

APPENDIX F. Quality Assurance Project Plan for Water Monitoring



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We Protect Hoosiers and Our Environment.

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Devin Bell, Chairman
Clinton County SWCD
860 S. Prairie Ave., Suite 1
Frankfort, IN 46041

September 9, 2010

Dear Mr. Bell:

Re: Subcontract Approval
FFY 2009 Section 205(j) Project
EDS 9-271

This is our approval of the subcontract with Commonwealth Biomonitoring, Inc., to help fulfill Task B of the above grant agreement. Specifically, a Quality Assurance Project Plan will be written for the subtask. Water quality monitoring for chemical parameters and bioassessment for fish and macroinvertebrate communities and a Qualitative Habitat Evaluation Index will be conducted. The total cost will not exceed \$40,000. Please note that the subcontract for the Section 205(j) project must not exceed the term of the grant agreement between the Clinton County SWCD and IDEM. Please also note that future subcontracts must be approved prior to being signed by both parties in accordance with the Assignment section of the grant agreement.

This subcontract was reviewed only for consistency with the scope of services, budget, and time frame of the contract. This was not meant in any way to be a legal review. Your office is responsible for obtaining any legal review that you consider necessary.

If you have any questions regarding this letter, please contact your Project Manager, Crystal Rehder, at 317/308-3185.

Sincerely,

Laura M. Bieberich, Sr. Environmental Mgr.
NPS/TMDL Section
Office of Water Quality

CC: Cindy Muffett, Resource Conservation Specialist

**QUALITY ASSURANCE PROJECT PLAN
FOR
South Fork of Wildcat Creek Watershed Monitoring
ARN: A305-9-271**

Prepared by

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Prepared for

Indiana Department of Environmental Management
Office of Water Management
Watershed Management Section

April 2010

Water Quality Analysis	<u>Greg R. Bright</u> Greg Bright	<u>May 3, 2010</u> Date
Bacteria Analysis	<u>Dennis Shirar</u> Dennis Shirar	<u>5/3/2010</u> Date
Watershed Coordinator	<u>Cynthia Muffett</u> Cynthia Muffett	<u>5/3/2010</u> Date
QA Project Manager:	<u>Betty Ratcliff</u>	<u> </u> Date
WMS Section Chief:	<u>Andrew Pelloso</u>	<u> </u> Date
WMS Branch Chief:	<u>Marylou Renshaw</u>	<u> </u> Date

Copies of the QAPP have been distributed to Greg Bright, Cynthia Muffett, Dennis Shirar, and Betty Ratcliff, of whom have responsibility for implementation of various tasks in the project.

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1.0 INTRODUCTION

The Clinton County Soil and Water Conservation District has received a 319 water quality grant from the Indiana Department of Environmental Management (IDEM) and the United States Environmental Protection Agency (USEPA). The purpose of the grant is to prepare a watershed management plan for the South Fork of Wildcat Creek. One of the tasks in the project is to monitor water quality using biological and chemical methods and use the information to make decisions that may be used to help prepare the watershed management plan. This document presents a quality assurance plan for monitoring.

2.0 PROJECT DESCRIPTION

2.1 General Overview:

The water quality assessment will use macroinvertebrate monitoring and aquatic habitat assessment to measure an Index of Biotic Integrity (IBI) at sixteen sites in the South Fork of Wildcat Creek watershed within Clinton and Tippecanoe Counties. The biological information will be supplemented by collecting water chemistry and *E. coli* data at some of these sites as well. The information will be used to diagnose water quality problems and propose solutions. This stream or its tributaries are on IDEM's 303(d) list of impaired waterbodies (for *E. coli* contamination, impaired aquatic communities, and low dissolved oxygen). A TMDL has been prepared for the watershed. The SWCD is also concerned about higher than recommended levels of the herbicide atrazine measured in previous sampling of the watershed.

2.2 Project Objectives:

The objectives of this project are to characterize the biological, physical, and chemical integrity of a 10-digit watersheds (0512010703) and to make recommendations to solve any identified problems.

In association with routine chemical measurements, bioassessments are extremely valuable tools in determining the ecological health of a waterbody. An accurate and reproducible measure of the ecological health of a stream can be made by comparing the number and kinds of animals present at a study site with those from an unimpacted "reference" site. The bioassessment technique results in a single biotic index value: the higher the value, the more ecologically healthy the site. In Indiana, the "reference" conditions have already been established by the IDEM mIBI.

In addition, bioassessments can diagnose problems. Healthy streams have good aquatic habitat. However, if habitat is good but the stream doesn't support a healthy aquatic community, a diagnosis of poor water quality can be made. The aquatic community can even help in the diagnosis of particular type of water quality problems. Certain animals are sensitive to different types of stresses. Comparison of the numbers and kinds of animals present can give important clues about degraded water quality due to toxic substances, excessive sedimentation, excessive nutrient inputs, or low dissolved oxygen concentrations. Because they are exposed to conditions 24 hours a day for up to a year, macroinvertebrates can detect water quality problems that occasional grab samples for chemical analysis may not discover.

E. coli are a bacteriological indicator of potential human health effects associated with whole body contact in water. Frequent analysis of *E. coli* concentrations at various sites within the watersheds during warm weather will help determine human health risk and potentially help locate problem sources of bacteria.

Excessive nutrient concentrations can create nuisance algae blooms and upset the trophic balance of healthy streams. Excess suspended sediment can clog the gills of aquatic animals and coat the rocky bottom that supports egg production. Atrazine has been found in some previous samples that can create toxicity problems to sensitive forms of aquatic life and make the water unsuitable for drinking.

2.3 Sampling Design:

The overall experimental design is to sample the biological community, the physical integrity of the stream's habitat, and basic water chemistry in a "targeted" manner to answer the following questions:

- 1) What is the overall ecological health of the watersheds?
- 2) Are the problems primarily from water quality or degraded habitat?
- 3) Are water chemistry parameters within normal ranges for aquatic life?
- 4) What can be done to make the identified problems better?

