Appendix A

Quality Assurance Project Plan

Fawn River Watershed Management Plan

EDS # A305-3-3

Prepared by:

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Prepared for:

Indiana Department of Environmental Management
Office of Water Quality
Watershed Planning & Restoration Section
June 2013

Approved By:

Project Manager:	______________________ David P. Arrington	________ Date
TLSS QA Manager:	______________________ Betty Ratcliff	________ Date
TLSS Section Chief:	______________________ Chuck Bell	________ Date

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4.0 Project Task/or Organization

4.1 Key Personnel

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Overall project responsibility, senior scientist and QA Officer

Julie Diehm, Senior Field Lab Technician
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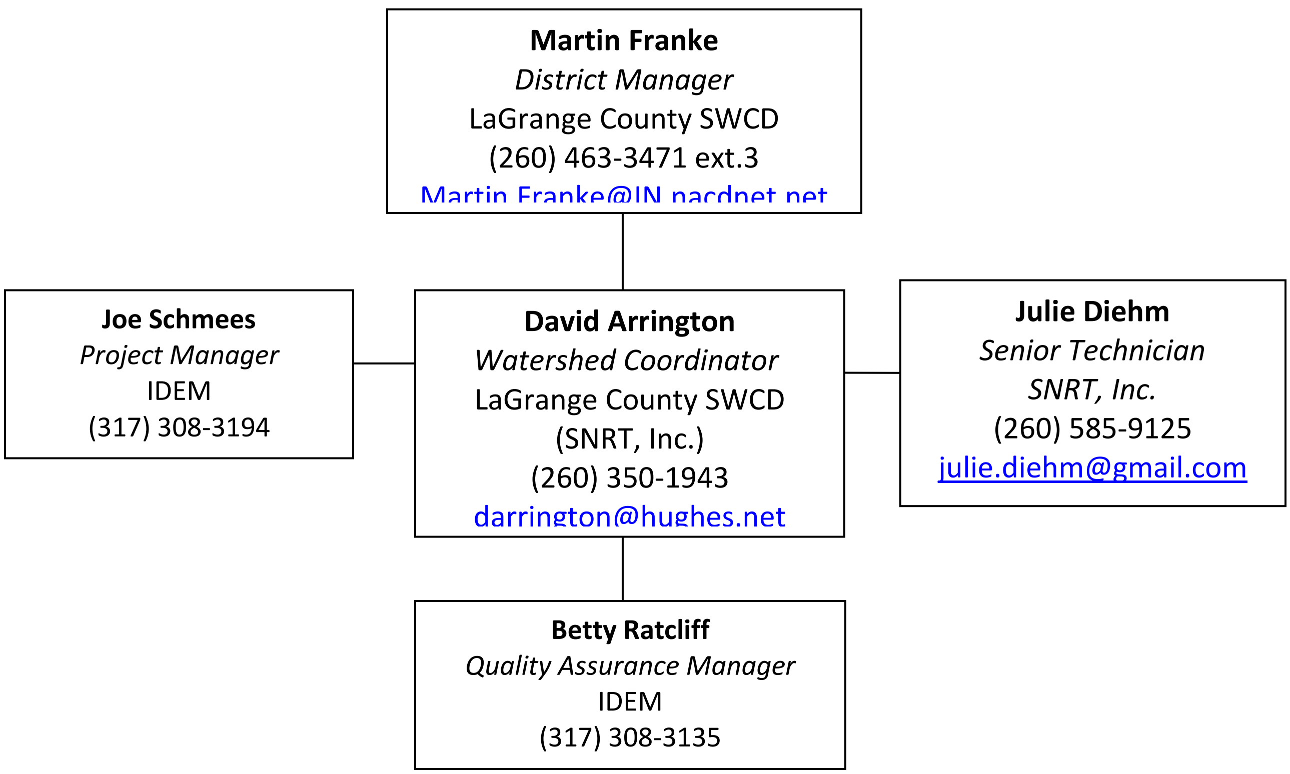
Supervises field and lab personnel

4.2 Project Organization Chart



The Watershed Coordinator (also the project manager) reports directly to the SWCD District Manager. The Senior Technician reports directly to the Watershed Coordinator and oversees other Field/Lab Technicians. The Watershed Coordinator will coordinate with the IDEM Quality Assurance Manager and IDEM Project Manager. A minimum of two contracted individuals will conduct sampling and analysis.

5.0 Special Training Needs/Certification & Qualifications

N/A

6.0 Problem Definition/Background

6.1 Problem Statement

Seed corn production is the major component along the drainage from western Steuben County until it empties into the St. Joseph River. Other food production such as green beans, beets, and potatoes play a significant role along this corridor. An important aspect in this type of agricultural landscape is the use of traditional tillage practices which includes fall plowing that exposes fields to wind and sheet erosion. Observations carried out by the LaGrange County SWCD indicate an absence of ditch/stream bank buffering of fields using traditional tillage practices. Additional evidence suggesting traditional tillage practices may be having a major influence is reflected in the IDEM 303(d) list of impaired waters for this drainage. Snow lake, Lake James, Jimmerson Lake, Big Otter Lake and Seven Sisters Lakes are listed for impaired biotic communities. Water quality sampling conducted by the Steuben County Lakes Council indicates raised total suspended solids loading during Spring rain events before crop coverage had been established.

