COOK COUNTY SOIL AND WATER CONSERVATION DISTRICT

BIOLOGICAL SAMPLING FOR THE POPLAR RIVER

QUALITY ASSURANCE PROJECT PLAN

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A. TABLE OF CONTENTS

A. Table of Contents 2
A2. QAPP contract requirements 3
A3. QAPP Distribution List 3
A4. Project/Task Objectives, Workplan, and Staff organization 3
A5. Problem Definition/Background 3
1. Rationale for initiating the project 4
2. Project objectives 5
A6. Project/Task Description 5
1. Project overview 5
2. Project summary and work schedule 5
A7. Quality Objectives and Criteria 6
1. Data quality objectives 6
A8. Special Training/Qualifications 6
A9. Documents and Records 7
1. Report format/information 7
2. Document/record control 7
3. Storage of project information 7
4. Backup of electronic files 7
B. Data Generation and Acquisition 7
B1. Study Design 7
B2. Sampling Methods 8
1. Habitat characteristics 8
B3. Sample Handling and Custody 12
1. Data entry QA procedures 12
B4. Analytical Methods 12
1. Biological evaluation and comparison among Poplar TMDL sites 12
2. Comparison with additional data sources 13
B5. Quality Control 13
B6. Data Management 13
C. Assessment/Oversight 14
C1. Project Assessment / Oversight 14
C2. Reports to Management 14
D. Literature 14

A2. QAPP contract requirements

This QAPP defines the objectives, responsibilities, protocols, procedures and methods for completion of the biological monitoring study required by the contract.

A3. QAPP Distribution List

Copies of the QAPP will be provided to MPCA and Cook County staff. Original copies are filed with NRRI and Cook County staff. Electronic versions of the QAPP will be posted on the LakeSuperiorStreams.org website and stakeholders will be notified via email.

A4. Project/Task Objectives, Workplan, and Staff organization

The QAPP document provides a description of the work to be performed and outlines procedures. Natural Resources Research Institute staff will collect invertebrate data and conduct a stream habitat survey. The MN Pollution Control Agency provided original funding for the project. Cook County Soil and Water Conservation District staff provides local project management, financial and project report administrative services. Personnel involved in project implementation are listed in Table 1 below.

Table 1: Project implementation personnel

Individual	Role in project	Organizational affiliation
Lucinda Johnson, Valerie Brady	Project consultation, review, report preparation	NRRI - UMD
Karen Evens	MPCA project manager	MPCA Regional Division
Greg Johnson	Technical advisor	MPCA St Paul
Dave Stark	Water plan coordinator	Cook County SWCD
Dan Breneman	Biological sampling coordinator	NRRI-UMD

A5. Problem Definition/Background

The Poplar River watershed is located in the Lake Superior basin of northeastern Minnesota. The watershed covers 83 km^2, with approximately 40 km of stream flowing from the headwaters to the confluence with Lake Superior. A majority of the Poplar River headwaters flows through low-gradient wetland complexes. A substantial drop in elevation occurs as the river reaches the escarpment above Lake Superior, where flow is concentrated through a channel of glacial deposits and bedrock. Elevation change at this point is dramatic, with an average drop in gradient approximately 12.5 m/km. Steep slopes along the riparian corridor include both unaltered forested land use and recreational development. A majority of the sampling effort on the Poplar River has been focused on a section downstream of the Superior Hiking Trail bridge to Lake Superior (RTI, 2006), approximately 4.8 km in length. The same sub-basin is the focus of this effort and includes approximately 532 hectares, only 1.8% of the total basin.

Results from water quality monitoring indicate the lower section of the Poplar River carries a substantial sediment load (Anderson et al. 2003). The Poplar River was listed as impaired in

2004 due to excessive turbidity, and placed on the Minnesota 303d list by the MPCA. Once listed, the MPCA began a TMDL study to determine the extent, cause, and possible impacts associated with this impairment. Water quality measurements provide a majority of the background data available on the Poplar River (RTI, 2006), with additional information provided by a slope stabilization work plan initiated by local land owners (NAWE 2007).

