or other shallow or steep area that prevents fish movement.

   Beaver Dams: Active beaver dams that prevent water flow and fish movement.

   Artificial Grade Controls/ Check Dams: Any man made dams or grade control that prevents fish movement.

   Rock Dams: Rock dams normally put in by people to create pools in the river. Downstream dam prevents fish movement.

   Carp Barrier: Barrier gates, dams, or electric fields to prevent carp movement, and causes other fish species movements to be limited.

B. Stressors- Nutrient/Sediment checklist - Check if present and when a potential problem. Check when photo taken or label S1, S2, etc. Include additional comments/descriptions of images (if needed) in section 2B on form.

5) Excess nutrients – Abundance of the following may indicate nutrient impairment or contribute to diurnal fluctuations in dissolved oxygen due to high biological oxygen demand (BOD):

   Filamentous or Substrate Algae: Green strands, long and hair like; often found attached to submerged logs or coarse substrates. Can be a problem when growing filamentous algae is matted or covering large areas of the stream channel.

   Blue-green Algae: Presence of Cyanobacteria that forms a bright blue-green paint-like coating on the water's surface. Can be a problem when algae covers large areas of the waters surface.

Dense Macrophytes: Plant growth that is extremely thick, causing high DO swings and preventing fish movement within the stream.

Duckweed: Presence of Duckweed in a stream usually indicates a high nutrient load. Problems conditions are often seen when flow is minimal or absent and the entire surface of a stream is covered in Duckweed.

6) Riparian zone management –*Land use practices immedeatly adjacent to stream reach:*

Row-crops to Stream Edge (<2m): Agricultural crops planted in rows to edge of stream or top of bank of modified/channelized reaches that is less than the riparian buffer distance required by state law. Can be a problem when occurring for more than half of either bank of the reach, or when row crops are abutting the stream edge or top of bank causing bank erosion or allowing overland sediment, fertilizer, or pesticides/herbicides to be washed or drift into stream.

Landscaping to Stream Edge: Residential, park, or commercial lawn care practices leave little riparian vegetation (<2 m). Can be a problem when occurring over more than half of either bank of the reach.

Herbicide Use to Stream Edge: Indicated by bare soil or dead plants immediately adjacent to the stream. Generally on sloping banks that are not eroded and have access to sunlight.

Heavily Grazed Pasture/Feedlot: Vegetation is very short, or bare from grazing animals. A problem when riparian vegetation roots can no longer protect the stream banks from erosion.

Animal Access to Stream: Animals have access to enter stream along the reach on one or both banks. Can be a problem when animal access is occurring through more than half of the site, or detrimental impacts to the stream channel, banks or immediate riparian zone are occurring.

Manure Storage/Lagoons near Stream: Presence of manure in stream or adjacent to stream. Can be a problem with large amounts of manure, or when direct runoff is occurring

Impervious Surfaces: Material that seals the soil surface, preventing rainwater infiltration. Including tarred roads, paths or sidewalks, parking lots or large buildings near stream. Can be a problem when large impervious areas are adjacent to or just upstream of a site, and the water runs to the stream.

7) Bank erosion/Sediment Transport – Bank conditions that may contribute to sediment loading. Descriptions of some conditions likely to be encountered are described as follows:

From Animal Trampling: Stream banks that have erosion issues due to animal paths on or along stream banks. Can be a problem when large banks or many banks are affected.

Ground Water Seeps: Groundwater seeps causing "pop-outs" (i.e., soil forced out of bank from groundwater) which may lead to bank erosion at the ground water seep site. Can be a problem when large banks or many banks are affected.

Steep, Non-cohesive Soil: Stream banks are steep (>45 degrees) and composed on non-cohesive sediment (easily crumble when touched). Little or no vegetation protects exposed banks from erosion during high and normal flows. Bank may collapse due to gravity when wet. Can be a problem when large banks or many banks are affected.

Cutting below Root Line (incised): Annual high flows run beneath the root line of vegetation. This condition occurs more often when the stream is down-cut (incised) and high erosive flows now run along unprotected, non-cohesive banks. Can be a problem when large banks or many banks are affected.

Mid-channel Bars: Seen downstream of areas with excessive erosion, and in areas of over-widened channels.

D. Photographic documentation of stressor related conditions: Consider taking photographs of stream conditions or potential stressors that are evident instream, within the riparian zone or immediately upland of the riparian zone.

Check the photo box or record a label (S1, S2) on the SCSI form and include a brief description in the name of the image.

If at all possible, digital images should be downloaded to a computer or flash drive while in the field. This will provide one more backup of all images during the week until downloading to the X: drive. After returning from the field all images should be downloaded to the X:drive and saved as **.jpg** files in the following folder: X:\Databases\Water_Quality\Biological_Monitoring\Streams\Pictures.

Most photographs taken will be used for the following: 1) general reach condition and stressor ID, 2) documentation of large fish species which are released without an accompanying species voucher, and 3) photo that best represents the site that will be used for the Environmental Data Access (EDA) website.

1) General Reach Condition and Stressor ID Pictures: Digital images are uploaded to the following location at MPCA: X:\Databases\Water_Quality\Biological_Monitoring\Streams\Pictures**Basin\(basin name)\(field number)**

   These should be named with the site number, date, and location or description (in that order) as follows: "**06SC075_2012Jun09_MU.jpg**" is an image that was taken at site 06SC075 at the x-point (mid-point) facing upstream on June 9, 2012. Please note: all months should use only 3 letters (e.g., Jun, Jul, Sep) and all dates should use two numbers (01, 11).

