

## **Des Plaines River Watershed Bioassessment Monitoring**

### **A Proposal Submitted to:**

Des Plaines River Watershed Workgroup (DRWW)  
Lake County Stormwater Management  
500 W. Winchester Rd.  
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November 30, 2015

### **Submitted by:**

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In response to the Request for Proposals (RFP) announced by the Des Plaines River Watershed Workgroup (DRWW) on November 3, 2015, the Midwest Biodiversity submits this proposal. MBI is fully dedicated to the development and implementation of biological assessments and biological criteria in support of water quality management and is fully qualified, staffed, equipped, and experienced to carry out the type of assessment described in the RFP. This proposal follows the outline suggested by the RFP and includes a description of the work to be accomplished to meet the stated goals and objectives of the RFP. The optional task for the development of a flow monitoring program is appended to the proposed schedule and budget.

A proposed schedule in accordance with the project period of (approximately) April 1, 2016-March 1, 2018 and a budget to meet the specifications of the RFP are included and organized by task and subtask. We are also including an alternate schedule and budget that we believe better fits the goals and objectives of the DRWW and in a more cost-effective manner. The tasks of the alternate plan are essentially the same as the RFP baseline, but are organized differently in terms of the projected schedule and completion of tasks and subtasks. The MBI personnel classifications that will be assigned to each task and subtask are also specified and were made with an understanding of what each involves.

### A. Project Understanding and Approach

The MBI proposal and outline of tasks and subtasks adheres to the description of the project in the DRWW RFP and are depicted in Figure 1. As a result there are seven major tasks to be accomplished in 2016 and 2017-18 as follows:

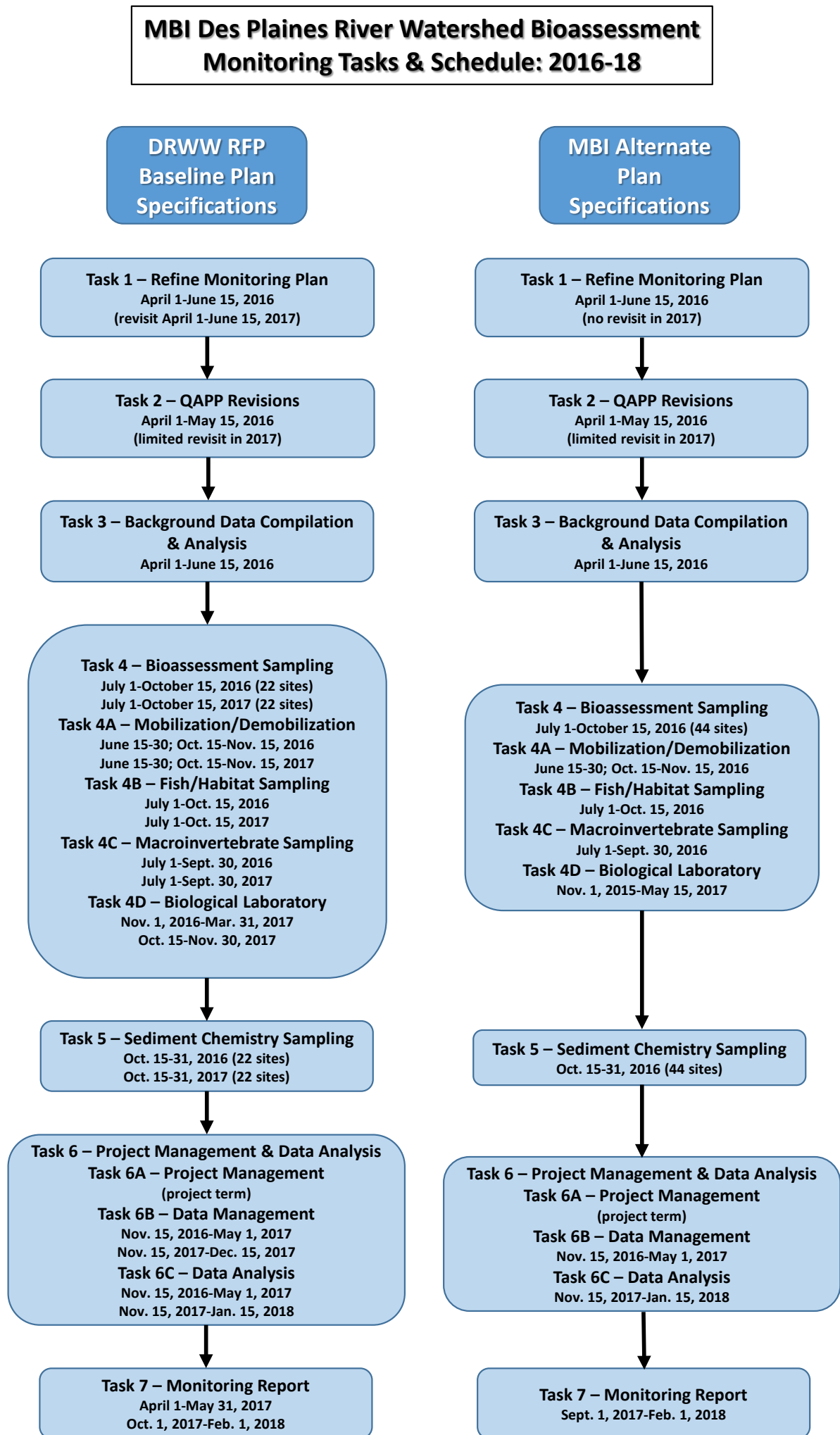
#### Task 1 – Refine Monitoring Plan

This task involves reviewing the Monitoring Plan provided in Appendix A of the RFP and identifying any deficiencies and making suggestions for improvements. The goal of the plan is to better support water quality decision-making with the results and analysis of the watershed biological and water quality assessment. This makes the delineation of impairments and the identification of associated causes<sup>1</sup> and sources<sup>2</sup> at an appropriate spatial scale a vital project

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<sup>1</sup> A cause is an agent that affects the biota in an adverse manner such that it results in a biological impairment – it includes 1) pollutants such as a toxic concentration of ammonia, low dissolved oxygen, or the indirect effects of elevated nutrients; 2) modified attributes of flow or habitat; or 3) the adverse impact of an introduced species.

<sup>2</sup> A source is the origin of the causal agents and includes point sources and nonpoint sources, the latter of which includes habitat alterations, flow alterations, and urban runoff in the DRWW study area.



**Figure 1.** Flow chart of the schedule and sequence of tasks and subtasks for the Des Plaines River Watershed Bioassessment under the DRWW Baseline Plan (Left column) and the MBI Alternate Plan (Right column).

objective. The elements and details of the Monitoring Plan will dictate to a large degree how successful and at what level of detail that objective will be accomplished. Specifically MBI will examine the selection of chemical, physical, and biological indicators following the principles of adequate monitoring and assessment (Yoder and Rankin 1998; Yoder 1998) and also the adequacy of the spatial and temporal aspects of the sampling design. MBI has designed several such watershed assessments for multiple clients since 2002 (see B. Project Experience and References and C. Project Team narratives).

While we understand the limitations that were faced by DRWW in developing the current set of specifications, we believe there are ways to cost-effectively improve the Monitoring Plan by allocating additional sites utilizing a rotating approach that spreads the workload over additional years. MBI has successfully done this in other areas to improve the spatial coverage and inclusion of streams and sites that would otherwise have been overlooked. The Alternate Plan proposed by MBI (see D. Project Fee and E. Project Schedule) does not accomplish everything that needs to be included to fully meet the goals of the DRWW, but it does approach the sequence of sampling and data analysis with a more practical and cost-effective strategy. Another consideration that will better support the outputs of the watershed bioassessment is the inclusion of regional reference sites. Given our familiarity with the Upper Des Plaines and other northeastern Illinois watersheds, finding comparatively good quality sites comparable to regional reference conditions in the DRWW study area will likely be a challenge. Thus one area of investigation will be the potential inclusion of 6-10 reference sites to the annual watershed bioassessment. This will better inform the delineation of causes and sources and ultimately use attainability issues that could arise as a result of the watershed bioassessment. The preference would be to utilize Illinois EPA/DNR reference sites, but using other sites in the region should not be ruled out.

Under the DRWW Baseline Plan specifications we envision this task being undertaken between April 1-June 15, 2016 and to include a geometric draw of sites to a resolution of  $\approx 1 \text{ mi.}^2$  drainage area. This will be in addition to the other issues described above. The design can be revisited again in 2017 just prior to the initiation of the second year of sampling. For the MBI Alternate Plan, this task will be completed in 2016 as all sampling will be conducted in 2016. This approach offers the possibility of adding sites to the base DRWW design in response to the findings of this task and as resources are available. It also reduces the overall cost of the project.

## **Task 2 – QAPP Revisions**

This task includes responding to Illinois EPA comments on the current Des Plaines River QAPP and making any needed changes or edits. While this is a straightforward task we note here that the DRWW QAPP is essentially the same as that initially developed by MBI for the DuPage River Salt Creek Workgroup (DRSCWG) in 2006-7 and as modified during the course of that project through 2015. This same QAPP was also adopted by the Lower DuPage River Watershed Coalition (LDRWC) in 2012 and again in 2015. There are some modifications that need to be made to the DRSCWG QAPP based on what was learned in the 10 years of bioassessment in

those watersheds. An example is the MAIS macroinvertebrate method that is described in Appendix E of the adopted DRWW QAPP. It was anticipated that the MAIS sampling method might be needed given that the Illinois EPA multihabitat method had not been used in small headwater streams (orders 1-3). However, the Illinois method eventually proved workable in these small streams. In addition, the reference to artificial substrates will need to be revised as the Illinois method was successfully used in the mainstem Lower DuPage River in 2012 and again in 2015. All of these adaptations were done in consultation with Illinois EPA. These details illustrate our grasp and understanding of the important methodological issues.

Under both the DRWW Baseline Plan and the MBI Alternate Plan we envision this task being undertaken between April 1-May 15, 2016 with a limited revisit in 2017 just prior to the initiation of the second year of sampling. There is no cost difference between either plan.

### **Task 3 – Background Data Compilation & Analysis**

We interpret this task to include gathering all relevant and readily available information that has been collected within the DRWW study area. MBI is familiar with the Illinois EPA and Illinois DNR databases in their role as a subcontractor in the revision of the Illinois fish and macroinvertebrate IBIs (2015-present). As such we presently have access to at least parts of the statewide biological database. We have also retrieved historical chemical/physical data in support of analyses of the DRSCWG and LDRWC data since 2006. However, we have found accessing the Illinois EPA databases to be labor intensive, thus our estimate of labor for this task includes that experience. In addition, if any of the Illinois habitat data consists only of the SHAP index then this will need to be converted to the QHEI at a later date to make it useful – this is not included in the MBI estimates.

This task needs to be completed in 2016 and in enough time to influence the 2016 sampling if it is necessary. It is the same under both the DRWW Baseline and MBI Alternate Plans.

### **Task 4 – Bioassessment Sampling**

This task includes all of the activities focused on the collection and processing of the biological samples. We have divided task 4 into four subtasks – 4A Mobilization and Demobilization; 4B – Fish and Habitat Sampling; 4C – Macroinvertebrate Sampling; 4D – Biological Laboratory. This task is divided equally into two years by the DRWW Baseline Plan – 22 sites to be sampled in each year with the attendant post-field laboratory processing in both 2016-17 and 2017 (Figure 1). The MBI Alternate Plan samples all 44 sites in 2016 and conducts the post-field laboratory processing in 2016-17 (Figure 1). Each subtask is described as follows:

#### ***Task 4A – Mobilization/Demobilization***

This subtask includes the preparation of all equipment and supplies need to conduct the field sampling taking place in the weeks immediately preceding the initiation of field work. It also includes the post-field demobilization of equipment and sample organization immediately after the field season.

***Task 4B – Fish/Habitat Sampling***

This includes the sampling of the fish assemblage in accordance with the QAPP and within a seasonal index period of July 1-October 15. Habitat will be assessed at the same sites and using the QHEI. The MBI estimate for both the DRWW Baseline and MBI Alternate Plans include 1 sampling pass at all 44 sites. It should be noted here that the DRSCWG and LDRWC fish sampling included 2 passes at sites larger than 5-10 mi.<sup>2</sup>. Adding a second pass to these sites would increase the proposal cost by \$12,000-\$16,000 depending on how many sites were included. MBI has 10 years of experience using Illinois EPA and DNR methods under the DRSCWG QAPP and will utilize Level 3 Qualified Data Collectors<sup>3</sup> as crew leaders.

***Task 4C – Macroinvertebrate Sampling***

Macroinvertebrate sampling will likewise be conducted under the specifications of the DRWW QAPP and within a seasonal index period of July 1-September 30. A site description that documents the details of the Illinois EPA multihabitat method will be recorded at each of the 44 sites. The Illinois method calls for a resampling of 10% of the sites (n=4), but this was not included due to the single pass limitations described in the DRWW Baseline Plan. Adding the resamples would be more plausible under the two pass fish scenario. MBI has 10 years of experience using Illinois EPA and DNR methods under the DRSCWG QAPP and will utilize Level 3 Qualified Data Collectors<sup>3</sup> as crew leaders.

***Task 4D – Biological Laboratory***

This includes all post-field laboratory tasks including the verification of fish identifications and the processing, sorting, and identification of macroinvertebrates in accordance with the DRWW QAPP. For the macroinvertebrates this subtask includes the identification of 4 samples by an independent and qualified macroinvertebrate taxonomist as part of the QA/QC process.

The MBI Alternate Plan is projected to result in a savings of \$5,107 over the DRWW Baseline Plan for Task 4 due primarily to the former sampling all sites in 2016 thus reducing the inherent duplication of some activities in both 2016 and 2017. It also reflects lower labor rates in 2016 as compared to a normal escalation of 3% in 2017. We believe there are some additional intangible benefits to the flow of data into the analysis and reporting tasks. A possible disadvantage is with the chemical sampling being conducted under a separate contract – all 44 sites would need to be sampled in 2016 to support the causal inferences that will be made later using that data.

***Task 5 – Sediment Chemistry Sampling***

This task includes the collection of sediment samples for chemical analysis. MBI has extensive experience with these collections in multiple projects throughout Ohio and following the Ohio EPA methods prescribed by the DRWW QAPP. The collections are best made in the latter one-half of October thus reflecting the accumulation of pollutants over the seasonal index period

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<sup>3</sup> QDCs are certified under the Ohio Credible Data Law (ORC 6111.5) and regulations (OAC 3745-4).

for biological sampling. As with Task 4 the MBI Alternate Plan collects all 44 samples in 2016 resulting in a very modest cost savings over the DRWW Baseline Plan.

### **Task 6 – Project Management and Data Analysis**

We have divided task 6 into three subtasks – 6A Project Management; 6B – Data Management; 6C – Data Analysis. This task is executed over two years by the DRWW Baseline Plan with one-half of the data being collated, stored, and processed in 2016 and the second one-half in 2017 (Figure 1). The MBI Alternate Plan conducts the post-field data management in late 2016 and through the first five months of 2017 (Figure 1). The reason data management extends this far into 2017 is the processing of the macroinvertebrate samples (see Subtask 4D). Each subtask is described as follows:

#### ***Task 6A – Project Management***

This includes administrative and communication tasks within MBI and between MBI and DRWW including monthly progress reports, invoicing, and general communication. There is no difference between the DRWW Baseline and MBI Alternate Plans as this will extend across the project timeline.