Biological assemblages are an integral component of aquatic ecosystem processes and are consistently relied upon to describe and predict the fundamental response mechanisms of stream impairment (c.f., Wiederholm 1980). Benthic macroinvertebrate are a useful tool for examining stream conditions because they; 1) are a vital link to nutrient cycling in streams, 2) provide a community composition that includes a variety of species, feeding habitats, life stages, and behaviors, and therefore represent a variety of response mechanisms, 3) are common regionally, and therefore lend results to multiple stream comparisons, 4) maintain a wide range of tolerances and sensitivities to water quality and habitat conditions, and 5) are a relatively non-mobile population of individuals and therefore respond rapidly and directly to localized conditions. Although reliable, the predictive utility of benthic community health as an indicator has limitations and should not be the sole response variable (Rosenberg and Resh 1992). A comprehensive evaluation of stream conditions should include, among other parameters, chemical and physical components to compliment the biological evaluation.

1. Rationale for initiating the project

a) *Problem*

Northeastern Minnesota is highly valued for its natural beauty, recreational opportunities, and resource potential. Lake Superior's North Shore contains unique geological structures that create a high density of stream corridors in small, relatively narrow, forested watersheds. Due to increased development and recreational activities, the North Shore region is experiencing dramatic anthropogenic alterations in the landscape. The extent to which landscape alterations influence biological stream processes is dependent on several factors, including hydrologic conditions and underlying geology. A major consequence of human development is alteration of natural drainage patterns. One easily identifiable consequence of development is an increase in impervious surfaces that result in concentrated flows from runoff. Increased runoff and higher flow rates are human controlled activities that lead to such impairments as amplified erosion or increased nutrient concentrations. These result in added stress on the system.

b) *Outcome*

North Shore watersheds often contain shallow, unstable soils highly susceptible to erosion. Increased runoff results in tributary streams transporting excess sediment directly into Lake Superior and negatively impacting stream and coastal habitats. High sediment load can influence macroinvertebrate and fish community structure directly by fine sediment deposits of sand, silt, and clay within the substrate. Excess fine sediments bury interstitial spaces used as refugia by invertebrates and young fish, reduce fecundity rates of gravid adults, and deliver to the stream excess nutrients and harmful chemicals. In addition to direct impacts, indirect results can be attributed to reductions or alterations in primary food resources (e.g., as algae are buried or abraded away).

Biological data from a previous Poplar River sampling effort (MPCA, 1998-98 LS007) will be incorporated into the current project evaluation. By combining existing data with new water quality monitoring, geomorphological evaluations, and biological indicators, both within and between stream comparisons of the benthic community structure and function will be available. This approach will place current stream conditions into a much broader context.

2. Project objectives

Project goals for the biological sampling component of the Poplar River TMDL project are outlined below:

GOAL 1: Develop sampling design based on best available information

Objective 1: Evaluate historical and contemporary data sources. Complete an on-site reconnaissance to prioritize and gain approval of potential sampling locations.

GOAL 2: Evaluate biological and habitat condition

Objective 1: Strengthen understanding of the Poplar River system by evaluating physical and biological condition of the stream habitat and riparian corridor, macroinvertebrate community composition, and periphytic assemblage

GOAL 3: Establish relationships and summarize results

Objective 1: Examine data and determine whether relationships exist among biological, geological/hydrological, and water quality parameters

Objective 2: Evaluate stream condition in context of the Poplar River watershed and among other North Shore streams.

A6. Project/Task Description

1. Project overview

Benthic macroinvertebrate and habitat sampling evaluations will be conducted at locations chosen to represent the most common instream and riparian conditions. A best effort was made to minimize bias from either direct or indirect landscape alterations when selecting sampling locations. Sampling sites outlined below (see B1. Study Design) are proposed based on several parameters (e.g., biological, geomorphological, etc.), but logistical considerations including best available access will influence site selection. Sampling protocols will follow standard operating procedures outlined by the NRRI-UMD Microscopy Laboratory standard operating procedures for field collection, laboratory sample processing, and data analysis (NRRI/TR-1999/37). All procedures outlined in the NRRI document are subject to change to respond to MPCA guidance and field conditions.

2. Project summary and work schedule

The main tasks and timeline are outlined in Table 2 below.

Table 2: Tasks and Timeline

Task
a) Develop QAPP –Aug 2007
b) Develop statistical design/sampling (amend QAPP) Aug/Sept 2007
c) Conduct sampling Aug/Sept 2007
d) Laboratory processing Oct – Dec 2007
e) Data analysis Jan-Feb 2008
f) Summary Mar-Apr 2008
g) Summary evaluation and report preparation June-Aug 2008
h) Report approval Sept 2008
i) Project end date: November 2008

A7. Quality Objectives and Criteria

1. Data quality objectives
Guidelines outlined by this QAPP will ensure that project objectives are appropriate for the decisions to be made based on the data collected. This determination will take into account both the best available procedures and the resources available for this project. Project management will advise technical staff on decisions related to data quality for this project regarding:

a) Unbiased evaluation and study design
b) Representative sampling
c) Thoroughness
d) Applicability

