Benthos Beneficial Use Impairment Assessment on Eighteenmile Creek Area of Concern, Newfane, NY

QUALITY ASSURANCE PROJECT PLAN

Date TBD

New York State Department of Environmental Conservation and United States Geological Survey

Approval Signatures

_____ Date _____
Brian Duffy – Co-Principal Investigator, NYSDEC

_____ Date _____
Barry Baldigo - Co-Principal Investigator, USGS

_____ Date_____
AJ Smith - Project Quality Assurance Officer, NYSDEC

_____ Date _____
Jason Fagel – Quality Assurance Officer, NYSDEC

_____ Date _____
Elizabeth VanRabenswaay - Project Officer, USEPA

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Distribution List

The following individuals must receive a copy of the approved QAPP in order to complete their role in this project. Copies will be distributed electronically and all sampling personnel will keep a hard copy in sampling vehicles.

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TBD	Macroinvertebrate Sample Processing Manager	TBD	TBD
TBD	Toxicity Laboratory Manager	TBD	TBD

Introduction

This Quality Assurance Project Plan (QAPP) has been prepared to meet the Quality Assurance/Quality Control (QA/QC) requirements of the assessment of the Eighteenmile Creek Area of Concern (AOC) Beneficial Use Impairment (BUI) number 6, Degradation of Benthos. The project will assess the condition of the benthic macroinvertebrate community through analysis of community and sediment toxicity data. This QAPP documents the project goals and objectives, standard operating procedures, sampling methods, data review and evaluation procedures, and QC methods that will be used in the AOC Benthos assessment.

The study is meant to enhance the rigor and spatial coverage of the study and expand it to include key areas not included in the previous assessment conducted by Ecology and Environment, Inc. (E&E) that suggested the benthos BUI may not be impaired (E&E 2013). It

will also provide a sound baseline dataset from which to compare evaluate the benefits of remediation of contaminated sediments. This assessment was modeled after previous assessments conducted at the St. Lawrence River at Massena and Rochester Embayment AOCs. It is funded by the Great Lakes Restoration Initiative (GLRI) grant received by the New York State Department of Environmental Conservation (NYSDEC) Great Lakes Program and the United States Geological Survey (USGS). The purpose of this grant is to support research and address BUI impairment of AOCs located with NYS.

I. Component Management

1. Organization/Responsibilities

The following people and parties will actively participate in this project and its oversight:

Co-principal investigators
Brian Duffy (principal investigator) of the NYSDEC Water Quality Management Section and Barry Baldigo of the USGS are responsible for all aspects field data collection including, but not limited to, sampling design, sample collection and processing, data analysis, interpretation and reporting.

Sampling personnel will be made up of both NYSDEC (central office and regional) and USGS staff and will take direction from and answer to the co-principal investigators.

Project Quality Assurance Manager
As the Project Quality Assurance Officer, Alexander Smith will be in charge of updates to this QAPP, electronic distribution this QAPP and ensuring all field and laboratory staff directly working on this project have read, understand, and are conforming to the Quality Assurance Plan.

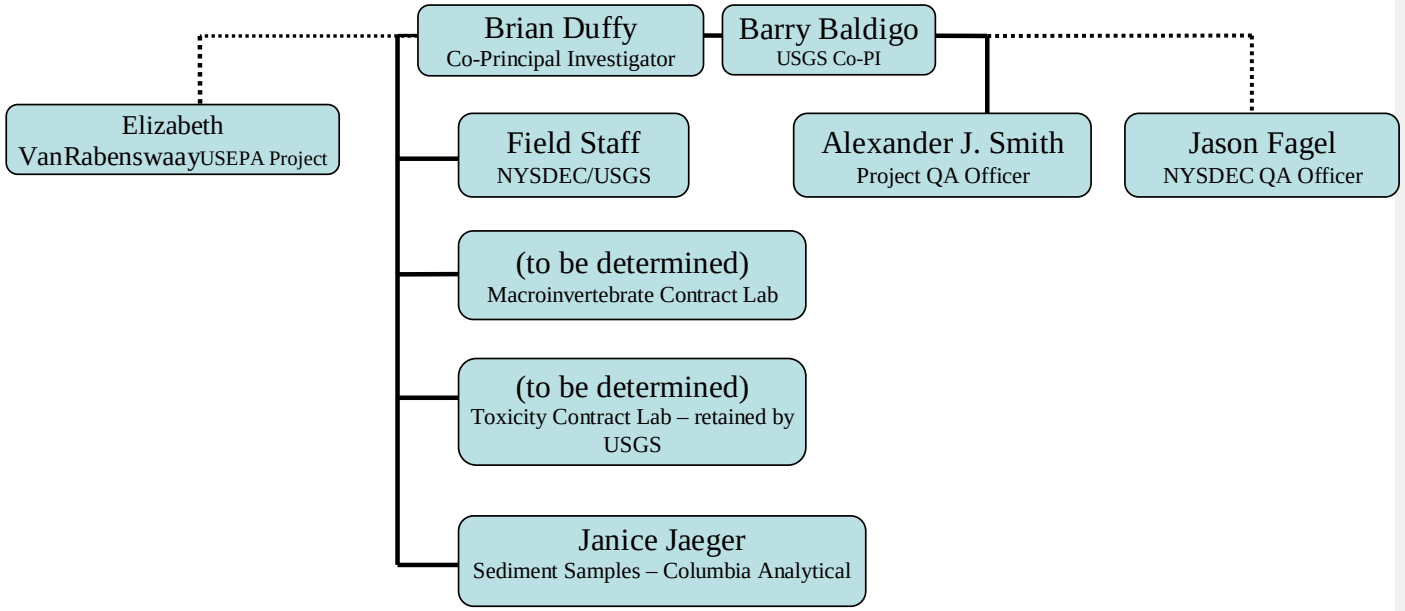
Water Chemistry Analytical Contract Laboratory – (ALS Environmental)
Sediment samples collected during this project will be sent to an outside analytical laboratory currently under NYSDEC contract for analysis. The laboratory will take directions from and answer directly to the Principal Investigator.