#### ***Task 6B – Data Management***

This is a post-field and post-laboratory task that includes the organization and logging of field and lab sheets, entering data, and proofing data entry. MBI will utilize its own version of the Ohio ECOS data management system which has been used to support the DRSCWG and LDRWC projects since 2006. The differences between the DRWW Baseline and MBI Alternate Plans are primarily in the timing of the data entry and volume of work in 2016 and 2017. The estimated cost differences are minor.

#### ***Task 6C – Data Analysis***

This subtask includes the analysis of all field collected data including the analysis of the chemical/physical data, POTW loadings data, calculation of the Illinois fish and macroinvertebrate IBI scores and metrics, and the conduct of use attainability analyses and the assignment of causes and sources to any documented biological impairments. Under the DRWW Baseline Plan this subtask is allocated equally between 2016 and 2017 given that one-half of the results will be available in each year. The MBI Alternate Plan allocates all of the data analysis to 2017 after all of the data becomes available in early to mid-2017. It also has the intangible benefit of analyzing the data over the entire study area at one time as opposed to assessing parts of the data at two different times. It simply feeds into the delineation of impairments and the assignment of causes and sources in a more sequenced and defensible fashion. We inserted the use attainability subtask into both plans since it is sound practice to do so, but it also prepared DRWW for the adoption of a TALU based approach by Illinois EPA should that materialize. MBI has been heavily involved in this process in Illinois since 2002 (see B. Project Experience and C. Project Team narratives).

While the cost differences between the DRWW Baseline and MBI Alternate Plans are minor, the organization of task 6 represents a more efficient and defensible sequencing of subtasks and outputs. This assertion is based on MBI's 15 years of experiencing in producing such assessments at the watershed scale.

### **Task 7 – Monitoring Report**

The final task is the production of a comprehensive report detailing the data and the conclusions based on the analyses of that data. We propose the following outline for the report (in addition to a cover page and table of contents):

#### ***Executive Summary***

A brief synopsis of the findings of the watershed monitoring including a quantitative description of impairments, major causes and sources of impairment, opportunities for restoration and protection, and recommendations for future monitoring.

#### ***Section 1 – Introduction***

This will describe the purposes of the monitoring and the goals and objectives of the DRWW for using monitoring data to support water quality decision-making.

#### ***Section 2 – Study Area Description***

A detailed description of the study area including maps and lists of sites, major pollution sources, dams, and other features that relate to the watershed biological assessment. This will benefit from DRWW input upfront in the process.

#### ***Section 3 – Methods***

A description and summary of all chemical, physical, and biological methods used to collect the data, data management, and data analysis including the delineation of impairments, a description of the process used to assign causes and sources, and an approach for conducting use attainability analyses.

#### ***Section 4 – Results***

A comprehensive reporting of chemical, physical, and biological quality using tables and graphs to report the results. This will include an assessment of POTW pollutant loadings, chemical water quality criteria exceedances, exceedances of biologically relevant thresholds, sediment chemical threshold exceedances, analysis of habitat attributes, and reporting fish and macroinvertebrate IBI and metrics results.

#### ***Section 5 – Synthesis of Results***

This section will report the results of the data analyses and causal assessment conducted under task 6C. This where the conclusions about causes and sources are explained including any patterns observed in the study area such as the differences in results observed between POTW influenced and nonpoint source influenced sites and reaches.



There are only minor differences in cost between the DRWW Baseline and MBI Alternate Plans. The key difference is in the sequencing of the transition between Task 4, 5, 6, and task 7 and what the data represents in terms of temporal consistency and defensibility. The MBI Alternate Plan also reflects a more sequenced production of the data analysis and report which comes after all of the data has been collected and processed as opposed to receiving the data in two distinct time periods.

### **Optional Task 8 – Flow Monitoring**

This optional task is the same under both the DRWW and MBI Plans and is proposed to occur at the end of the project. The subtasks that we have outlined are an approximation of what we perceive to be the need for a real-time stormwater monitoring program designed to produce loading estimates at various points in the watershed. This will require close cooperation with the DRWW to insure that these details are understood prior to embarking on project design.

### **B. Project Experience and References**

Three major watershed assessment projects conducted by MBI are provided. Each of these includes the full range of analyses and tasks included in the DRWW Baseline and MBI Alternate Plans.

#### **Project 1. Metropolitan Sewer District of Greater Cincinnati (MSDGC) Watershed Assessment**

- i. Watershed Bioassessment of MSDGC Service Area Rivers and Streams, Hamilton County, OH.
- ii. Ting Lu, MSDGC, 1600 Gest Street, Cincinnati, OH 45204
- iii. MBI served as the prime contractor.
- iv. March 2011 – December 2015
- v. \$2,128,858
- vi. Developed a comprehensive watershed assessment plan utilizing a four-year watershed and mainstem river rotation. Completed four annual watershed assessments totaling ≈100 sites each year for water and sediment chemistry, habitat, and biological data (fish, macroinvertebrates) and a comprehensive report including delineation of impairments and causes/sources. Reports are available at:  
[www.msdgc.org/initiatives/water\\_quality/index.html](http://www.msdgc.org/initiatives/water_quality/index.html).
- vii. Ting Lu, MSDGC, 1600 Gest Street, Cincinnati, OH 45204 (513)244-5137
- viii. MBI was enlisted in 2011 by the MSDGC to produce a watershed-based monitoring and biological assessment plan for the MSD service area within Hamilton County, Ohio. This plan described the spatial and temporal sampling design and the indicators and parameters that are to be collected at each sampling site. It also describes the types of biological sampling methods for fish and macroinvertebrate assemblages and habitat assessment. Chemical and physical measures were also included to provide supporting data and information for the biological assessment. This included indicators and parameters for recreational use assessment in addition to aquatic life use assessment. The plan has been

used to guide the development of detailed study plans for two of four years of field work and the subsequent data analysis for a baseline bioassessment in beginning in 2011. The sampling design employs a combination of a geometric (stratified-random) and intensive pollution surveys. These are being employed to fulfill multiple management purposes and goals in addition to the determination of the existing status of the biological assemblages and their relationship to chemical, physical, and biological stressors. As such, the principles of adequate monitoring and assessment (ITFM 1995; Yoder 1998) were used in anticipation that the resulting biological assessments will support the development of cost-effective watershed management responses to existing and emerging issues. A restoration project prioritization ranking scheme similar to that developed for the DRSCWG was developed to support MSDGC in meeting the terms of a CSO consent decree and for local watershed groups in developing their restoration project priorities and scope.

## **Project 2. DuPage River Salt Creek Working Group Watershed Assessments**

- i. Watershed Bioassessment of DRSCWG Rivers and Streams, DuPage and Cook Counties, IL.
- ii. Stephen McCracken, DRSCWG, 10 S. 404 Knoch Knolls Rd., Naperville, IL 60565
- iii. MBI served as the prime contractor.
- iv. March 2006 – present
- v. \$1,228,837
- vi. Developed a comprehensive watershed assessment plan utilizing a three-year watershed and mainstem river rotation. Completed ten annual watershed assessments totaling ≈35-50 sites each year for water and sediment chemistry, habitat, and biological data (fish, macroinvertebrates) and a comprehensive report including delineation of impairments and causes/sources. Reports are available at: [www.drscwg.org/wp/bioassessment](http://www.drscwg.org/wp/bioassessment).
- vii. Stephen McCracken, DRSCWG, 10 S. 404 Knoch Knolls Rd., Naperville, IL 60565 (630) 768-7427
- viii. MBI designed a comprehensive watershed assessment for the DuPage River-Salt Creek watersheds in northeastern Illinois in 2005-6. MBI then executed the implementation of that design for the bioassessment portion of the project by sampling these watersheds during 2006-2012. The lower DuPage River watershed was added in 2012. This included using the Illinois EPA fish and macroinvertebrate IBIs including the development of programming to calculate each index. MBI produced the first project report that included data analysis of the bioassessment and chemical/physical data and the assessment of multiple stressors affecting use attainment in the DuPage River-Salt Creek watersheds in 2009. Annual watershed reports have followed each year since. These have been used to verify and expand the present listings of impaired waters and to improve the TMDL and watershed management process as a whole. The project was extended to include second and third rounds of sampling during 2009 through 2015. In addition, the 2006-15 bioassessments are being used to update a restoration project prioritization ranking scheme that has been used by the DRSCWG to determine restoration project priorities and scope since 2010.

### **Project 3. Biological Assessment of the Lower Black River**

- i. Bioassessment of the lower Black River, Lorain County, OH.
- ii. Kristen Risch, Coldwater Consulting, 46 W. Columbus Street, Galena, OH 43021
- iii. MBI served as a subcontractor to Coldwater.
- iv. March 2006 – present
- v. \$258,475
- vi. Developed a bioassessment plan to evaluate habitat restorations and water quality in the lower Black River. Completed five years of bioassessment totaling ≈30 sites each year for water and sediment chemistry, habitat, and biological data (fish, macroinvertebrates) and a comprehensive report including delineation of impairments and causes/sources. Reports are available at: <http://www.midwestbiodiversityinst.org/publications?type=r&page=1>.
- vii. Kristen Risch, Coldwater Consulting, 46 W. Columbus Street, Galena, OH 43021 (740) 936-5368.
- viii. MBI designed and conducted biological and water quality assessments to evaluate the effectiveness of NOAA funded habitat and riparian restoration projects in the lower Black River lacustrary and navigation channel. This included fish, macroinvertebrate, habitat, and water quality (including sediment chemistry) sampling and data analysis over a consecutive four year period 2010-2013. MBI assessed biological and habitat data against Ohio Beneficial Use Impairment benchmarks and interim benchmarks developed by NOAA. The assessment of physical habitat and biological condition was complicated by legacy pollutants from past and current discharges in the upper lacustrary. This necessitated an adaptive approach to the study design. The project is scheduled to continue in 2015.

Additional and relevant MBI projects are listed under the Curriculum Vitae of the Project Manager in Appendix A.

### **C. Project Team**

The MBI project team will consist of a project manager, a senior research associate, 3-4 research associates (will also serve as biological and sediment crew leaders), a GIS analyst, and 3-4 field technicians. These are each described as follows with CVs for full time personnel provided as Appendix A.

- i. Project Manager – Chris O. Yoder will serve as the project manager and oversee all facets of the project and production of data, analyses, and reports including editing the final watershed report.
- ii. Senior Research Associate – Edward T. Rankin will serve as the database manager and as the senior staff member for conducting the assessment of historical data, data analysis in support of the watershed assessments, and producing the watershed assessment report.
- iii. Research Associate – Vickie L. Gordon will serve as the fish and sediment chemistry crew leader, lead in all data entry tasks, assist with data management and analysis, and production of the project report. Jack T. Freda will assist with data analysis and in report

production. Martin J. Knapp will serve as the lead macroinvertebrate taxonomist and will oversee all related tasks and subtasks.

- iv. GIS Analyst – Rachel Day will serve as the GIS analyst and will assist with the development of the geometric sampling design portion of task 1 and in producing maps for the report.
- v. Field Technicians – MBI employs seasonal technicians to assist with the collection of water quality and biological samples. Persons with skills in fish identification and field work are sought in a formal hiring process during the winter if each year.

#### **D. Project Fee**

Budgets for the DRWW Baseline Plan (Table 1) and the MBI Alternate Plan (Table 2) include details of the tasks and subtasks. The budgets also include the personnel level that will be assigned to each task along with the current (2016) and projected (2017) MBI billing rates. The hourly rate includes the fringe factor that ranges from 10-25% and the indirect rate of 50% is factored into the total labor for each task and subtask. Other Direct Costs (ODCs) include supplies, mileage, and travel support. One trip per year is budgeted for the Project Manager to meet with DRWW on site ahead of the field sampling for each year.

#### **E. Project Schedule**

The project schedule is detailed in Figure 1 and for each of the DRWW Baseline and MBI Alternate Plans.

**Table 1. MBI cost proposal by task and subtask for the 2016-18 bioassessment of the Upper Des Plaines River per specifications of the DRWW RFP.**

Task Descriptions	2016				2017-18			
	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
<b>Task 1 - Refine Monitoring Plan</b>								
Project Manager - Review & Modify Plan	\$63.69	40	\$2,547.60		\$65.60	8	\$524.80	
GIS Analyst - Geometric Design Options	\$25.00	24	\$600.00		\$25.75	0	\$0.00	
Direct Labor Costs		64	\$3,147.60			8	\$524.80	
<b>Task 1 Labor Fee (OM 1.5 applied)</b>			<b>\$4,721.40</b>				<b>\$787.20</b>	
Project Manager Travel - Meet with DRWW	\$1,000.00	1	\$1,000.00		\$1,000.00	1	\$1,000.00	
<b>ODC Subtotal</b>			<b>\$1,000.00</b>				<b>\$1,000.00</b>	
<b>Task 1 Subtotal</b>				<b>\$5,721.40</b>				<b>\$1,787.20</b>
<b>Task 2 - QAPP Revisions</b>								
Project Manager - Review & Revise QAPP	\$63.69	16	\$1,019.04		\$65.60	4	\$262.40	
Research Associate - Review & Revise Methods	\$27.05	8	\$216.40		\$27.86	0	\$0.00	
Direct Labor Costs		24	\$1,235.44			4	\$262.40	
<b>Task 2 Labor Fee (OM 1.5 applied)</b>			<b>\$1,853.16</b>				<b>\$393.60</b>	
<b>Task 2 Subtotal</b>				<b>\$1,853.16</b>				<b>\$393.60</b>
<b>Task 3 - Background Data Compilation &amp; Analysis</b>								
Project Manager - Write & Edit Summary Report	\$63.69	16	\$1,019.04		\$65.60	0	\$0.00	
Senior Research Associate - Acquire & Evaluate Data	\$56.34	40	\$2,253.60		\$58.03	0	\$0.00	
GIS Analyst - Assist with Data Acquisition	\$25.00	16	\$400.00		\$25.75	0	\$0.00	
Direct Labor Costs		72	\$3,672.64			0	\$0.00	
<b>Task 3 Labor Fee (OM 1.5 applied)</b>			<b>\$5,508.96</b>				<b>\$0.00</b>	
<b>Task 3 Subtotal</b>				<b>\$5,508.96</b>				<b>\$0.00</b>
<b>Task 4 - Bioassessment Sampling</b>								
<b>Task 4A - Field Mobilization/Demobilization</b>								
Project Manager - Project Management & Oversight	\$63.69	16	\$1,019.04		\$65.60	8	\$524.80	
Fish Crew Leader - Mobilize/Demobilze Equipment	\$27.05	40	\$1,082.00		\$27.86	36	\$1,002.96	
Macroinvertebrate Crew Leader - Field Prep.	\$30.05	16	\$480.80		\$30.95	12	\$371.40	
Field Technician X2 - Assist Crew Leaders	\$15.86	80	\$1,268.80		\$16.34	72	\$1,176.48	
Direct Labor Costs		152	\$3,850.64			128	\$3,075.64	
<b>Task 4A Labor Fee (OM 1.5 applied)</b>			<b>\$5,775.96</b>				<b>\$4,613.46</b>	
<b>Task 4A Subtotal</b>				<b>\$5,775.96</b>			<b>\$5,138.26</b>	
<b>Task 4B - Fish/Habitat Sampling</b>								
Fish Crew Leader - Lead Fish Crew (22 sites annually)	\$27.05	100	\$2,705.00		\$27.86	100	\$2,786.00	
Field Technician X2 - Field Sampling Labor	\$15.86	160	\$2,537.60		\$16.34	160	\$2,614.40	
Field Technician X2 (OT) - Field Samling Labor	\$23.79	40	\$951.60		\$24.51	40	\$980.40	
Direct Labor Costs		300	\$6,194.20			300	\$6,380.80	
<b>Task 4B Labor Fee (OM 1.5 applied)</b>			<b>\$9,291.30</b>				<b>\$9,571.20</b>	