There is also a livestock influence in the watershed and that influence is growing. The Amish community is rather small along the Fawn River when compared to the Little Elkhart River and Pigeon River drainages but this community continues to grow resulting in an expansion of livestock based agriculture. Livestock related issues have been visually documented and are validated in water quality testing results with the Fawn River-Orland segment being listed as an impaired water body for E.coli. In addition, water quality testing has shown elevated levels of nitrates and phosphorus.

Urban influences likely have an impact on water quality throughout this drainage. Angola in Steuben County, is an MS4 city that currently influences 040500010802-Tamarack Lake and 040500010803-Lake James-Crooked Lake HUC 12 subwatersheds. It is anticipated, that as the city grows north, the HUC 12 subwatershed 040500010801-Snow Lake will be included into the city's area of drainage influence. Other urban influences include Fremont and Orland in Indiana, and the southern portion of Sturgis, Michigan. The town of Constantine, Michigan primarily influences the St. Joseph River directly, but may have an influence along the northern edge in residential areas. In addition the majority of moderate to large sized lakes within the river drainage have dense residential areas along the shorelines. These residential areas likely have a runoff influence on the lake systems through the use of lawn fertilizers.

Although long-term quantitative water quality studies do not exist, short duration studies conducted by both Michigan and Indiana environmental/natural resource departments have indicated a significant agricultural influence for nutrient, sediment, and E.coli loading. Both the Steuben and LaGrange County Lakes Councils have begun long-term water quality testing at many lakes to include both inlet and outlet systems. With three years of quantitive data collection in Steuben County and one year of collection in LaGrange County, the data clearly suggests a major agricultural input of non-point source pollutants reaching the lake systems. Hoosier River Watch Data, although not quantitative, indicates a non-point source pollutant contamination by nutrients, suspended solids, and E.coli. In addition, many of the smaller lake *systems do not have centralized sewers and rely on septic systems for waste treatment. There is a high probability that during wet seasons these septic systems play some role in surface water contamination.*

6.2 Historical & Background Information

See 6.1 and 7.1.

7.0 Process Design

7.1 Study Site Description

The Fawn River drainage begins in Steuben County, Indiana at Fish Lake north of the town of Fremont and flows northwest for a short distance before entering Branch County, Michigan where it encompasses several large lake systems. The drainage then turns south reentering Steuben County, Indiana where it encompasses many large and small lake systems north and northwest of the city of Angola. This portion of the river system involves the bulk of the county"s largest lakes that are a significant economic base for the region. From this point the river flows west by northwest and enters LaGrange County, Indiana in the northeast corner and continues for a short distance before reentering Branch County, Michigan. The drainage flows west by northwest and enters St. Joseph County, Michigan southeast of the town of Sturgis where it turns southwest reentering LaGrange County, Indiana north of the town of Howe. This portion of the river encompasses many large and small lake systems in both Michigan Counties. The river flows west from Howe paralleling Interstate 80 to the northwest corner of LaGrange County, Indiana before turning north flowing into St. Joseph County, Michigan. The river drainage continues north encompassing several large lake systems before turning west where it empties into the St. Joseph River north of the town of Constantine, Michigan. The Fawn River drainage as a whole includes slightly over 156,000 acres and over 70 lake systems. Agriculture is the major land usage for the entire drainage.

8.0 Quality Objectives & Criteria for Measurement Data

8. 1 Goal Statements & Objective Statements

The goals listed below are designed to provide a quantitative assessment of physical and chemical parameters within each HUC 12 of the Fawn River drainage. The watershed coordinator will use the results during the WMP development to prioritize future BMP implementation by subwatershed or HUC 12. Statistical procedures such as ANOVA and Regression Analysis will be employed in the prioritization process. Continued sampling during and after BMP implementation is essential in evaluating WMP goal success and for evaluation of land use change effects on water quality.

Macroinvertebrate and habitat evaluations will be conducted using Indiana River Watch methods. The data collected will be less quanitative than physical/chemical data but will provide trend data during long term monitoring.

Monitoring Goal 1: The primary goal is to establish a baseline in the 9 HUCs listed under EDS# A305-3-3.

Objective 1: Establish baseline data that is comparable at a quantitative level.

Objective 2: Isolate problematic segments for BMP installation prioritization.

Monitoring Goal 2: Demonstrate differences between subwatersheds.

Objective 1: Continue collecting baseline data before and after BMP installation.

Objective 2: Establish all BMPs in treatment watershed by Fall 2014.

8.2 Study Site

The project area is the entire drainage of the Fawn River consisting of 9 HUC12s (Appendix A). Water quality testing will be conducted in all subwatersheds. Under this study data will be collected in watersheds:

040500010801 – Snow Lake

040500010802 – Tamarack Lake

040500010803 – Lake James-Crooked Lake

040500010804 – Fawn River-Orland

040500010805 – Fawn River-Himebaugh Drain

040500010806 – Fawn River-Clear Lake

040500010807 – Fawn River-Wegner Ditch

040500010808 – Sherman Mill Creek

040500010809 – Fawn River-Fawn River Drain

An average of six sites per HUC12 have been selected and will be sampled monthly during the "ice-out" season (Appendix A). A total of 54 sites have been selected and are listed below and collected with a Megellan Vehicle GPS:

Site#	Latitude (N)	Longitude(E)	Site Description
1	41.7083	84.9753	Culvert-Marsh Lake Inlet

South side of culvert on 500N between Seven Sisters Lakes and Marsh lake.