Macroinvertebrate Sample Contract Laboratory - (to be determined through the formal bid process)
Macroinvertebrate samples collected during this project will be sent to an outside laboratory for processing and organism identification. The laboratory will take directions from and answer directly to the Principal Investigator.

Sediment Toxicity Laboratory - (to be determined through the formal bid process)
Sediment samples will be sent to an outside laboratory for sediment toxicity assays. The laboratory will take directions from and answer directly to the NYSDEC Co-Principal Investigator.

NYSDEC Division of Water (DOW) Quality Assurance Officer –
Jason Fagel, DOW QAO, will be responsible for assuring this project plan meets QA/QC requirements.

Organization Chart



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2. Background – Description of Problem

The International Joint Commission (IJC) has designated Eighteenmile Creek as an Area of Concern in the US and Canada Great Lakes Water Quality Agreement (Annex 2 of the 1987 Protocol). This designation indicates that the area has been identified as exhibiting the degradation of environmental conditions, to the extent in which beneficial uses of the water and/or biota are considered to be impaired. The Eighteenmile Creek AOC includes the creek from the mouth up to the Burt Dam. The entire Eighteenmile Creek watershed is designated as the source area of concern (Figure 1). The benthic macroinvertebrate community or "benthos" Beneficial Use Impairment (BUI) was designated degraded because past NYSDEC data indicated impairment in Olcott Harbor based on elevated levels of sediment contamination (NYSDEC 1997). Recent sampling efforts in 2012 by E&E as part of a project to reassess the benthos BUI indicate that the sediment dwelling macroinvertebrate communities may not be impaired and sediment toxicity was not limiting to growth and survival of indicator organisms in Eighteenmile Creek AOC (E&E, 2013). The study did not collect replicate samples, however, nor did it evaluate the condition of Olcott Harbor where data was collected that supported the impaired benthos BUI designation for the Eighteenmile Creek AOC (NYSDEC, 1997). This assessment will ~~will~~ expand on the work conducted by E&E (2013) and provide a statistically defensible community assemblage and sediment toxicity dataset that may support removal of the benthos BUI. It will also provide a baseline dataset from which to measure effects of remediation of contaminated sediments that currently still exist both in the AOC and upstream source area (NCSWCD 2011).

One of the priority goals stated in New York's Great Lakes Basin: Framework for Action 2011 is to "accelerate the delisting of New York's Areas of Concern by implementing actions focused on restoring beneficial uses impaired by pollutants". This project will assess the benthos BUI using an ~~an~~ approach consistent with that used for previous AOC benthos assessments in NYS to help make a determination on the current status of the benthos BUI.

The Eighteenmile Creek Remedial Action Plan (RAP) established specific criteria in the Eighteenmile Creek AOC for delisting (restoring and protecting) the "Degradation of Benthos" BUI.

(1) ~~(1)~~ "Benthic macroinvertebrate communities are "non-impacted" or "slightly impacted" according to NYSDEC indices (Smith et al. 2014)"; ~~or~~ OR

(2) In the absence of NYSDEC data, riffle habitats require benthic macroinvertebrate communities with a species richness higher than 20, EPT richness greater than 6, a biotic index value less than 4.51, and a percent model affinity greater than 50; OR

(3~~2~~) "In the absence of benthic community data, this use will be considered restored when the level of toxic contaminants in sediments is not significantly higher than controls.

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Additionally, given the current emphasis on eutrophication and sedimentation, evaluation relative to control sites is an important step in assessing benthic conditions in the context of current water and sediment quality issues. Detailed background information on the Eighteenmile Creek AOC and the RAP

can be found in the report, "Eighteenmile Creek Remedial Action Plan Stage II- Update" (NCSWCD 2011). More comprehensive information on the status of benthic communities and toxicity of bed sediments are needed inside the Eighteenmile Creek AOC and at non-AOC (control) sites to determine if delisting criteria have been achieved in the AOC.

3. Project/Task Description

The objective of this study is to determine if the benthos beneficial use is, or is not impaired in ~~parts of~~ the Eighteenmile Creek AOC. Benthic macroinvertebrate community data and bed sediment-toxicity test results will be used specifically to test whether bed sediments in the Eighteenmile Creek AOC meet established criteria (see above) for delisting the benthos BUI. Replicated macroinvertebrate samples using the petite ponar dredge will be used to assess whether sediment associated benthic communities continue to show impact from contamination resulting from past and present industrial sources in the city of Lockport~~Rochester~~ (Smith et al. 2014). Toxicity assays using *Chironomus dilutus* will be used to determine if the sediments are toxic to this representative indicator organism. Depending on contract bids, either a 10-day (less costly, test method 100.3) chronic test or a 20 day (more costly, test method 100.5) abbreviated life-cycle test will be conducted (USEPA 2000). In summary, the bioassays will expose the midge, *C. dilutus*, in 300-mL chambers to 100 mL of bed sediment and 175 mL of reconstituted water to measure acute (survival) and chronic (growth) endpoints. In order to for macroinvertebrate community data to be applicable to NYSDEC index values, all sampling will occur within the macoinvertebrate sampling index period during July or August, 2014.

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In order to determine the influence of legacy industrial impacts from the AOC versus current impacts resulting from basin-wide eutrophication and sedimentation issues, a control/impact study design will be used. Macroinvertebrate community data will be collected using a petite ponar dredge from sites located both within and outside the AOC. Three sites will be sampled within the Eighteenmile Creek AOC between the mouth and Burt Dam, two sites above the Burt Dam with the source area, and five sites (two above Waterport Pond) will be sampled as control sites on Oak Orchard Creek. A total of 10 sites will be evaluated. Best effort will be made to collect samples at consistent depth (Figure 1; Table 3).

