VFC Index - Watershed (Plan)

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Morse Reservoir/Cicero Creek Watershed Management Plan

Boone, Clinton, Hamilton, and Tipton Counties, Indiana

February 2011

Prepared by:
V3 COMPANIES

Prepared for:
UPPER WHITE RIVER WATERSHED ALLIANCE
MORSE WATERWAYS ASSOCIATION

Executive Summary

The Upper White River Watershed Alliance and the Morse Waterways Association has received funding from the Department of Natural Resources, Division of Fish and Wildlife Lake and River Enhancement Program for a Watershed Management Plan (WMP) for the Morse Reservoir and the 10-digit HUC 0512020106 Cicero Creek watershed in Hamilton, Boone, Tipton and Clinton Counties, Indiana. Cicero Creek has its origins in southeast Clinton County and flows northeast through Tipton County before turning south and flowing through central Hamilton County. The watershed also encompasses portions of Boone County. The Morse Reservoir/Cicero Creek Watershed consists of approximately 144,343 acres of mixed land use of which approximately 1,500 acres is Morse Reservoir.

Morse Waterways Association (MWA) was founded in May 2005 to serve the Morse Reservoir community by promoting safety and the environment. As a means for achieving the goals of promoting safety and the environment, the Association is operating in partnership with the Upper White River Watershed Alliance (UWRWA), and in alignment with local and state agencies/organizations goals in the development of this Watershed Management Plan. A Steering Committee of stakeholders within the watershed was organized to work with MWA and UWRWA to develop and implement the Watershed Management Plan.

The Morse Reservoir/Cicero Creek Watershed Management Plan (WMP) is intended as a guide for the protection and enhancement of the environment and quality of the watershed while balancing the different uses and demands of the community on this natural resource. This plan will address items such as:

- education and outreach;
- increasing preservation, restoration and protection of this vital system;
- increasing cooperation, coordination and collaboration among all stakeholders in the watershed; and
- maintaining a solid organization to look to the welfare of this important natural resource.

The WMP follows the Indiana Department of Environmental Management (IDEM) requirements for watershed management plans, including sections on: watershed inventory, identifying problems, identifying causes, sources and load reductions, setting goals and identifying critical areas, choosing measures and BMPs to apply, creating an action register and schedule, and tracking effectiveness.

Watershed Inventory

The watershed inventory is a comprehensive inventory that quantifies, describes, and summarizes all available watershed data. This inventory is used to determine the current conditions of the watershed and identify the link between the stakeholder concerns and those watershed conditions. Part one of the watershed inventory focuses on the data at a watershed-wide scale and includes broad topics not easily summarized at the subwatershed scale. Part two of the watershed inventory provides detailed water quality data gathered at the subwatershed scale. And part three of the watershed inventory summarizes and explains the relationships of the data gathered in parts one and two.

Identify Problems and Causes

Problem statements were developed during the planning process in an effort to link watershed concerns with existing and historical water quality data. Four major concern categories were identified during this process.

1. Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.
2. Agriculture and typical urban area practices (i.e. lawn care, pet waste disposal, erosion control during construction…etc.) within the watershed contributes a significant amount of pollutants, thereby contributing to the frequent exceedances of water quality targets and growth of algae within the reservoir.
3. *E. coli* levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.
4. Soil erosion and sedimentation within the watershed is degrading the water quality/quantity and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed.

Watershed Goals

Based on the identified concerns and possible sources, goal statements were developed for each problem statement. Implementation of policies and programs to meet these goal statements will improve watershed management in the Morse Reservoir/Cicero Creek Watershed.

The goal statements indicate the ultimate goal for a specific project. In some cases this goal may not be obtainable in the short term; therefore there a list of short term and long term objectives were included with each goal.

1. Develop and implement an education and outreach program within the watershed.
2. Reduce the nutrient loads so that there are no exceedances of EPAs suggested targets for Nitrate + Nitrite of 1.6 mg/L and Total Phosphorus of 0.076mg/L.
3. Reduce *E. Coli* concentrations to meet the state standard of 235 CFU/100mL.
4. Reduce sediment loads to meet the IDEM statewide draft TMDL target of 30 mg/L for TSS.

Critical Areas

Critical areas are defined as areas where project implementation can remediate current water quality impairments or reduce the impact of future water quality impairments. The critical areas within the Morse Reservoir/Cicero Creek watershed were identified based on the Watershed Inventory, the identified problems and the goals of the Watershed Management Plan. Critical areas were split into two categories: Subwatershed Critical Areas and Specific Source Critical areas.

High Priority Subwatersheds
Little Cicero Creek
Tobin Ditch
Teter Branch
Morse Reservoir/Cicero Creek

Medium Priority Subwatersheds
Cox Ditch
Prairie Creek
Hinkle Creek

Low Priority Subwatersheds
Buck Creek
Dixon Creek
Weasel Creek

Specific Source Critical Areas
Livestock Access
Absent or Insufficient Stream Buffers
Excessive Streambank Erosion
Agricultural Areas Practicing Conventional Till

Best Management Practices

To choose an appropriate BMP, it is essential to determine in advance the objectives to be met by the BMP and to calculate the cost and related effectiveness of alternative BMPs. Once a BMP has been selected, expertise is needed to insure that the BMP is properly installed, monitored, and maintained over time.

BMPs identified for implementation within the Morse Reservoir/Cicero Creek Watershed were divided into two categories: Agricultural/Rural and Urban, with cost estimates and pollutant removal rates provided for each BMP.

Action Register and Schedule

The success of a watershed management plan can be measured by how readily it is used by its intended audience and how well it is implemented. The Morse Reservoir/Cicero Creek WMP is very ambitious and continued implementation of the plan will require and even greater degree of cooperation and coordination among partners and funding for projects. The action register is a tool used to easily identify each objective, milestone, estimated cost, and possible partners for easier implementation of the plan.

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Section 1 – Watershed Community Initiative

Intentions of the Watershed Management Plan

The Upper White River Watershed Alliance and the Morse Waterways Association has received funding from the Department of Natural Resources, Division of Fish and Wildlife Lake and River Enhancement Program for a Watershed Management Plan (WMP) for the Morse Reservoir and the 10-digit HUC 0512020106 Cicero Creek watershed in Hamilton, Boone, Tipton and Clinton Counties, Indiana.