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Table 1. Physical, chemical and biological parameters to be measured at each site

Habitat Measurements

Qualitative Habitat Evaluation Index at 16 sites in the watershed..

Biological Measurements

Macroinvertebrate IBI at 16 sites in the watershed (one sampling event).

Chemical and Physical Measurements

Nitrogen (nitrates+nitrites), total phosphorus, total suspended solids, pH, temperature, conductivity, dissolved oxygen, stream flow. These parameters will be measured at 12 sites. Measurements will be made six times (every other month) for one year. At least two sampling events will be immediately following a storm.

Atrazine analysis at 8 sites. There will be three sampling events (May, July, and September)..

***E. coli* Measurements**

E. coli will be measured at 12 sites.

Samples will be collected and analyzed weekly for five weeks in May and June and another five week period in September and October.

Parameter	Method	Table 1		Holding Site	
		Detection	Limit	Time	
Biotic Index	INmIBI	N/A	N/A	Field	
QHEI	Ohio EPA	N/A	N/A	N/A	Field
NO2+NO3	SM 4500 NO3	0.5 mg/l		28 days	Lab
Total P	SM 4500 P F	0.03 mg/l		2 days	Lab
TSS	SM 2540 B	1 mg/l		7 days	Lab
pH	SM 4500 H+	0.1 SU		N/A	Field
Temp.	Thermocouple	0.1 degree		N/A	Field
Cond.	SM 2510 A	1 uS		N/A	Field
D.O.	SM 4500 O G	0.1 mg/l		N/A	Field
Flow	velocity meter	N/A		N/A	Field
Atrazine	EPA 507	1 ug/l		7 days	Lab
E.coli	SM 9223 B	1 MPN/100ml		6 hrs	Lab

2.4 Project Timetable:

The project will be conducted during 2010 and 2011 with a final report to be available for inclusion in the watershed management plan by May 31, 2011.

- QAPP approved May 2010
- Biological Sampling August 2010
- Habitat Analysis August 2010
- Chemical Sampling May, July, September, November 2010
January, March 2011
- Atrazine Sampling April, May, and June 2006
April, May, and June 2007
- E.coli Sampling May to October 2010
- Data Analysis April 2011

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The Project Manager (Greg R. Bright) is responsible for biological quality assurance, management of the project field logistics, the collection, analysis, and interpretation of biological data, identification of biological specimens, and writing the biological report. A copy of the lab's Standard Operating Procedures is attached in the Appendix. Greg Bright will also be responsible for chemistry quality assurance and laboratory chemical analysis. A copy of the lab's Standard Operating Procedures for the required chemical analysis is attached in the Appendix.

Aquatic biologist Dr. Melody Myers-Kinzie is responsible for assisting in sample collections and for doing the macroinvertebrate identifications and analysis.

Frankfort Wastewater Treatment Plant Superintendent Dennis Shirar is responsible for overseeing the analysis of E.coli samples in the WWTP laboratory.

The Watershed Coordinator (Cynthia Muffett) is responsible for coordinating the project with Commonwealth Biomonitoring, IDEM, and the Clinton County SWCD. She will collect the E.coli samples and deliver them to the Frankfort Wastewater Treatment Lab for analysis.

The IDEM quality assurance coordinator (Betty Ratcliff) is responsible for oversight of the quality assurance portion of the grant.

4.0 DATA QUALITY OBJECTIVES

4.1 Accuracy/Bias

Accuracy and bias in macroinvertebrate and chemical analyses are dependent on maintenance of standard procedures for sample processing, labeling, sorting, identification, counts, and chemistry laboratory procedures. A definitive measurement of accuracy in biological assessments cannot be made because there is no "true" value for reference. However, by stressing conformance with the procedures outlined in this plan, we expect a high degree of accuracy and a low degree of bias.

For both the field and laboratory chemical measurements, we expect accuracies within 10% of the true value, based on previous results obtained by laboratories participating in performance evaluations.

Bias is evaluated by the use of field blanks. We will use field blanks on each sampling trip.

4.2 Precision

Precision of biological sampling will be evaluated by performing analyses on field duplicates of biological community measurements at 10% of the sites. The data quality objective for precision is IBI scores of duplicates within 10% of the mean score.

$\text{Sample 1 IBI} / (\text{Sample 1 IBI} + \text{Sample 2 IBI} / 2)$ is less than 0.1

Habitat assessments are conducted at each site by the same crew member. At one site a duplicate assessment will be conducted by a second trained biologist. If data differs by more than 10% in total QHEI assessment scores, then biologists will discuss and attempt to reach a consensus. Adjustments to assessment scores are then documented and made in the data set.

Precision of the laboratory chemical analyses is expected to result in chemical recoveries of 95 to 105%. Precision will be measured by analyzing the results of duplicate samples collected in the field and measuring the relative percent difference.

4.3 Completeness

Completeness for IBI and chemical measurements should be 90% or 14 valid samples.. Completeness is defined as:

$$\text{Completeness} = v/n * 100$$

where: v = number of samples necessary to achieve project objectives

 n = total number of measurements anticipated.

4.4 Representativeness

The samples collected for chemical and biological analysis should be representative of the biological health of the site where the sample is collected. To assure representativeness, all samples will be collected on the same day, using the same collection technique from the same habitat. The sites that have been selected for analysis represent the entire watershed.

4.5 Comparability

Comparability is ensured through the use of identical sampling techniques at each sample site. The results may be compared to historical samples of water quality collected in the watersheds by IDEM since 1998 and forwarded to the Clinton County SWCD by IDEM staff..

4.6 Sensitivity

Sensitivity is the detection level achievable for each measured parameter. This is listed as “detection limit” in Table 1.

5.0 FIELD PROCEDURES

Benthic macroinvertebrates will be collected by dipnet using a multi-habitat technique (IDEM, 2006).