Because of the inherent variability in biological sampling, five macroinvertebrate community replicates will be collected at all sites. All sites will necessarily be located where sufficient habitat exists for the collection of sediment samples. When possible, sites will be located where contaminant loads are known to exist within the AOC especially in Olcott Harbor where data was collected that drove the benthos impairment designation. The purpose of this is to represent the potentially most degraded conditions and therefore ensuring that any potential BUI removal will be well justified. In general, sample sites will be selected to ensure that most habitat conditions are similar between all AOC and control sites.

Macroinvertebrate community samples will be collected using petite ponar dredges and following established NYSDEC protocols for sample collection and processing (SOP #208-14). Sediments used for toxicity assays will be taken from a composite of five sediment samples collected using the petite ponar. One to two liters of material will be taken for this test, depending on laboratory requirements, and shipped overnight on ice to the selected sediment toxicity laboratory. Two sites will be selected for duplication of toxicity assays, particle size, and TOC analysis (1 AOC, 1 control). This will yield 20% duplication.

Particle size will be characterized (ASTM 2007) and total organic carbon (TOC)(Lloyd Kahn method) will be measured to associate physical habitat with benthic community condition to help explain variation due to factors other than toxic effects. All particle size and TOC samples will be taken from a homogenized five sample composite of benthic sediments collected for toxicity assays. These percentages will be used to weight each size category converted to phi values as described in Cummins (1962). Exceedence of three phi units difference between sites indicates potential overriding physical habitat influence beyond sediment/water quality (Bode et al. 1990).

Habitat conditions (temperature, depth, velocity, DO, canopy cover, and substrate sizes) at each sample site will be recorded on a NYS DEC field data sheet (attachment A) and used to determine habitat criteria (and comparability) for control and AOC sites following guidelines established by Bode et al. (1990). Most, if not all, bed sediment samples for toxicity and benthic-community analyses will be collected using a boat/raft and a petite ponar dredge. Depth and surface velocity (if detectable) will be measured using a calibrated cable or depth finder and a velocity meter (e.g., Marsh-McBirney or Pygmy). Minimally acceptable differences in surface velocities at study sites within the same river will be defined as those being within 50 percent, or 20 cm/s of each other according to Bode et al. (1990). Bed sediments will be inspected prior to sample collection and the percentage of each substrate particle-size class will be visually estimated.

Temperature, conductance, and dissolved oxygen (DO) profiles will also be obtained at each sampling site using a YSI multi-probe to characterize water quality and confirm that conditions near the bottom of the water column (and at the sediment interface) are not anoxic and that they are relatively similar among sites between AOC and control sites. Although water temperature, DO, conductance, and depth data will be used initially to minimize site-to-site differences, no criteria for maximum acceptable differences have been assigned by Bode et al. (1990). Thus, these data will be used during analyses to characterize site conditions and to determine if community differences among sites might be related to factors other than bed sediment toxicity.

Table 2: Project Schedule

Task	Completion Date
Contract Finalization	June 2014
Sample Collection	July/August 2014
Data Analysis	January 2015
Draft Report	June 2015
Final Report	November 2015

4. Quality Objectives and Criteria

All criteria for test conditions, activity schedule, and test acceptability of sediment toxicity results are described in detail in USEPA (2000) but summarized in Table 6. Levels of taxonomic resolution required for macroinvertebrates are listed in NYSDEC #SOP 208-14.

5. Training Requirements/Certifications

Training is the responsibility of both the DEC and USGS Co-Principal Investigators. Training is required for all field staff involved in the current project to ensure the proper collection and handling of sediment samples. This Quality Assurance Project Plan will be distributed electronically to each individual involved in field work by the Project Quality Assurance Officer to ensure proper adherence to the procedures outlined within. An onsite training will be held for all samplers collecting and handling samples as part of this project. Training will be based on sampling methods described in NYSDEC DOW SOP #208-14 and USEPA (2000). Procedures to minimize exposure to potentially hazardous materials will be followed according to USEPA (2000) and will be emphasized during the on-site training. Other topics covered will include safety training, sample preparation, and chain of custody procedures. Each participant in the training will sign and date a participant form acknowledging their training (Appendix V).

Training of individuals employed by contract laboratories for processing water and sediment samples is the responsibility of the contract laboratories and must be done according to their procedures. The selected contract laboratory processing macroinvertebrate samples must adhere to and be trained according to the procedures outlined in NYSDEC DOW #SOP 208-14. The contract laboratory processing sediment toxicity samples must adhere to and be trained according to procedures outlined in USEPA (2002).

The selected macroinvertebrate contract lab will be required to use Society for Freshwater Science (SFS) Level II certified taxonomists for this project. The certification process is overseen by SFS.

6. Documentation and Records

Field data, including exact site coordinates and all field notes, will be recorded on paper field sheets and transcribed to electronic format upon return from sampling. Electronic records will be stored on a NYSDEC server class computer on the United State Geological Survey (USGS) Water Science Center computer system. Complete system backups are performed every Friday evening by USGS computer services staff in which all electronic files stored on the computer network are recorded to tape and stored indefinitely. In addition, incremental backups are performed on a daily basis.

Laboratory results from the macroinvertebrate samples will be reported to the Principal Investigator using a customized Microsoft Excel spreadsheet/form. After the raw data are entered on the form, Visual Basic Macros automatically create a species list for import into the custom built Macroinvertebrate Database in Microsoft Access and Visual Basic.net. This database also houses all water chemistry information collected during this project. Electronic data files are delivered from the outside water chemistry and biological sample contract laboratories and are imported

into the database. Data analysis and incorporation of raw data into the Stream Biomonitoring Unit data management system are executed by programs in the database.

Sediment toxicity data will be reported in MS Excel format. TOC and grain size data will be reported electronically using the standard ALS Columbia Analytical Services MS Excel column format. Data will be stored centrally on a NYSDEC server class computer on the USGS Water Science Center computer system in Troy, NY.