   For the 7 reach photos, photos are named according to the location within the reach and direction facing as follows: "DD" is taken at the downstream end, facing downstream and "DU" is taken at the downstream end, facing upstream. "MD" is at the x-point (middle of reach), facing downstream and "MU" is at the x-point (middle of reach). "UD" is taken at the upstream end, facing downstream and "UU" is taken at the upstream end, facing upstream. Also take a wide-view (WV) image of the riparian zone: "**98LM042_2012Jun09_WV.jpg**".

   Other photographs should also be taken of nuisance algae, excessive bank erosion, and other potential biological stressors. These photographs should be named with the site number, date, and description. For example, if algae is present and an issue, name the image "07MS001_2012Jun09_algae.jpg". When describing images, use a "_" between words (e.g., bank_erosion). If more than one image, number them (e.g., algae1, algae2, WV1, WV2, etc.)

   **Please also copy/paste images of potential periphyton nuisance conditions in the following folder: X:\Databases\Water_Quality\Biological_Monitoring\Streams\Pictures\IntensivePics-WaterChem\ (current year) Periphyton photos

2) Voucher Photos (for large fish species sampled in field and released without retaining a voucher specimen):

   X:\Databases\Water_Quality\Biological_Monitoring\Streams\Pictures**Voucher Photos\(current year) Voucher Photos**

   These photos should be named with the site number, species identification using the common name, and sampling date as follows: "**08RD002_2012jun08_shorthead_redhorse.jpg**" is a fish voucher image that was taken at site 08RD002 of a shorthead redhorse on June 8, 2012.

3) Best stream photo for MPCA Environmental Data Access: While reviewing and renaming your site images, decide which picture would provide the best representation of the stream to be used on the EDA website. Make a copy of this image and paste in the following folder: X:\Databases\Water_Quality\Biological_Monitoring\Streams\Pictures**Basin\Best Photos (current year)** Rename the image according to the EDA website conventions (e.g., MPCAB_12LM002.jpg) and record the image in the excel spreadsheet in the same folder.

STREAM CONDITION AND STRESSOR IDENTIFICATION (SCSI) WORKSHEET

(revised 6-12)

1. Stream Documentation

Field Number: _____ Stream Name: _____

Date: _____ Person Scoring: _____

2. General Reach Condition

A. Photographs of reach segments (frame #)

Site Number _____ Wide-view (WV) _____

DD _____ MD _____ UD _____

DU _____ MU_____ UU _____

B. Comments - stream condition / stressors.
Asterisk (*) SID comments for photo form in StmBioMon.

_____

_____

_____

_____

_____

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3a. Riparian Condition:

Indicate percentage (to nearest 10%) of land that is undisturbed in the following areas.

RB		DS End to X-pt	LB	
0-15m	15-30m		0-15m	15-30m
		Undisturbed		
		X-pt to US End		
		Undisturbed		

Describe the type of disturbance observed.

_____

_____

3b. Row Crop Agriculture in Riparian

Record a Y or N to note if row-crop (RC) has been planted w/in or adjacent to minimum buffer width (MBW = 50ft NA, 16.5 ft OC)

RB		LB
	RC w/in or adjacent to MBW	

Next, indicate percentage (to nearest 10%) of land that is involved in row crop agriculture.

RB		LB
% Row Crop		% Row Crop
	NA: Within 50' (3m) of High Water Level	
	OC: Within 16.5' (5.3m) of top of bank	

4. Stream Condition/ Stressor Identification Checklist

A. Check if present. Check or label S1, S2, etc. when photos taken. Include additional comments/ descriptions in 2B.

Present	Photo	Stream Condition/ Hydrologic Influences
		A. Substrate Quality
		Run/ Riffle Substrate Suitable for Spawning
		Excess Sedimentation in Riffles
		Excess Sedimentation in Runs
		Excess Sedimentation in Pools
		B. Wetlands/ Groundwater
		Draining/Downstream of Wetland
		Channel through Wetland
		Wetland Riparian (eg Hummocks, Cat Tails, Alder)
		Springs/ Groundwater Seeps
		C. Hydrologic Influences
		Drain Tiles
		Storm Water Culverts
		Center Pivot Irrigation Near Stream
		Irrigation Pumps in Stream
		D. Dams / Blockage to Fish Passage
		Perched Culvert (≥15 cm above H20 surface)
		Dam Upstream of Site (<1 mile)
		Dam Downstream of Site (<1 mile)
		Natural Grade Controls/ Waterfall
		Beaver Dams
		Artificial Grade Controls/ Check Dams
		Rock Dams
		Carp Barrier

B. Check left if Present, right if could be a Problem. Check or label S1, S2, etc. when photos taken. Include additional comments in 2B.

Present	Photo	Stressors – Nutrients/	Problem
		E. Excess Nutrients	
		Filamentous or Substrate Algae	
		Blue/Green Algae Bloom	
		Dense Macrophytes	
		Duckweed	
		F. Riparian Management	
		Row Crop near stream edge	
		Landscaping to Stream Edge	
		Herbicide Use on Stream Edge	
		Heavily Grazed Pasture/ Feedlot	
		Animal Access to Stream	
		Manure Storage/ Lagoons near	
		Impervious Surfaces/Pavement	
		G. Bank Erosion/ Sediment	
		From Animal Trampling	
		From Groundwater Seeps	
		Steep or Non Cohesive Soils	
		Cutting Below Root Line (Incised)	
		Mid-channel Bars	