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Chemical and E.coli sampling will consist of grab samples collected from pooled areas. High density plastic containers will be used to collect all chemical samples except atrazine. Atrazine sample containers will be 1-liter amber glass bottles. E.coli containers will be pre-sterilized 100 ml plastic containers. Samples for nitrogen and phosphorus analysis will be preserved with sulfuric acid. All samples will be placed on ice for transport to the lab.

Sample conditions

Macroinvertebrate sampling will be conducted during low- to moderate-stable periods. Periods of high flow will be avoided. For chemical sampling, four of the six samples will be collected during dry weather (no significant rain within the prior 7 days). Two samples will be collected during wet weather (at least 0.3 inches of rain within the previous 24 hours). One E. coli sample will be collected each week during the recreational season (May through October). Both wet and dry conditions are expected to occur during sampling.

Habitat

Qualitative habitat will be measured using the protocol developed by Ohio EPA (1989).

Field Chemistry and Physical Measurements

Field measurements will include temperature, flow, dissolved oxygen, pH, and conductivity. Temperature and dissolved oxygen will be measured with a Hach D.O. meter. Conductivity will be measured with a Hanna instruments conductivity probe. The pH of all samples will be measured with a field pH meter. Flow will be measured by a current meter each time a sample is collected (including all E.coli samples). This flow information will be supplemented by daily flow data collected by the USGS gauging station on the South Fork of Wildcat Creek near Dayton.

6.0 LABORATORY PROCEDURES

Laboratory Chemistry

Additional water quality parameters will be measured in the laboratory, using standard operating procedures outlined in Appendix 3.

Macroinvertebrates

Macroinvertebrate samples will be preserved with 70% isopropanol and returned to the lab. In the lab, each sample will be spread onto a grid and randomly selected grids will be picked for 15 minutes, collecting at least a 100 organism subsample. All macroinvertebrates in the subsample will be identified to genus or species, as outlined in Appendix 4.

7.0 CUSTODY PROCEDURES

Sample custody will begin with the crew chief and samples are to remain in the custody of the field team until the samples are returned to the appropriate laboratory shipping and receiving room for entering into the sample tracking system. A chain-of-custody form will be completed for all samples. This form will include the sample date, sample time, sample site, and the name of the person collecting the sample. An example chain-of-custody form is attached in Appendix 5.

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All sample sites will be assigned a designated number. Sites will be consecutively numbered and all standardized data forms generated from a site will be indexed and computerized according to that number.

Containers will be preserved, labeled, and placed in a sealed cooler for transport to the laboratory. Samples will be retained in the laboratory under chain-of-custody procedures. Samples will be inspected for leakage or damage from transport weekly. Loss of fluid preservatives for community samples will be replaced. Taxonomic composition and relative abundance information is submitted to the Project Manager.

All raw data (including data forms, logbooks, etc.) are retained by the Project Manager in an organized fashion and archived for future reference.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

The dissolved oxygen and pH meters will be calibrated according to the manufacturer's specifications. Calibration records will be maintained in a field notebook. The instruments will be calibrated prior to taking the field measurements and on the same day as the measurements.

9.0 PREVENTATIVE MAINTENANCE

The field crew leader is responsible for maintaining all files for all field equipment. Individual team members may be given responsibility for different equipment and its deployment in the field. All nets will be inspected at the completion of each site for holes caused by snagging or other damage. The nets will be repaired immediately.

A list of critical spare parts that should always accompany field sampling surveys to minimize downtime follows:

- 70% isopropanol
- Dipnet
- Macroinvertebrate sample containers
- Macroinvertebrate sieve
- All equipment required in Standard Operating Procedures.
- QAPP

10.0 DATA REDUCTION, REVIEW AND REPORTING

10.1 Raw Data

Raw data for macroinvertebrates will be in the form of genus and species names and numbers for the biological assessment and in appropriate quantitative values for the habitat assessment.

10.2 Data Reduction

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The macroinvertebrate data will be analyzed using genus and species level identifications (EPA Protocol 3) and analyzed using IDEM metrics (IDEM, 2006).. The IBI metrics for this study are shown in Table 2.

Table 2. SCORING VALUES FOR METRICS

	5 points	3 points	1 point
Total Taxa	>41	21 - 41	<21
Total Number of Individuals	>258	129-258	<129
# of EPT Taxa	Dependent on stream drainage area		
% Orthoclads & Tanytarsids	<24	24-47	>47
% non-non-insects	<18	18 - 35	>35
# Diptera Taxa	>14	7 - 14	<7
% Intolerant species	>32	16 - 32	<16
% Tolerant species	<13	13 - 25	>25
% Predators	>36	18 - 36	<18
% Shredders & scrapers	>20	10 - 20	<10
% Collector filterers	<10	10 - 20	>20
% Sprawlers	<6	3 - 6	>3

The scores for each metric (1 to 5) will be added (12 metrics) to calculate an IBI score for each site (a range of scores from 12 to 60).

10.3 Data Review

All chemical data will be checked for completeness before leaving a site. Data collected in the laboratory will be checked to assure that the required metrics can be calculated. Data sheets from each site are checked by the field crew leader to verify accuracy and completeness.

10.4 Data Reporting

Biological data will be reported by the names and numbers of the species collected. The IBI will be reported as a value between 12 and 100. Habitat data will be reported as a number between 0 and 100.

Chemical data will be reported in mg/l.

E.coli data will be reported in MPN/100 ml

A final report of the data will be submitted electronically to IDEM using the NPS data spreadsheets provided by IDEM.

11.0 QUALITY CONTROL PROCEDURES

Standard quality control procedures used by Commonwealth Biomonitoring for biological assessments will be employed in this study (Appendix 4). These include checks of identification and enumeration of macroinvertebrates by two different experts at one site during each sampling season.