**Table 1. MBI cost proposal by task and subtask for the 2016-18 bioassessment of the Upper Des Plaines River per specifications of the DRWW RFP.**

Task Descriptions	2016			2017-18		
	Unit Cost	Est. Project Units	Cost Estimate	Unit Cost	Est. Project Units	Cost Estimate
<b>Task 4B - Fish/Habitat Sampling - ODCs</b>						
Vehicle & Equipment Use - Vehicle, Boats, E-Fishing Gear	\$500.00	2	\$1,000.00	\$500.00	2	\$1,000.00
Vehicle Mileage - Travel to sites	\$0.575	800	\$460.00	\$0.575	800	\$460.00
Supplies - miscellaneous items, preservatives	\$1,000.00	1	\$1,000.00	\$1,000.00	1	\$1,000.00
Lodging/Food/Misc. - Daily allowance per person	\$125.00	21	\$2,625.00	\$125.00	21	\$2,625.00
<b>ODC Subtotal</b>			<b>\$5,085.00</b>			<b>\$5,085.00</b>
<b>Task 4B Subtotal</b>			<b>\$14,376.30</b>			<b>\$14,656.20</b>
<b>Task 4C - Macroinvertebrate Sampling</b>						
Macroinvert. Crew Leader - Lead Macro. Crew (22 sites annually)	\$30.05	60	\$1,803.00	\$30.95	60	\$1,857.00
Field Technician - Field Sampling Labor	\$15.86	40	\$634.40	\$16.34	40	\$653.60
Field Technician (OT) - Field Sampling Labor	\$23.79	20	\$475.80	\$24.51	20	\$490.20
Direct Labor Costs		120	\$2,913.20		120	\$3,000.80
<b>Task 4C Labor Fee (OM 1.5 applied)</b>			<b>\$4,369.80</b>			<b>\$4,501.20</b>
Vehicle & Equipment Use - Vehicle	\$300.00	1	\$300.00	\$300.00	1	\$300.00
Vehicle Mileage - Travel to sites	\$0.575	800	\$460.00	\$0.575	800	\$460.00
Field Supplies - miscellaneous items, preservatives	\$1,000.00	1	\$1,000.00	\$1,000.00	1	\$1,000.00
Lodging/Food/Misc. - Daily allowance per person	\$125.00	10	\$1,250.00	\$120.00	10	\$1,200.00
<b>ODC Subtotal</b>			<b>\$3,010.00</b>			<b>\$2,960.00</b>
<b>Task 4C Subtotal</b>			<b>\$7,379.80</b>			<b>\$7,461.20</b>
<b>Task 4D - Biological Laboratory</b>						
Fish Vouchers - i.d. verifications per QAPP	\$27.05	16	\$432.80	\$27.86	8	\$222.88
Macroinvertebrate Sample Sorting & QA - sort samples	\$27.05	180	\$4,869.00	\$27.86	180	\$5,014.80
Macroinvertebrate Taxonomy & QA - i.d. samples	\$30.05	200	\$6,010.00	\$30.95	200	\$6,190.00
Direct Labor Costs		396	\$11,311.80		388	\$11,427.68
<b>Task 4D Labor Fee (OM 1.5 applied)</b>			<b>\$16,967.70</b>			<b>\$17,141.52</b>
Lab Supplies - preservatives, slides, containers	\$1,000.00	1	\$1,000.00	\$1,000.00	1	\$1,000.00
Lab Equipment Usage - Binocular & microscopes	\$150.00	3	\$450.00	\$150.00	3	\$450.00
Macroinvertebrate QA/QC (n = 2 each year)	\$400.00	2	\$800.00	\$400.00	2	\$800.00
<b>ODC Subtotal</b>			<b>\$2,250.00</b>			<b>\$2,250.00</b>
<b>Task 4D Subtotal</b>			<b>\$13,561.80</b>			<b>\$13,677.68</b>
<b>Task 4 Subtotal</b>			<b>\$41,093.86</b>			<b>\$40,933.34</b>
<b>Task 5 - Sediment Chemistry Sampling</b>						
Chemical Crew Leader - Lead Sediment Crew	\$27.05	48	\$1,298.40	\$27.86	48	\$1,337.28
Field Technician X 1 - Field Labor	\$15.86	40	\$634.40	\$15.86	40	\$634.40
Field Technician (OT) - Field Labor	\$23.79	8	\$190.32	\$24.51	8	\$196.08
Direct Labor Costs		96	\$1,932.80		88	\$1,971.68
<b>Task 5 Labor Fee (OM 1.5 applied)</b>			<b>\$2,899.20</b>			<b>\$2,957.52</b>

**Table 1. MBI cost proposal by task and subtask for the 2016-18 bioassessment of the Upper Des Plaines River per specifications of the DRWW RFP.**

Task Descriptions	2016				2017-18			
Task 5 - Sediment Chemisrty Sampling (continued)	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
Equipment Use - Vehicle	\$300.00	1	\$300.00		\$300.00	1	\$300.00	
Vehicle Mileage - Travel to sites	\$0.575	800	\$460.00		\$0.575	800	\$460.00	
Lodging/Food/Misc. - Daily allowance per person	\$125.00	10	\$1,250.00		\$125.00	10	\$1,250.00	
<b>ODC Subtotal Task 5</b>			<b>\$2,010.00</b>				<b>\$2,010.00</b>	
<b>Task 5 Subtotal</b>				<b>\$4,909.20</b>				<b>\$4,967.52</b>
<b>Task 6 - Project Management and Data Analysis</b>								
<b>Task 6A - Project Management</b>	<b>Unit Cost</b>	<b>Est. Project Units</b>	<b>Cost Estimate</b>	<b>Task Subtotal</b>	<b>Unit Cost</b>	<b>Est. Project Units</b>	<b>Cost Estimate</b>	<b>Task Subtotal</b>
Principal Investigator - Project Management & Oversight	\$63.69	12	\$764.28		\$65.60	8	\$524.80	
Fish Crew Leader - Track Progress	\$27.05	6	\$162.30		\$27.86	6	\$167.16	
Macroinvertebrate Crew Leader - Track Progress	\$30.05	6	\$180.30		\$30.95	6	\$185.70	
Direct Labor Costs		24	\$1,106.88			20	\$877.66	
<b>Task 6A Labor Fee (OM 1.5 applied)</b>			<b>\$1,449.48</b>				<b>\$1,230.52</b>	
<b>Task 6A Subtotal</b>			<b>\$1,449.48</b>				<b>\$1,230.52</b>	
<b>Task 6B - Data Management</b>	<b>Unit Cost</b>	<b>Est. Project Units</b>	<b>Cost Estimate</b>		<b>Unit Cost</b>	<b>Est. Project Units</b>	<b>Cost Estimate</b>	
Research Associate - Fish & Habitat Entry	\$27.05	16	\$432.80		\$27.86	16	\$445.76	
Research Associate - Macroinvertebrate Entry	\$27.05	24	\$649.20		\$27.86	24	\$668.64	
Research Assoc. - POTW Loadings & Water Chemistry Data	\$27.05	24	\$649.20		\$27.86	24	\$668.64	
Direct Labor Costs		64	\$1,731.20			64	\$1,783.04	
<b>Task 6B Labor Fee (OM 1.5 applied)</b>			<b>\$3,029.60</b>				<b>\$3,120.32</b>	
<b>Task 6B Subtotal</b>			<b>\$3,029.60</b>				<b>\$3,120.32</b>	
<b>Task 6C - Data Analysis</b>	<b>Unit Cost</b>	<b>Est. Project Units</b>	<b>Cost Estimate</b>		<b>Unit Cost</b>	<b>Est. Project Units</b>	<b>Cost Estimate</b>	
Sr. Res. Assoc. - POTW Loadings	\$30.05	8	\$240.40		\$30.95	8	\$247.60	
Sr. Res. Assoc. - Water Column & Sediment Chemical WQ	\$56.34	16	\$901.44		\$58.03	16	\$928.48	
Sr. Res. Assoc. - Fish & Macroinvertebrate IBIs	\$56.34	8	\$450.72		\$58.03	8	\$464.24	
Sr. Res. Assoc. - Habitat & Field Chemistry	\$56.34	8	\$450.72		\$58.03	8	\$464.24	
Sr. Res. Assoc. - Use Attainability & Attainment	\$30.05	24	\$721.20		\$30.95	24	\$742.80	
Sr. Res. Assoc. - Causes & Sources	\$56.34	40	\$2,253.60		\$58.03	40	\$2,321.20	
Direct Labor Costs		104	\$5,018.08			104	\$5,168.56	
<b>Task 6C Labor Fee (OM 1.5 applied)</b>			<b>\$7,527.12</b>				<b>\$7,752.84</b>	
<b>Task 6C Subtotal</b>			<b>\$7,527.12</b>				<b>\$7,752.84</b>	
<b>Task 6 Subtotal</b>				<b>\$12,006.20</b>				<b>\$12,103.68</b>
<b>Task 7 - Monitoring Report</b>	<b>Unit Cost</b>	<b>Est. Project Units</b>	<b>Cost Estimate</b>	<b>Task Subtotal</b>	<b>Unit Cost</b>	<b>Est. Project Units</b>	<b>Cost Estimate</b>	<b>Task Subtotal</b>
Sr. Res. Assoc. - Introduction/Study Area/Methods	\$30.05	12	\$360.60		\$30.95	12	\$371.40	
Sr. Res. Assoc. - Chemical WQ Results	\$56.34	16	\$901.44		\$58.03	24	\$1,392.72	
Sr. Res. Assoc. - Habitat Quality	\$56.34	8	\$450.72		\$58.03	24	\$1,392.72	

**Table 1. MBI cost proposal by task and subtask for the 2016-18 bioassessment of the Upper Des Plaines River per specifications of the DRWW RFP.**

Task Descriptions	2016				2017-18			
	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
<b>Task 7 - Monitoring Report (continued)</b>								
Sr. Res. Assoc. - Biological Assemblage Assessment	\$56.34	8	\$450.72		\$58.03	40	\$2,321.20	
Sr. Res. Assoc. - Discussion & Conclusions	\$30.05	0	\$0.00		\$30.95	60	\$1,857.00	
Project Manager - Review & Editing	\$63.69	0	\$0.00		\$58.03	60	\$3,481.80	
Direct Labor Costs		44	\$2,163.48			220	\$10,816.84	
<b>Task 7 Labor Fee (OM 1.5 applied)</b>			<b>\$3,245.22</b>				<b>\$16,225.26</b>	
Project Manager Travel - Present Report to DRWW	\$0.00	0	\$0.00		\$1,000.00	1	\$1,000.00	
<b>ODC Subtotal</b>			<b>\$0.00</b>				<b>\$1,000.00</b>	
<b>Task 7 Subtotal</b>				<b>\$3,245.22</b>				<b>\$17,225.26</b>
<b>Total 2016 &amp; 2017-18 Upper Desplaines R. Bioassessment</b>				<b>\$74,338.00</b>				<b>\$77,410.60</b>
<b>Grand Total 2016-18 Upper Desplaines RFP Specifications</b>								<b>\$151,748.60</b>

**Estimate Includes:**

- One sampling pass for fish at 44 sites - 22 each year
- IEPA multihabitat invert sampling at 44 sites - 22 each year
- QHEI at all sites
- No sampling for reference sites - suggest adding to plan
- Full data analysis and report per established format

Optional Task Description	2016				2017-18			
	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
<b>Task 8 - Flow Monitoring (Optional Task)</b>								
Project Manager Establish quantitative data needs	\$63.69	0	\$0.00		\$65.60	24	\$1,574.40	
Research Associate - Establish equipment needs	\$27.05	0	\$0.00		\$27.86	24	\$668.64	
Project Manager - Describe flow gage network	\$63.69	0	\$0.00		\$63.69	24	\$1,528.56	
Research Associate - Cost of installation & maintence	\$27.05	0	\$0.00		\$27.86	24	\$668.64	
Research Associate - Cost of operation	\$27.05	0	\$0.00		\$27.86	16	\$445.76	
Sr. Res. Assoc. - Data management & access	\$56.34	0	\$0.00		\$58.03	24	\$1,392.72	
Direct Labor Costs		0	\$0.00			136	\$6,278.72	
<b>Task 8 Labor Fee (OM 1.5 applied)</b>			<b>\$0.00</b>				<b>\$9,418.08</b>	
<b>Task 8 Subtotal</b>				<b>\$0.00</b>				<b>\$9,418.08</b>



**Table 2. MBI cost proposal by task for the 2016-18 bioassessment of the Upper Des Plaines River per specifications of an Alternate Plan.**