Sampling site locations and any changes thereof, are entered directly into the appropriate database tables. Physical/chemical parameters measured in the field are entered directly into the appropriate database tables. Changes and additions to the Stream Biomonitoring Unit's master species list are also made directly in the database. A custom, user friendly frontend to the Stream Biomonitoring Database provides the ability to make changes to the database. Database backups ensure the preservation of the database integrity in the event that an unrecoverable error is made.

Documentation of field and lab records are kept indefinitely while raw macroinvertebrate sample material is disposed of after one year. Field instrumentation calibration results are stored in instrument specific bound log books for future reference and validation of collected data. Sediment will be stored for eight weeks and will be discarded after this period.

Water chemistry sample, field and laboratory quality control check results (duplicates) will be recorded within the main database and will be used for future reference and validation of sample results.

Quality assurance plan revisions and audit reports will be maintained by the NYSDEC Co-Principal Investigator for review upon request.

All results will be summarized in a final report, as required by EPA grant procedures, to be prepared in cooperation by the NYSDEC and USGS co-principal investigators.

II. Data Generation and Acquisition

1. Rationale of Monitoring Design

The Eighteenmile Creek AOC was established as a result of multiple industrial influences mostly located upstream of the AOC in the city of Lockport. Levels of PCBs, metals, and pesticides have been found well above NYSDEC applicable standards in the source area above Burt Dam (NYSDEC, 2006; E&E2, 2009). Using the sediment quality triad approach (USEPA 1994), the E&E project conducted in 2012 (E&E, 2013) suggested that benthic communities may no longer be impaired. This study did not include replicated macroinvertebrate sampling and did not include sites located within Olcott Harbor, the area originally sampled to justify benthos

impairment and Eighteenmile Creek as an AOC. The NYSDEC Rotating Integrated Basin Studies (RIBS) program has sampled the Eighteenmile Creek watershed several times since 1989 and found water quality in riffles of the source area most recently in 2005 to be slightly impacted.

This assessment will include replicated sampling at depositional locations within the AOC, the source area, and a local river system (Oak Orchard Creek) that will serve as a control to represent current water quality issues (eutrophication stemming from agriculture). Sampling will be extended into the settling area above Burt Dam to document benthic conditions in the source area along with the impact area (AOC) downstream of the dam. While the delisting criteria for benthos does not directly reference sediment toxicity evaluation this assessment will follow the approach used in both the St. Lawrence River at Massena and Rochester Embayment AOCs.

Sediment toxicity using indicator organisms in combination with sediment dwelling community assemblage data at both AOC and control sites provides an ensemble approach to benthic assessment. It allows for 1) community metric evaluation (ie BAP scores), 2) toxicity relative to laboratory controls, 3) community metric evaluation relative to ambient controls (ie Oak Orchard Creek), 4) toxicity relative to ambient controls, and 5) direct community assemblage evaluation relative to controls. These multiple lines of evidence provide a means of evaluating legacy toxic effects that drove the benthos BUI status while simultaneously assessing conditions relative to contemporary issues (ei eutrophication).

Sampling locations will be selected to provide a broad spatial representation of both inside and outside the AOC (impact vs control, respectively). First, it will assess the community structure using established NYSDEC biomonitoring ponar (sediment dwelling macroinvertebrate community) methodologies, metrics, and multimetric indices and sampling within the designated index period of July through September (NYSDEC SOP #208-14). Second, the design will allow for the assessment of upstream influences on the designated AOC area by including sampling locations with the AOC source area above Burt Dam. Third, it will include non-AOC control sites for statistical comparison. Samples above Burt Dam will be compared to samples taken in the area of Waterport Pond on Oak Orchard Creek to include the impoundment effects on the upstream community assemblages and sediments. Fourth, the co-principal investigators have chosen to evaluate both community structure and toxicity assays using an indicator organism along with habitat measures (particle size, TOC, depth, etc.) to lend weight of evidence to the assessment. Sediments to be used in toxicity assays will be a composite from each site to account for spatial variability in sediments (USEPA 2000).

Experience with this design for the St. Lawrence River at Massena benthos assessment (2012) and Rochester Embayment assessment (2013) indicates that the community structure in conjunction with toxicity are complimentary but the possibility for conflicting results exists.

Because community structure is the primary criteria, a multivariate analysis of structure and habitat will be weighted higher if results are conflicting.

A. Sample Distribution/Map

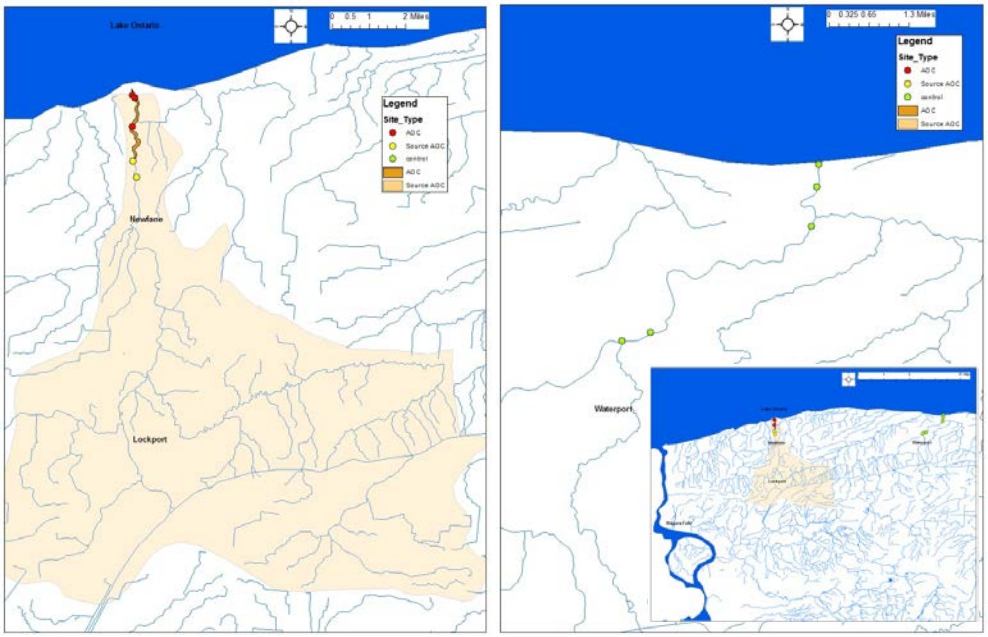

Figure 1. Map of potential benthic sampling sites for the Eighteenmile Creek and control site benthos assessment.