The Morse Reservoir/Cicero Creek Watershed Management Plan (WMP) is intended as a guide for the protection and enhancement of the environment and quality of the watershed while balancing the different uses and demands of the community on this natural resource. This plan will address items such as:

- education and outreach;
- increasing preservation, restoration and protection of this vital system;
- increasing cooperation, coordination and collaboration among all stakeholders in the watershed; and
- maintaining a solid organization to look to the welfare of this important natural resource.

The WMP follows the Indiana Department of Environmental Management (IDEM) requirements for watershed management plans, including sections on: watershed inventory, problem cause and stressor identification, stressor source identification, critical watershed areas, setting goals and indicator selection for performance assessment, selecting measures for improvement, calculating load reductions, implementation of planned measures, monitoring indicators, and plan evaluation and adaptation.

Public input is essential for the sustainability and success of the watershed improvement effort. Stakeholder input was sought and included during all aspects of the planning process. This local input was essential for developing a plan that would have broad appeal throughout the watershed and continued support. A steering committee was developed to address the diverse needs in the watershed.

As mentioned previously, the Morse Reservoir/Cicero Creek WMP is intended to be comprehensive, identifying problem areas and suggesting improvement measures for both water quality and quantity concerns. The watershed is large and diverse, and thus has a variety of issues and concerns that need to be addressed. To address some of these issues, the Steering Committee will work with local stakeholder groups to pursue Best Management Practices (BMPs) that will result in the improvement of water quality within the watershed. Because of the size of the task at hand, this plan will also be used as a platform upon which to pursue additional grants and other funding for implementation of the many different improvement measures recommended in the plan.

Community Involvement

Morse Waterways Association

Morse Waterways Association (MWA) was founded in May 2005 to serve the Morse Reservoir community by promoting safety and the environment.

The Morse Waterways Association is a non-profit organization. The Association sponsors several projects throughout the year including an annual safety awareness day and an annual reservoir clean-up day. Its membership consists of many types of stakeholders seeking to ensure that the reservoir will remain a healthy water resource within the Central Indiana region.

Additionally, as a drinking water reservoir for the surrounding communities, the Morse Reservoir must supply a viable source of fresh water for human consumption. Therefore water quality impairments have a direct impact on the health of the community and the cost of treating this water.

As a means for achieving the goals of promoting safety and the environment, the Association is operating in partnership with the Upper White River Watershed Alliance, and in alignment with local and state agencies/organizations goals in the development of this Watershed Management Plan.

Upper White River Watershed Alliance

The Upper White River Watershed Alliance (UWRWA) was formed in 1999 through a local municipal initiative. Not long thereafter, a substantial fish kill occurred as a result of a pollution incident along the White River near Anderson, Indiana. Public and municipal concern regarding overall water quality in the river continues to rise. Current urban development pressures, concern for the quality of area water supplies, and other use impairments drive the Alliance's activities.

Morse Reservoir and the Cicero Creek Watersheds lie within the Upper White River watershed boundary, and therefore the information within this WMP is important to incorporate into the ongoing work for the Upper White River. The watershed coordinators and other members of the UWRWA have participated in the Morse Reservoir/Cicero Creek Steering Committee and helped facilitate communication between each group. The website for the Steering Committee is hosted by the UWRWA so that communication at a single point could occur. The improvements recommended by this WMP and implemented within the watershed will ultimately provide benefit to the Upper White River. Additionally, these communities have very similar demographics and a coordinated education and outreach program between the Upper White and Morse Reservoir/Cicero Creek will help get a broader message across to the people that live within these watersheds.

Steering Committee

Mission/Vision Statement

The Morse Waterways Association mission is to promote safety and the environment within the Morse Reservoir Watershed.

The Upper White River Watershed Alliance's vision is to become the principal regional watershed leader by creating resources, education programs and partnerships, that promote, protect, and enhance the biological, chemical, and physical integrity of the White River ecosystem.

The stakeholders of the Morse Reservoir/Cicero Creek Watershed have many important partners in conservation including:

- Morse Waterways Association (MWA),
- Upper White River Watershed Alliance (UWRWA),
- Indiana University Purdue University Indianapolis (IUPUI) - Center for Earth and Environmental Science (CEES),
- Indiana Department of Natural Resources (IDNR) ,
- Indiana Department of Environmental Management (IDEM),
- White River Watchers,
- Veolia Water Indianapolis, LLC.,
- Hamilton County SWCD,
- Tipton County Surveyor
- City of Noblesville
- Town of Cicero

A complete list of stakeholder groups and related organizations is available in Appendix C of this document.

Representatives from the stakeholder groups listed above comprise the Morse Reservoir/Cicero Creek Watershed Steering Committee. The steering committee's purpose is to review the concerns from the public meetings guide the development of the management plan, and provide additional data as requested. They meet monthly or bi-monthly to accomplish these goals. The Steering Committee meeting agendas, sign-in sheets and minutes are available in Appendix D.

Steering Committee Planning Process

As stated previously, public input is essential for the sustainability and success of the watershed improvement effort. A steering committee was formed to review the concerns from the public meetings and guide the development of the management plan.

Plan Development

The steering committee was directly involved in all aspects of the development of the plan, including input at public meetings, steering committee meetings, and completion of the windshield surveys. The following steps were used in the development of the plan for the Morse Reservoir/Cicero Creek Watershed.

- Outreach to stakeholders
- Develop watershed management partnership with relevant stakeholders and staff a planning committee
- Solicit public input on watershed problems and opportunities
- Formulate project goals and objectives for watershed plan
- Identify and collect existing studies and other watershed data
- Synthesize and summarize existing watershed data

- Collect new data where needed
- Complete assessment of watershed conditions
- Identify best management practices and policies appropriate for the watershed
- Develop an action plan recommending watershed improvement projects and policies
- Identify potential funding sources for watershed improvements
- Obtain public official and general public input from review of draft watershed plan
- Develop implementation schedule and complete final watershed management plan

Public Meetings

A Public Meeting was held on April 30, 2009 at the Red Bridge Community Center to address the concerns of stakeholders in the Morse Reservoir Watershed. Twenty nine people were in attendance which included members of the steering committee, industrial and commercial businesses representatives, governmental entities, and home owners along Morse Reservoir.