A8. Special Training/Qualifications

MPCA will determine whether mandatory and/or voluntary training sessions for key personnel are required to ensure quality data collection. Project managers with the MPCA will be responsible for advising contractors on alterations in standard protocols and data collection procedures. Biological sampling will be completed by the NRRI Benthic Laboratory. Trained staff will supervise all team members working on the project. Laboratory operations take place in three separate facilities that consist of a wetlab/storage area, prepatory wetlab accommodations, and a microscopy room. Benthic Lab capabilities range from both vertebrate and invertebrate aquatic sampling protocols in the field, to calculating periphytic Ch*a* content and digitizing invertebrates to generate biomass estimates, and data analysis. A variety of federal, state, county, and tribal environmental programs contract through the Benthic Lab for sample processing, taxonomic collections, and data analysis. Benthic Lab personnel have successfully completed quality assurance project plans, standard operating procedures, and environmental impact statements for both public and private organizations.

A9. Documents and Records

1. Report format/information
Data formats will be consistent with MPCA requirements and procedures where they exist. Currently there are no MPCA reporting protocols for TMDL related invertebrate data. Raw data will be available in electronic format with compatible spreadsheet software. Appropriate metadata files will accompany raw data files after complying with NRRI established QA/QC protocols. Data will include raw entries in univariate ('long') format. MPCA reporting guidance is based on previous MPCA/NRRI contracts. An approved NRRI technical report will serve as a template for summary and report preparation (NRRI/TR-2007/14)

2. Document/record control
The Cook County SWCD project manager will have ultimate responsibility for any and all changes to records and documents. Similar controls will be put in place for electronic records.

3. Storage of project information
NRRI will be solely responsible for data collection and data transfer. Draft copies, samples, post-processed information, and reference collections will be maintained by NRRI during the project period and provided to MPCA and Cook County upon request. MPCA and Cook SWCD staff will provide assistance in organizing the data for storage and analysis.

4. Backup of electronic files
Electronic data will be maintained through daily and weekly backups. Data will be filed at NRRI and electronic versions secured on an accompanying drive, an external hard drive, and saved in CD or DVD format at the end of each month.

B. Data Generation and Acquisition

B1. Study Design

Sampling protocols listed and referenced herein will provide an overview of the available habitat conditions and community composition associated with the lower section of the Poplar River. Sample locations (PR07-A through D) are positioned to ensure samples are collected upstream and downstream of important stream, riparian zone, or landscape features, and to isolate areas or sub-basins within the sampling area for more detailed comparisons, should these prove necessary. Sample collection equipment (described below) will be selected to ensure both sample precision and accuracy meet project objectives. Sample quantity will be sufficient to capture the inherent variability of the stream community.

Field observations and site evaluations will be conducted on data collected from four locations along the Poplar River main channel (Fig. 1). Samples will be collected at base flow conditions from all sites, with samples being collected within the shortest time frame possible, reducing potential variability due to weather. The proposed site furthest downstream (PR07-A) is above the current MPCA permanent gauging station (MPCA S000-261 at 47^0 39' 09.43" N 90^0 07' 7.70"), within a reach containing a relatively intact riparian corridor. Moving upstream, a second site (PR07-B at 47^0 39' 34.60" N 90^0 43' 4.40") sits directly upstream from a series of ski lift

stations and is also located at the end of a reach with relatively little riparian disturbance. A third sampling site (PR07-C) will be in close proximity to a previous MPCA biological sampling location (98LS007 at 47^0 39' 34.60" N 90^0 43' 4.40") in an attempt to complete invertebrate metric comparisons over two sample seasons. Site PR07-D is the furthest upstream in the lower Poplar basin. The last site will either be positioned near the Lake Superior hiking trail footbridge (PR07-D2) in order to reference a MPCA site (S0001-753 at 47^0 40' 00.39" N 90^0 43' 19.48"), or located further downstream of the first drop in stream elevation. The alternate PR07-D1 site (47^0 40' 47.70" N 90^0 43' 02.11") is again located at the end of a relatively intact riparian corridor. The latter site appears more similar in habitat condition to the proposed downstream sites (A-C) than does site D2.

B2. Sampling Methods

Provided below is a summary of materials and methods used in a variety of stream surveys conducted by staff at NRRI. Further details are available in a standard operating procedure (SOP) report (NRRI/TR-1999/37), subsequent amended protocols, or in current published literature.