Voucher specimens of all species collected will be retained and placed in the Purdue University Entomology collection for future reference and inspection by qualified biologists, for checks on species identifications, if necessary

Habitat assessments are conducted at each site by the same crew member. At one site a duplicate assessment will be conducted by a second trained biologist. If data differs by more than 10% in total QHEI assessment scores, then biologists will discuss and attempt to reach a consensus. Adjustments to assessment scores are then documented and made in the data set.

Field chemistry quality control procedures include the analysis of duplicate samples at ten percent of all sample sites.

Laboratory quality control procedures include the analysis of spikes, duplicates, and method blanks every tenth sample (see Appendix 3).

12.0 DATA QUALITY ASSESSMENT

Specific procedures for assessment of precision and accuracy on a routine basis are outlined and described in section 4.0. The data will be evaluated after each sampling event to assure that the data quality objectives are being met. If data fall outside the project goals of the Data Quality Objectives in Section Four, the laboratory will take corrective action, as stated in Section Fourteen. Data falling outside the data quality objectives will be flagged as follows:

R: Rejected Data not used in any evaluations.

J: Estimated. Small errors in QC found but still used in evaluations.

Q: One or more of the QC checks or criteria was out of control.

H: The analysis for this parameter was performed out of the holding time. The results will be estimated or rejected on the basis listed below:

- 1) If the analysis was performed between the holding time and 1½ times the holding time the result will be estimated (HJ).
- 2) If the analysis was performed outside the 1½ times the holding time window the result will be rejected (HR).

D: The Relative Present Difference (RPD) for this parameter was above the acceptable control limits. The parameter will be considered estimated or rejected on the basis listed below:

- 1) If the RPD is between the established control limits and two times the established control limits then the sample will be estimated (DJ)
- 2) If the RPD is twice the established control limits then the sample will be rejected (DR)

B: This parameter was found in field or lab blank. Whether the result is accepted, estimated, or rejected will be based upon the level of contamination listed below.

- 1) If the result of the sample is greater than the reporting limit but less than five times the blank contamination the result will be rejected (BR).
- 2) If the result of the sample is between five and ten times the blank contamination the result will be estimated (BJ).
- 3) If the result of the sample is less than the reporting limit or greater than ten times the blank contamination the result will be accepted within the concentration identified (e.g.B,45).

U: The result of the parameter is above the Method Detection Limit (MDL) but below the

reporting limit and will be estimated.

13.0 PERFORMANCE AND SYSTEMS AUDITS

Internal performance and system audits required to monitor the capability and performance of the laboratories will be conducted on appropriate log sheets, data sheets, verification sheets, and calibration equipment log sheets at each site in the field and after each of the two sampling seasons after all data have been collected.. All laboratory audits will be conducted by the Project Manager. Calibration logs will be made available to IDEM staff upon request for an external audit.

14.0 CORRECTIVE ACTION

Most of the biological samples will be analyzed by one taxonomic expert (the project manager) to provide consistency between samples. One sample each sampling period will be analyzed by two different people. If there is more than 10% variance in sample numbers, identifications, or IBI scores, the samples will be analyzed again by the project manager. Discrepancies in identification and counts will be noted for that sample. Differences in identification of a particular organism will be discussed between the two to arrive at a consensus. Consultation of an outside taxonomist may be necessary. Changes will be made based on the consensus conclusion.

If water chemistry analyses fall outside the objectives listed in Section Four or if field blanks indicate contamination, the lab or field personnel will not analyze any additional samples until a cause for the discrepancy has been identified. Sample results collected during this time will not be discarded but will be identified as potentially suspect.

15.0 QUALITY ASSURANCE REPORTS

A quality assurance report will be prepared by the project coordinator and will include all pertinent information relating to measurement data accuracy, precision, and completeness, as outlined in the Standard Operating Procedures and this Quality Assurance Program Plan.

Quality Assurance (QA) reports will be submitted to IDEM's Watershed Management Section every year as part of the Quarterly Progress Report. The results will also be included in the project Final Report.

The QA report will include:

- Assessment of the data in terms of its accuracy, precision, and completeness;
- Results of any performance audits performed during the quarter;
- Any significant quality control problems encountered and the recommended solutions. Results that fall outside the precision and accuracy goals will be flagged. Blank samples that are contaminated will be flagged. The flagged samples will be identified in bold print and will not be used in statistical analysis of results.
- Discussion of whether the QA objectives are being met and the resulting impact on decision – making; and
- Any limitations on the use of the data.

REFERENCES CITED

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5, 28 pp.

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APPENDIX 1. - Sampling Sites (See Appendix 2 for map locations)

			Latitude		Longitude
Site 1	Shanty Creek (upper Kilmore Creek)		40 21	17.7	86. 20 14.0
Site 2	Swamp Creek (downstream from Michigantown)		40 19	47.7	86 2.4 25.8
Site 3	Kilmore Creek (upstream)		40 20	54.8	86 20 14.0
Site 4	Kilmore Creek (middle)		40 18	53.2	86 30 55.2
Site 5	Kilmore Creek (downstream)		40 20	9.2	86 37 0.0
Site 6	Prairie Creek (downstream)		40 18	37.0	86 30 25.8
Site 7	Prairie Creek (upstream)		40 15	52.1	86 30 10.2
Site 8	Mann Ditch (upstream from Frankfort)		40 16	15.6	86 30 4.7
Site 9	Spring Creek (mouth)		40 18	57.5	86 37 50.0
Site 10	Lauramie Creek (mouth)		40 18	48.7	86 44 54.5
Site 11	Lauramie Creek (upstream)		40 16	21.6	86 43 3.4
Site 12	Unnamed tributary (mouth)		40 24	1.2	86 45 57.2
Site 13	South Fork of Wildcat Creek (upstream)		40 19	6.1	86 28 57.0
Site 14	South Fork of Wildcat Creek (Downstream from Frankfort)		40. 19	14.4	86. 37 5.1
Site 15	South Fork of Wildcat Creek(middle)	40 19	10.3		86 43 58.5
Site 16	South Fork of Wildcat Creek (downstream)	40. 25	5.7		86. 46 5.2