2	41.7213	84.9727	Culvert-Marsh Lake Inlet

West side of culvert just north of 500N on 100E.

3	41.7387	84.9285	Culvert-Fish Lake Outlet

On Fremont Road just north of 700N.

4	41.7743	84.9568	Culvert-Huyck Lake Outlet

West side of culvert on Allen Road just south of Southern Road.

5	*41.7755*	*85.0010*	*Culvert Lake George Inlet*

South side of culvert on Kope Ken Road west of Angola Road.

6	*41.7393*	*84.0201*	*Culvert-Lake George Outlet*

South side of culvert on SW side of Lake George.

7	*41.7315*	*85.0260*	*Culvert-Snow Lake Inlet*

South side of culvert on SR 120 just west of Dave's Restaurant.

8	*41.7245*	*85.0232*	*Bridge-Snow Lake Inlet*

West side of bridge on 100W south of SR 120.

9	*41.7277*	*85.0023*	*Culvert-Big Otter Lake Inlet*

South side of culvert at west side of outlet mall parking lot, south of SR 120.

10	*41.7213*	*85.0015*	*Culvert-Little Otter Lake Inlet*

West side of culvert next to Bait Shop parking lot on Pokagon Road.

11	*41.6728*	*85.0273*	*Culvert-Crooked Lake Inlet*

West side of culvert on 200N just west of 100W.

12	*41.6700*	*85.0317*	*Culvert-Crooked Lake inlet*

West side of culvert approximately ¼ mile south of site 11.

13	*41.6707*	*85.0500*	*Culvert-Culver Crooked Lake Inlet*

North side of culvert just west of 200W.

14	*41.6882*	*85.0532*	*Culvert-Crooked Lake Outlet*

West side of culvert on 350N.

15	*41.6895*	*85.0822*	*Culvert-Lake Gage Inlet*

West side of culvert just south of 400N.

16	*41.7077*	*85.1212*	*Culvert-Lake Gage Outlet*

North side of culvert at north end of Lake George just west of 675W.

17	*41.6785*	*85.0215*	*Culvert-Lake James Inlet*

North side of culvert on south side of Lake James.

18	*41.6893*	*85.0390*	*Bridge-Lake James Outlet*

West side of bridge on 300N between Lake James and Jimmerson Lake.

19	*41.7253*	*85.0792*	*Bridge-Jimmerson Lake Outlet*

West side of bridge on 575N on NW corner of Jimmerson Lake.

20	*41.7307*	*85.1204*	*Bridge-Fawn River*

East side of bridge on 675W just south of SR 120.

21 41.7307 85.1352 Bridge-Fawn River

East side of bridge on 800W just south of SR 120.

22 41.7318 85.1812 Culvert-Wall Lake Ditch

South side of culvert on 650N ½ mile west of SR 327.

23 41.7383 85.1810 Culvert-Lime Lake Outlet

South side of culvert on 700N ½ mile west of SR 327.

24 41.7583 85.2088 Bridge-Fawn River

West side of bridge on 1100E just south of 750N.

25 41.7723 85.2225 Bridge-Fawn River

East side of bridge on 1125E just north 750N.

26 41.7852 85.2382 Culvert-Ditch to Fish Lake

South side of culvert on Southern Road.

27 41.7855 85.2535 Culvert Ditch to Fish Lake

South side of culvert on Southern Road.

28 41.7808 85.2573 Culvert-Fish Lake Inlet

West side of culvert on Dutch School Road just south of Mallow Road.

29 41.7725 85.2732 5 Culverts-Fawn River

East side of culverts at intersection of Trayer and Gunthorpe roads.

30 41.7728 85.2817 Bridge-Himebaugh Drain

North side of bridge on Round Lake Road west of Dauber Road.

31 41.7790 85.2882 Culvert-Fawn River

West side of culvert ½ mile south of Round Lake Road.

32 41.7833 85.3037 Culvert-Ditch

South side of culvert on Fawn River Road just west of Watt Road.

33 41.7800 85.3358 Bridge-Fawn River

West side of bridge on Fawn River Road.

34 41.7755 85.3557 Bridge-Fawn River

South side of bridge on Kene Drive.

35 41.7788 85.3743 Culvert-Lee Lake Inlet/Williams Lake Outlet

South side of culvert on Fawn River road.

36 41.7587 85.3775 Bridge-Fawn River

West side of bridge on Miller Road.

37 41.7360 85.3738 Culvert-Cedar lake Outlet

North side of culvert on 700N just west of golf course.

38 41.7293 85.3585 Culvert-Cedar Lake Inlet

North side of culvert on 600N west of 375E.

39 41.7393 85.4210 Bridge-Fawn River

West side of bridge on 050E.

40 41.7590 85.4702 Culvert-Nye Drain

West side of culvert on Balk Road.

41 41.7558 85.4755 Bridge-Fawn River

West side of bridge on south end of Balk Road.

42 41.7397 85.4818 I-80/90 Overpass-South End

East side of culvert on Stubey Road.

43 41.7535 85.5035 Bridge-Fawn River

West side of bridge on Shimmel Road.