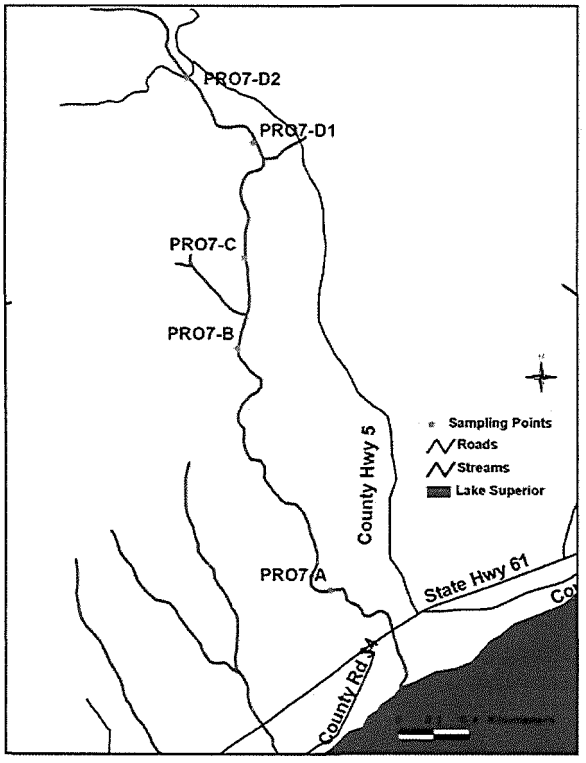

Figure 1. Proposed Poplar River sample sites.

1. Habitat characteristics

Habitat data at each sample location (i.e., 'site') along the Poplar River will be collected both from transects established perpendicular to flow, and from whole-reach observations (Fig. 3). A minimum of 10 transects will be placed evenly along the reach (110 m minimum reach length). Total reach length is dependent on mean stream width (i.e., generally 35 x mean stream wetted width) and will include as many riffle/run sequences as possible. Transect observations will be used to evaluate substrate characteristics (e.g., particle size and organic matter content), stream features (e.g., riffle, run, pool, etc.), bank conditions, and available habitat types. A cross-sectional diagram at each transect will be completed to help describe channel structure. A schematic diagram will be completed of the entire stream reach noting general transect placement, habitat position and type.

a) Transect points

Points along transects are used to evaluate stream characteristics. Data will be recorded from five points evenly spaced along each transect. Information regarding stream features (riffle, run, pool etc), discharge rates, and substrate type and proportional coverage (percent cover based on 6 size classifications) are used to describe the most common habitat. Metrics such as substrate embeddedness by fine particles (as % of substrate covered), in-stream habitat cover (i.e., woody

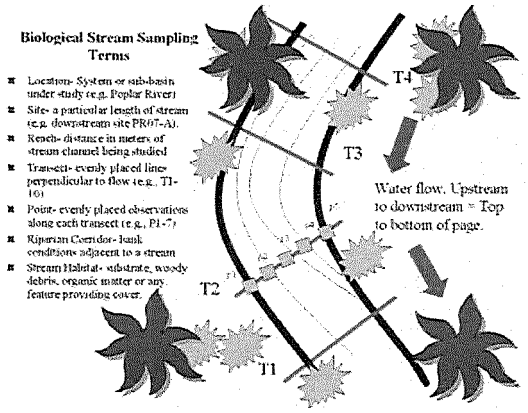

Figure 2 Schematic diagram describing sample site

i. *Substrate*- Each point on the transect will be covered by a grid (50 cm^2). The extent (in percent surface area covered) and type of substrate particles will be estimated for all particle sizes within the grid. We will use standardized particle size categories (c.g. Brusven and Prather 1974, Friedman and Sanders 1978, Gee and Bauder 1986), which typically include bedrock, boulders, cobble, gravel, pebble, sand, and silt/clay. The extent large substrate particles are embedded by fine particles (sand and silt/clay) will also be estimated (as percent embedded) at one point within each grid. An additional sediment depth measurement along each transect will be measured using a sediment rod to determine the maximum extent of fine particle deposition. This point will not be random; rather, a subjective choice will be made based on the amount of fine particle accumulation. This measurement will be repeated to obtain a maximum fine particle depth per transect. Finally, a 7.62 cm diameter core will be used to extract depositional sediment samples to determine the size distribution and volume of fine particles. Approximately 500 cm3 of sediment from three depositional areas will form a composite across transects (typically 4 to 6 transects). Composite samples (approximately 1200 - 2000 cm3 per site) will be labeled and stored on ice and/or frozen until analysis.