Sites for benthic analysis

All 16 sites

Sites for benthic and chemical analysis:

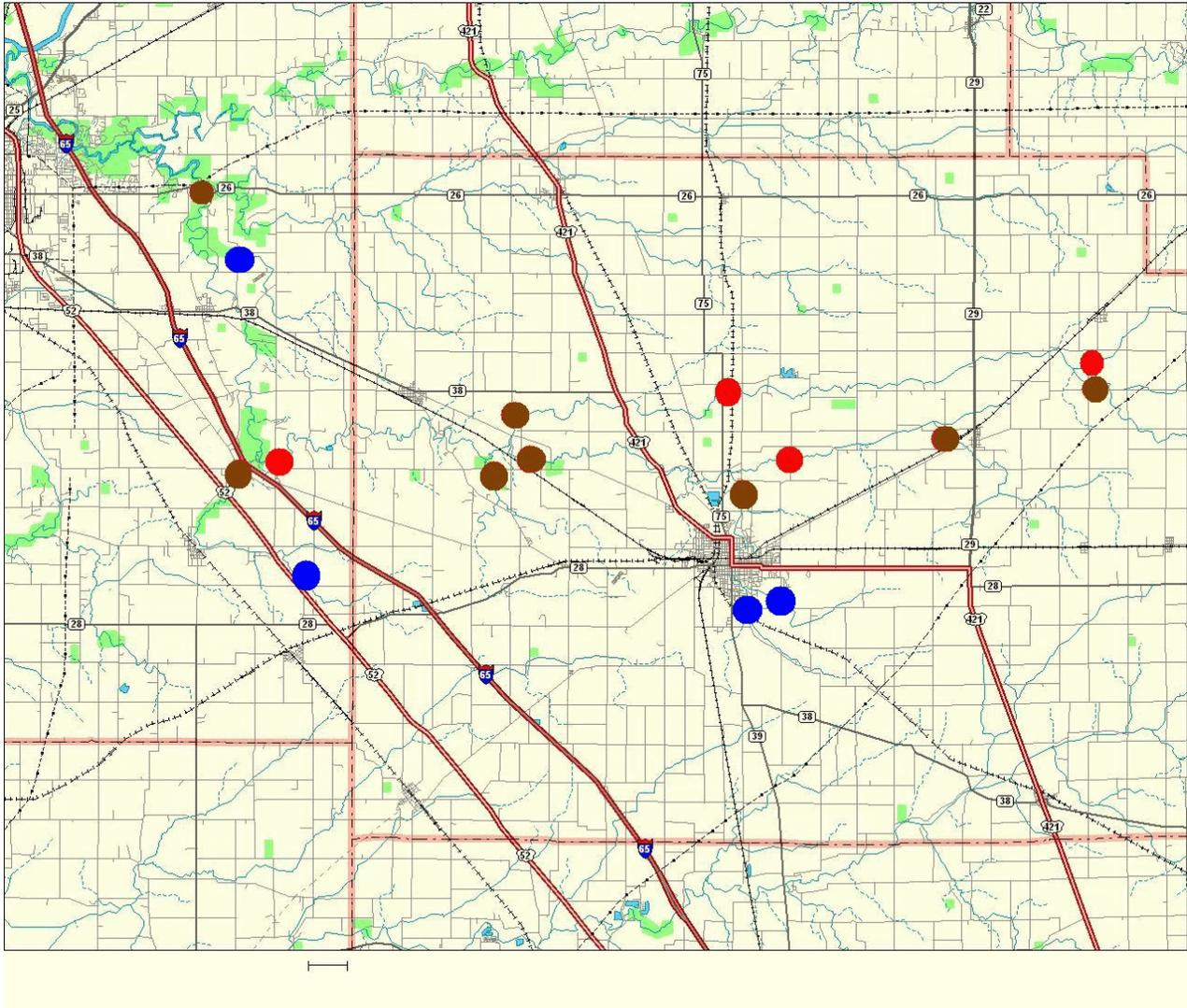
Sites 1, 2, 3, 4, 5, 6, 9, 10, 13, 14, 15, 16

Sites for benthic, chemical, and atrazine analysis

Site 2, 3, 5, 6, 9, 10, 14, 16

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APPENDIX 2. Sampling Site Map



Brown = All Parameters Measured
Red = All Parameters Except Atrazine
Blue = Macroinvertebrates Only

APPENDIX 3 - Standard Operating Procedures for Laboratory Water Chemistry

Total Suspended Solids
Nitrogen (Nitrate + Nitrite)

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Total Phosphorus
Atrazine
E. coli

Total Suspended Solids (TSS)

Reference

Standard Method 18th Edition for the Examination of Water and Wastewater, 2540; A, B, or C.

Sample Handling and Preservation

Samples are to be collected without any preservatives being added to them.

Apparatus and Materials

Analytical Balance
Drying Oven
Desiccator
Vacuum pump
Connection Tubing
Baking pans used in drying oven
Pre-weighed paper filters, with trays
Suction Flask
Membrane Filter
Membrane Filter Funnel
Clamp
Metal or Plastic tweezers

Reagents

Deionzied Water

Procedures

Assemble the suctioning apparatus to filtering apparatus.

Place the membrane filter inside the suction flask

On the TSS record sheet write down the pre-weighed filter number and weight in the correct spaces provided. Place that filter on top of the membrane filter, then place the membrane funnel and clamp the funnel down to the suction flask.

Shake the sample to have a representative sample.

Pour off 100 ml of sample into the filtering apparatus

Pump air out of the filtering appratus.

Rinse the sides of the beaker with deionzied water getting all particles off the walls of the beaker. Pour that into the membrane funnel with the rest of the sample. Once the sample has gone through the pre-

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weighed filter, rinse the funnel for any remaining particles.

After all water has been suctioned through the pre-weighed filter, turn off air manifold valve. Release the clamp. Remove the membrane funnel. Use the tweezers to remove the pre-weighed filter and place that filter in its original tray.