A second Public Meeting was held on October 8, 2009 at the Tipton County 4-H Fairgrounds Education Center to address the concerns of stakeholders in the Morse Reservoir Watershed. Sixteen people were in attendance which included members of the steering committee, agricultural land owners and representatives from governmental agencies.

At the public meetings, stakeholders were informed of the purpose of a Watershed Management Plan, informed on the planning process, updated on the Steering Committee progress, and given the opportunity to evaluate the priority resource concerns for the Morse Reservoir/Cicero Creek Watershed.

The priority resource concerns that were identified during the public meeting are listed below. Specific concerns were taken from the stakeholders and later listed in categories to aid understanding of the issues. The information will be used to prioritize watershed issues and aid in the planning and implementation process. Once stakeholders finished identifying issues and concerns they were given the opportunity to rank their top three issues. A value of 3 represented their highest priority issue. Ranking is provided in parenthesis in the format of: (total value / number of votes).

Pollution Issues:

- Silt inputs from Watershed into Morse Reservoir (35/15)
- Stormwater after rain event (7/4)
- Erosion along Big Cicero Creek (5/2)
- Water clarity (5/2)
- Polluted runoff – non-point source pollution (4/2)
- Failing septic systems impact water quality (5/3)
- Streambank deterioration caused by severe erosion. (2/1)
- *E. coli* in Little Cicero (1/1)
- Landfill leaking (1/1)
- Leaking of oil and gas while using the reservoir for recreational purposes
- Phosphorus – Internal nutrient loading
- Brown water
- Debris in curbs and grates
- Grass clippings/Litter in water

Agricultural Issues:

- Conflict between water quality and production agriculture (11/6)
- Nutrient Management (11/4)
- Subsurface Drainage (3/1)
- Ditch Maintenance (1/1)
- Farming in Tipton County increase sediment and nutrients to watershed (1/1)
- Atrazine
- Buffer Areas
- Manure management
- Livestock access to surface water within the watershed

Development/Urban Issues:

- Combined sewer overflows – Tipton County (4/2)
- Cost of streambank maintenance (2/1)
- Water level (1/1)
- Water quality pre- and post development (1/1)
- Silt from construction sites (1/1)
- Runoff from construction sites (1/1)
- Building zoning restriction
- Erosion control at construction sites
- Residential fertilizer use
- Need for dredging
- Construction Clearing

Wildlife/Habitat Issues:

- Streambank Erosion (29/9)
- Habitat Degradation (5/3)
- Streambank stabilization (3/1)
- Canada Geese waste impact on water quality (2/1)
- Big Cicero habitat degradation (2/1)
- Increase in Canada Geese population

Water Use Concerns:

- Safety of using Morse Reservoir recreationally (10/4)
- Flooding (5/2)
- Wastewater Package Plants (1/1)
- Fish consumption advisories/safety
- Effectiveness of Indianapolis drinking water treatment
- Odor/taste of water
- Water treatment plant operation/Lime in water
- How to prioritize numerous watershed concerns for maximum improvement
- Need for water storage reservoir by Anderson

Watershed Education and Outreach:

- Education and outreach of watershed issues (16/7)
- Cooperation/Communication between counties (3/2)
- Changing public perception of stormwater as a bi-product
- Stewardship quality/too few interested parties within watershed

Blue – Green Algae Issues and Concerns:

- Public concern over blue – green algae (11/5)
- Skin irritation/Toxin (5/3)
- Safety of using water for irrigation due to presence of blue-green algae
- Effectiveness of algae treatments

The Public Meeting agendas and sign-in sheets are available in Appendix E.

Section 2 – Watershed Inventory

The watershed inventory is a comprehensive inventory that quantifies, describes, and summarizes all available watershed data. This inventory will be used to determine the current conditions of the watershed and identify the link between the stakeholder concerns and those watershed conditions.

Part one of the watershed inventory focuses on the data at a watershed-wide scale and includes broad topics not easily summarized at the subwatershed scale. Part two of the watershed inventory provides detailed water quality data gathered at the subwatershed scale. And part three of the watershed inventory summarizes and explains the relationships of the data gathered in parts one and two.