44 41.7595 85.5357 Culvert-Aldrich Lake

West side of culvert on Aldrich Lake Road.

45 41.7782 85.5800 Bridge-Fawn River

West side of bridge on Fawn River road betweem Crooked Creek and Scott Roads.

46 41.7877 85.5368 Culvert-Klinger Lake Inlet at Golf Course

South side of culvert just north of golf course clubhouse.

47 41.8228 85.5037 Culvert-Ditch

West side of culvert on Shimmel Road between Thompson and Tamarack Lakes.

48 41.8090 85.5315 Culvert Klinger Lake Inlet

North side of culvert on NE corner of lake just south of Klinger Lake Road.

49 41.8085 85.5387 Bridge-Klinger Lake Inlet

West side of bridge on Klinger Lake Road, NW corner of Klinger Lake.

50 41.8050 85.5807 Bridge-Fawn River

North side of bridge on Dickinson Road west of Block Road.

51 41.8288 85.5817 Closed Bridge-Fawn River

East side of bridge on Haybridge Road, from south side.

52 41.8332 85.5807 Culvert-Fawn River Drain

South side of culvert on Mintdale Road 1 mile west of Engle Road.

53 41.8355 85.6240 Bridge-Fawn River

West side of bridge on Lutz Road.

54 41.8377 85.6583 Bridge-Fawn River Outlet into St. Joseph River East side of bridge on Featherstone Road.

8.3 Sampling Design

A synoptic approach was chosen to give a representative analysis of the 9 HUC 12s involved. The synoptic approach will provide data that isolates segments and "finger" tributaries revealing trends that may require intervention during future implementation of BMPs.

Electronic field instruments will be used to collect data at each site on dissolved oxygen, pH, temperature, total dissolved solids, and turbidity on a monthly basis. Total phosphorus, nitrates, total suspended solids and E.coli will be collected for lab analysis on a monthly basis..

Macroinvertebrates and habitat data will be collected during the first summer of the project using Hoosier River Watch procedures.

8.4 Study Timetable

Sampling under this QAPP will begin June 2013 and will continue through May 2015 (Table 1). Analysis of data will be on-going throughout the study to indentify and steer current implemetation programs to problematic locations. Macroinvertebrate sampling will be completed late summer 2013.

The major constraint during sampling will be during winter when many sites may be frozen. Every attempt will be made to sample as many sites as possible during winter.

Table1: Study Schedule

Activity	Start Date	End Date
Sample collection: DO, Temp, pH, TP, NO_3, Turb, TDS, TSS, *E. coli* and flow. (monthly) BOD (yearly)	June 2013	May 2015
Flow (monthly at sites: 5,7,12,21,22,34,40,41,55,60)	June 2013	May 2015
Macroinvertebrate/Habitat data collection (once)	Summer 2013	Summer 2013
Analysis (on-going)	June 2013	May 2015

9.0 Data Quality Indicators (*for Measurement Data)*

9.1 Precision

Field Chemistry Parameters

Field equipment will be calibrated in accordance with manufacturer's specifications. Replicate/field blank samples will be taken with the following field equipment: Hach instruments sensION 156 (DO, pH, Temp, TDS), 2100 Turbidmeter, 2000-11 Flo-Mate Portable Velocity Sensor. Three replicate samples and three field blanks will be taken during each sampling cycle or 1 replicate/blank per 20 samples. Precision will be calculated using the RPD method:

$$RPD = \frac{(C-C')x100\%}{(C+C')/2}$$

Where:

C=the larger of two values

C'=the smaller of two values

Laboratory Water Chemistry Parameters

Grab samples will be collected for, total phorsphorus, nitrates, and total suspended solids at each site for analysis with the Hach DR2500 or DR 3800 Spectrophotometer. Three duplicate samples and three field blanks will be taken per sampling cycle or 1 duplicate/blank per 20 samples. Standards will be used in accordance with manufacturer's guidelines. E. coli samples will be collected using sterile containers with duplicates of each sample analyzed using the Easy Gel method with incubator set at 35°C for 24 hours. Precision will measured using the RPD method. The laboratory is located at the Par Gil Natural Resources Learning Center, 250 North SR9, LaGrange, IN 46761. The phone number is 260-463-8822.

The electronic field instruments will be calibrated before each sampling cycle to insure accuracy within the limits of each device. In the laboratory, strict adherence to procedures and consistant calibration of the Hach DR2500/DR3800 in accordance with manufacturer's specifications employed.

Macroinvertibrates Parameters - Both technicians are fully trained with 16 years experience in collection and data analysis. To ensure precision the watershed coordinator will participate in the sampling.

9.2 Accuracy and or Bias

The majority of parameters will be collected using precision instruments that have specific +/- accuracies associated with each parameter. Equipment will be calibrated prior to each sampling cycle in order to maintain manual accuracy specifications. Field protocol procedures will be strictly adhered to ensuring site sampling accuracy is maintained.

To reduce bias, additional samples will be collected and analyzed. To further reduce bias, the same technicians that have worked on similar projects for 16 years will be employed. Familiarity with protocols will reduce bias.