Before placing the next clean pre-weighed filter on the membrane filter, remember to clean the membrane funnel before the next sample is analyzed.

Place the tray in a baking pan that can be placed in the drying oven once the baking pan is full or all of the samples have been analyzed.

Weigh the filter after drying. Calculate TSS as the dry weight of the filter after drying minus then original weight of the filter.

Detection Limit

1 mg/l

Quality Assurance/Quality Control

There should be a duplicate analyzed every tenth sample.

Nitrogen (Nitrate + Nitrite)

1) Scope

This procedure uses cadmium reduction and a colorimetric technique to determine nitrite plus nitrate nitrogen.

2) Reference

Standard Methods 4500 NO₃

3) Sample Handling and Preservation

Samples are to be collected with sulfuric acid in a pre-preserved bottle.

9.4 Apparatus and Materials

1) Colorimeter

9.5 Reagents

1) Hach NitraVer 3 and NitroVer 6 reagents

9.6 Procedures

1) Shake the sample container to get a well mixed sample

2) Pour off 5 ml. Add one packet each of Hach NitraVer 3 and NitraVer 6 reagents.

3) Allow color to develop for 30 minutes.

4) Place sample in a colorimeter. Measure absorbance at 540 nm.

5) Determine sample concentration by graphical interpolation.

7) Detection Limit - 0.5 mg/l

8) Quality Assurance/Quality Control

Duplicate every tenth sample. A method blank is analyzed every tenth sample and method blank spike preceding method blank, should be analyzed every tenth sample. Also a sample spike is to be analyzed with each batch. If a batch does not contain 10 samples, a method blank and method spike blank is to be analyzed along with that batch.

Total Phosphorus

1) Scope

This procedure uses sample digestion, ascorbic acid, and a colorimetric technique to determine total phosphorus.

2) Reference

Standard Methods 4500 P F

3) Sample Handling and Preservation

Samples are to be collected with sulfuric acid in a pre-preserved bottle.

4) Apparatus and Materials

- 1) Colorimeter
- 2) Hot Block

5) Reagents

- 1) Deionzed Water
- 2) Nitric Acid
- 3) Hanna Phosphate Reagent (HI 93713-0)

6) Procedures

- 1) Shake the sample container to get a well mixed sample
- 2) Take the well-mixed sample and pour 50 mL into the digestion cups.
- 3) Add 1.5 mL of concentrated nitric acid into the sample.
- 4) Heat in the hot block at sample temperature of 95°C until sample is approximately 5 ml.
- 5) Remove samples from the hot block and allow sample to cool. Bring the sample volume back up to 50mL with DI water.
- 6) Once sample has been digested, pour off 10 ml. Add one packet of Hanna phosphate reagent.
- 7) Allow color to develop for 30 minutes.
- 8) Place sample in a colorimeter. Measure absorbance at 660 nm.
- 9) Determine sample concentration by graphical interpolation.

7) Detection Limit - 0.03 mg/l

8) Quality Assurance/Quality Control

Duplicate every tenth sample. A method blank is analyzed every tenth sample and method blank spike proceeding method blank, should be analyzed every tenth sample. Also a sample spike is to

APPENDIX F. Quality Assurance Project Plan for Water Monitoring

be analyzed with each batch. If a batch does not contain 10 samples, a method blank and method spike blank is to be analyzed along with that batch.

Atrazine

Scope:

This procedure uses gas chromatography to determine atrazine concentrations.

Method Summary:

Method 507 covers 46 nitrogen- and phosphorus-containing pesticides. A one liter sample is fortified with a surrogate standard, salted, buffered, extracted with methylene chloride and concentrated; then the solvent is exchanged with methyl tert-butyl ether (MTBE) and concentrated again, and a 2 μ : L aliquot of a sample extract is injected into a gas chromatographic system equipped with a selective nitrogen-phosphorus detector and a capillary column for analysis.

Instrumentation:

A gas chromatograph system (GC) equipped with a nitrogen-phosphorus detector (NPD) is needed.

Column #1: 30 M x 0.25 mm ID DB-5 bonded fused silica column, 0.25 μ : m film thickness, or equivalent;

Column #2: 30 M x 0.25 mm ID DB-1701 bonded fused silica column, 0.25 μ m film thickness, or equivalent.

Sampling Method:

Grab samples are collected in 1 L glass sample bottles (pre-washed with detergent and hot tap water, rinsed with reagent water, and dried in an oven at 400 E/C for 1 hour) with screw caps lined with PTFE-fluorocarbon.

Sample Preservation:

Add mercuric chloride to the sample bottle in amounts to produce a concentration of 10 mg/L. If residual chlorine is present, add 80 mg of sodium thiosulfate per liter of sample to the sample bottle prior to collection. After collection, seal bottle and shake vigorously for 1 minute, then cool the sample to 4 E/C immediately and store it at 4 E/C in the dark until extraction.

Maximum Holding Time:

Maximum holding time of the samples, and in some cases the extracts, is 14 days.

Quality Assurance/Quality Control

Duplicate every tenth sample. A method blank is analyzed every tenth sample and method blank spike preceding method blank, should be analyzed every tenth sample.

E. coli

Location

This procedure is performed in the bacteriological laboratory of the Frankfort Wastewater Treatment Plant (45 CR 100 N, Frankfort, IN 46041).

Purpose

This method is used to determine the Most Probable Number of Escherichia coli (E. coli) in wastewater, potable waters, and all other water matrixes.

Scope

This procedure uses the Colilerted sample in a Quanti-Tray to determine the MPN for the E. coli present.

Reference

Standard Methods 20th Edition – Method 9223 B

Sample Handling and Preservation

Samples are to be collected in a sterile bottle provide by the lab.