ii. *Flow* - Stream discharge will be estimated from velocity measurements at 5 points on each transect to provide a description of flow characteristics. Variability in flow among different substrate size classes (e.g., cobble, bolders, etc.) and instream cover types (e.g., woody debris, undercut banks, etc.) will help formulate a view of conditions in a habitat context. Water depth will be recorded at each transect point along with velocity measurements at a point equivalent to 60% of total water depth. Discharge will be estimated following instructions for flow-weighted averaging (FWA) provided in the Marsch-McBirney Flowmate operators' manual (March-McBirney 1990).

iii. *In-stream cover* - When transect lines intersect in-stream habitat cover, the type, size, and stability will be described. Large woody debris (greater than 1 m in length and 10 cm dia.), debris dams, roots wads, etc., that intersect each transect will be recorded in

detail, noting length or surface area, stability, and position along the transect. Large wood standing stocks will be accessed via methods of Johnson et al. 2003.

iv. *Bank structure* - Bank or shoreline structure and condition (stable or unstable) will be evaluated on all transects by noting the presence or absence of undercut bank conditions. Bank full width and bank substrate composition will be recorded, as well as high water marks or indicators of flood extent. Bank slope will be determined by calculating the rise over run distance at selected points from wetted to bank-full width using a magnifying level and survey staff.

v. *Riparian corridor* – Densiometer readings at a mid-stream point in four directions (upstream, downstream, left bank, and right bank) on each transect will be used to estimate stream shading potential. Riparian width is ranked (e.g., 0-10, 10-50, 50-100, >100 m) and adjacent vegetation type will be described using predetermined categories. Landscape and landuse characteristics from 30 m and beyond will also be categorized using a standardized list.

b) Whole-reach observations

Schematic diagrams of the size, shape, and dimensions of habitat cover such as large boulders, islands, etc., will be recorded in relation to the reach transects. Large woody debris (greater than 1 m in length and 10 cm dia.), debris dams, roots wads, etc., that are not included on each transect will be recorded in detail, noting length or surface area, stability, and position near the closest transect. Total amount of woody debris per reach will also be estimated by counting the number of intact units (100 cm in length by 10 cm diameter). A reach survey qualitative habitat evaluation index (Ohio EPA, 1987) to rank overall stream condition for fish habitat will be completed for each site.

i. *Water quality parameters* - Water chemistry parameters at each location will be recorded with a YSI 556 multi-probe meter to establish baseline information on water temperature, dissolved oxygen, conductivity, pH, and oxidation-reduction potential (ORP) during the sampling effort. Water clarity observations are completed in triplicate using a transparency tube. Grab samples for various water chemistry analyses will be collected as directed by the Cook Co. water coordinator and transferred to the NRRI Central Analytical Laboratory (Ameel et al.).

c) Biological sampling

i. *Benthic macroinvertebrates* - Samples will be collected using a multi-habitat sampling approach (Lenat 1988) during baseflow conditions. Quantitative samples will be collected in triplicate from several run, riffle, and pool habitats using either a modified Hess (0.086 m^2) in riffles or sediment core tube (0.0045 m^2) in shallow depositional areas. All quantitative samples will be washed on-site through a 254-µm mesh net or sieve. Qualitative samples will be collected from the following habitats, if available: beneath banks or over-hanging vegetation, woody debris dams, boulder piles or rip-rap (NRRI/TR-1999/37). Additional qualitatively sampled habitats in streams may include depositional sediments and aquatic vegetation in run and pool habitats using a D-frame kick net (mesh size: 500 µm). The D-net effort will be timed

and measured (approx. 30 seconds per sample and a 10 m distance). Extensive herbaceous bank vegetation and instream aquatic vegetation will be swept, while wood dams and boulder piles are jabbed (*sensu* Barbour et al. 1999) to dislodge invertebrates. All invertebrates from each sample type will be preserved in the field using a Kahle's preservative, 10% formalin, or 70% ethyl alcohol (ETOH).

ii. *Periphytic assemblage* - Epilithic algal (periphyton) biomass will be measured as ash-free dry weight (AFDW) and chlorophyll-a (NRRI/TR-1999/37). Samples will be collected using rockscrubs from a known surface area (20-40 cm dia.). All samples will be place on ice for transport to the laboratory, transferred to standard glass fiber filters, and frozen until analysis. A set of periphyton samples from each site will be preserved with Lugol's solution and archived for later identification.