Part One of the Watershed Inventory

Relevant Relationships

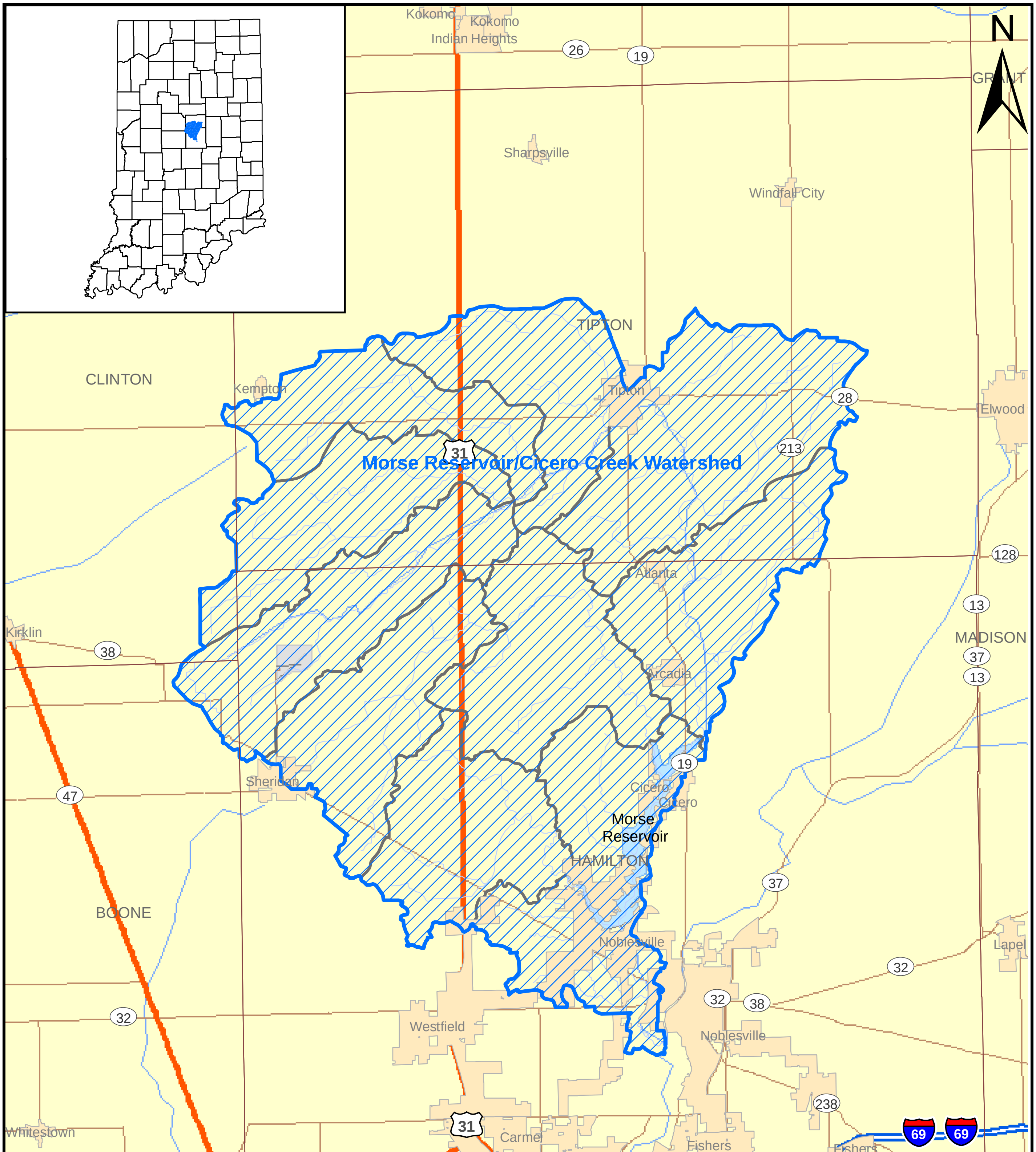
A healthy watershed is essential for a healthy environment and economy. The watersheds we live in provide us with drinking water, jobs, recreation, food and shelter. Watersheds are a unique, dynamic complex combination of natural resources; air, water, soil, plants and animals. Each characteristic of a watershed (e.g. topography, soils, land use, wetlands, etc.) plays a role in the overall health of a watershed. How these characteristics interact with each other can not only negatively impact certain characteristics within the watershed but can also impact the watershed itself.

For example, sandy soils allow the ground to soak up water faster. This reduces surface runoff, but can affect ground water. Sandy soils tend to erode easily when not covered with dense vegetation. Clayey soils, on the other hand, are tighter and do not allow as much water infiltration. This can lead to more runoff and soil erosion. Similarly, wetlands utilize nutrients and tie up sediment to help improve water quality. Wetlands also act as natural sponges to absorb peak flows of water and reduce flooding. Many fish and wildlife species rely on wetlands for rearing their young, and for food and shelter. The combination of population centers and septic tank unsuitable soils may be a source of an *E. coli* problem. These are some of the ways that watershed characteristics are related to each other. The following sections of this WMP further explain the characteristics found in the Morse Reservoir/Cicero Creek Watershed.

Location, Characteristics and Size

Cicero Creek has its origins in southeast Clinton County and flows northeast through Tipton County before turning south and flowing through central Hamilton County (Exhibit 1). The watershed also encompasses portions of Boone County. The Morse Reservoir/Cicero Creek Watershed consists of approximately 144,343 acres of mixed land use of which approximately 1,500 acres is Morse Reservoir.

The distribution of watershed area within each county is shown in Table 1.



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TITLE: **Location Exhibit**

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**

BASE LAYER: StreetMap USA

CLIENT: Upper White River Watershed Alliance
P.O. Box 2065
Indianapolis, Indiana 46206

PROJECT NO.	EXHIBIT:	SHEET: 1 OF: 1
09005	1	
QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 20000'

Table 1: Counties Within the Watershed		
County	**Acres**	**Percentage**
Boone	1,674	1.2%
Clinton	1,646	1.1%
Hamilton	77,606	53.8%
Tipton	63,417	43.9%

Approximately 197.7 linear miles of cumulative waterways are contained in the Morse Reservoir/Cicero Creek Watershed. Some of the cities and towns located in the watershed include: Arcadia, Atlanta, Cicero, Noblesville, Sheridan, Tipton, and Westfield.

Geology/Topography

The bedrock geology of Indiana formed primarily during the Paleozoic Era. The principal bedrock formations in the Morse Reservoir/Cicero Creek Watershed are associated mainly with rocks of Silurian and Devonian age, and consist mainly of limestone and dolomites with some shale or argillaceous zones, whereas the Silurian material consists of limestone, dolomite, and much more argillaceous material than in the Devonian age rock.

The topography of Cicero Creek, which lies in the Tipton Till Plain physiographic unit, consists of a flat to slightly rolling plain. Streams tend to have very low gradients, and lie only a few feet below the general land surface. Extensive alteration of the drainage system has occurred via ditching and the installation of drainage tiles. This has resulted in excellent land for agricultural production. Some rolling and hummocky areas may be present and are related to glacial activity. The gradient throughout the watershed ranges from an elevation of approximately 965 feet at the western edge of the watershed in Boone County to an elevation of approximately 740 feet at the confluence of Cicero Creek with the White River in Hamilton County, or a change of 225 feet.