9.3 Completeness

Field and Laboratory Chemistry Parameters

The sampling schedule is aggressive to allow room for missed measurements. In this study quantitative and qualitative analysis will be achieved if 75% of measurements are taken for each site and for each parameter (Table 2). All sites have been surveyed for access and proper sampling hydrology. However, during extreme climatic events acquiring samples at some locations may become impossible. The most plausable constraint will be during winter months when ice conditions may make sampling difficult at best. In addition, during drought conditions flow may stop on several "finger" drainages.

$$\% \text{ completeness} = \frac{\text{(number of valid measurements)}}{\text{(number of valid measurements expected)}} \times 100\% = \frac{1296}{1728} \times 100\% = 75\%$$

Macroinvertebrate Parameters

In order to achieve the desired level of completeness for this study 100% of macroinvertibrate analysis must be completed (Table 2). This should be attainable since there is flexibilty in selecting sampling dates that are conducive to achieve 100% collection.

Table 2: Data Quality Objectives

Parameter	Precision	Accuracy	Completeness
DO, pH, Turb, Temp, TDS, TSS	RPD<5%	Instrument limits See Table 4	75%
TP, NO_3	RPD<5%	Instrument limits See Table 4	75%
E. coli	RPD<10%	High	75%
Flow	RPD<5%	$\pm$3% + zero stability zs=$\pm$0.1m/sec	75%
Macroinvertebrate	High	High	100%
Habitat	High	High	100%

9.4 Representativeness

In using the synoptic approach, a relatively even representation of water quality throughout the sub-watersheds will be achieved. Test sites were selected and field varified to isolate segments of each watershed and allow easy access for personnel. If extremely high levels of contaminants are found in any given segment (higher than surrounding segments) additional sites may be added to futher isolate the source. If this occurs, then an addendum will be submitted.

9.5 Comparability

Data collected from this study will not be compared to other studies but will provide a baseline for future sampling to assess the effectiveness of water quality improvement practices. It is intended to follow sampling procedures used here in future projects administered by LaGrange County SWCD. Methods used will meet EPA-approved standards.

9.6 Sensitivity

Sensitivity for each parameter tested can be seen in Table 4 under "Performance Range or Detection Limits".

10.0 Non Direct (Secondary Data)

N/A

11.0 Monitoring Requirements

11.1 Monitoring Process Design

See Section 11.2

11.2 Monitoring Methods

Water chemistry samples will be taken at each station to test the parameters listed in Table 3. Temperature, dissolved oxygen, pH, turbidity, total dissolved solids and flow measurements will be made in the field using the following instruments: Hach sensION 156 for temperature, dissolved oxygen, total dissolved solids, and pH; Hach 2100P Turbidmeter for turbidity; and the Hach Flo-Mate 2000-11 for velocity. All measurements will be taken accordng to the standard operating procedures provided by the manufacturer of the equipment. Project personnel will record water chemistry field measurements on standardized field data sheets (Appendix B).

Flow measurements will be taken utilizing protocols outlined in Marsh-McBirdy (1990). A tape measure will be staked across the width of the channel prior to any measurements being taken. If the stream is less than 2" deep, then multiple point velocity measurements will be taken throughout the width of the channel. Channel depths will measured at a minimum of five points across the channel. Discharge will be calculated using the following formula:

$$\text{Discharge} = \frac{(\Sigma d_i)\, w*v}{(n+1)}$$

where d equals stream depth, n equals the number of stream depths measured, w equals the width of the stream, and v equals the velocity of the stream (0.9 times the fastest velocity recorded). The equation has been modified from EPA (1997).

If the stream is greater than 2" deep, then the trapezoid channel method will be utilized to calculate stream discharge. The interval width, thus the number of flow measurements recorded across the channel, is determined by channel width. If the channel width is less than 15', then the interval width will be equal to the stream width divided by 5. If the channel width is greater than 15', then the interval width will be equal to the channel width multiplied by 0.1. Stream depths will be recorded at the right and left edges of the predetermined trapezoid (SI_0 and SI_1). Flow measurements will be recorded at the midpoint of each trapezoid ($SI_{1/2}$). All data will be recorded on the data sheet included in Appendix C. Discharge will be calculated using an Excel spreadsheet to minimize errors.

Grab samples will be collected for the remaining parameters: total phosphorus, nitrates, total suspended solids and E. coli. Samples will be placed in prepared containers. Sample collection will follow the method outlined in EPA Volunteer Stream Monitoring: A Methods Manual (1997). The technician will wade or dip into the center of the streams thalweg to collect the water sample. The technician will then invert a clean sample bottle into the thalweg. The same procedure will be followed for a separate E. coli sample. At a depth of 8 to 12 inches below the water surface, the technician will turn the bottle into the current and allow collection of water. If the stream depth is shallower than 16", water collection will be midway between the surface and bottom. Once the bottle is full the technician will "scoop" the bottle toward the surface.

The sample containers will be labeled with date, time, technician initials, site, and parameter to be analyzed. All samples will be stored on ice and transported to the laboratory for immediate analysis. Technicians collecting samples will complete laboratory analysis. Water chemistry analysis will be in accordance with specified procedures as outlined in the manual for the DR 2500 or DR3800. E. coli samples will be prepared using the Coliform Easygel method.

Macroinvertebrate/Habitat Sampling

Macroinvertebrate/Habitat sampling will follow procedures described in the River Watch Manual.