Task Descriptions	2016				2017-18			
	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
<b>Task 1 - Refine Monitoring Plan</b>								
Project Manager - Review & Modify Plan	\$63.69	40	\$2,547.60		\$65.60	0	\$0.00	
GIS Analyst - Geometric Design Options	\$25.00	24	\$600.00		\$25.75	0	\$0.00	
Direct Labor Costs		64	\$3,147.60			0	\$0.00	
<b>Task 1 Labor Fee (OM 1.5 applied)</b>			<b>\$4,721.40</b>				<b>\$0.00</b>	
Project Manager Travel - Meet with DRWW	\$1,000.00	1	\$1,000.00		\$1,000.00	0	\$0.00	
<b>ODC Subtotal</b>			<b>\$1,000.00</b>				<b>\$0.00</b>	
<b>Task 1 Subtotal</b>				<b>\$5,721.40</b>				<b>\$0.00</b>
<b>Task 2 - QAPP Revisions</b>								
Project Manager - Review & Revise QAPP	\$63.69	16	\$1,019.04		\$65.60	4	\$262.40	
Research Associate - Review & Revise Methods	\$27.05	8	\$216.40		\$27.86	0	\$0.00	
Direct Labor Costs		24	\$1,235.44			4	\$262.40	
<b>Task 2 Labor Fee (OM 1.5 applied)</b>			<b>\$1,853.16</b>				<b>\$393.60</b>	
<b>Task 2 Subtotal</b>				<b>\$1,853.16</b>				<b>\$393.60</b>
<b>Task 3 - Background Data Compilation &amp; Analysis</b>								
Project Manager - Write & Edit Summary Report	\$63.69	16	\$1,019.04		\$65.60	0	\$0.00	
Senior Research Associate - Acquire & Evaluate Data	\$56.34	40	\$2,253.60		\$58.03	0	\$0.00	
GIS Analyst - Assist with Data Acquisition	\$25.00	16	\$400.00		\$25.75	0	\$0.00	
Direct Labor Costs		72	\$3,672.64			0	\$0.00	
<b>Task 3 Labor Fee (OM 1.5 applied)</b>			<b>\$5,508.96</b>				<b>\$0.00</b>	
<b>Task 3 Subtotal</b>				<b>\$5,508.96</b>				<b>\$0.00</b>
<b>Task 4 - Bioassessment Sampling</b>								
<b>Task 4A Mobilization &amp; Demobilization</b>								
Project Manager - Project Management & Oversight	\$63.69	24	\$1,528.56		\$65.60	0	\$0.00	
Fish Crew Leader - Mobilize/Demobilize Equipment	\$27.05	40	\$1,082.00		\$27.86	0	\$0.00	
Macroinvertebrate Crew Leader - Field Prep.	\$30.05	16	\$480.80		\$30.95	0	\$0.00	
Field Technician X2 - Assist Crew Leaders	\$15.86	80	\$1,268.80		\$16.34	0	\$0.00	
Direct Labor Costs		160	\$4,360.16			0	\$0.00	
<b>Task 4A Labor Fee (OM 1.5 applied)</b>			<b>\$6,540.24</b>				<b>\$0.00</b>	
<b>Task 4A Subtotal</b>			<b>\$6,540.24</b>				<b>\$0.00</b>	
<b>Task 4B - Fish/Habitat Sampling</b>								
Fish Crew Leader - Lead Fish Crew (44 sites in 2016)	\$27.05	200	\$5,410.00		\$27.86	0	\$0.00	
Field Technician X2 - Field Sampling Labor	\$15.86	320	\$5,075.20		\$16.34	0	\$0.00	
Field Technician X2 (OT) - Field Sampling Labor	\$23.79	80	\$1,903.20		\$24.51	0	\$0.00	
Direct Labor Costs		600	\$12,388.40				\$0.00	
<b>Task 4B Labor Fee (OM 1.5 applied)</b>			<b>\$18,582.60</b>				<b>\$0.00</b>	

**Table 2. MBI cost proposal by task for the 2016-18 bioassessment of the Upper Des Plaines River per specifications of an Alternate Plan.**

Task Descriptions	2016				2017-18			
	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
<b>Task 4B - Fish/Habitat Sampling - ODCs</b>								
Vehicle & Equipment Use - Vehicle, Boats, E-Fishing Gear	\$500.00	4	\$2,000.00		\$500.00	0	\$0.00	
Vehicle Mileage - Travel to sites	\$0.575	1200	\$690.00		\$0.575	0	\$0.00	
Supplies - miscellaneous items, preservatives	\$1,000.00	2	\$2,000.00		\$1,000.00	0	\$0.00	
Lodging/Food/Misc. - Daily allowance per person	\$125.00	40	\$5,000.00		\$125.00	0	\$0.00	
<b>ODC Subtotal</b>			<b>\$9,690.00</b>				<b>\$0.00</b>	
<b>Task 4B Subtotal</b>			<b>\$28,272.60</b>				<b>\$0.00</b>	
<b>Task 4C - Macroinvertebrate Sampling</b>								
Macroinvert. Crew Leader - Lead Macro. Crew (22 sites annually)	\$30.05	120	\$3,606.00		\$30.95	0	\$0.00	
Field Technician - Field Sampling Labor	\$15.86	80	\$1,268.80		\$16.34	0	\$0.00	
Field Technician (OT) - Field Sampling Labor	\$23.79	40	\$951.60		\$24.51	0	\$0.00	
Direct Labor Costs		240	\$5,826.40			0	\$0.00	
<b>Task 4C Labor Fee (OM 1.5 applied)</b>			<b>\$8,739.60</b>				<b>\$0.00</b>	
Vehicle & Equipment Use - Vehicle	\$300.00	2	\$600.00		\$300.00	0	\$0.00	
Vehicle Mileage - Travel to sites	\$0.575	1200	\$690.00		\$0.575	0	\$0.00	
Field Supplies - miscellaneous items, preservatives	\$1,000.00	2	\$2,000.00		\$1,000.00	0	\$0.00	
Lodging/Food/Misc. - Daily allowance per person	\$125.00	20	\$2,500.00		\$120.00	0	\$0.00	
<b>ODC Subtotal</b>			<b>\$5,790.00</b>				<b>\$0.00</b>	
<b>Task 4C Subtotal</b>			<b>\$14,529.60</b>				<b>\$0.00</b>	
<b>Task 4D - Biological Laboratory</b>								
Fish Vouchers - i.d. verifications per QAPP	\$27.05	0	\$0.00		\$27.86	24	\$668.64	
Macroinvertebrate Sample Sorting & QA - sort samples	\$27.05	0	\$0.00		\$27.86	360	\$10,029.60	
Macroinvertebrate Taxonomy & QA - i.d. samples	\$30.05	0	\$0.00		\$30.95	400	\$12,380.00	
Direct Labor Costs		0	\$0.00			784	\$23,078.24	
<b>Task 4D Labor Fee (OM 1.5 applied)</b>			<b>\$0.00</b>				<b>\$34,617.36</b>	
Lab Supplies - preservatives, slides, containers	\$1,000.00	0	\$0.00		\$1,000.00	2	\$2,000.00	
Lab Equipment Usage - Binocular & microscopes	\$150.00	0	\$0.00		\$150.00	6	\$900.00	
Macroinvertebrate QA/QC (n = 4)	\$400.00	0	\$0.00		\$400.00	4	\$1,600.00	
<b>ODC Subtotal</b>			<b>\$0.00</b>				<b>\$4,500.00</b>	
<b>Task 4D Subtotal</b>			<b>\$0.00</b>				<b>\$27,578.24</b>	
<b>Task 4 Subtotal</b>				<b>\$49,342.44</b>				<b>\$27,578.24</b>
<b>Task 5 - Sediment Chemistry Sampling</b>								
Chemical Crew Leader - Lead Sediment Crew	\$27.05	96	\$2,596.80		\$27.86	0	\$0.00	
Field Technician X 1 - Field Labor	\$15.86	80	\$1,268.80		\$15.86	0	\$0.00	
Field Technician (OT) - Field Labor	\$23.79	16	\$380.64		\$24.51	0	\$0.00	
Direct Labor Costs		192	\$3,865.60			0	\$0.00	
<b>Task 5 Labor Fee (OM 1.5 applied)</b>			<b>\$5,798.40</b>				<b>\$0.00</b>	

**Table 2. MBI cost proposal by task for the 2016-18 bioassessment of the Upper Des Plaines River per specifications of an Alternate Plan.**

Task Descriptions		2016			2017-18			
Task 5 - Sediment Chemistry Sampling - ODCs	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
Equipment Use - Vehicle	\$300.00	2	\$600.00		\$300.00	0	\$0.00	
Vehicle Mileage - Travel to sites	\$0.575	1,200	\$690.00		\$0.575	0	\$0.00	
Lodging/Food/Misc. - Daily allowance per person	\$125.00	20	\$2,500.00		\$125.00	0	\$0.00	
<b>ODC Subtotal Task 5</b>			<b>\$3,790.00</b>				<b>\$0.00</b>	
<b>Task 5 Subtotal</b>				<b>\$9,588.40</b>				<b>\$0.00</b>
<b>Task 6 - Project Management and Data Analysis</b>								
Task 6A - Project Management	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
Principal Investigator - Project Management & Oversight	\$63.69	12	\$764.28		\$65.60	8	\$524.80	
Fish Crew Leader - Track Progress	\$27.05	6	\$162.30		\$27.86	0	\$0.00	
Macroinvertebrate Crew Leader - Track Progress	\$30.05	6	\$180.30		\$30.95	0	\$0.00	
Direct Labor Costs		24	\$1,106.88			8	\$524.80	
<b>Task 1 Labor Fee (OM 1.5 applied)</b>			<b>\$1,449.48</b>				<b>\$524.80</b>	
<b>Task 6A Subtotal</b>			<b>\$1,449.48</b>				<b>\$524.80</b>	
Task 6B - Data Management	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
Research Associate - Fish & Habitat Entry	\$27.05	32	\$865.60		\$27.86	0	\$0.00	
Research Associate - Macroinvertebrate Entry	\$27.05	0	\$0.00		\$27.86	48	\$1,337.28	
Research Assoc. - POTW Loadings & Water Chemistry Data	\$27.05	40	\$1,082.00		\$27.86	0	\$0.00	
Direct Labor Costs		72	\$1,947.60			0	\$1,337.28	
<b>Task 6B Labor Fee (OM 1.5 applied)</b>			<b>\$3,029.60</b>				<b>\$2,674.56</b>	
<b>Task 6B Subtotal</b>			<b>\$3,029.60</b>				<b>\$2,674.56</b>	
Task 6C - Data Analysis	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
Sr. Res. Assoc. - POTW Loadings	\$30.05	0	\$0.00		\$30.95	32	\$990.40	
Sr. Res. Assoc. - Water Column & Sediment Chemical WQ	\$56.34	0	\$0.00		\$58.03	32	\$1,856.96	
Sr. Res. Assoc. - Fish & Macroinvertebrate IBIs	\$56.34	0	\$0.00		\$58.03	32	\$1,856.96	
Sr. Res. Assoc. - Habitat & Field Chemistry	\$56.34	0	\$0.00		\$58.03	32	\$1,856.96	
Sr. Res. Assoc. - Use Attainability & Attainment	\$30.05	0	\$0.00		\$30.95	40	\$1,238.00	
Sr. Res. Assoc. - Causes & Sources	\$56.34	0	\$0.00		\$58.03	60	\$3,481.80	
Direct Labor Costs		0	\$0.00			228	\$11,281.08	
<b>Task 6C Labor Fee (OM 1.5 applied)</b>			<b>\$0.00</b>				<b>\$16,921.62</b>	
<b>Task 6C Subtotal</b>			<b>\$0.00</b>				<b>\$16,921.62</b>	
<b>Task 6 Subtotal</b>				<b>\$4,479.08</b>				<b>\$20,120.98</b>
Task 7 - Monitoring Report	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
Sr. Res. Assoc. - Introduction/Study Area/Methods	\$30.05	0	\$0.00		\$30.95	24	\$742.80	
Sr. Res. Assoc. - Chemical WQ Results	\$56.34	0	\$0.00		\$58.03	60	\$3,481.80	
Sr. Res. Assoc. - Habitat Quality	\$56.34	0	\$0.00		\$58.03	32	\$1,856.96	

**Table 2. MBI cost proposal by task for the 2016-18 bioassessment of the Upper Des Plaines River per specifications of an Alternate Plan.**

Task Descriptions	2016				2017-18			
	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
<b>Task 7 - Monitoring Report (continued)</b>								
Sr. Res. Assoc. - Biological Assemblage Assessment	\$56.34	0	\$0.00		\$58.03	48	\$2,785.44	
Sr. Res. Assoc. - Discussion & Conclusions	\$30.05	0	\$0.00		\$30.95	60	\$1,857.00	
Project Manager - Review & Editing	\$63.69	0	\$0.00		\$58.03	60	\$3,481.80	
Direct Labor Costs		0	\$0.00			284	\$14,205.80	
<b>Task 7 Labor Fee (OM 1.5 applied)</b>			<b>\$0.00</b>				<b>\$21,308.70</b>	
Project Manager Travel - Present Report to DRWW	\$0.00	0	\$0.00		\$1,000.00	1	\$1,000.00	
<b>ODC Subtotal</b>			<b>\$0.00</b>				<b>\$1,000.00</b>	
<b>Task 7 Subtotal</b>				<b>\$0.00</b>				<b>\$22,308.70</b>
<b>Total 2016 &amp; 2017 Upper Desplaines R. Bioassessment</b>				<b>\$76,493.44</b>				<b>\$70,401.52</b>
<b>Grand Total 2016-17 Upper Desplaines Alternate Plan</b>								<b>\$146,894.96</b>

**Estimate Includes:**

- One sampling pass for fish at 44 sites in 2016
- IEPA multihabitat invert sampling at 44 sites in 2016
- QHEI at all sites
- No sampling for reference sites - suggest adding to plan
- Full data analysis and report per established format

Task Descriptions	2016				2017-18			
	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal	Unit Cost	Est. Project Units	Cost Estimate	Task Subtotal
<b>Task 8 - Flow Monitoring (Optional Task)</b>								
Project Manager Establish quantitative data needs	\$63.69	0	\$0.00		\$65.60	24	\$1,574.40	
Research Associate - Establish equipment needs	\$27.05	0	\$0.00		\$27.86	24	\$668.64	
Project Manager - Describe flow gage network	\$63.69	0	\$0.00		\$63.69	32	\$2,038.08	
Research Associate - Cost of installation & maintenance	\$27.05	0	\$0.00		\$27.86	24	\$668.64	
Research Associate - Cost of operation	\$27.05	0	\$0.00		\$27.86	16	\$445.76	
Sr. Res. Assoc. - Data management & access	\$56.34	0	\$0.00		\$58.03	24	\$1,392.72	
Direct Labor Costs		0	\$0.00			144	\$6,788.24	
<b>Task 8 Labor Fee (OM 1.5 applied)</b>			<b>\$0.00</b>				<b>\$10,182.36</b>	
<b>Task 8 Subtotal</b>				<b>\$0.00</b>				<b>\$10,182.36</b>

## **Appendix A. MBI Personnel Curriculum Vitae**



## Chris O. Yoder

Research Director

### PROJECT MANAGER

### SR. ENVIRONMENTAL SCIENTIST

### EDUCATION

M.A., Zoology, DePauw University, Greencastle, IN

B.Sc. Natural Resources, The Ohio State University, Columbus, OH

### YEARS OF EXPERIENCE

MBI: 14

Total: 40

### LICENSES/REGISTRATIONS

Certified Fisheries Scientist, American Fisheries Society, 1986

Level 3 Qualified Data Collector & Trainer, Fish & Habitat, Ohio Credible Data Program, 2008-present

### PROFESSIONAL AFFILIATIONS

Society for Freshwater Science

American Fisheries Society

Ohio Academy of Science

Sigma Xi

### AREAS OF EXPERTISE

- Fish ecology & taxonomy: New England, Northeastern & Mid-Atlantic U.S., Midwestern U.S., Upper Mississippi & Great Lakes regions, Red River of the North.
- Biological criteria development
- Water Quality Standards
- Biological, habitat, & water quality assessments
- Biological methods & index development & implementation
- Monitoring networks and design
- Bioassessment & Habitat assessment training
- Causal diagnosis & stressor-response relationships
- State CWA program reviews

Chris O. Yoder is the Research Director at the Midwest Biodiversity Institute. He is presently the principal investigator of cooperative agreements with the U.S. EPA, Office of Water, grants with nongovernmental organizations, and contracts with private and public organizations. He was most recently a senior research associate at Ohio University's Voinovich Center for Leadership and Public Affairs (2001-2006) and prior to that Manager of the Ecological Assessment Section at Ohio EPA (1989 – 2001) and supervisor and staff member since 1976. His 38 years of work experience includes service on national, regional, and state working groups and committees dealing with monitoring and assessment, biological criteria, environmental indicators, and water quality standards (WQS). Primary areas of expertise include fish distribution, ecology, and taxonomy, water quality, biological assessment, monitoring program design and execution, and state bioassessment program review and redesign. He is a lead instructor for the Qualified Data Collector training as part of the Ohio Credible Data program (2006-present), serves on a U.S. EPA working group for biocriteria and tiered aquatic life uses (2000-present), and the National Research Council committee on the role of science in the TMDL process (2001 and 2013). He received the Wayne S. Nichols award for his state service in November 1997, The Nature Conservancy Outstanding Public Service Award in May 2002, and the Environmental Stewardship Award from the North American Benthological Society (now SFS) in 2009. He has authored 63 technical publications and more than 200 oral presentations. Current research includes the development of a fish assemblage assessment of non-wadeable rivers in Maine and New England, temperature criteria development for inland freshwater rivers and streams, and designing bioassessment programs to better support watershed management.