Table 3. Potential sampling locations for Eighteenmile Creek and control sites on Oak Orchard Creek.

River	Site	Latitude	Longitude	Site Type
Eighteenmile Creek	XEMIL-06	43.338457	-78.718649	AOC
	XEMIL-05	43.337596	-78.717461	AOC
	XEMIL-03	43.326121	-78.717843	AOC
	XEMIL-02	43.312493	-78.716682	Source AOC
	XEMIL-01	43.306261	-78.714534	Source AOC
Oak Orchard Creek	XORCH-05	43.371528	-78.191897	control
	XORCH-04	43.359667	-78.192479	control

XORCH-03	43.350348	-78.193856	control
XORCH-02	43.323867	-78.244479	control
XORCH-01	43.321641	-78.253609	control

B. Sampling Schedule

Macroinvertebrate sampling will be performed, as mentioned in section I. 3, during the summer 2014 during the months of July or August. All sampling will be based on a single event. Sampling will be postponed in the event of elevated flows. Weather events may create unsafe and unrepresentative sampling conditions. Under ideal sampling conditions, macroinvertebrate sampling will occur over the course of a two to three day sampling trip.

2. Sampling Methods

A. Benthic Macroinvertebrate Sampling - Ponar
Sample Collection: Ponar samples will be collected using the methods described in NYSDEC #SOP 208-14. Five replicate samples will be collected at each location. A total of up to 50 samples will be collected and analyzed.

Sample Processing: Sorting and subsampling will be carried out by the selected contracted laboratory using the method described in NYSDEC SOP #208-14. Approximate density will be calculated by dividing the amount of the sample processed by the total sample using a gridded tray.

B. Sediment Collection for Toxicity, Grain Size, and TOC

Sample Collection Bottles: All bottles will be provided by contract laboratories and cleaned according to method protocols.

Sediment Processing (field): Ponar samplers will be brushed off using a bristled brush and rinsed before leaving each sampling location and then rinsed again in ambient water at the next sampling location. This procedure is consistent with decontamination procedures described in NYSDEC SOP #207-14. Five ponar dredges will be composited and homogenized into a clean and rinsed (with ambient water) stainless steel bucket. Homogenization will be performed for 5-10 seconds seconds using a cleaned and rinsed mixing rod attached to an electric drill. Sample will be partitioned into the appropriate containers for each analysis (toxicity, particle size, TOC) using a cleansed and rinsed scoop. Samples will be held on ice and in the dark until all sediments have been collected. The maximum time samples will be held in the field is 72 hours. All samples will be stored according to USEPA (2000) guidelines.

Sample Processing (lab): Samples are composited in the field, packed in plastic bags, and then packed in ice filled coolers, which are then sent to an outside laboratory where analysis will be conducted according to established protocols (USEPA 2000; Kahn 1988). Toxicity assays will be commensed within two weeks of delivery. Because of the proximity to ALS Environmental, particle size, and TOC samples may be delivered directly by the samplers.

C. In Situ Water Quality Measurements

Measurement of in-situ water quality parameters (pH, DO, %DOsat, spCond, temp) will be measured at a central location relative to points where sediment samples are collected. Depth will be determined and a profile of measurements will be taken at 0.5 m from the surface and bottom and for sampling locations. At depths greater than 3 meters, measurements will be taken at 25th, 50th, and 75th percent of the maximum depth.

3. *Sample Custody Procedures*

It is the responsibility of the NYSDEC Principal Investigator to ensure that the proper sample handling and chain of custody procedures are followed by field and laboratory staff at all times.

All samples: Samples must be handled in accordance with the NYSDEC DOW SOP 101-11 for Sample Handling, Transport, and Chain-of-Custody. Examples of macroinvertebrate and sediment toxicity chain of custody form for laboratory work to be used for this project is provided in Appendix I. ALS Environmental COC is provided in Appendix II.

Field notes will be taken to document sample collection times, locations, dates, and sampling personnel. Individual sample containers will be marked to identify each station number, collection time, date, and location. Laboratory analysis sheets will also include this information along with a description of the specific analyses to be performed and the time and date of shipment to the lab. Sample holding times and laboratory preparation techniques will be summarized in a final laboratory analysis report.

Couriers will deliver all samples, on ice and in the dark, to the contract laboratory for analysis within twenty-four hours from time of shipping to assure temperatures do not reach above 6° C (USEPA 2000). Maximum time from sediment sample collection to delivery at the laboratory is 96 hours. Recommended maximum storage times range from 2 weeks to 8 weeks according to USEPA (2000). All tests will arrive and commence prior to 2 weeks from the sample date. Upon arrival at the laboratories, samples must be refrigerated at < 6° C until all analyses are completed. Processing and analysis of samples will begin immediately upon receipt by respective laboratories.

The laboratory manager shall record the time of sample receipt and start of analysis along with any problems encountered with equipment or samples. This information will be documented in the final laboratory analysis report.

4. Analytical Methods

Bed sediment toxicity assays will be conducted according to USEPA (2000). Because bid prices are not yet known, either a 10 day test (Test Method 100.3) or 20 day abbreviated life cycle test (Test Method 100.5) may be conducted. If funding is sufficient the 20 day test will be used (USEPA 2000). The 20 day abbreviated life cycle test is a widely known and used shortened version of the less efficient full life cycle test. Acute and chronic (survival and growth, respectively) endpoints are measured at day 20 rather than continuing until emergence (~60 days). TOC analysis will be conducted according to Kahn (1988) and particle size analysis will be conducted according to ASTM (2007).