1. Sample processing

i. *Benthic macroinvertebrates* - Samples will be processed by washing materials through two sieve sizes (4 and 0.25 mm) to separate contents into large and small size fractions. Invertebrates will be completely picked (whole picked) from the large size fraction (>4 mm). Amount of sample processed from the 4-0.25 mm fraction will be determined on an individual basis tracked by time (sample volume/effort accrual). All samples will be ¼, ½, or whole picked. Invertebrates will be removed from organic and inorganic sample materials under a dissecting microscope or a 2 x magnification lens. Each completed sample will be subject to quality assurance/quality control (QA/QC) inspection (100% inspection). Rejected samples will be re-processed until QA/QC guidelines are passed. When appropriate, a representative portion of Chironomidae (Diptera) will be sub-sampled (approximately 30-100 individuals per sample) and permanently mounted on slides for identification to genus. Other macroinvertebrates will be identified to the lowest practical taxonomic level using appropriate keys (Hilsenhoff 1981, Wiederholm 1983, Brinkhurst 1986, Thorp and Covich 1991, Merritt and Cummins 1996). A reference collection will also be established from non-chironomid invertebrates among all sites. Specimens will be subject to a rigorous QA/QC inspection (further details available from NRRI/TR-1999/37) prior to data entry.

ii. *Periphytic assemblage* - Epilithic periphyton biomass will be estimated using AFDM and chlorophyll-a measurements following standard protocols (APHA 1985).

iii. *Sediment* - Particle size and sediment AFDW are determined from the same sample. Thawed sediment samples will be transferred to a basin and homogenized for 1 min. A small amount of water will be added to each sample to facilitate thorough mixing. Homogenized sediment in the mixing container will be tamped to settle material uniformly. Sediment will be sub-sampled in triplicate by extracting 250 cm3 using a 5 cm (dia.) sediment core. Sub-samples will be placed in labeled pans and dried (105° C) to a constant weight determined with a standard balance. Dried samples will be ignited for 1 h at 500° C. After samples cool, reagent-grade water will be added to re-wet ash and compensate for water weight not driven off from clay particles during the

drying period (APHA, 1992). Samples will be dried to a constant weight at 105° C and re-weighed to determine AFDW of each sub-sample.

iv. *Substrate particle size analysis*- Dried sub-samples will be run through a set of six sieves (4, 2, 0.5, 0.25, and 0.0625 mm) for 1 min using a row-tapper to obtain six particle size fractions: 1) > 4 mm, 2) 4 - 2 mm, 3) 2-0.5 mm, 4) 0.5 - 0.25 mm, 5) 0.25 - 0.0625 mm, and 6) < 0.0625 mm (Gordon et al. 1992). Sediment retained in each size fraction will be weighed using a standard balance.

B3. Sample Handling and Custody

Preserved sample bottles will be clearly labeled on both the inside and outside of each bottle, logged in, approved by signature, and stored in room 126, NRRI. Archived samples and unused sample preservatives will remain in chemical storage (room 106, NRRI). Frozen samples will be clearly labeled on the inside and outside of each sample container, logged in, and kept frozen until analysis. Sample quantity and label information will be recorded in field notebooks as samples are collected. A complete sample list will accompany all samples returned to the laboratory (NRRI/TR-1999/3). Chain of custody forms will be completed and verified with the field sample list as delivery and transfer are finalized. Chain of custody forms and a field sample list will be duplicated, with copies to the outside agency (or project manager), field notes folder, and the project log book.

1. Data entry QA procedures
Data from laboratory sheets will be entered into Microsoft Access or the NRRI server database. The data will be subject to a 10% random evaluation according to the number of data records. An error rate greater than 1% will result in re-entry. In addition, database queries for missing, out-of-range, and uncommon values will be run to ensure data quality and accuracy.

Prior to post-processing data, raw files will be merged with an invertebrate trait information database to ensure record continuity, check for errors, and provide supplemental information on taxa traits. Taxa not listed in the database will be either re-identified or compared to the Integrated Taxonomic Information System (ITIS) database for confirmation (http://www.itis.usda.gov). Once the taxa name field properly merges with the ITIS system, the raw data will be analyzed in SAS using NRRI or USGS trait information to generate taxa counts and abundance values for selected metrics (e.g., taxonomic, structural, and functional traits).