Table 3: Sampling Procedures

Parameter	Sampling Frequency	Sampling Method	Sample Container	Sample Volume	Holding Time
DO	Monthly*	Field Meter-Hach sensION156	N/A	N/A	In field
pH	Monthly*	Field Meter-Hach sensION156	N/A	N/A	In field
TDS	Monthly*	Field Meter-Hach sensION156	N/A	N/A	In field
Turb	Monthly*	Field Meter-Hach 2100 Portable	100mL vial	100ml	In field
Temp	Monthly*	Field Meter-Hach sensION156	N/A	N/A	In field
TP	Monthly*	Grab Sample	500mL plastic bottle	25mL	7 days
TSS	Monthly*	Grab Sample	500mL plastic bottle	25mL	7 days
NO_3	Monthly*	Grab Sample	500mL plastic bottle	25mL	7 days
E. coli	Monthly*	Grab Sample	250mL sterile plastic cup	1mL	8 hours
Flow	Monthly*	Global Water Flow Probe/ISCO 6712/HOBO Flow Monitor	N/A	N/A	In field
Macro invertebrate/ Habitat	2013	Hoosier River Watch	N/A	N/A	In field

11.3 Site Description

See Appendix A

11.4 Field QC Activities

QC activities in the field will be conducted by the watershed coordinator at a minimum interval of once per quarter. The first three months of collection will include the watershed coordinator. Quality control and accuracy will be achieved by strict adherence to written protocol. To achieve precision in field measurements, replicate measurements and field blanks will be taken at 3 of the 54 sampling sites for each sampling event. Field equipment will be properly calibrated before each sampling event in accordance with manufacturer's guidelines. To achieve precision in the laboratory, a duplicate sample and field blank will be taken at 3 of the 54 sampling sites for each sampling event. Laboratory equipment will be calibrated according to manufacturers guidelines. In the laboratory reference standards and blanks will be used as necessary to assure data quality. Collection containers/equipment will be washed/maintained within manual outlined protocols. For macroinvertebrate sampling, strict adherence to protocol will be followed by all personnel. Any discrepancies in data will be resolved by the watershed coordinator.

12.0 Analytical Requirements

12.1 Analytical Methods

Equipment used in the field and laboratory present data in usable form and require no analytical methods by the technician. For E. coli, procedures using the Coliscan Easygel method will be employed. Macroinvertibrate/habitat sampling will follow procedural guidelines under Hoosier River Watch method.

Table 4 lists analytical procedures and performance range for electronic equipment or each parameter .

Table 4: Analytical Procedures

Parameter	Analytical Method	Performance Range or Detection Limits	Units
DO	Hach sensION 156 Electronic Meter EPA 360.1	0 to 20; 0.1mg/l	mg/L
TDS	Hach sensION 156 Electronic Meter EPA 130.1	0 to 42; 0.1g/l	g/L
pH	Hach sensION 156 Electronic Meter EPA 150.2	-2 to 19.99;0.1SU	Standard Units
Turb	Hach 2100P Portable Meter EPA 180.1	0 to 1000; 0.1NTU	NTU
Temp	Hach sensION 156 Electronic Meter EPA 170.1	-10 to 110; 0.1°C	^{0}C
TP	Hach DR 2500/3800 Method 8190 EPA 360.3	0.06 to 3.5 mg/l; 0.01mg/l	mg/L
NO_3,	Hach DR 2500/3800 Method 10020 EPA 352.1	0.2 to 30.0mg/l; 0.1mg/l	mg/L
TSS	Hach DR 2500/3800 Method 8006 EPA 160.2	O to 750;0.1mg/l	mg/l
E. coli	Coliscan Easygel incubated at 35°C for 24 hours	N/A	Colonies/100 ml
Flow	Hach 2000-11 Flo-Mate Flow Monitor Manuals	0.1 to 30	FPS
Macroinvertibrate/Habitat	Hoosier River Watch	N/A	N/A

12.2 Analytical QC Activities

Statistical analysis will be used for HUC 12 comparisons using ANOVA procedures by the watershed coordinator.

DATA GENERATION & ACQUISITION

13.0 Sample Handling and Custody Requirements

Samples that require transportation will be clearly labled with date, time, technician initials, site, and parameter to be measured. Analysis of samples will occur in the laboratory by the same individual and will occur the same day as collection.

Samples will be placed on ice in a small cooler for transportation that is clearly labled with "Water Samples" on the outside. Since the same individual will be doing the analysis, no transfer sheets are required.

14.0 Testing, Inspection Maintenance and Calibration

The multi-parameter meter, the turbidity meter, and the spectrophotometers will require calibration. Calibration procedures will be followed for the field meters before sampling begins that day. The spectrophotometer will be calibrated before each sampling cycle for each parameter being measured.

Calibration will be in accordance with manufacturer's instructions.

ASSESSMENTS/OVERSIGHT

15.0 Assessment/Oversight/Data Quality Assessment & Decision Rules

15.1 Data Quality Indicators

Precision-Accuracy/Bias

Data will be reviewed after each collection stage for validity. For invalid data (data that does not meet criteria outlined in Table 2) the effected sites will be immediately resampled. All data determined to be accurate will be considered valid and will be reported even if completeness objectives are not met.