5. Quality Control

The following measurements will be used to assess the quality of data being generated in the project. The target acceptance limits for these quality control procedures are listed in Tables 5, 6 and 7.

Table 5. - Analytical Specifications and QA/QC Requirements for Water Column Samples

Parameter	Analytic Lab	Standard Method	Precision	Accuracy	Calibration			Method Detection Limit	Reporting Limit
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Field Parameters		Std.Methods							
Temperature	*In Situ*	2550 B	+/-1°C	+/-1.5°C	Factory-set	--	--	±0.1 DegC	±0.1 DegC
Dissolved Oxygen		4500-O G	+/-1%	+/-2%	Daily	--	--	±0.1 mg/l	±0.1 mg/l
pH, field		4500-H + B	+/-0.05SU	+/-.2 SU	Weekly	--	--	±0.1 SU	±0.1 SU
Conductivity, field		2510 B	+/- 1 µs/cm	+/- 1%	Weekly	--	--	±1 µmhos/cm	±10 µmhos/cm

Table 6. Analytical Specifications and QA/QC Requirements for Sediment Samples

Parameter	Method Name	Method Type	Hold Time	Preservation	Precision	Accuracy	Instrument Detection Limit	Reporting Limit
TOC	SW-846 9060A w/ Lloyd Kahn	Pyrolysis/IR	14 days	<=6 deg C, dark	<35% RPD	75-125 RPD	20 mg/kg	300 mg/kg
Grain Size	ASTM D421/D422	Gravimetric	6 months	N/A	N/A	N/A	N/A	N/A

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Table 7. Starting age and control test acceptability results for sediment toxicity assays using *Chironomus dilutus*.

Test Method	Organism Age at start	Control Test Acceptability	
		Survival	Growth (AFDW)
100.3 (10-d)	10-d	>70%	0.48 mg
100.5 (20-d)	<24 h	>70%	0.48 mg

A. Precision

Precision can be defined as the relative uncertainty about a given measurement and is determined by replicate analyses. Two duplicate sediment samples will be collected from and homogenized bucket to assess the precision of toxicity assays, particle size, and TOC. Data from these duplicates will be used to evaluate the analytical precision or variability. These samples will be collected at the same time and adjacent to the original samples. Laboratory control acceptability limits are described in USEPA (2000).

B. Accuracy

USEPA (2000) describes control test acceptability for both growth and survival for both potential tests (100.3 and 100.5).

C. Representativeness

Appropriateness for macroinvertebrate sampling was first priority and water column sampling will be conducted at each site selected. Sites must be free of large substrate, woods, and logs. As described above, sampling locations will be selected based on known contaminant locations so as to represent worst case conditions and to limit potential criticism that site selection was biased to favor the benthos BUI removal.

D. Completeness

Completeness can be defined as the percentage of acceptable data necessary to accomplish the study objectives. Due to the high cost of sample analysis and the limited number of samples to be collected, it is important that staff strictly adhere to all QA criteria to accomplish the survey objectives. Ideally all 10 proposed benthic sampling locations will be sampled and processed but because appropriate fine sediments are necessary, it is possible that not all samples will be collected. Locations were selected to best characterize the AOC and surrounding areas but not all sites are necessary to assess benthic condition. Condition of any particular location will not be assessed without obtaining community data, although loss of supporting data such as particle size and TOC, will not preclude assessment and comparison to other sampling locations.

6. Instrument/Equipment Testing, Maintenance, and Calibration Procedures

For all water column parameters measured, the YSI 556 multi-probe sensor is calibrated within a day prior to departure for sampling, or at any time when a reading is by best professional judgment of the samplers, outside expected values. All calibration results are recorded in a bound log book. All sensors are serviced on a monthly basis (when in use) according to the manufacturer's instructions. Specific calibration procedures are listed for each parameter. Deficiencies in calibration and maintenance of all equipment are resolved on a case by case basis. The actual maintenance, calibration, and log keeping of all equipment work performed upon it is the responsibility of the Project Director. Back up equipment for all sampling parameters is available for use in cases of equipment malfunction. All calibration, maintenance, and operations of the YSI 556 multi-probe sensor can be found in NYSDEC SOP 211-14.

Dissolved oxygen: Air calibrated each sampling day prior to sampling using local absolute barometric pressure and ambient air temperature.

pH: Calibrated using fresh commercial pH 4 and 7 or 7 and pH 10 buffers. If measurements of buffers differ from theoretical values by more than 0.2 pH units, the manufacturer's maintenance procedure is performed, and the unit is re-calibrated. Probe condition is tracked through the recording of millivolts at each calibration. The probe is replaced or reconditioned when millivolts are outside the range described by the manufacturer.

Specific conductance: Calibrated using standard solution of 1000 µS/cm.

Temperature (YSI): Calibration is factory-set, and requires no re-calibration. Temperature is periodically checked against a laboratory quality glass thermometer.

Contract laboratories should maintain appropriate service contracts for laboratory instruments, and perform routine instrument maintenance at intervals suggested by the manufacturer or by internal laboratory SOP.

7. Supplies and Consumables

Inspection of supplies and consumables must be made upon arrival of new materials and immediately before their use in the field or laboratory. For newly arrived supplies and consumables all materials must be in their original packaging and free of noticeable damages. For materials already obtained and about to be used no noticeable defects will be allowed. The Project Manager is responsible for ensuring the quality of all supplies and consumables.