### Relevant Project Experience

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#### Watershed Monitoring Design and Bioassessment for the MSD Greater Cincinnati Service Area - Hamilton County, Ohio: 2010-present

*Client: Metropolitan Sewer District of Greater Cincinnati, Ohio*

MBI was enlisted in 2011 by the MSDGC to produce a watershed-based monitoring and biological assessment plan for the MSD service area within Hamilton County, Ohio. This plan described the spatial and temporal sampling design and the indicators and parameters that are to be collected at each sampling site. It also describes the types of biological sampling methods for fish and macroinvertebrate assemblages and habitat assessment. Chemical and physical measures were also included to provide supporting data and information for the biological assessment. This included indicators and parameters for recreational use assessment in addition to aquatic life use assessment. The plan has been used to guide the development of detailed study plans for two of four years of field work and the subsequent data analysis for a baseline bioassessment in beginning in 2011. The sampling design employs a combination of a geometric (stratified-random) and intensive pollution surveys. These are being employed to fulfill multiple management purposes and goals in addition to the determination of the existing status of the biological assemblages and their relationship to chemical, physical, and biological stressors. As such, the principles of adequate monitoring and assessment (ITFM 1995; Yoder 1998) were used in anticipation that the resulting biological assessments will support the development of cost-effective watershed

management responses to existing and emerging issues. A restoration project prioritization ranking scheme similar to that developed for the DRSCWG will be developed to support MSDGC and the local watershed groups in developing their restoration project priorities and scope.

### **Integrated Assessment of the DuPage River and Salt Creek Watersheds, Illinois: 2006-present**

*Client: DuPage River-Salt Creek Work Group and Conservation Foundation*

MBI designed a comprehensive watershed assessment for the DuPage River-Salt Creek watersheds in northeastern Illinois in 2005-6. MBI then executed the implementation of that design for the bioassessment portion of the project by sampling these watersheds during 2006-2012. The lower DuPage River watershed was added in 2012. This included using the Illinois EPA fish and macroinvertebrate IBIs including the development of programming to calculate each index. MBI produced the first project report that included data analysis of the bioassessment and chemical/physical data and the assessment of multiple stressors affecting use attainment in the DuPage River-Salt Creek watersheds in 2009. Annual watershed reports have followed each year since. These have been used to verify and expand the present listings of impaired waters and to improve the TMDL and watershed management process as a whole. The project was extended to include second and third rounds of sampling during 2009 through 2015. In addition, the 2006-15 bioassessments are being used to update a restoration project prioritization ranking scheme that has been used by the DRSCWG to determine restoration project priorities and scope since 2010.

### **Assessment of NOAA Restoration Projects in the Black River Lacustrary (Lake Erie): 2010-present**

*Client: NOAA and Arcadis*

MBI designed and conducted biological and water quality assessments to evaluate the effectiveness of NOAA funded habitat and riparian restoration projects in the lower Black River lacustrary and navigation channel. This included fish, macroinvertebrate, habitat, and water quality (including sediment chemistry) sampling and data analysis over a consecutive four year period 2010-2013. MBI assessed biological and habitat data against Ohio Beneficial Use Impairment benchmarks and interim benchmarks developed by NOAA. The assessment of physical habitat and biological condition was complicated by legacy pollutants from past and current discharges in the upper lacustrary. This necessitated an adaptive approach to the study design. The project is scheduled to continue in 2015.

### **Development of Tiered Aquatic Life Uses (TALU) and Biocriteria for Illinois Rivers and Streams**

*Client: Illinois Association of Wastewater Agencies (IAWA)*

MBI is developing the justification, rationale, framework, and implementation strategy for the adoption of tiered aquatic life uses (TALUs) and biocriteria in the Illinois WQS and as a part of the Illinois EPA water program. This was initiated and sponsored by the IAWA who is facilitating the outreach to relevant state agencies and stakeholder groups. The project product is a comprehensive supporting document, technical assistance to the affected agencies, and eventually a proposed rulemaking for the Illinois WQS.

### **Policy and Technical Support for Development of Biological Standards and Tiered Aquatic Life Uses (TALU) for Water Quality Management in Minnesota**

*Client: Minnesota Pollution Control Agency (MPCA)*

MBI is developing the justification, rationale, framework, and implementation strategy for the adoption of tiered aquatic life uses (TALUs) and biocriteria in the Minnesota WQS and as a part of the MPCA water program. This was initiated and sponsored by MPCA who is facilitating the outreach to relevant state agencies and stakeholder groups. The project product is a comprehensive implementation document, the development of a Biological Condition Gradient model for specific lotic ecotypes, resolution of specific



and relevant technical issues, technical assistance to the affected agencies, and eventually a proposed rulemaking for the Minnesota WQS.

### **Regional Bioassessment of the Non-Wadeable Rivers of New England: 2008-14**

*Client: U.S. EPA, Region I and ORD*

MBI conducted fish and habitat assessments at more than 200 randomly selected sampling sites and more than 300 additional targeted sites on selected mainstem rivers in New England during 2008-9. This included an intensive survey of the Connecticut River mainstem and selected tributaries. The purpose was to determine the applicability of non-wadeable fish and habitat sampling methods, determine the condition of the fish assemblages in New England rivers, and develop improved stressor identification and biological assessment methods. MBI was responsible for all pre- and post-survey tasks including the development of a project QAPP, study plan, coordination with state and federal agencies, data collection, data management, data analysis, and reporting. A project report was produced and includes detailed analyses of spatial data and an Atlas of fish distributions throughout New England..

### **Region I States Biological Assessment Programs Review: 2006-10**

*Client: U.S. EPA, Region I*

MBI conducted in-depth reviews of each New England state bioassessment program (included Vermont DEC) under a grant from U.S. EPA. The review consisted of an on-site visit to each state, a review of all program documentation (including WQS and listed methodologies), and a critical technical elements evaluation to determine the level of rigor of each state program. The emphasis was on the better use of bioassessment information to support the development and implementation of biocriteria and their adoption in the state WQS. A report entitled “*Region I state biological assessment programs review: critical technical elements evaluation (2006-2010)*” was produced as the principal project product. Recommendations for each state program were included.

### **National Rivers and Streams Assessment (NRSA): 2008-9**

*Client: U.S. EPA-OWOW and Tetrattech*

MBI mobilized field crews, equipment, and provided for all logistics to execute sampling for the National Rivers and Streams Assessment in 2008 and 2009. MBI participated on a contractor team to EPA where in-kind services were requested by the states. As a result MBI sampled more than 220 sites in 9 states (includes VT) and employed up to three separate field crews. The principal product was biological, chemical, and physical data produced under rigorous QA/QC requirements and at remote and difficult-to-access locations. MBI was responsible for pre- and post-field tasks including location of sites and disposition of samples and completed data forms. MBI also performed comparison sampling to ascertain the differences between common state methods and EPA NRSA methods and is responsible for the analysis of that data.

### **Cooperative Agreements with U.S. EPA for Biocriteria, Bioassessments, and Indicators Development**

*Client: U.S. EPA-OST/HECD and Region V*

MBI executed a 5 year project beginning in 2001 to develop ways to support the EPA national biocriteria program. This included providing direct support to U.S. EPA headquarters staff in the development of the underlying concepts for what later became the TALU process. This project was designed specifically to bring the experiences of Ohio EPA and other key states to bear on the national process, which resulted in the present day EPA TALU program. A key focus of this effort was to initiate a working group process in Region V by dealing with the six states (IL, IN, MI, MN, WI, and OH) individually and collectively in the better development of their bioassessment and biocriteria programs specifically as they relate to the goal of support all relevant water quality management programs. A major product of this effort was the “*Region V State Bioassessment and Ambient Monitoring Programs: Initial Evaluation and Review*” which summarized in detail the status of each states bioassessment and biocriteria programs and the challenges



and tasks facing each. The report can be found at:  
[http://www.epa.gov/region5/water/wqb/wqb\\_r5mon.htm](http://www.epa.gov/region5/water/wqb/wqb_r5mon.htm).

### **Technical Support for U.S. EPA National Biocriteria Program and TALU Implementation**

*Client: Great Lakes Environmental Center and U.S. EPA-OST/HECD*

MBI, as a subcontractor to GLEC, serves on the contract team that is developing the EPA process for the development and implementation of tiered aquatic life uses (TALUs) in State and Tribal programs. This was highlighted by the production of the document entitled *“Use of biological information to better define designated aquatic life uses in state and tribal water quality standards”* (U.S. EPA, Office of Water, Washington, DC. EPA 822-R-05-001. 188 pp.) and *“Biological Assessment Program Review: Assessing Level of Technical Rigor to Support Water Quality Management”* (U.S. EPA, Office of Water, Washington, DC. EPA 820-R-13-001. 188 pp. February 2013). These documents provide technical and implementation guidance for states that are interested in developing a TALU based approach in their water quality standards and monitoring and assessment programs. To date 23 different states have been evaluated. Related to this effort MBI has also facilitated a working group of the six states (includes Minnesota) in Region V since 2002 with an emphasis on advancing the bioassessment and biocriteria programs of each towards meeting the goals of EPA’s TALU program. This effort has developed into a pilot for the national program and is termed *“Best Practices in State Bioassessment Programs”*. A similar process with the six states of EPA Region I was initiated under a grant from EPA in 2007.

### **Maine Rivers Fish Assemblage Assessment and IBI Development: 2002-present**

*Client: U.S. EPA, Region I*

MBI executed a cooperative agreement and four contract work assignments for the development of a fish assemblage methodology and applying it to non-wadeable rivers in Maine. This included sampling and logistics to develop baseline information about the composition of the fish assemblages and how they are influenced by multiple stressors including habitat, temperature, flow, and non-native species interactions. The project products include a fish assemblage protocol, a fish distribution atlas, and a fish IBI applicable to Maine’s large rivers. This work has continued in a more focused project to evaluate dam removals and fish passage improvements in the Lower Kennebec and Sebasticook Rivers through 2012. One development was the addition of IBI metrics for diadromous fish guilds to improve the assessment of coastal rivers.

### **Beneficial Use Impairment (BUI) Assessment of Ohio Lake Erie Areas of Concern (AoCs): 2011-present**

*Client: Ohio EPA*

MBI is conducting field sampling and data analysis in support of the assessment of BUI listings for Lake Erie AoCs. Sampling includes collections of brown bullhead (*Ameiurus nebulosus*) for tumor assessment using passive gear and electrofishing samples for the assessment of the Ohio lacustrine IBI and DELT anomalies. Habitat is assessed using the lacustrine modification of the QHEI. Tasks in addition to the field collections include prepping bullhead tissue samples and performing all data management and analysis tasks for the fish assemblage and habitat data. The results will be used by Ohio EPA to modify existing BUI listings as warranted by the analysis of the results by MBI.

### **Biological Assessment Guidance for the Upper Mississippi River**

*Client: Upper Mississippi River Basin Association and Water Quality Task Force*

MBI conducted support and development for the production of the Clean Water Act (CWA) biological assessment guidance for the Upper Mississippi River (UMR) during 2009-11. This project included the development of a draft guidance document entitled *“Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance”* (Yoder et al. 2011) and two supporting documents *“Preliminary Analysis of Biological Assessment Thresholds for Determining Aquatic Life Use Attainment Status in the Upper Mississippi River*

Mainstem” and “Development of a Biological Condition Gradient for Fish Assemblages of the Upper Mississippi River and Development of a “Synthetic” Historical Fish Community”. In addition a project scoping report entitled “Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance - Background and Scoping Report” was produced following an initial information gathering effort.

### **Fish Assemblage and Habitat Assessment of the Red River, North Dakota: 2010-15**

*Client: U.S. EPA, Region 8 and North Dakota Health Department*

MBI planned and executed a comprehensive assessment of the fish assemblages and habitat of the Red River of the North under a contract with U.S. EPA and funding from North Dakota. The project included sampling fish and assessing habitat along the Red River mainstem following an intensive survey design. MBI was responsible for all aspects of planning, field sampling, data management, data analysis, and reporting. A project report was completed in 2015.

### **Fish Assemblage Assessment and Methods Comparison for Non-Wadeable Rivers in Region V: 2004-7**

*Client: ORSANCO and U.S. EPA-ORD and Region V*

MBI, as a subcontractor to ORSANCO, provided field sampling and logistical support, data analysis, and report production for a probabilistic assessment of major mainstem tributaries to the Upper Mississippi and Ohio Rivers during 2004-7. In addition to the development of a regionally calibrated fish IBI, MBI also conducted and reported on an electrofishing methods comparison with 8 participants (mostly states) in 2006.

### **Development and refinement of indicators and methods for the development of TALUs in the non-wadeable Rivers of Region V: 2006-10**

*Client: U.S. EPA, Region V*

MBI conducted a regional assessment of non-wadeable rivers in the Illinois and Rock River basins of Illinois, Wisconsin, and Indiana to determine the efficacy of using fish and algal assemblage indicators to assess widespread habitat and nutrient enrichment impacts and to determine the limits of wadeable and non-wadeable assessment tools. This included applying non-wadeable methods and using available fish and algal indices to evaluate the results.

### **National Wadeable Streams Survey: Region V States: 2004-5**

*Client: U.S. EPA-OWOW and Region V*

MBI performed sampling for the National Wadeable Streams Survey sites within 5 of 6 Region V states during 2004-5. MBI provided all field sampling and laboratory support for data that was included in the U.S. EPA final WSA report. In addition, MBI conducted analyses of the Region V dataset from all six states focusing on sampling design and scale issues, stressor gradients, and habitat assessment methodology comparisons. In addition, 20 sites were sampled in conjunction with each Region V state to generate data for bioassessment comparability analyses. A final report was produced in 2010.

### **Biological Criteria and Habitat Assessments Training: 2001-present**

*Clients: U.S. EPA-OST/HECD, Region V, Ohio EPA*

MBI provides support for multi-day training sessions dealing with biocriteria and TALU development and implementation and habitat assessment using the QHEI since 2001. These are conducted on location and include classroom and field instruction. The training is open to any participant or stakeholder based on an open announcement. Recently, Ohio EPA has adapted this training as part of their Qualified Data Collector certifications under the Ohio Credible Data Law. In addition, the MBI instructors also participate in the 5-day level 3 OCDL certification training that is offered periodically by Ohio EPA and more recently by MBI. In addition to the above offering, training has also been conducted for U.S. EPA Regions V and VII, Wisconsin DNR, Illinois EPA, Indiana DEM, and Indiana DOT.