Water chemistry data will be checked with blanks randomly each month. If data has been compromised the sampling process will be immediately repeated for the effected parameter at all sites. E. coli analysis (colony counts) will be conducted by both technicians. If there is discepancy in counts the watershed coordinator will conduct a count in an attempt to resolve the difference. If unable to resolve the descrepency, samples will be retaken for the effected sites. Biological monitoring will be conducted by one technician and the watershed coordinator *to ensure agreement on identification. The watershed coordinator will make all final decisions concering discrepancies.*

Completeness

Data will meet completeness criteria if percentages outlined in Section 3 are met for each parameter.

If completeness goals are not met data will still be used. Data will be qualified by association with time of year and flow rates.

15.2 Corrective Action

Unusually high/low readings in the field will be used to trigger a potential corrective action. Corrective action will be an immediate equipment check and recalibration followed by another site sample. In the labratory unusually high/low readings and positive blanks will trigger corrective action. Corrective action will include an equipment check and recalibration. Positive blanks will require resampling.

16.0 Performance and System Audits

Performance audits for each section will be performed once each quarter by the SWCD District Manager. Systems audits will be conducted semi-annually by an external scientist selected by the SWCD District Manager.

IDEM reserves the right to conduct external performance and/or systems audits of any component of this study.

17.0 Preventative Maintenance

Preventative maintenance will be performed in accordance with the associated equipment manual.

An ample supply of batteries will be kept with field equipment. In addition, any parts associated with equipment that have limited time performance will have duplicates readily available.

VALIDATION & USABILITY

18.0 Data Review, Verification, Validation and Reconciliation with DQIs.

18.1 Data Review and Verification

Unusually high/low readings in the field will be used to trigger a potential corrective action. Corrective action will be an immediate equipment check and recalibration followed by another site sample. In the labratory unusually high/low readings and positive blanks will trigger *corrective action. Corrective action will include an equipment check and recalibration. Positive blanks will require resampling.*

18.2 Validation & Qualifiers

Qualifiers and Flags will be applied to collected data when necessary. See IDEM table below.

18.3 Reconciliation with User Requirements

The application of Qualifiers and Flags will be applied by the Watershed Coordinator and the IDEM QA Officer will verify the application when receiving data in the Required Spreadsheet.

Equipment used in the field and laboratory completes all data conversions into meaningful units.

*Below is an **example table** of a qualifiers and definitions used by IDEM Watershed Assessment & Planning Branch to validate data.*

Data Qualifiers and Flags

R: Rejected

J: Estimated.

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.*
2) *If the analysis was performed outside the 1½ times the holding time window the result will be rejected.*

D: The Relative Percent 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.*
2) *If the RPD is twice the established control limits then the sample will be rejected.*

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 Sample result is greater than the reporting limit but less than five times the blank contamination the result will be rejected.*
2) *If the Sample result is between five and ten times the blank contamination the result will be estimated.*
3) *If the Sample result is less than the Reporting limit or greater than ten times the Blank contamination the result will be accepted.*
4) *If the Sample result is < 10 times the Reporting limit then the result will be flagged (J+) as estimated high. In other words it is usable but the result is probably biased high.*

U: The result of the parameter is above the Method Detection Limit (MDL) but below the reporting limit and will be estimated.

18.4 Modeling or Statistical Methods Used

Final analysis approaches will be determined after four months of sampling and consultation with Purdue University. It is likely correlation and regression analysis will be employed along with ANOVA techniques.

19.0 Reports to Management, Documentation, Records

All data will be checked for errors and omissions by the watershed coordinator.

19.1 Data Reporting

The data and associated information will be collected by the project staff in a preformatted spreadsheet provided by the IDEM QA Officer.

19.2 Data Management

Data records such as field sheets and lab sheets will be stored for 5 years and/or provided to IDEM to be added to the project data as a pdf file in the AIMs database and to EPA.

19.3 Quality Assurance Reports

Quality Assurance (QA) reports will be submitted to IDEM's Watershed Planning and Restoration Section every three months as part of the Quarterly Progress Report and/or Final Report. The report will be a writen narrative listing any descrepencies found during QA reviews.

20.0 References

Ledet, N.D. 1991. Fawn River, LaGrange and Steuben Counties. Indiana Department of Natural Resource Report.