Consumables Required

Item	Supplier	Size	Quantity
pH buffer 4	Masters Chemicals	0.5 liter	2
pH buffer 7	Masters Chemicals	0.5 liter	2

pH buffer 10	Masters Chemicals	0.5 liter	2
Ethanol	Pharmco	5 gallon	5
Batteries	Lowes	C	10
Rite in the Rain – All weather Copier Paper	Forestry Suppliers	8.5” x 11”	200
Sample Jars and lids	Krackeler Scientific	quart	50

8. Data Management

Data management will be performed as described in detail in section 6. Field data for this project will be collected using Pocket PCs and downloaded to a system backed up on a weekly basis. A master copy of all data collected will be stored along with a copy of each sampling trip. Data will be transferred to its final version in the Stream Biomonitoring Unit’s Access Database following procedures described in the Biomonitoring Data Management System User Manual (Smith et al 2007). Taxonomic data received within customized lab data sheets will be transferred to the Access Database also following procedures outlined in Smith et al 2007. Toxicity data will also be stored both on the same computer under previously described backup protocols. In addition to storing field and taxonomic and toxicity data on a backed up machine, additional backups will be made by burning data onto CDs. All stored data will be kept indefinitely.

III. Assessment and Oversight

1. Performance and System Audits

Potential taxonomic consulting laboratories will be required to submit recent taxonomic quality assurance results of samples that have been reidentified. This is intended to assure accuracy and precision of taxonomic data produced. Upon receipt, co-principal investigators will review taxonomic data.

Toxicity laboratories will be required to submit organism culture source, monthly reference toxicity test data (cusum charts) for 12 months prior to bid submission for both 10 and 20 day tests, and training and experience resumes for all personnel to be used on the project.

For chemical analysis, the contract analytical laboratory participates in semi-annual performance samples and annual on-site audits under the NYSDOH ELAP Program.

A field audit will be performed at the request of the DOW QAO and will entail an accompaniment on one or all sampling days for this project.

2. Corrective Action

Revisions to the Quality Assurance Plan are to be made by the Principal Investigator, and the Project Quality Assurance Officer will ensure that the plan is distributed to those on the distribution list upon completion of revision.

Corrective action procedures are outlined for the major program elements:

Organism identification: Species identifications that are not found on the New York State species list or the U.S. EPA regional species checklist, and which are outside of the known distribution of the species as given in the primary reference must be verified by consultation with regional biologists or the appropriate taxonomic authority. Taxonomic discrepancies are corrected by auditing previous identifications of the species in question and making necessary changes to insure consistency. All species name changes are corrected on the species list, and a record made of the previous name.

Sample results: Outlying indices determined to be spurious may be rejected. Outliers will be defined by greater than 1.5 times the width of the interquartile range outside the 25^{th} and 75^{th} percentiles of the index data.

Data entry validation and transmittal errors: All computer-entered data that are not verified by number of individuals and number of species from the Laboratory Data Sheet are considered invalid until corrections have been made. Errors found in spot checks of individual entries must be corrected, and additional spot checks conducted.

Any person observing a deviation from intended plans and procedures will report such deviation to the project staff person responsible for the operation or analysis in question. The appropriate project personnel shall then:

1. Develop a corrective action plan to ensure that future sampling, analyses, etc. are conducted in accordance with the QA procedures presented in this QAPP;
2. Rerun procedures in the appropriate manner and re-analyze samples if sufficient sample material is available and holding times are not exceeded;
3. Report all problems and deviations to the principal investigator. The principal investigator shall also be consulted during the development of any proposed corrective action plans and;
4. Record all deviations from intended plans and procedures in the appropriate field or laboratory notebooks.

3. Reports to Management

A final report is written cooperatively by the co-principal investigator and is issued upon completion of the major program elements. The report will include a summary of sampling locations and overall findings as well as lab and field results. This report is prepared in a format agreed upon between the Principal Investigators, and will be distributed to those people listed in the distribution list of the document.

Project Fiscal Information

Listed below are resource requirements for the project which may be used for computing cost estimates.

4. Budget

Equipment	$ 300
Supplies and Materials	$ 300
Other	$ 300
Consultant Services	$ 8,250
Macroinvertebrate (approx.)	$ 6,000
ALS Env. (approx.)	$ 2,250
Total DEC contribution	$ 9,150
Toxicity (USGS)	$10,000

5. Data Validation and Usability

A. Toxicity and sediment analysis
First, analytical laboratory staff follows specific laboratory protocols to assure the quality and validity of the data. For additional information, refer to the NYSDEC Prescribed Analytical Protocols (2011). Second, the co-principal investigators will review data results during the processing of the electronic data files.

All data will be reviewed to determine its validity prior to use and distribution. Those data not meeting the previously identified criteria for precision and accuracy will be re-analyzed where possible, or flagged if additional sample material is not available. An indication as to why flagged data did not meet the minimum QA criteria will be provided.

B. Macroinvertebrate Community
Macroinvertebrate data results are validated according to the methods detailed in SOP 208-14, Biological Monitoring of Surface Waters in New York State. A request for proposal will stipulate the need for external re-identification of 10% of the samples processed and calculation of percent taxonomic disagreement and percent difference in enumeration. Exceeding 10% in either category will indicate the need for investigation into the reason for the discrepancy.

Data validation and accepatability will be determined USEPA test acceptability criteria (USEPA 2000).