## Relevant Publications

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- Yoder, C.O. 2012. Framework and Implementation Recommendations for Tiered Aquatic Life Uses: Minnesota Rivers and Streams. Technical Report MBI/2012-4-4. Report to Minnesota PCA, St. Paul, MN. 97 pp. <http://www.midwestbiodiversityinst.org/index.php>.
- Yoder, C.O. 2011. A Framework and Implementation Plan for Tiered Aquatic Life Uses: Illinois Rivers and Streams. Technical Report MBI/2011-2-4. Report to Illinois Association of Wastewater Agencies, Springfield, IL. 59 pp. <http://www.midwestbiodiversityinst.org/index.php>.
- Yoder, C.O., R.J. Miltner, V.L. Gordon, E.T. Rankin, N.B. Kale, and D.K. Hokanson. 2011. Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance. Upper Mississippi River basin Association, St. Paul, MN. 95 pp. <http://www.umrba.org/wq.htm>.
- Yoder, C.O., V.L. Gordon, N.B. Kale, and D.K. Hokanson. 2010. Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance: Background and Scoping Report. Upper Mississippi River basin Association, St. Paul, MN. 25 pp. + Appendices. <http://www.umrba.org/wq.htm>.
- Davies, S.P. and C.O. Yoder. 2011. Region I state biological assessment programs review: critical technical elements evaluation (2006-2010). EPA Grant X7-97166801-4. EPA, Region I. Midwest Biodiversity Institute, Columbus, OH. 41 pp. + appendices.
- Rankin, E.T. and C.O. Yoder. 2011. Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance: Development of a Biological Condition Gradient for Fish Assemblages of the Upper Mississippi River and Development of a "Synthetic" Historical Fish Community. MBI Technical Report/2011-5-2. Submitted to UMRBA WQTF. 24 pp. <http://www.umrba.org/wq.htm>.
- Miltner, R.J., Yoder, C.O. and E.T. Rankin. 2011. Preliminary Analysis of Biological Assessment Thresholds for Determining Aquatic Life Use Attainment Status in the Upper Mississippi River Mainstem. MBI Technical Report/2011-5-1. Submitted to UMRBA WQTF. 58 pp. <http://www.umrba.org/wq.htm>.
- Yoder, C.O. and M.T. Barbour. 2009. Critical technical elements of state bioassessment programs: a process to evaluate program rigor and comparability. Environ. Mon. Assess. DOI 10.1007/s10661-008-0671-1: 31-42.
- Barbour, M.T. and C.O. Yoder. 2009. Critical technical elements of a bioassessment program. U.S. EPA, Office of Water, Washington, DC. 75 pp.
- Yoder, C.O., R.F. Thoma, L.E. Hersha, E.T. Rankin, B.H. Kulik, and B.R. Apell. 2008. Maine Rivers Fish Assemblage Assessment: Development of an Index of Biotic Integrity for Maine Rivers. MBI Technical Report 2008-11-2. Report to U.S. EPA, Region I, Boston, MA. 69 pp.
- Yoder, C.O. 2007. Challenges with modernizing a temperature criteria derivation methodology: the fish temperature modeling system, pp. 1-1 to 1-19. *in* Robert Goldstein and Christine Lew (eds.). Proceedings of the Second Thermal Ecology and Regulation Workshop, Electric Power Research Institute, Palo Alto, CA.
- Yoder, C.O., B.H. Kulik, B.J. Apell, and J.M. Audet. 2007. 2005 Maine Rivers Fish Assemblage Assessment: I. Northern Maine Rivers Results; II. Maine Rivers Fish Species Distribution Atlas; III. Toward the Development of a Fish Assemblage Index for Maine Rivers. MBI Technical Report 12-06-1. Report to U.S. EPA, Region I, Boston, MA. 71 pp. + appendices.

Yoder, C.O., B.H. Kulik, and J.M. Audet. 2006. The spatial and relative abundance characteristics of the fish assemblages in three Maine Rivers. MBI Technical Report MBI/12-05-1. Grant X-98128601 report to U.S. EPA, Region I, Boston, MA.. 136 pp. + appendices.

Tewes, R., E. Emery, J. Thomas, L.E. Hersha and E.T. Rankin. 2006. Evaluation and development of biological assessment methods and standardized protocols for Region V: Boat electrofishing methods comparison study. C.O. Yoder (editor). Report to U.S. EPA. Region V (grant CP-96510501). 110 pp. + appendices.

60 other publications; 200+ oral presentations.



## Edward T. Rankin

Senior Environmental Scientist

P-4

### SR. ENVIRONMENTAL SCIENTIST

#### EDUCATION

M.S., Zoology, The Ohio State University, Columbus, OH

B.S. Biology, Saint Bonaventure University, NY

#### YEARS OF EXPERIENCE

MBI: 14

Total: 32

#### LICENSES/REGISTRATIONS

Level 3 Qualified Data Collector & Trainer, Fish & Habitat, Ohio Credible Data Program, 2008-present.

#### AREAS OF EXPERTISE

- Fish ecology: Midwestern U.S., Upper Mississippi & Great Lakes regions, Mine-Affected Streams, Red River of the North, New England.
- Biological criteria development
- Water Quality Standards
- Biological, habitat, & water quality assessments
- Biological methods & index development & implementation
- Bioassessment & Habitat assessment training
- Causal diagnosis & stressor-response relationships

Edward T. Rankin is a senior scientist at the Midwest Biodiversity Institute. He is a principal researcher and data analyst on multiple projects conducted by MBI. He was most recently a senior research associate at Ohio University's Voinovich Center for Leadership and Public Affairs (2002-2012) and prior to that an ecological scientist with the Ecological Assessment Section at Ohio EPA (1984 – 2003). His 30 years of work experience includes service on national, regional, and state working groups and committees dealing with monitoring and assessment, biological criteria, environmental indicators, and water quality standards (WQS). Primary areas of expertise include fish ecology, water quality, biological assessment, and watershed stressor analyses; was the primary developer of the Qualitative Habitat Evaluation Index (QHEI), a widely used habitat assessment tool. He is a lead instructor for the Qualified Data Collector training as part of the Ohio Credible Data program (2006-present). He has served on a number of Federal workgroups including U.S. EPA, Tiered Aquatic Life Uses (TALU) technical document writing team (Sept. 2004 – 2007); US EPA Science Advisory Board on Mountaintop Mining (2009-2010); and National Academy of Science, Committee on Reducing Stormwater Discharge Contributions to Water Pollution (Jan 2006 - Oct 2008). He has authored over 50 technical publications and more than 100 oral presentations. Current research includes the development of an integrated priority system for streams and rivers in the service area of the Metropolitan Sewer District of Greater Cincinnati (MSDGC) fish assemblage assessment of non-wadeable rivers in Maine and New England, and designing bioassessment programs to better support watershed management.

### Relevant Project Experience

#### Watershed Monitoring Design and Bioassessment for the MSD Greater Cincinnati Service Area - Hamilton County, Ohio: 2010-present

*Client: Metropolitan Sewer District of Greater Cincinnati, Ohio*

MBI was enlisted in 2011 by the MSDGC to produce a watershed-based monitoring and biological assessment plan for the MSD service area within Hamilton County, Ohio. This plan described the spatial and temporal sampling design and the indicators and parameters that are to be collected at each sampling site. It also describes the types of biological sampling methods for fish and macroinvertebrate assemblages and habitat assessment. Chemical and physical measures were also included to provide supporting data and information for the biological assessment. This included indicators and parameters for recreational use assessment in addition to aquatic life use assessment. The plan

has been used to guide the development of detailed study plans for two of four years of field work and the subsequent data analysis for a baseline bioassessment in beginning in 2011. The sampling design employs a combination of a geometric (stratified-random) and intensive pollution surveys. These are being employed to fulfill multiple management purposes and goals in addition to the determination of the existing status of the biological assemblages and their relationship to chemical, physical, and biological stressors. As such, the principles of adequate monitoring and assessment (ITFM 1995; Yoder 1998) were used in anticipation that the resulting biological assessments will support the development of cost-effective watershed management responses to existing and emerging issues. I have been involved in all aspects of the data management and analysis and I am the lead researcher on the restoration project prioritization ranking scheme. This is similar to that developed for the DRSCWG will be developed to

support MSDGC and the local watershed groups in developing their restoration project priorities and scope.

### **Fish Assemblage and Habitat Assessment of the Red River, North Dakota: 2010-15**

*Client: U.S. EPA, Region 8 and North Dakota Health Department*

MBI planned and executed a comprehensive assessment of the fish assemblages and habitat of the Red River of the North under a contract with U.S. EPA and funding from North Dakota. The project included sampling fish and assessing habitat along the Red River mainstem following an intensive survey design. MBI was responsible for all aspects of planning, field sampling, data management, data analysis, and reporting. A project report was completed in 2015.

### **Exploration of the Ecological Limits of Hydrologic Alteration (ELOHA) to Aquatic Assemblages in the Great Lakes Watersheds of Ohio**

*Client: Ohio Nature Conservancy*

This was a project conducted on behalf of the Ohio Nature Conservancy. This project was conducted with the goal of quantifying ecologically safe water withdrawals for Ohio streams and rivers protective of aquatic assemblages. We applied methods described in the Ecological Limits of Hydrologic Alteration (ELOHA) methods developed by the Nature Conservancy and applied these in the Great Lakes watersheds of Ohio. We linked biological indicators from Ohio's large ecological database to a suite of low flow regime indicators to provide a framework for the protection of ecological conditions in Ohio's streams and rivers. We focused on the Ohio IBI sensitive species metric, which primarily consists of fluvial dependent and specialist species, as an ecological indicator to gauge the influence of flow removal from streams of varying sensitivity. Our stream flow baseline was based on the September monthly average, the lowest flow period by month for Ohio streams.

### **Assessment of Wabash River biodiversity and biological condition relative to stressors**

*Client: Indiana TNC*

This project used the Biological Condition Gradient (BCG) process to 1) model fish and macroinvertebrate assemblages based on historical data and recent assessments of species directional change with stress, 2) create stressor intolerance values to develop estimates of historical stressor conditions, and 3) compare existing identified stressors in Wabash River Huc11 watersheds. We used these data to generate restoration targets based on responses of index and species traits to current chemical, physical, and hydrological stressors. We modeled historical fish assemblages and estimated expected stressor conditions by back-calculating stressor intolerance values for each species. This was compared to back-calculated stressor levels for reaches of the Wabash River based on current assemblages and other Midwestern large rivers. This effort allowed us to estimate the extent of restoration needed in reaches of the Wabash River to attain specific biological assemblage conditions as measured by a fish IBI.

### **Integrated Assessment of the DuPage River and Salt Creek Watersheds, Illinois: 2006-present**

*Client: DuPage River-Salt Creek Work Group and Conservation Foundation*

MBI designed a comprehensive watershed assessment for the DuPage River-Salt Creek watersheds in northeastern Illinois in 2005-6. MBI then executed the implementation of that design for the bioassessment portion of the project by sampling these watersheds during 2006-2012. The lower DuPage River watershed was added in 2012. This included using the Illinois EPA fish and macroinvertebrate IBIs including the development of programming to calculate each index. MBI produced the first project report that included data analysis of the bioassessment and chemical/physical data and the assessment of multiple stressors affecting use attainment in the DuPage River-Salt Creek watersheds in 2009. Annual watershed reports have followed each year since. These have been used to verify and expand the present listings of impaired waters and to improve the TMDL and watershed management process as a whole. The project was extended to include a second round of sampling during 2009 through 2011. In addition,



the 2006-12 bioassessments are being used to develop a restoration project prioritization ranking scheme that is now being used by the DRSCWG to determine restoration project priorities and scope.

### **Policy and Technical Support for Development of Biological Standards and Tiered Aquatic Life Uses (TALU) for Water Quality Management in Minnesota**

*Client: Minnesota Pollution Control Agency (MPCA)*

MBI is developing the justification, rationale, framework, and implementation strategy for the adoption of tiered aquatic life uses (TALUs) and biocriteria in the Minnesota WQS and as a part of the MPCA water program. This was initiated and sponsored by MPCA who is facilitating the outreach to relevant state agencies and stakeholder groups. The project product is a comprehensive implementation document, the development of a Biological Condition Gradient model for specific lotic ecotypes, resolution of specific and relevant technical issues, technical assistance to the affected agencies, and eventually a proposed rulemaking for the Minnesota WQS.

### **Biological Assessment Guidance for the Upper Mississippi River**

*Client: Upper Mississippi River Basin Association and Water Quality Task Force*

MBI conducted support and development for the production of the Clean Water Act (CWA) biological assessment guidance for the Upper Mississippi River (UMR) during 2009-11. This project included the development of a draft guidance document entitled “Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance” (Yoder et al. 2011) and two supporting documents “Preliminary Analysis of Biological Assessment Thresholds for Determining Aquatic Life Use Attainment Status in the Upper Mississippi River Mainstem” and “Development of a Biological Condition Gradient for Fish Assemblages of the Upper Mississippi River and Development of a “Synthetic” Historical Fish Community”. In addition a project scoping report entitled “Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance - Background and Scoping Report” was produced following an initial information gathering effort.

### **Fish Assemblage Assessment and Methods Comparison for Non-Wadeable Rivers in Region V: 2004-7**

*Client: ORSANCO and U.S. EPA-ORD and Region V*

MBI, as a subcontractor to ORSANCO, provided field sampling and logistical support, data analysis, and report production for a probabilistic assessment of major mainstem tributaries to the Upper Mississippi and Ohio Rivers during 2004-7. In addition to the development of a regionally calibrated fish IBI, MBI also conducted and reported on an electrofishing methods comparison with 8 participants (mostly states) in 2006.

### **National Wadeable Streams Survey: Region V States: 2004-5**

*Client: U.S. EPA-OWOW and Region V*

MBI performed sampling for the National Wadeable Streams Survey sites within 5 of 6 Region V states during 2004-5. MBI provided all field sampling and laboratory support for data that was included in the U.S. EPA final WSA report. In addition, MBI conducted analyses of the Region V dataset from all six states focusing on sampling design and scale issues, stressor gradients, and habitat assessment methodology comparisons. In addition, 20 sites were sampled in conjunction with each Region V state to generate data for bioassessment comparability analyses. A final report was produced in 2010.

### **Biological Criteria and Habitat Assessments Training: 2001-present**

*Clients: U.S. EPA-OST/HECD, Region V, Ohio EPA*

MBI provides support for multi-day training sessions dealing with biocriteria and TALU development and implementation and habitat assessment using the QHEI since 2001. These are conducted on location and include classroom and field instruction. The training is open to any participant or stakeholder based on an

open announcement. Recently, Ohio EPA has adapted this training as part of their Qualified Data Collector certifications under the Ohio Credible Data Law. In addition, the MBI instructors also participate in the 5-day level 3 OCDL certification training that is offered periodically by Ohio EPA and more recently by MBI. In addition to the above offering, training has also been conducted for U.S. EPA Regions V and VII, Wisconsin DNR, Illinois EPA, Indiana DEM, and Indiana DOT.