Hydrology

Climate

The Morse Reservoir/Cicero Creek Watershed is within a humid continental climate region. The humid continental climate is marked by variable weather patterns and a large seasonal variance. Summers are often warm and humid with frequent thunderstorms and winters can be very cold with frequent snowfall and persistent snow cover. The National Oceanic and Atmospheric Administration, National Climatic Data Center publishes the normals of average monthly and annual maximum, minimum, and mean temperature, monthly and annual total precipitation (inches), and heating and cooling degree days (base 65 degrees F) for individual locations throughout the United States, Puerto Rico, Virgin Islands, and Pacific Islands. The monthly precipitation and temperature normals were obtained for Indiana for the time period of 1971 – 2000. Out of the 113 climate stations within Indiana, only one falls within the Morse Reservoir/Cicero Creek Watershed. Table 2 summarizes the temperature and precipitation data for the Tipton 5 SW station.

Table 2: NOAA Monthly Normals for Tipton 5 SW, 1971- 2000		
Month	**Average Temperature (°F)**	**Average Precipitation (in.)**
January	23.5	1.91
February	27.7	1.67
March	37.6	3.02
April	48.1	3.62
May	59.1	3.96
June	68.7	4.24
July	72.1	4.20
August	69.9	3.03
September	63.4	2.89
October	51.7	2.47
November	40.2	3.24
December	28.9	2.94

USGS gage 03349510 Cicero Creek at Arcadia has information on stream discharge and gage height dating back to 2004. This information is valuable to understand the characteristics of the stream and when the flows are the highest and lowest.

Morse Reservoir

Construction of Morse Reservoir was completed in 1956. The primary purpose of the reservoir was to provide a consistent source of water supply to the Indianapolis Water Company's White River Water Treatment Facility. In the early 1970's real estate development began around the reservoir, resulting in development along most of its 32.5 miles of shoreline. The reservoir has a maximum depth of approximately 42 feet, a storage capacity of 8.3 billion gallons, and a surface area of approximately 1500 acres. In addition to water supply, Morse Reservoir is currently widely used for recreation purposes including swimming, boating, and fishing (see Exhibit 1).

Based on information provided in previous studies (IDEM and Little Cicero Creek WMP) for Morse Reservoir, the volume within the reservoir is completely replaced by the input volume (surface water, groundwater, direct precipitation, etc.) every 56 days. Therefore, meaning the hydraulic retention time for the approximate 135,680 acre tributary area to the watershed is 56 days. Based on the size of the reservoir and tributary area, this is somewhat of a short retention time which ultimately suggests that the reservoir will respond in a short time after implementation of upstream BMPs for pollutant reduction.

Wetlands

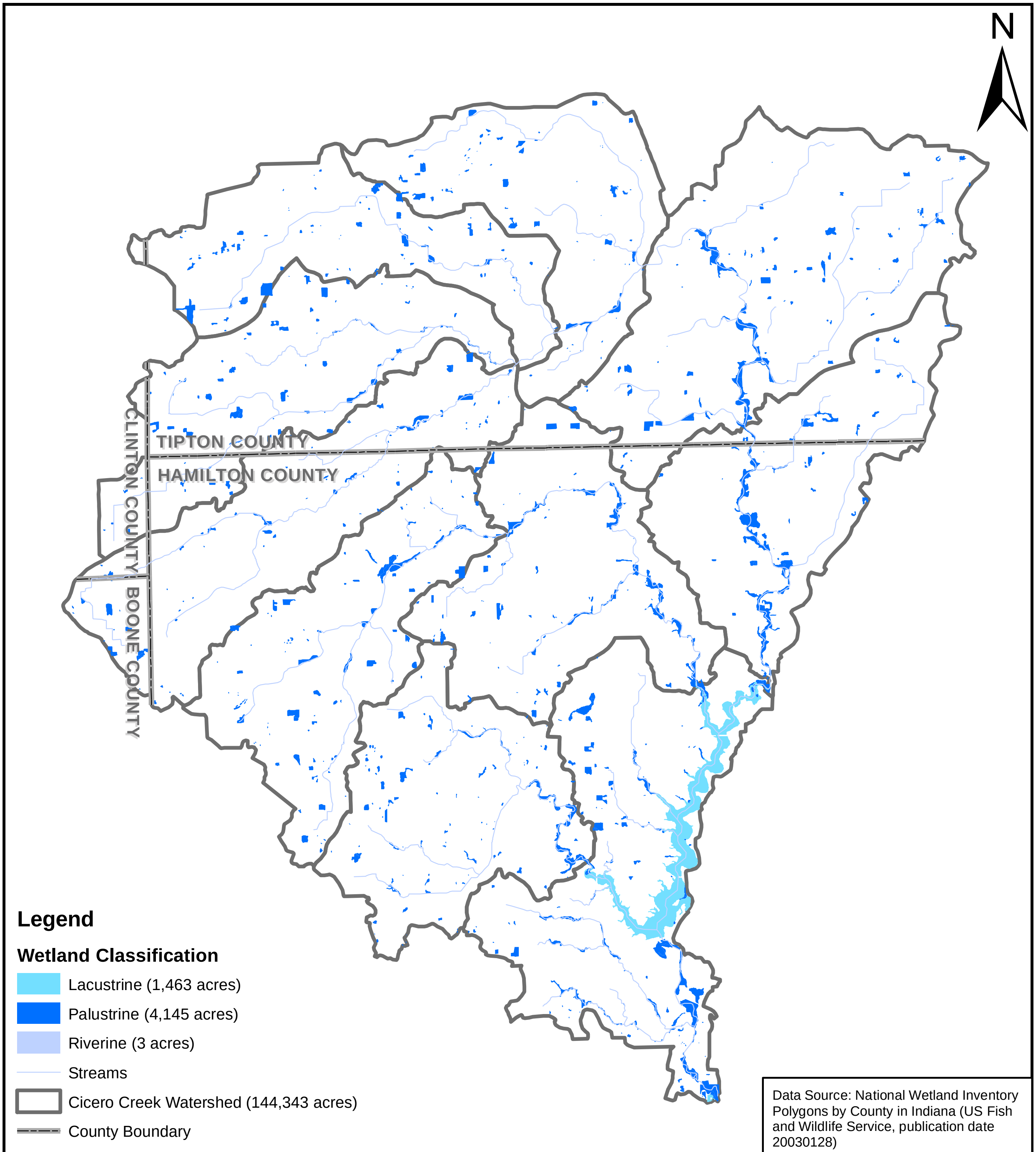
Wetlands are a valuable resource not only for the habitat they create but for the water detention/retention and filtration they provide within a watershed. Wetland classifications are based on attributes which can be measured and when combined, help to define the nature of a specific wetland and distinguish it from others. The three wetland classifications within the Morse Reservoir/Cicero Creek Watershed include lacustrine, palustrine, and riverine. There are 5,611 acres (3.9% of the watershed) of wetlands scattered throughout the watershed. Among the three wetland classification 1,463 acres are considered lacustrine, 4,145 acres are palustrine, and 3 acres are riverine (Exhibit 2). The shapefiles used to create this exhibit were obtained directly from the National Wetland Inventory Polygons by County in Indiana (US Fish and Wildlife Service, publication date 20030128). The Weasel Creek, Little Cicero Creek and Cox Ditch subwatersheds all have approximately 1 acre of riverine wetland.