Apparatus and Materials

Quanti-Tray

Quanti-Tray sealer

Incubator

Reagents

Colilert

Procedures

If the bottle is filled past the 100 mL mark on the bottle, dispose of the excess liquid. Add Colilert to the sample, and shake well. Open the Quanti-Tray by squeezing the sides and pulling the foil tab on top, making sure not to touch the inside of the tray. Pour entire sample into the tray. Place the filled tray onto the tray carrier. Slide the tray carrier into the sealer with well side down and open end out. Place tray into incubator (set to 35 degrees C) and wait 24 hours. Remove from incubator 24 hours later and place under a fluorescent light and count the number of wells fluorescing.

Look at the manufactures table to obtain a MPN, which is equivalent to CFU/100 ml

* Make sure to always wear sterile gloves before handling the bottle when opening. Never touch the underside of the bottle lid. This is done to make sure there is no contamination by the lab.

Quality Assurance/Quality Control

A blank sample is analyzed with every batch, to provide assurance of a contamination free work area for that day. Duplications are analyzed every tenth sample.

APPENDIX 4

STANDARD OPERATING PROCEDURE

FOR

BENTHIC MACROINVERTEBRATES

Commonwealth Biomonitoring
Indianapolis, Indiana

February 2010

Sampling Procedure:

Variable (usually by dipnet). Sometimes artificial substrates are used. Animals are sampled from both riffles (1-minute kick sample) and other habitats present within a 50 m length of stream.

Sorting Procedure:

The sample is first thoroughly rinsed in a 500 micron screen or a sampling net to remove fine sediments. Any large organic material (whole leaves, twigs, algal and macrophyte mats) should be rinsed thoroughly, visually inspected, and discarded from the sample.

The sample contents are placed in a large, flat pan (approximately 30x45 cm or so) with a light colored bottom. The bottom of the pan will be marked with a numbered grid pattern. Each grid will measure 5x5 cm. Organisms should be evenly distributed in the pan. Samples too large to be effectively sorted in a single pan may be thoroughly mixed in a container with some water, half of the homogenized sample placed in each of two gridded pans. Each half of the sample must be composed of the same kinds and quantity of debris and an equal number of grids must be sorted from each pan, in order to ensure a representative subsample. Also since the samples will be preserved in alcohol it will be necessary to soak the sample contents in water for about 15 minutes to hydrate the benthic organisms, preventing them from floating on the water surface during sorting. Use only enough water to allow complete dispersion of the sample within the pan. An excessive amount of water will allow sample material to shift within the grid during sorting.

A random numbers table is used to select a number corresponding to a square within the gridded pan. Remove all organisms from within that square and proceed with the process of selecting squares and removing organisms until the total number sorted from the sample is within 10% of 100. Any organism which is lying over a line separating two squares is considered to be in the square containing its head. In those cases where it is not possible to determine the location of the head (e.g. worms), the organism is considered to be in the square containing the largest portion of its body. Any square sorted must be sorted in its entirety, even after the 100-organism count has been reached. If many of the organisms are very small use an illuminated 5X magnifier to facilitate sorting. The total number of animals picked in 15 minutes is retained for analysis.

Organism Identification:

All benthic macroinvertebrates in the subsample should be identified to the lowest positively identified taxonomic level (generally genus or species), enumerated, and recorded on the laboratory bench sheet. This accomplished in two phases. Phase I consists of Family level identification of the organisms for a sample and tallying the counts for the families on the computer generated bench sheet for that sample. Organisms are put in alcohol filled 5 dram vials by taxonomic Order and placed in large alcohol filled jars labelled with their respective Orders. HBI and EPT:Chironomiidae calculations are made for preliminary site assessment. Also the preliminary number of taxa, number of individuals in the sample, taxonomist, date and number of vials forwarded are also recorded.

Taxonomic Order, family, organism name, count, life stage, taxonomist and date are recorded. Based on the taxonomic identifications, functional feeding group classifications can be assigned for most aquatic insects using a reference such as Merritt and Cummins (1984). Once a functional feeding group classification list has been established, it can be incorporated into the computer analysis for computation of the metrics. Care should be taken to note the presence of early instars which may represent different functional feeding groups from later instars. The scraper and filtering collector functional groups are considered the important indicators in the riffle/run community; numbers of individuals representing each of these two groups are recorded on the laboratory bench sheet.

CPOM Functional Feeding Group Determination:

If requested, the CPOM sample is collected to provide data on the relative abundance of the shredders at the site. Shredders of large particulate material are important in forested areas of stream ecosystems ranging from stream orders 1 through 4 (Minshall et al., 1985). The absence of large particulate shredders is characteristic of unstable, poorly retentive headwater streams in disturbed watersheds or in dry areas where leaf material processing is accomplished by terrestrial detritivores (Minshall et al., 1985).

CPOM samples are processed separately from the riffle/run samples and used for Functional Feeding Group characterization. Taxonomic identification is not necessary for this component. Sorted organisms (see above) are classified by functional feeding group. Numbers of individuals representing the shredder functional group, as well as total number of macroinvertebrates collected in this sample, are recorded on the CPOM laboratory bench sheet.

Mounting Chironomidae:

Members of this family are mounted directly from the 80% alcohol preservative in

which they have been stored in the initial phase I taxonomy. Two drops of mounting medium is placed on each slide allowing enough room for a label on the left end of the slide. Working under the dissection microscope if necessary a group of approximately 10 larvae are gathered up and picked up with a pair of forceps. While holding them firmly with the forceps touch them lightly to a paper towel to remove excess alcohol. This is accomplished by capillary action and there is no need to release the larvae from the forceps. The 10 larvae are then placed into a drop of medium on the microscope slide. This is repeated again to deliver larvae into the other drop of medium previously placed on the slide. The next step is to place the slide under the microscope and pull the larvae into parallel lines within the drop of medium orienting the heads in the same direction (to the right if you are right handed). Once both drops have had their respective larvae arranged the operator should, larvae by larvae, with two minuten needles pop the heads off and orient them ventral side up and tap the head to spread the mandibles. These slides should then have a microscope slide label attached to it containing all the information found on the vial label. Always label all slides with a label prior to processing another sample. This avoids all possibility of mislabeled slides due to sample manipulations.