Marsh - McBirney. 1990. Model 2000 Installation and Operations Manual

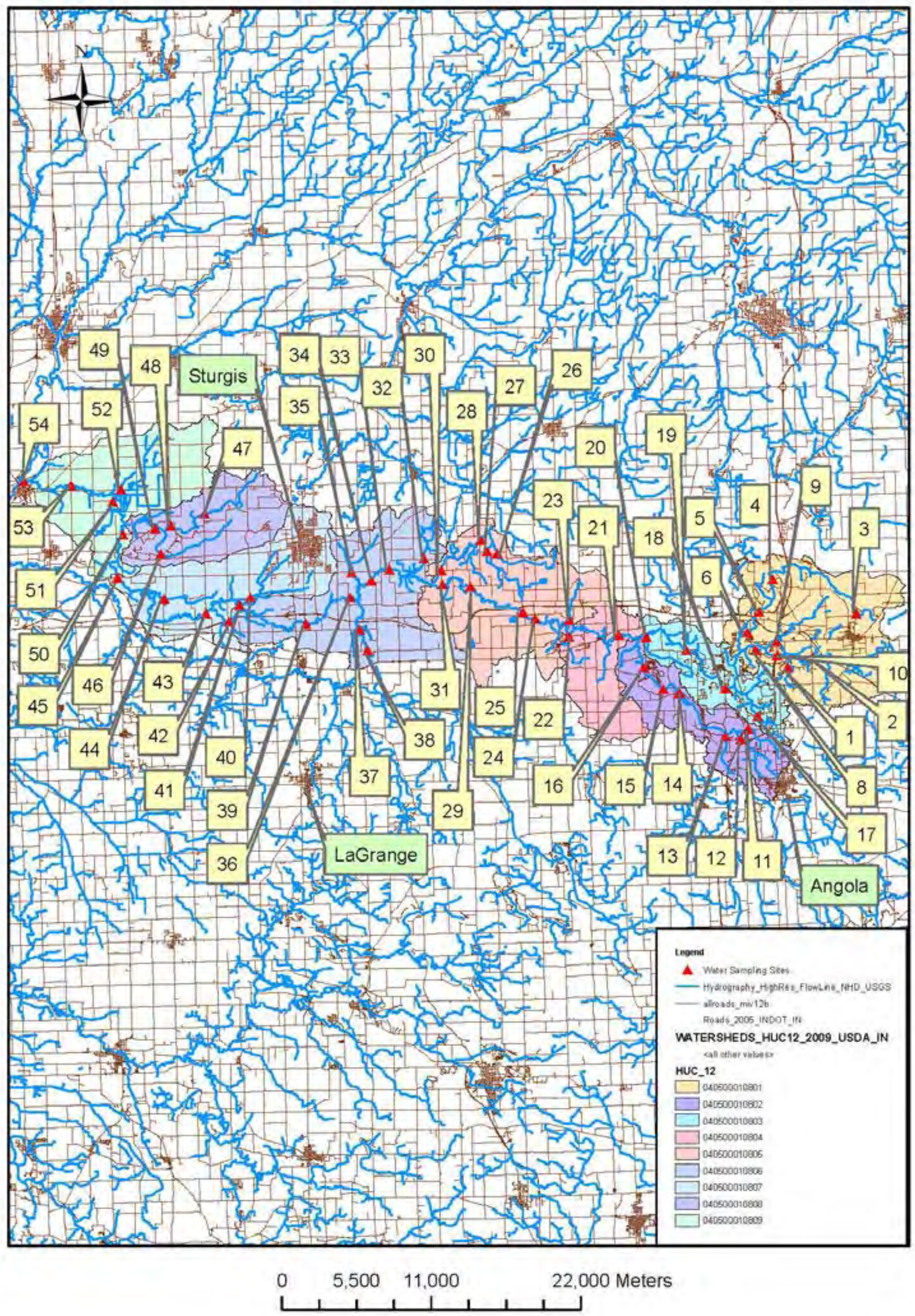
Ohio Environmental Protection Agency. 1989. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Division of Water Quality Monitoring and Assessment, Columbus, Ohio.

U.S.Environmental Protection Agency. 1997. Volunteer Stream Monitoring. A Methods Manual. EPA-841-B-97-003.

Volunteer Stream Monitoring Training Manual: Hoosier Riverwatch - Indiana's Volunteer Stream Monitoring Program. Indiana Department of Natural Resources, March 2001.

21.0 Appendices

Appendix A: Water Quality Sample Site Map



Appendix B: Water Sampling Field Log Sheet

WATER QUALITY SAMPLING FIELD LOG

SITE NUMBER AND LOCATION: ____

DATE: _______________ PROJECT NAME: ____________________________

TIME: _______________

FIELD CREW: _____________________________________

WEATHER CONDITIONS: ____

OTHER OBSERVATIONS: ____

EQUIPMENT CALIBRATION (Date): _______________________

FIELD PARAMETERS REPLICATE/Field Blank (if taken)

pH: _____________ pH: ____________ RPD = _______

Temp: ___________ Temp: _

DO: _____________ DO: ____________ RPD = _______

TDS: ____________ TDS: ___________ RPD = _______

Turb: ____________ Turb: ___________ RPD= _______

Calculated Flow: ______________

Relative Percent Difference (RPD) = $\frac{(sample1-sample2)}{((sample1+sample2)/2)}$

LAB PARAMETERS

E. Coli: ___________

Nitrate: ___________

TP: ______________

BOD: _____________

TSS: _____________

Field Crew Leader Signature: ___________________________

Appendix C: Discharge Measurement Sheet

DISCHARGE MEASUREMENT

Site: ____________________ Date: _________ Time: ________
Project#: _________________ Project Name: ________________
Crew Members: _______________________ Equipment: ___________________
Site Physical Description: ____

If stream is <2” deep:
Stream width: ______ feet
Stream Depths: ______, ______, ______, _____, _____, _____, _____, _____, _____feet
U: _____, _____, _____, _____, _____, _____, _____, _____, _____, _____ ft/s
U_{max}: _____ft/s

If stream is >2” deep:
Stream width: ______ feet
Interval Width (IW) (If W<15’, then IW=W/5. If W>15’, then IW=W*0.1): _____ feet

Segment	$\underline{SI_0}$ Location Depth	$\underline{SI_1}$ Location Depth	½ IW Location Depth	$\underline{U_{0.4}}$ Set Depth Rate
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Field Crew Leader Signature: ________________________________