B4. Analytical Methods

1. Biological evaluation and comparison among Poplar TMDL sites
Trait characteristics for each invertebrate taxon will be derived from an NRRI-maintained database compiled from a variety of sources (c.f., Merritt and Cummins 1996, Thorp and Covich 1991, Weiderholm 1983). These traits consist of functional feeding group classifications, trophic levels designations, methods of locomotion, preferred habitats, and various characteristics that help define aquatic invertebrate interactions within their environment. Invertebrate community traits are used to isolate trends or species-specific behaviors. Metrics are generated based on either occurrence, abundance, known ethological or ecological behavior, and response to

environmental condition (e.g., burrowers are at higher risk of accumulating polar compounds due to increased exposure to contaminated sediments). Invertebrate metrics will be compared among Poplar TMDL sites using a variety of statistical procedures. Such tests may include a parametric one-way analysis of variance (ANOVA) procedure, or non-parametric redundancy analysis (RDA) for community comparisons. Substrate, habitat, and water chemical/physical parameters will be compared among sites in a similar fashion.

Another way to indicate biotic condition is to use published tolerance values for various taxa. Each invertebrate taxon will also be assigned a tolerance value (0 to 10), indicating the taxon's overall level of tolerance to stress. A value 0 indicates the least tolerant. Tolerance values are primarily from Hilsenhoff (1987), supplemented by values from EPA (Barbour *et. al.* 1999). Sensitive taxa are defined as taxa with a tolerance value of 3 or less, and tolerant taxa are those with a tolerance value of 7 or higher. Mean tolerance scores for each sampling station will be calculated by averaging total scores for riffle samples only. Typically the most sensitive insects reside in riffles, which are the predominantly sampled habitat; this will allow the greatest comparability among datasets.

2. Comparison with additional data sources

Data comparisons across studies are fraught with difficulties, most generated by differences in gear-type and non-compatible methods. Thus, assessments and conclusions using such comparisons will proceed with caution. In addition, important considerations when comparing data from various sites, streams, or different years, among other parameters, include climactic conditions, seasonal variability, hydrologic influences, and various geomorphological attributes. Information on real time MPCA/NRRI/DNR probes (www.lakesuperiorstreams.org) will be used as comparison to estimated stream discharge in the field. We will take all factors into consideration when making comparisons with historic data. Corrections will be applied where needed.

B5. Quality Control

Benthic sampling processing QA/QC procedures outlined in NRRI Microscopy Laboratory SOP (NRRI/TR-1999/37) will be followed to ensure high quality data standards. Parallel procedures have been demonstrated in recent sampling efforts (NRRI/TR-2007/14)

B6. Data Management

As part of this project, MPCA will develop a data management strategy and amend this QAPP as needed. The project manager is responsible for ensuring:

1. A data management scheme is in place, from field to final use and storage
2. Standard recordkeeping and tracking practices are current (citing relevant agency documentation)
3. Data handling equipment/procedures will adequately process, compile, analyze, and transmit data reliably and accurately
4. Individuals are qualified and meet all elements of the data management scheme, and
5. A process is in place for data archival and retrieval.

Documentation and Records

NRRI will prepare progress reports that address task and subtask milestones, deliverables, adherence to schedules and final progression as requested by the local project manager and as required for semi-annual and annual reporting to the state. NRRI will develop and manage a complete repository for all data and information to develop the required report and maintain a repository file for this project. Applicable data files and information used to develop the biological report will be submitted to SWCD staff for archiving and potential use in a MPCA data retrieval system.

Copies of formal reports and supporting materials will be archived in NRRI libraries and identified with NRRI technical document coding for retrieval at future dates. Sample sheets completed on site during field sampling and all field sheets, logs, chain of custody documents, and benthic sample materials will be retained by NRRI for a minimum of three years, or placed in the custody of SWCD..

C. ASSESSMENT/OVERSIGHT

C1. Project Assessment / Oversight

A project team consisting of SWCD staff, NRRI staff and MPCA staff will collaborate as needed to address issues of concern or work order changes during the project time span. Day to day oversight of the project is managed by Dan Breneman (NRRI) and Dave Stark (SWCD).

C2. Reports to Management

NRRI will submit a draft report to the Cook SWCD and MPCA describing the work completed, present data collected, and provide analysis of stream condition. The report will discuss stream health from a macroinvertebrate perspective with any comparisons to other analyses completed on similar streams along the North Shore of Lake Superior. NRRI will incorporate comments into a final report as a NRRI technical document prior to completion of the contract.