As defined by the U.S Fish and Wildlife Service, lacustrine wetlands are associated with lakes and are characterized by a lack of trees and a dominance of emergent and submersed aquatic vegetation. Lacustrine wetlands typically extend from the shoreline to depths of 6.5 feet or until emergent vegetation no longer persists. Lacustrine wetlands are important in removing sediment and nutrients as well as providing habitat for fish and macroinvertebrates which are a vital food source within a lake ecosystem. The Lacustrine System includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and (3) total area exceeds 20 acres. Similar wetland and deepwater habitats totaling less than 20 acres are also included in the Lacustrine System if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 6.6 feet at low water.

Palustrine wetlands are related to marshes, swamps and bogs. Palustrine habitats are wetlands dominated by trees, shrubs, persistent emergents, and emergent mosses or lichens. Palustrine habitats have structural features that provide feeding, breeding, nesting, over wintering and migration habitat for wildlife in addition to their natural filtration properties. Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. Riverine wetlands are directly affected by streamflow including overbank and backwater conditions. Riverine wetlands are very important in sediment retention as well as pollutant removal.

Wetlands provide numerous valuable functions that are necessary for the health of a watershed. They play a critical role in protecting and moderating water quality. Water quality is improved through a combination of filtering and stabilizing processes. Wetland vegetation adjacent to waterways helps to stabilize slopes and prevent mass wasting, thus reducing the sediment load within the river system. An unprotected streambank can easily erode, which results in an increase of sediment and nutrients entering the water. Additionally, wetland vegetation removes pollutants through the natural filtration that occurs, or by absorption and assimilation. This effective treatment of nutrients and physical stabilization leads to an increase in overall water quality to downstream reaches.

In addition, wetlands have the ability to increase storm water detention capacity, increase storm water attenuation, and moderate low flows. These benefits help to reduce flooding and reduce erosion. Wetlands also facilitate groundwater recharge by allowing water to seep slowly into the ground, thus replenishing underlying aquifers. This groundwater recharge is also valuable to wildlife during the summer months when precipitation is low and the base flow of the river draws on the surrounding groundwater table.



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TITLE: National Wetland Inventory Map	PROJECT: Morse Reservoir/Cicero Creek Watershed Management Plan			
BASE LAYER: National Wetland Inventory	PROJECT NO. 09005	EXHIBIT: 2	SHEET: 1 OF: 1	
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'	

Although wetlands occupy a small percentage of the surrounding landscape, these areas typically contain large percentages of wildlife and produce more flora and fauna per acre than any other ecosystem. As a result of this high diversity, wetlands provide many recreational opportunities, such as fishing, hunting, boating, hiking and bird watching. Many of these recreational activities are available in the wetland areas within the Morse Reservoir/Cicero Creek Watershed. However, wetlands within this watershed have experienced degradation as a result of urbanization and development. Development projects that have wetlands present or adjacent to the property are applying for and receiving Section 404 of the Clean Water Act permits to fill and develop wetlands. This practice reduces the amount of wetland acreage in the watershed.

Isolated and adjacent wetlands are regulated through IDEM and the Army Corps of Engineers (ACOE), respectively. Although wetlands are typically avoided during the development phase of properties, permits have been given to fill wetlands that cannot be avoided. Some isolated wetlands are being converted to detention/retention basins in new residential developments. Some development and agency permits require on-site mitigation, which includes the creation of wetlands and natural areas on the same piece of land where wetland impacts occur. Some development projects that impact wetlands are allowed to mitigate for wetland impacts at an approved off-site wetland mitigation bank facility. In this case, the wetland impacts are offset through the purchase of wetland mitigation credits at an approved wetland mitigation bank. The Indiana Department of Transportation (INDOT) requires impacts to wetlands associated with roadway improvements to be mitigated for in the same watershed. Stream enhancement and stream mitigation are some of the options that INDOT offers to offset wetland/stream impacts.

Threatened or Endangered Species

The Indiana Department of Natural Resources Division of Nature Preserves was contacted to provide any Indiana Natural Heritage Data or related records for all listed threatened, endangered or rare species documented within the Morse Reservoir/Cicero Creek Watershed. Their response indicated that the watershed is home to one State Rare Species, seven Species of Special Concern to Indiana, six State Endangered Species, one State Threatened Species, two Federally Endangered Species, and one Federal Candidate Species (Table 3).

Table 3: Threatened or Endangered Species			
Type	**Common Name**	**State Status**	**Federal Status**
Amphibian	Common mudpuppy	Species of Special Concern	
Bird	Black-crowned Night Heron	Endangered	
	Upland Sandpiper	Endangered	
Mammal	American Badger	Species of Special Concern	
Mollusk	Little Spectaclecase	Species of Special Concern	
	Clubshell	Endangered	Endangered
	Kidneyshell	Species of Special Concern	
	Rayed Bean	Species of Special Concern	Candidate Species
	Rabbitsfoot	Endangered	
	Round Hickorynut	Species of Special Concern	
	Wavyrayed	Species of Special Concern	
	Northern Riffleshell	Endangered	Endangered
Vascular Plant	Leiberg's Witchgrass	Threatened	
	Awned Sedge	Endangered	
	Spoon-leaved Sundew	Rare	

Nuisance Wildlife and Exotic Invasive Species

According to IDNR, many wild animals in Indiana have become displaced as the result of urban growth and removal of their habitat. While some species may move to other areas where natural habitat exists, some species actually thrive in urban settings. Species such as raccoons, opossums, Canada geese and even red foxes are becoming more common in urban areas and are frequently seen by people. However, these animals can also cause problems when they use a person's attic for shelter, destroy shingles and soffits, utilize lawns as homes, and eat their garbage.