### Relevant Publications

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- Yoder, C.O. (editor), E. T. Rankin, V. L. Gordon, M.J. Knapp, M. Micacchion and J. T. Freda. Biological and Water Quality Study of Great Miami River and Tributaries 2013. MBI Technical Report MBI/2013-11-13.
- Yoder, C.O. (editor), E. T. Rankin, V. L. Gordon, M.J. Knapp, M. Micacchion and J. T. Freda. Biological and Water Quality Study of Little Miami River and Tributaries 2012. MBI Technical Report MBI/2012-11-13.
- Smith, T.D., E.T. Rankin and Chris O. Yoder (editor). 2013. Assessment of the Fish Assemblages and Habitat Quality in the Lower Black River 2010-2012: Lacustrary Portion in Lorain, OH. MBI Technical Report
- Midwest Biodiversity Institute. 2012. An Analysis of Predicted Changes in Fish Habitat Downstream of the Dresden Island Dam from a Proposed Hydroelectric Facility. Submitted by: Midwest Biodiversity Institute, MBI Technical Report MBI/2012-5-8, May 7, 2012, A Third Party Assessment for Consideration by: Illinois EPA Illinois DNR, Northern Illinois Hydropower, Inc.
- Rankin, E.T. 2012. Aquatic Life Stressor Identification Handbook for Southeast. MBI Technical Report MBI/2012-11-13, Submitted to Environmental Management Program, Voinovich School of Leadership and Public Affairs, Building 22, The Ridges, Ohio University, Athens, OH 45701.
- Midwest Biodiversity Institute. 2011. Assessment of the Biological Assemblage Condition of Small Headwater Streams in Ohio Subject to the Proposed General Use Provisions of Ohio's Water Quality Standards. MBI Technical Report MBI/2011-6-6. June 30, 2011. Prepared on behalf of: U.S. EPA Region V, Water Division, 77 W. Jackson Street, Chicago, IL 60604
- Rankin, E.T. and R.M. Mueller. 2011. Ecological Low Flow Protection Process for Ohio Streams and Rivers of the Lake Erie Basin, Prepared by the Midwest Biodiversity Institute for The Nature Conservancy in Ohio, 6375 Riverside Drive, Dublin, OH 43017
- Rankin, E.T. and C.O. Yoder. 2011. Identification of Predictive Habitat Attributes for Minnesota Streams to Support Tiered Aquatic Life Uses. Prepared by the Midwest Biodiversity Institute for Minnesota Pollution Control Agency. Nov 2011.
- Yoder, C.O., R.J. Miltner, V.L. Gordon, E.T. Rankin, N.B. Kale, and D.K. Hokanson. 2011. Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance. Upper Mississippi River basin Association, St. Paul, MN. 95 pp. <http://www.umrba.org/wq.htm>.
- Rankin, E.T. and C.O. Yoder. 2011. Improving Water Quality Standards and Assessment Approaches for the Upper Mississippi River: UMR Clean Water Act Biological Assessment Implementation Guidance: Development of a Biological Condition Gradient for Fish Assemblages of the Upper Mississippi River and Development of a "Synthetic" Historical Fish Community. MBI Technical Report/2011-5-2. Submitted to UMRBA WQTF. 24 pp. <http://www.umrba.org/wq.htm>.
- Miltner, R.J., Yoder, C.O. and E.T. Rankin. 2011. Preliminary Analysis of Biological Assessment Thresholds for Determining Aquatic Life Use Attainment Status in the Upper Mississippi River Mainstem. MBI Technical Report/2011-5-1. Submitted to UMRBA WQTF. 58 pp.



<http://www.umrba.org/wq.htm>.

- Rankin, E.T. 2010. Calibration of the Ohio IBI and ICI Using Continuous Scoring Methods. Environmental Management Program, Voinovich School of Leadership and Public Affairs, Building 22, The Ridges, Ohio University, Athens, OH 45701
- Rankin, E.T., Dyer, J., Johnson, K., López, D., Springer, G.S., Stoertz1, M.W., Stuart, B.J., Vis-Chiasson, M.L., Yoder, C.O. and M. Hughes. 2009. Refined biocriteria classification for fish and macroinvertebrate assemblages in the Western Allegheny Plateau ecoregion of Ohio. Chapter 1 of the Final Report to the U.S. EPA for STAR grant # R831365
- Rankin, E.T., Dyer, J., Johnson, K., López, D., Springer, G.S., Stoertz1, M.W., Stuart, B.J., Vis-Chiasson, M.L., Yoder, C.O. and M. Hughes. 2009. Identification of key stressors limiting aquatic life in the Western Allegheny Plateau ecoregion of Ohio. Chapter 2 of the Final Report to the U.S. EPA for STAR grant # R831365
- Rankin, E.T. and C.O. Yoder. 2009. Temporal Change in Regional Reference Condition as a Potential Indicator of Global Climate Change: Analysis of the Ohio Regional Reference Condition Database (1980-2006). Final Project Report to: Tetrattech, Inc. Center for Ecological Sciences, Owings Mills, MD 21117
- Rankin, E.T. and C.O. Yoder. 2009. Initial Exploration of the Influence of Flow Regime on Ecological Indicators in Ohio Streams and Rivers. Prepared for the Ohio Nature Conservancy, Columbus, Ohio.
- Miltner, R.J. and E.T. Rankin. 2009. Analysis of National Wadeable Stream Survey Results in Region V: 2004-5. Prepared by: Midwest Biodiversity Institute for U.S. EPA, Region V, Water Division, 77 W. Jackson Blvd., Chicago, IL 60605 and U.S. EPA, Office of Wetlands, Oceans, and Watersheds, Ariel Rios Building, 1200 Pennsylvania Avenue, N. W., Washington, DC 20460.
- Armitage, B. J., R. Mueller and E. T. Rankin. 2009. An Assessment of Threats to the Biological Condition of the Wabash River Aquatic Ecosystem of Indiana. In Two Parts. Prepared for The Indiana Nature Conservancy, Indianapolis, IN.
- Rankin, E.T., B.J. Armitage and C.O. Yoder. 2009. Sensitivity of Unionid mussels to chemical and habitat stressors: Field results and comparisons to laboratory-derived stressor studies. MBI Technical Report MBI/2009-10-4. Prepared for U.S. EPA, Region V.
- Yoder, C.O., R.F. Thoma, L.E. Hersha, E.T. Rankin, B.H. Kulik, and B.R. Apell. 2008. Maine Rivers Fish Assemblage Assessment: Development of an Index of Biotic Integrity for Maine Rivers. MBI Technical Report 2008-11-2. Report to U.S. EPA, Region I, Boston, MA. 69 pp.
- Yoder, C.O. and E.T. Rankin. 2008. Evaluating options for documenting incremental improvement of impaired waters under the TMDL program. U.S. EPA, Office of Wetlands, Oceans, and Watersheds, Assessment and Watershed Protection Division, TMDL Program, Results Analysis Project, MBI Technical Report MBI/2008-11-1.
- Rankin, E.T. 2008. Recalibration of the Ohio Biocriteria: Initial Steps and Recommendations. July 2008, Prepared for Ohio EPA by Ohio University, ILGARD, Voinovich School, Bldg 22, The Ridges, Athens, Ohio 45701.
- National Research Council. 2008. Urban Stormwater Management in the United States. National Research Council, Division on Earth and Life Studies, Water Science and Technology Board, National Academies Press, Washington DC.

- Purcell, A.H., D.W. Bressler, M.J. Paul, M.T. Barbour, E.T. Rankin, J.L. Carter, and V.H. Resh. In Press. Assessment Tools for Urban Catchments: Developing Biological Indicators based on Benthic Macroinvertebrates. *Journal of the American Water Resources Association*.
- Pomeroy, C. A., Roesner, L.A., Coleman II, J.C., and E.T. Rankin. 2008. Protocols for studying wet weather impacts and urbanization patterns, Project 03-WSM-3. Water Environment Research Foundation (WERF), Alexandria, VA.
- Barbour, M.T., Paul, M.J., Bressler, D.W., Purcell, A.H., Resh, V.H., and E.T. Rankin. 2007. Bioassessment: A tool for managing aquatic life uses for urban streams. Project 01-WSM-3. Water Environment Research Foundation (WERF), Alexandria, VA.
- Tewes, R., E. Emery, J. Thomas, L.E. Hersha and E.T. Rankin. 2007. Evaluation and development of biological assessment methods and standardized protocols for Region V: Boat electrofishing methods comparison study. C.O. Yoder (editor). Report to U.S. EPA. Region V (grant CP-96510501). 110 pp. + appendices.
- Yoder, C.O., B.J. Armitage, and E.T. Rankin. 2005. Re-evaluation of the technical justification for the existing Ohio River mainstem temperature criteria. Report to the Ohio River Valley Water Sanitation Commission (ORSANCO) ad hoc Committee on Temperature Criteria Re-evaluation. MBI Technical Report MBI/05-05-2. 55 pp. + Appendices.
- Yoder, C.O. and 9 others. 2005. Changes in fish assemblage status in Ohio's nonwadeable rivers and streams over two decades, pp. 399-429. in R. Hughes and J. Rinne (eds.). Historical changes in fish assemblages of large rivers in the America's. *American Fisheries Society Symposium Series*.
- 40 additional publications and 100+ oral presentations.



## Vickie L. Gordon

Research Associate

P-2

### BIOLOGIST

### EDUCATION

B.Sc. Natural Resources, Wildlife Management, Specialization: Fisheries; The Ohio State University

### YEARS OF EXPERIENCE

MBI: 9

Total: 13

### LICENSES/REGISTRATIONS

Level 3 Qualified Data Collector, Ohio Credible Data Program, Fish & Habitat, 2010-present

### PROFESSIONAL AFFILIATIONS

American Fisheries Society

### AREAS OF EXPERIENCE

- Fish ecology & taxonomy: New England, Midwestern U.S., Great Lakes region & states, North Dakota, Red River of the North.
- Biological, habitat, & water quality assessments.
- MSD of Greater Cincinnati Bioassessment & Chemical Crew Leader & Survey coordination 2011-14.
- Quality Management & Safety Officer, 2007-present

Vickie L. Gordon is a Research Associate at the Midwest Biodiversity Institute. She began her work with MBI as a field technician in 2004 and is currently employed full time as a Research Associate and Quality Management and Safety Coordinator. She was a crew leader for the NRSA project in 2008 and 2009. She is also involved in evaluating the applicability of Tiered Aquatic Life Uses (TALU) in large rivers in Region V. Her main interest is fish assemblages in large rivers and streams. Vickie graduated with a Bachelor of Science degree from The Ohio State University in Fisheries and Wildlife Management with a focus on Fisheries. While attending the university she studied under and worked as a research assistant for Dr. Ted Cavender at the Museum of Biodiversity Fish Division. After graduating she completed two internships as a fisheries technician with the Ohio River Valley Water Sanitation Commission (ORSANCO). She also worked two seasons as a creel clerk for the Ohio Division of Wildlife Fish Management Division in district five. Just prior to becoming full time with MBI, Vickie was Site Coordinator for a private environmental firm with an office located in Louisville, KY.

### Project Experience

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#### Watershed Monitoring Design and Bioassessment for the MSD Greater Cincinnati Service Area - Hamilton County, Ohio: 2010-present

*Client: Metropolitan Sewer District of Greater Cincinnati, Ohio*

MBI was enlisted in 2011 by the MSDGC to produce a watershed-based monitoring and biological assessment plan for the MSD service area within Hamilton County, Ohio. This plan described the spatial and temporal sampling design and the indicators and parameters that are to be collected at each sampling site. It also describes the types of biological sampling methods for fish and macroinvertebrate assemblages and habitat assessment. Chemical and physical measures were also included to provide supporting data and information for the biological assessment. This included indicators and parameters for recreational use assessment in addition to aquatic life use assessment. The plan has been used to guide the development of detailed study plans for two of four years of field work and the subsequent data analysis for a baseline bioassessment in beginning in 2011. The sampling design employs a combination of a geometric (stratified-random) and intensive pollution surveys. These are being employed to fulfill multiple management purposes and goals in addition to the determination of the existing status of the biological assemblages and their relationship to chemical, physical, and biological stressors. As such, the principles of adequate monitoring and assessment (ITFM 1995; Yoder 1998) were used in anticipation

that the resulting biological assessments will support the development of cost-effective watershed management responses to existing and emerging issues. A restoration project prioritization ranking scheme similar to that developed for the DRSCWG will be developed to support MSDGC and the local watershed groups in developing their restoration project priorities and scope.

#### Integrated Assessment of the DuPage River and Salt Creek Watersheds, Illinois: 2006-present

*Client: DuPage River-Salt Creek Work Group and Conservation Foundation*

MBI designed a comprehensive watershed assessment for the DuPage River-Salt Creek watersheds in northeastern Illinois in 2005-6. MBI then executed the implementation of that design for the

bioassessment portion of the project by sampling these watersheds during 2006-2012. The lower DuPage River watershed was added in 2012. This included using the Illinois EPA fish and macroinvertebrate IBIs including the development of programming to calculate each index. MBI produced the first project report that included data analysis of the bioassessment and chemical/physical data and the assessment of multiple stressors affecting use attainment in the DuPage River-Salt Creek watersheds in 2009. Annual watershed reports have followed each year since. These have been used to verify and expand the present listings of impaired waters and to improve the TMDL and watershed management process as a whole. The project was extended to include a second round of sampling during 2009 through 2011. In addition, the 2006-12 bioassessments are being used to develop a restoration project prioritization ranking scheme that is now being used by the DRSCWG to determine restoration project priorities and scope.

### **National Rivers and Streams Assessment (NRSA): 2013-14**

*Client: U.S. EPA-OWOW and PG Environmental*

MBI mobilized field crews, equipment, and provided for all logistics to execute sampling for the National Rivers and Streams Assessment in 2013-14. MBI participated on a contractor team where in-kind services were requested by U.S. EPA. As a result MBI sampled more than 400 sites in 17 states and employed up to four separate field crews. The principal product was biological, chemical, and physical data produced under rigorous QA/QC requirements and at remote and difficult-to-access locations ranging from headwater streams to large and great rivers including the Mississippi River. MBI was responsible for pre- and post-field tasks including location of sites, disposition of samples, verification of vouchers, and completed data forms.

### **Regional Bioassessment of the Non-Wadeable Rivers of New England: 2008-14**

*Client: U.S. EPA, Region I and ORD*

MBI conducted fish and habitat assessments at more than 200 randomly selected sampling sites and more than 100 targeted sites on selected mainstem rivers in New England during 2008-9. This included an intensive survey of the Connecticut River mainstem. The purpose was to determine the applicability of non-wadeable fish and habitat sampling methods, determine the condition of the fish assemblages in New England rivers, and develop improved stressor identification and biological assessment methods. MBI was responsible for all pre- and post-survey tasks including the development of a project QAPP, study plan, coordination with state and federal agencies, data collection, data management, data analysis, and reporting. A project report is expected in March 2013.

### **National Rivers and streams Assessment (NRSA): 2008-9**

*Client: TetraTech*

MBI mobilized field crews, equipment, and provided for all logistics to execute sampling for the National Rivers and Streams Assessment in 2008 and 2009. MBI participated on a contractor team to EPA where in-kind services were requested by the states. As a result MBI sampled more than 220 sites in 9 states and employed up to three separate field crews. The principal product was biological, chemical, and physical data produced under rigorous QA/QC requirements and at remote and difficult-to-access locations. MBI was responsible for pre- and post-field tasks including location of sites and disposition of samples and completed data forms. MBI also performed comparison sampling to ascertain the differences between common state methods and EPA NRSA methods and is responsible for the analysis of that data.