D. LITERATURE

Ameel, J. Ruzycki, E., Owen, C.J. and R. Axler, 1998 (revised 2003). Analytical chemistry and quality assurance procedures for natural water, wastewater, and sediment samples Natural Resources Research Institute, University of Minnesota Duluth, MN. Technical Report NRRI/TR–98/28.

American Public Health Association (APHA), American Water Works Association, and Water Pollution Control Federation. 1985. *Standard Methods for the Examination of Water and Waste Water. 16th ed.* Washington, D.C. 1067 p.

American Standards for Testing and Materials (ASTM), 1985. *Annual Book of ASTM Standards. Part 31; Water*. Philidelphia, PA.

Anderson, J., M. Evenson, T. Estabrooks and B. Wilson. 2003. An assessment of representative

Barbour, M.T., Gerritsen. J., Snyder, B.D., and Stribling, J.B. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates, and fish, Second edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Brinkhurst, R.O. 1986. Guide to the Freshwater Aquatic Microdrile Oligochaetes of North America. Canadian Special Publication of Fisheries and Aquatic Sciences 84. 259 pp.

Brusven, M.A. and K.V. Prather, 1974. Influence of stream sediments on distribution of macrobenthos. J. Entomol. Soc. Brit. Columbia. 71:25-32.

Friedman, G.M. and J.E. Sanders. 1978. *Principles of Sedimentology*. John Wiley and Sons, New York.

Gee, G.W. and J.W. Bauder, 1986. Particle-size analysis. In; *Methods of Soil Analysis, Part I. Physical and Mineralogical Methods*, A. Klute, ed. American Society of Agronomy-Soil Science Society of America, Madison, WI. Pp. 383-411.

Gordon, N.D., T.A. McMahon, and B.L. Finlayson. 1992. *Stream Hydrology: An Introduction for Ecologists*. John Wiley and Sons, Inc. NY, NY. 526 p.

Hilsenhoff, W.L. 1981. Aquatic Insects of Wisconsin. Keys to Wisconsin genera and notes on biology, distribution, and species. Publication of the Natural History Council, University of Wisconsin-Madison, 60 pp.

Johnson, L.B., D. Breneman, C. Richards. 2003. Macroinvertebrate community structure and function associated with large wood in low gradient agricultural streams. River Research and Applications 19(3):199-218. Lake Superior basin tributaries. Stream Water Quality Assessment Technical Report Series.

Marsh-McBirney Inc. 1990. *Flow-Mate Model 2000 Installation and Operations Manual.* Marsh-McBirney Inc. Fredrick, MD.

Merritt, R.W. and K.W. Cummins, ed. 1996. *An Introduction to the Aquatic Insects of North America, 3rd ed.* Kendall/Hunt Publishing Co., Dubuque.

Minnesota Pollution Control Agency, St. Paul, MN.55155.

Natural Resources Research Institute (NRRI). 1999. Standard Operating Procedures (SOP): Benthic Sample Collection and Processing, University of Minnesota Duluth, Natural Resources Research Institute, Technical Report, NRRI/TR-1999/37, 17 p.

North American Wetland Engineering. 2007. Slope Stabilization Work Plan for Poplar River Management Board. Executive Summary Report (Draft Report 0118071). 59 p.

Ohio Environmental Protection Agency (EPA). 1987. Biological criteria for the protection of aquatic life. Vol. 2. User's manual for biological assessment of Ohio surface waters. Ohio Environmental Protection Agency, Columbus, Ohio.

Rosenberg, D.M. and V.H. Resh. 1992. Introduction to freshwater biomonitoring and benthic macroinvertebrates. In *Freshwater Biomonitoring and Benthic Macroinvertebrates*. D.M Rosenberg and V.H. Resh (ed). Chapman and Hall, New York. pp. 1-9.

RTI International. 2006. Poplar River turbidity total maximum daily load: summary of existing water quality data and information. USEPA No. 68-C-02-110.

Thorp, J.H. and A.P. Covich (ed.). 1991. *Ecology and Classification of North American Freshwater Invertebrates.* Academic Press, Inc. 911 pp.

Wiederholm, T. 1980. Use of benthos in lake monitoring. Journal of the Water Pollution Control Federation. 52:537-47.

Wiederholm, T. (ed.). 1983. *Chironomidae of the Holarctic Region*. Ent. Scand. Suppl.

27
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COOK COUNTY SOIL AND WATER CONSERVATION DISTRICT

BIOLOGICAL SAMPLING FOR THE POPLAR RIVER

QUALITY ASSURANCE PROJECT PLAN

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