Canada geese are a particular problem within the watershed, specifically for the reservoir. As stated by the DNR, many people enjoy seeing Canada geese, but problems can occur when too many geese concentrate in one area. Typically, developers and landowners unknowingly cause the problem by creating ideal goose habitat. Geese are grazers and feed extensively on fresh, short, green grass. Add a permanent body of water adjacent to their feeding area and you have the created the perfect environment for geese to set up residence, multiply and concentrate. Geese, including their young, also have a strong tendency to return to the same area year after year. Once geese start nesting in a particular place, the stage is already set for more geese in successive years. The problem is further exacerbated when well-intentioned people purposefully feed geese. Artificial feeding of geese tends to concentrate larger numbers of geese in areas that under normal conditions would only support a few geese. Artificial feeding can also disrupt normal migration patterns and hold geese in areas longer than what would be normal. With an abundant source of artificial food available, geese can devote more time to locating nesting sites and mating. Artificial feeding can also concentrate geese on adjacent properties where their presence may not be welcomed, resulting in neighbor/neighborhood conflicts.

Congregating geese can cause a number of problems. Damage to landscaping can be significant and expensive to repair or replace, while large amounts of excrement can render swimming areas, parks, golf courses, lawns, docks, and patios unfit for human use. Since they are active grazers, they are particularly attracted to lawns and ponds located near apartment complexes, houses, office areas and golf courses. Geese can rapidly denude lawns, turning them into barren, dirt areas. Most of the problems in metropolitan areas occur from March through June during the nesting season. Breeding pairs begin nesting in late February and March. Egg-laying begins soon after nest construction is complete.

Based on information obtained from the DNR website, the Indiana Legislature created an Invasive Species Task Force in October 2007 to study the economic and environmental impacts of invasive species in Indiana and provide findings and recommendations on strategies for prevention, early detection, control and management of invasive species to minimize these impacts. Specific information for the analysis of aquatic vegetation/exotic species within Morse Reservoir was not included in the scope of this plan, however, based on other studies, Blue-Green Algae, Eurasian Watermilfoil, and Zebra Mussels have been reported in the watershed.

Invasive plant species are a threat to natural areas. They displace native plants, eliminate food and cover for wildlife, and threaten rare plant and animal species. Many agencies and organizations have joined together to form the Invasive Plant Species Assessment Working Group (IPSAWG) to assess which plant species threaten natural areas in Indiana and develop recommendations regarding the use of that specific plant species. The IPSAWG's goal is that all partner agencies and organizations would utilize the species assessment when recommending or selling plants.

Specific locations and magnitudes of nuisance wildlife and exotic invasive species were not determined. However, general locations can be inferred from the information provided in the WMP.

Regulatory Floodplain

Flooding is one of the most common hazards in the United States. Floods can occur on a local level, or can affect entire river basins. The Federal Emergency Management Agency (FEMA) has developed Flood Insurance Rate Maps (FIRMs) for many parts of the country in order for individuals and governments to assess the risk of flooding in specific areas. These maps also indicate what insurance rates property owners may need to pay to develop property in these areas. The current FIRM panels for the Morse Reservoir/Cicero Creek Watershed are shown on Exhibit 3.

There are three flood hazard areas identified within the watershed. Zone A, which is defined as an area inundated by 100-year flooding for which no base flood elevations (BFEs) have been established comprises 4,975 acres (3.4% of the watershed). In this zone there is a 1% chance of annual flooding, and a 26% chance that the area will be inundated at sometime during the life of a 30-year mortgage. Zone AE, which is defined as an area inundated by 100-year flooding for which BFEs have been determined, comprises 3,265 acres (2.3% of the watershed). Chance of flooding in Zone AE is the same as in Zone A. However, Zone A floodplain boundaries are based off of approximate methods, and Zone AE floodplain boundaries are based off of detailed hydrologic and hydraulic analyses, establishing BFEs and making the delineation more accurate. Zone X, which is defined as an area that is either determined to be outside the 100-year floodplain but within the 500-year floodplain (0.2% chance of annual flooding) or have a 1% chance of sheet flow flooding where the average

Legend

- Streams
- County Boundary
- Zone A Floodplain (4,975 acres)
- Zone AE Floodplain (3,265 acres)
- Zone X Floodplain (46 acres)
- Cicero Creek Watershed (144,343 acres)

Data Source: Digital Flood Insurance Rate Map Database (Indiana Department of Natural Resources, publication date 20040528)

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TITLE: **FEMA Floodplain Map**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: FEMA Floodplain	PROJECT NO. 09005	EXHIBIT: 3	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance, P.O. Box 2065, Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

depths are less then 1 foot, comprises only 46 acres (0.3% of the watershed). These areas are considered to have a moderate or minimal risk of flooding, and the purchase of flood insurance is available but not required. The rainfall data used to create these maps is based on Bulletin 71 rainfall depths. Bulletin 71 is a study that relied primarily on data from 275 daily reporting stations of the National Weather Service cooperative network, which had records exceeding 50 years. Based on USGS information, Central Indiana has experienced two 500-year floods in the last 18 years.