### **Fish Assemblage and Habitat Assessment of the Red River, North Dakota: 2010-11**

*Client: U.S. EPA, Region 8 and North Dakota Health Department*

MBI planned and executed a comprehensive assessment of the fish assemblages and habitat of the Red River of the North under a contract with U.S. EPA and funding from North Dakota. The project included sampling fish and assessing habitat along the Red River mainstem following an intensive survey design. MBI was responsible for all aspects of planning, field sampling, data management, data analysis, and reporting. An initial project report was completed in 2011.

## **Evaluation of the Feasibility of Applying TALUs to Non-Wadeable Rivers in Region V: 2005-10**

*Client: U.S. EPA, Region V*

MBI provided field sampling, data analysis, and reporting on a project to evaluate the feasibility and technical aspects of applying TALUs to the non-wadeable rivers of Region V. This project commenced in 2005 and concluded in 2009. It included the sampling of approximately 300 fish assemblage sites in selected mainstem rivers in IL, IN, MN, MI, WI, and OH. The data from the above referenced REMAP project was also included in this analysis. A major goal was to test the various large river fish IBIs and determine their applicability and the comparative usefulness of the Biological Condition Gradient for assessing and setting TALUs for large rivers. In addition, methodological issues were addressed as a central part of TALU implementation.

## **Development and refinement of indicators and methods for the development of TALUs in the non-wadeable Rivers of Region V: 2006-10**

*Client: U.S. EPA, Region V*

MBI conducted a regional assessment of non-wadeable rivers in the Illinois and Rock River basins of Illinois, Wisconsin, and Indiana to determine the efficacy of using fish and algal assemblage indicators to assess widespread habitat and nutrient enrichment impacts and to determine the limits of wadeable and non-wadeable assessment tools. This included applying non-wadeable methods and using available fish and algal indices to evaluate the results.

## **National Wadeable Streams Survey: Region V States: 2004-5**

*Client: U.S. EPA-OWOW and Region V*

MBI performed sampling for the National Wadeable Streams Survey sites within 5 of 6 Region V states during 2004-5. MBI provided all field sampling and laboratory support for data that was included in the U.S. EPA final WSA report. In addition, MBI conducted analyses of the Region V dataset from all six states focusing on sampling design and scale issues, stressor gradients, and habitat assessment methodology comparisons. In addition, 20 sites were sampled in conjunction with each Region V state to generate data for bioassessment comparability analyses. A final report was produced in 2010.



## Martin J. Knapp

Senior Research Associate

P-3

### MID-LEVEL STATISTICIAN

#### EDUCATION

M.A.S., Statistics, Ohio State University, Columbus, OH

M.S., Aquatic Biology, University of Akron, Akron, OH

B.S., Biology, University of Akron, Akron, OH

#### YEARS OF EXPERIENCE

MBI: 7

Total: 33.

#### LICENSES/REGISTRATIONS

Level 3 Qualified Data Collector & Trainer, Macroinvertebrate Sampling, data Analysis, and Taxonomy, Ohio Credible Data Program, 2013-present.

#### AREAS OF EXPERTISE

- Macroinvertebrate ecology & taxonomy: Midwestern U.S., Upper Mississippi & Great Lakes regions.
- Ecological statistics
- Water Quality Standards
- Biological, habitat, & water quality assessments
- Biological methods & index development & implementation
- Training for macroinvertebrate field collection and laboratory identification

Martin J. Knapp is a Senior Research Associate at the Midwest Biodiversity Institute (MBI). He is presently the principal investigator of the macroinvertebrate group at MBI. He was most recently an environmental specialist at the Ohio Environmental Protection Agency (1981-2007). His 32 years of work experience includes service on national, regional, and state macroinvertebrate assemblages dealing with monitoring and assessment, biological criteria, environmental indicators, and water quality standards (WQS). Primary areas of expertise include macroinvertebrate distribution, ecology, and taxonomy, water quality, biological assessment, monitoring program design and execution. He is a lead instructor for the Qualified Data Collector macroinvertebrate training as part of the Ohio Credible Data program (2013-present) and is a lead instructor of Primary Headwater Habitat (PHWH) sampling and analyses in small urban streams in Ohio. He developed the Wetland Invertebrate Community Index (WICI) at the Ohio EPA. He provided statistical guidance on fish impingement at Ohio River power plants for the Ohio EPA, and statistical research analyses of macroinvertebrate and diatom data in wetland communities on the Bad River Reservation, Wisconsin, for MBI.

### Project Experience

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#### Integrated Assessment of the DuPage River and Salt Creek Watersheds, Illinois: 2006-present

*Client: DuPage River-Salt Creek Work Group and Conservation Foundation*

MBI designed a comprehensive watershed assessment for the DuPage River-Salt Creek watersheds in northeastern Illinois in 2005-6. MBI then executed the implementation of that design for the bioassessment portion of the project by sampling these watersheds during 2006-2012. The lower DuPage River watershed was added in 2012. This included using the Illinois EPA fish and macroinvertebrate IBIs including the development of programming to calculate each index. MBI produced the first project report that included data analysis of the bioassessment and chemical/physical data and the assessment of multiple stressors affecting use attainment in the DuPage River-Salt Creek watersheds in 2009. Annual watershed reports have followed each year since. These have been used to verify and expand the present listings of impaired waters and to improve the TMDL and watershed management process as a whole. The project was extended to include a second round of sampling during 2009 through 2011. In addition, the 2006-12 bioassessments are being used to develop a restoration project prioritization ranking scheme that is now being used by the DRSCWG to determine restoration project priorities and scope.

#### Assessment of the Fish and Macroinvertebrate Assemblages and Habitat Quality in the Lower Black River, 2010-2013

*Client: Arcadis and National Oceanographic and Atmospheric Administration*

MBI conducted a comprehensive biological assessment of the Black River lacustrine during 2010-13 in support of GLRI funded remediation of habitat and legacy toxic contamination. The Black R. lacustrine is an Area of Concern and our study documented progress towards meeting Beneficial Use Impairment (BUI) guidelines and NOAA derived targets for biological and habitat endpoints. The remediation actions included the construction of "fish shelves" and riparian zone restoration. MBI conducted fish, macroinvertebrate, and habitat assessments and related the 2010-13 results to prior results obtained by Ohio EPA dating to 1982 in order to establish restoration baselines and monitoring the effectiveness of

GLRI funded restoration projects. The lower Black R. is a complex setting that includes modifications for navigation and a natural lacustuary setting impacted by existing point and nonpoint source impacts and legacy toxic contamination from industrial sources. Follow-up monitoring is intended to continue in 2015.

## **Project Relevant Experience**

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### **Watershed Monitoring Design and Bioassessment for the MSD of Greater Cincinnati Service Area - Hamilton County, Ohio: 2010-present**

*Client: Metropolitan Sewer District of Greater Cincinnati, Ohio*

MBI was enlisted in 2010 by the MSDGC to produce a watershed-based monitoring and biological assessment plan for the MSD service area within Hamilton County, Ohio. This plan described the spatial and temporal sampling design and the indicators and parameters that are to be collected at each sampling site. It also describes the types of biological sampling methods for fish and macroinvertebrate assemblages and habitat assessment. Chemical and physical measures were also included to provide supporting data and information for the biological assessment. This included indicators and parameters for recreational use assessment in addition to aquatic life use assessment. The plan has been used to guide the development of detailed study plans for two of four years of field work and the subsequent data analysis for a baseline bioassessment in beginning in 2011. The sampling design employs a combination of a geometric (stratified-random) and intensive pollution surveys. These are being employed to fulfill multiple management purposes and goals in addition to the determination of the existing status of the biological assemblages and their relationship to chemical, physical, and biological stressors. As such, the principles of adequate monitoring and assessment (ITFM 1995; Yoder 1998) were used in anticipation that the resulting biological assessments will support the development of cost-effective watershed management responses to existing and emerging issues. A restoration project prioritization ranking scheme similar to that developed for the DRSCWG will be developed to support MSDGC and the local watershed groups in developing their restoration project priorities and scope.

### **Biological Criteria and Habitat Assessments Training: 2001-present**

*Clients: U.S. EPA-OST/HECD, Region V, Ohio EPA*

MBI provides support for multi-day training sessions dealing with biocriteria and TALU development and implementation and habitat assessment using the QHEI since 2001. These are conducted on location and include classroom and field instruction. The training is open to any participant or stakeholder based on an open announcement. Recently, Ohio EPA has adapted this training as part of their Qualified Data Collector certifications under the Ohio Credible Data Law. In addition, the MBI instructors also participate in the 5-day level 3 OCDL certification training that is offered periodically by Ohio EPA and more recently by MBI. In addition to the above offering, training has also been conducted for U.S. EPA Regions V and VII, Wisconsin DNR, Illinois EPA, Indiana DEM, and Indiana DOT.





**P-2**

**ENVIRONMENTAL SCIENTIST**

**EDUCATION**

M.En., Institute for the Environment and Sustainability, Miami University, Oxford, OH

GIS Certificate, Miami University, Oxford, OH

B.S. Biology and Chemistry Minor, Ashland University, Ashland, OH

**YEARS OF EXPERIENCE**

MBI: 3 years

Ohio Environmental Council: 3 months

Ashland University Biology Department: 2 years

Total: 5.25 years

**LICENSES/REGISTRATIONS**

First Aid and CPR, Motorboat Operation Training Course

**PROFESSIONAL AFFILIATIONS**

National Association for Environmental Professionals (NAEP); Miami University Chapter Treasurer (2012-2013)

**AREAS OF EXPERTISE**

- Water quality assessment data collection
- Implementation of ESRI ArcGIS software (9.3 and 10.2) for map development and data analysis.
- Taxonomic Keys
- R Statistical Software
- Epifluorescent (Olympus IX71)

Rachel Day is a Research Assistant at the Midwest Biodiversity Institute. In January 2014 Rachel obtained a Master's in Environmental Science from the Institute for the Environment and Sustainability (IES) as well as a Certificate in Geographic Information Systems (GIS) from the Geography Department at Miami University. Previously she graduated from Ashland University with a B.S. in Biology and a Chemistry Minor.

Her most recent projects include overseeing and coordinating water chemistry data collection from the Great Miami River and its tributaries in Southwest Ohio. She also assisted in the deployment and retrieval of Datasondes. During the summer of 2012 Rachel held an internship with the Ohio Environmental Council's vernal pool conservation program and assisted with developing literature for community outreach.

**Project Experience**

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**National Rivers and Streams Assessment (NRSA): 2013-14**

*Client: U.S. EPA-OWOW and PG Environmental*

MBI mobilized field crews, equipment, and provided for all logistics to execute sampling for the National Rivers and Streams Assessment in 2013-14. MBI participated on a contractor team where in-kind services were requested by U.S. EPA. As a result MBI sampled more than 400 sites in 17 states and employed up to four separate field crews. The principal product was biological, chemical, and physical data produced under rigorous QA/QC requirements and at remote and difficult-to-access locations ranging from headwater streams to large and great rivers including the Mississippi River. MBI was responsible for pre- and post-field tasks including location of sites, disposition of samples, verification of vouchers, and completed data forms. Rachel provided GIS support for pre-survey reconnaissance and with tracking field crew sites sampled production and also performed field crew duties.

**Watershed Monitoring Design and Bioassessment for the MSD of Greater Cincinnati Service Area - Hamilton County, Ohio: 2010-present (2013)**

*Client: Metropolitan Sewer District of Greater Cincinnati, Ohio*

MBI was enlisted in 2010 by the MSDGC to produce a watershed-based monitoring and biological assessment plan for the MSD service area within Hamilton County, Ohio. This plan described the spatial and temporal sampling design and the indicators and parameters that are to be collected at each sampling site. It also describes the types of biological sampling methods for fish and macroinvertebrate assemblages and habitat assessment. Chemical and physical measures were also included to provide supporting data and information for the biological assessment. This included indicators and parameters for recreational use assessment in addition to aquatic life use assessment. The plan has been used to guide the development of detailed study plans for two of four years of field work and the subsequent data analysis for a baseline bioassessment in beginning in 2011. The sampling design employs a combination of a geometric (stratified-random) and intensive pollution surveys. These are being employed to

fulfill multiple management purposes and goals in addition to the determination of the existing status of the biological assemblages and their relationship to chemical, physical, and biological stressors. As such, the principles of adequate monitoring and assessment (ITFM 1995; Yoder 1998) were used in anticipation that the resulting biological assessments will support the development of cost-effective watershed



management responses to existing and emerging issues. A restoration project prioritization ranking scheme similar to that developed for the DRSCWG will be developed to support MSDGC and the local watershed groups in developing their restoration project priorities and scope. Rachel served as a research assistant overseeing the collection and coordination of water chemistry data collection and sediment samples.

### **Development of Educational Uses for Talawanda High School Natural Areas (2011 – 2012)**

*Client: Talawanda School District Oxford, Ohio*

The Talawanda School District (TSD) in Butler County, Ohio serves over 3,000 students from pre-school through 12th grade. With a 99.2% graduation rate, the district received a rating of “Excellent with Distinction” for the 2010-2011 academic year. This is the highest academic rating that can be given to Ohio school districts from the Ohio Department of Education under the current Report Card grading system. In line with efforts to continuously improve and offer an effective curriculum, TSD purchased 147 acres of land for the construction of a new high school. Approximately 50 acres of the land was used for the high school, parking lots, and sports fields. The remaining 97 acres are located nearly 400 yards from the Talawanda High School (THS) and composed of an agricultural field, forests, wetlands, and prairies. The TSD wished to incorporate these habitats into the high school curriculum; however the THS property lacks an established trail system that would allow the students and teachers to explore the 97 acres of natural and agricultural land. In addition, the distance from the school to the property is such that it would be difficult to visit the property during a regular class period, thus there was the need to develop options for making the site more accessible to students visiting from the high school. Rachel was part of a team of IES graduate students who partnered with TSD to provide a design of a trail system on the THS land that incorporated the needs of school curricula, sports teams, and outdoor recreation. They also explored multiple options for making the natural areas more accessible to students in order to maximize the time available to conduct educational environmental surveys on the property.

### **Green fluorescent protein-labeled *Escherichia coli*: An effective tool to enhance visibility of small *Daphnia* when monitoring behavioral responses in tank experiments (2009 – 2011)**

Chemical cues released from both plants and animals are thought to impact the behavior of *Daphnia*. *Daphnia dentifera*, native to Sites Lake, OH (40°N, 82°W) is thought to alter its behavior when exposed to kairomones from planktivorous fish or similar signals from aquatic plants. The small size of these organisms (<1.2mm) impedes the ability to effectively monitor their behavior in experimental tanks. To enhance their visibility, a method was developed in which *Daphnia* were fed transgenic *Escherichia coli* labeled with the Green Fluorescent Protein (GFP). GFP-labeled *E. coli* fluoresce when exposed to UV light, and such fluorescence is observable microscopically using a fluorescent microscope or macroscopically using a black light. Initial studies revealed that *D. dentifera* do consume the GFP-labeled *E. coli*, but that gut fullness varies. Rachel served as a student research assistant conducting experiments to establish conditions that optimize animal visibility in aquaria using this approach. This method may prove to be an essential tool for future studies analyzing the behavior demonstrated by *Daphnia dentifera* and other small species.