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Appendix I. Chain of Custody Forms – Macroinvertebrate and Sediment Sample

			Project# :	
			Project Name and Company:	
			Total # of Samples this project:	
			# of Samples Shipped this shipment:	

	In Box #	#of Jars	Stream	Site #	Rep	Habitat	Device	Collection Date	Notes
	2	*3*	*Burro Creek*	*36554*	*T2*	*Riffle*	*Hess*	*4/26/2005*	*CT Method*
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

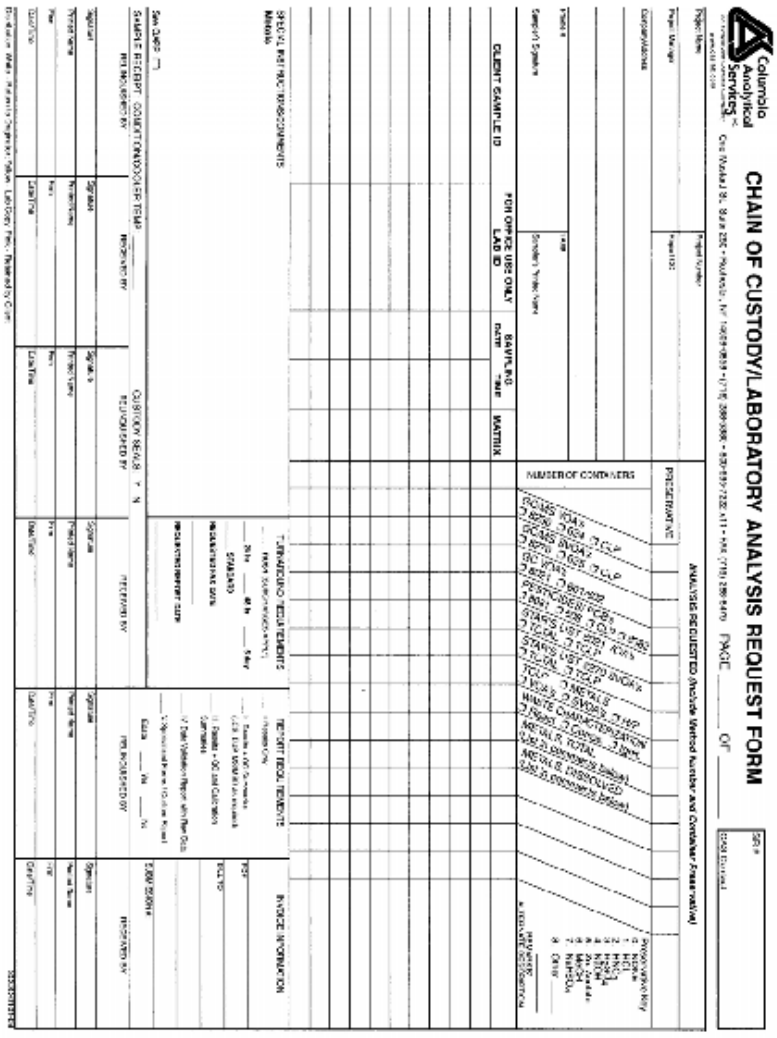
Relinquished By/ Date: _____ **Condition:** _____
Company:

Received By/ Date: _____ **Condition:** _____
Company:

Relinquished By/ Date: _____ **Condition:** _____
Company:

Received By/ Date: _____ **Condition:** _____
Company:

Appendix II. Columbia Analytical Services Chain of Custody



Appendix III. Field Sampling Sheet

Eighteenmile Creek Benthos Project

Waterbody	_____	Sample Type	Ponar
Station	_____	Date	_____
Latitude	_____	Time	_____
Longitude	_____		
Collectors			

Depth	_____	m
Current	_____	cm/s
Distance from Shore		m (est.)

Invertebrate Est. % Macrophyte Cover (1 sq. m)

A	_____%
B	_____%
C	_____%
D	_____%
E	_____%

Depth	Temp (C)	Sp. Cond	pH	DO (mg/L)	DO (%Sat)
0.5 from top					
25th _____					
50th _____					
75th _____					
0.5 from bottom					

Notes
A
B
C
D
E

Check List

_____ 5 invert bottles

_____ 1 toxicity bottle (composite)

_____ 1 particle size bottle

_____ 1 water quality bottle

Appendix IV. Sediment Field Sampling Protocol

SEDIMENT SAMPLING PROTOCOL

1. Navigate to sampling location using coordinates from site list.
2. Rinse ponar and buckets with site water.
3. Collect bottom sample (ponar) and verify sediment particle sizes are acceptable.
4. Drop Anchor then record:
    a. the starting coordinates and
    b. time on the field sheet.
5. Label all bottles with:
    a. site ID,
    b. replicate (for invertebrates only)
    c. date, and
    d. time.
    [Use 1 toxicity, 1 particle size, 5 invertebrate, and maybe 1 water bottle at each site]
6. Measure temperature, DO, pH, and other parameters as available at:
    a. the top - 0.5m below surface,
    b. the bottom - 0.5m above the bottom,
    c. 50% depth if the site is more than 2m deep,
    d. 25% and 75% depth if mid-depth temp or DO are more than 20% different from top or bottom measures,
    [There will be a total of 1 to 5 measurement depths]
7. If a the meter does not measure pH, collect a surface grab sample with a 500 ml bottle, label it, and place it on ice (in a cooler).
8. Collect five (5) toxicity ponars for sediment toxicity composite sample:
    a. place all five samples into one bucket (for a composite sample), then,
    b. mix the composite sample thoroughly (use drill/mixer?), and
    c. collect one 2L (1/2 gallon) sample for toxicity and
    d. collect one 250 ml (glass jar) sample for particle size and organic carbon (content) analysis, then:
    e. place all bottles on ice.
    [The boat can be moved to 2 or 3 nearby locals if needed]
9. Collect 5 separate ponars for invertebrate taxonomy:
    a. note the percentage macrophyte coverage (for each ponar) on the field form,
    b. remove fines from each sample using a 500 um sieve-bottom bucket.
    c. place each sample into a 0.5 to 1L nalgene jar and
    d. add as much 90% Ethanol as there is debris.
    e. Place the 5 jars into a shaded local.
10. Rinse buckets and ponar with site water.
11. Move to next site or collect a duplicate sample for toxicity and sediment sizes only (no invertebrates).

Appendix V. ~~Rochester~~Eighteenmile Creek Benthos Training Participant Acknowledgment Form

I _____ , certify that I have read, understood, and been trained by NYSDEC and USGS Co-Principal Investigators on sediment sampling and safety protocols as described in NYSDEC SOP #208-12 and USEPA (2000) and have demonstrated capability to adhere to prescribed procedures.

Sign _____
Date_____