SAFETY AND WASTE HANDLING

Preserved specimens are handled carefully to avoid skin contact. Waste preservatives are discarded in the sink and flushed with generous amounts of water.

LABORATORY QA/QC

INTRODUCTION:

Comprehensive QA/QC is an end product of careful expediting both the field and laboratory components of the overall project. The whole QA/QC of such a project, particularly when several people of various levels of experience are directly involved in its completion, starts with comprehensive record keeping of all activities. Many such projects compromise the integrity of the final data sets by poor record keeping including inaccurate site descriptions, unreliable labeling of samples, unreliable tracking of specimens, improper curation of samples, lack of voucher specimens, inconsistent taxonomic identifications, absence of cross-checks on data entry and retrieval, etc.

LAB DUPLICATES--Laboratory duplicates are to be carried out on all samples collected at sites where field duplicates were acquired. The two field samples, one being a field duplicate, are each subsampled one additional time in the laboratory to create 2 laboratory duplicates. The staff person performing the subsample must enter certain information into the record in the Laboratory Notebook.

SAMPLE LABELING- Consistent and conscientious record keeping in the field was the foundation for proper sample identification. This is especially critical when large numbers of samples are being taken over a relatively short period of time. The value of any field collection is contingent on the accuracy of the label associated with that sample relative to the where, when, who, and how of its collection. Samples are collected into 1/2 gallon jars and a pre-printed label is filled out by the investigators and placed inside the jar. A tape label is placed on the lid telling the stream name and date. The internal label is the official sample label.

TAXONOMIC IDENTIFICATIONS--Accurate and consistent taxonomic identifications for benthos is critical for correct implementation of metrics associated with biocriteria. The lab supervisor is responsible for all QA/QC procedures and ultimate data consistency and uniformity. This project has resulted updating and standardizing taxonomic references within the laboratory. All staff have been given copies of these sources or have had copies made available to them.

METRICS CALCULATIONS

MODIFIED HILSENHOFF BIOTIC INDEX (if requested)

-Summarizes overall pollution tolerance of the benthic arthropod community (modified to include non-arthropod taxa)

-Range: 0-10 increasing as water quality decreases.

$$\text{Procedure: HBI} = \frac{\sum x_i \times t_i}{n}$$

x_i = number of individuals within a taxon.

t_i = tolerance value of a taxon.

n = total number of organisms in sample (used for the index)

TOLERANCE VALUES

Those recommended and used by IDEM

FUNCTIONAL FEEDING GROUPS

Those recommended and used by IDEM

REFERENCES

Cummins, K.W. and M.J. Klug. 1979. Feeding ecology of stream invertebrates. *Ann. Rev. Ecol. Syst.* 10:147-172.

Cummins, K.W., M.A. Wilzbach, D.M. Gates, J.B. Perry, and W.B. Taliaferro. 1989. Shredders and riparian vegetation. *Bioscience.* 39(1):24-30.

U.S. Environmental Protection Agency (EPA) 1989. Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA/444/4-89/001. U.S. EPA, Washington, D.C.

Hilsenhoff, W.L. 1987. An improved biotic index of organic stream pollution. *Great Lakes Entomol.* 20:31-39.

Shackleford, B. 1988. Rapid Bioassessments of Lotic Macroinvertebrate communities: Biocriteria Development. Arkansas Department of Pollution Control and Ecology, Little Rock, Arkansas.

APPENDIX 5- CHAIN OF CUSTODY FORM

Commonwealth Biomonitoring, Inc
8061 Windham Lake Drive
Indianapolis, IN 46214
317-297-7713

CLIENT NAME: Clinton County SWCD

PURPOSE OF SAMPLE: Water quality monitoring

SAMPLE IDENTIFICATION NUMBERS:

DESCRIPTION: _____

DATE SAMPLE COLLECTED: _____

NAME OF PERSON COLLECTING SAMPLE: _____

VOLUME OF SAMPLE: _____

SAMPLE CONTAINER: _____

NUMBER OF CONTAINERS: _____

SAMPLE STORAGE: _____

PRESERVATIVES: _____

Relinquished by: _____

Date: _____

Time: _____

Received by: _____

Date: _____

Time: _____

Relinquished by: _____

Date: _____

Time: _____

Received by: _____

Date: _____

Time: _____

COMMENTS:

APPENDIX F. Quality Assurance Project Plan for Water Monitoring



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

We Protect Hoosiers and Our Environment.

Mitchell E. Daniels Jr.
Governor

Thomas W. Easterly
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
Toll Free (800) 451-6027
www.idem.IN.gov

December 21, 2010

Cindy Muffett, Watershed Coordinator
Clinton County Soil & Water Conservation District
860 S. Prairie Ave., Suite 1
Frankfort, IN 46041

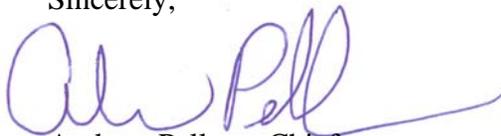
Dear Ms. Muffett:

Re: QAPP Amendment
FFY 2009 Section 319 Project
ARN 305-9-271

This letter is to inform you that the amendment to the Quality Assurance Project Plan (QAPP) requested in a memo dated December 13, 2010, from the *South Fork Wildcat Creek Watershed Management Plan Project* for the 319 Grant Program has been approved by our office. Because of the late start in the sampling schedule, a schedule revision was requested for sampling to be conducted in September-October of 2010 and May-June 2011.

If you have any questions or if we can be of further assistance, do not hesitate to contact your Project Manager and QA Manager, Betty Ratcliff, at 317/308-3135.

Sincerely,



Andrew Pelloso, Chief
NPS/TMDL Section
Office of Water Quality

CC: Leah Harden, Clinton County SWCD