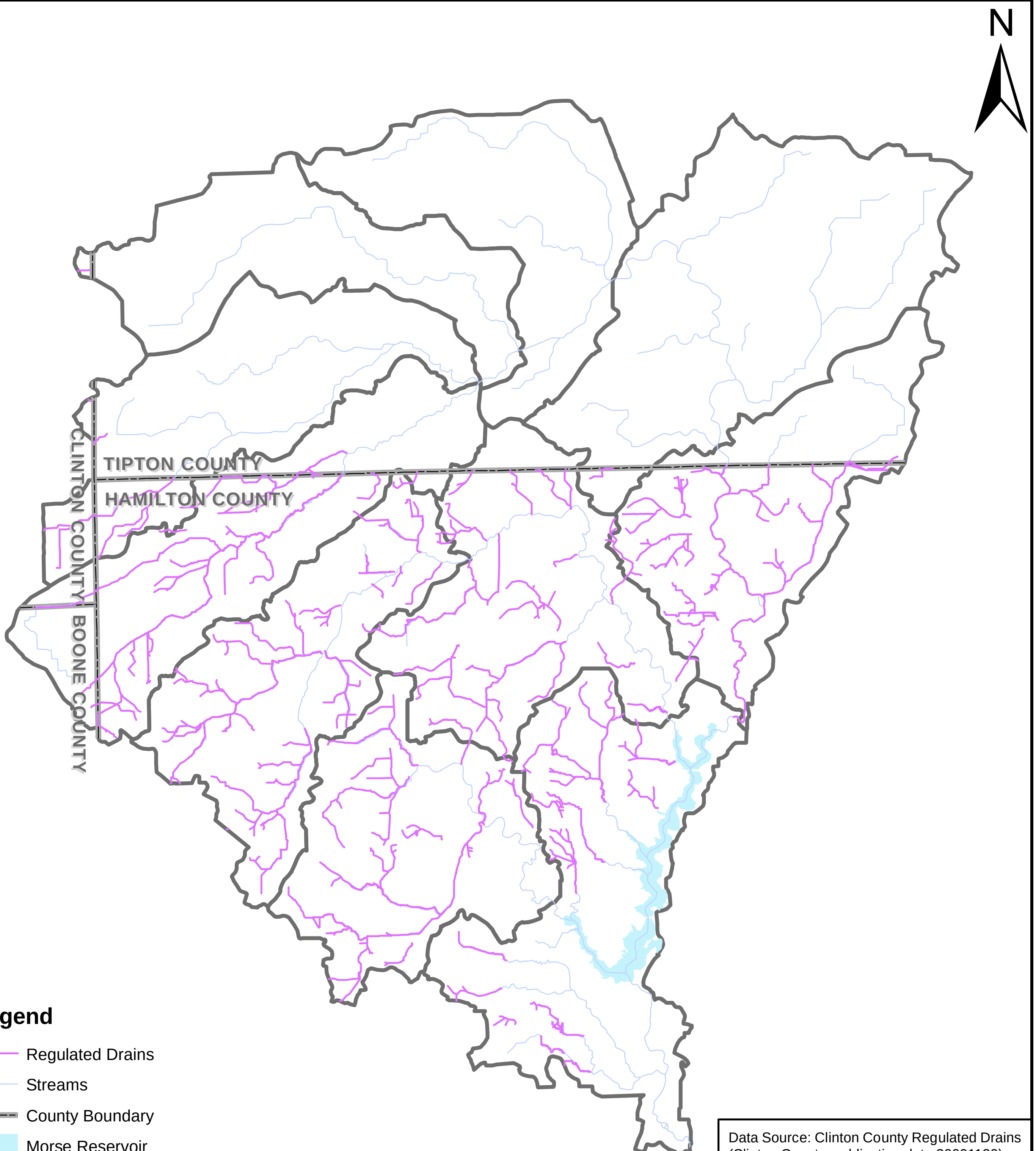
Teams of USGS hydrographers have traveled to 40 streamflow-gaging stations to keep station instruments operating and to verify streamflow data needed for National Weather Service (NWS) flood forecasts. USGS personnel have worked closely with Federal, state, and local agencies during the flood to provide flood information for emergency managers, the media, and the public.

Identifying the location of floodplain areas within the Morse Reservoir/Cicero Creek Watershed allows for targeted areas for floodplain management and/or restoration. Floodplain management is the operation of a community program of corrective and preventative measures for reducing flood damage. These measures take a variety of forms and generally include requirements for zoning, and special-purpose floodplain ordinances. In addition to stormwater runoff, flooding can negatively affect water quality as large volumes of water transport contaminants into water bodies and also overload storm and wastewater systems. Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground and ultimately increases during periods of flooding. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, and streams.

Regulated Drains

Regulated drains consist of creeks, ditches, tiles (underground pipe systems), and other structures intended to move run-off water. Regulated drains are under the jurisdiction of the local county drainage board or the County Surveyor's office. Regulated drains are common throughout the watershed and are mainly tiles and open ditches. It should be noted that regulated drain locations were requested from all four counties within the watershed but only Hamilton and Clinton County provided data which is shown on Exhibit 4. Information on the regulated drains in Boone and Tipton Counties was not provided and therefore is not included on the exhibit.

Regulated drains are typically maintained by the County Surveyors office. This maintenance includes dredging with large construction equipment, removal of debris, and management of vegetation both within the regulated drains and within the riparian zone associated with the drains. Based on the unpredictable maintenance schedule of regulated drains within the watershed, it is difficult to assign a priority rating to these areas for potential improvement of wildlife habitat, water quality improvement measures, and erosion control measures within the Morse Reservoir/Cicero Creek Watershed. However, the selected BMPs and Action Registers include measures and implementation projects that include regulated drains. Coordination with the County Surveyors Office will be necessary during the implementation project evaluation phase.



Legend

- Regulated Drains
- Streams
- County Boundary
- Morse Reservoir
- Cicero Creek Watershed (144,343 acres)

Data Source: Clinton County Regulated Drains (Clinton County, publication date 20091120) Hamilton County Regulated Drains (Hamilton County, publication date 20080317)

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TITLE: **Regulated Drain Map**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: Regulated Drains	PROJECT NO. 09005	EXHIBIT: 4	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

Future potential BMPs within regulated drains in the watershed should be evaluated prior to implementation. If regulated drains are considered for BMP measures, the steering committee should contact the local County Surveyors offices of Boone, Clinton, Hamilton, and Tipton Counties to confirm the location of the regulated drain.

Wellhead Protection Areas

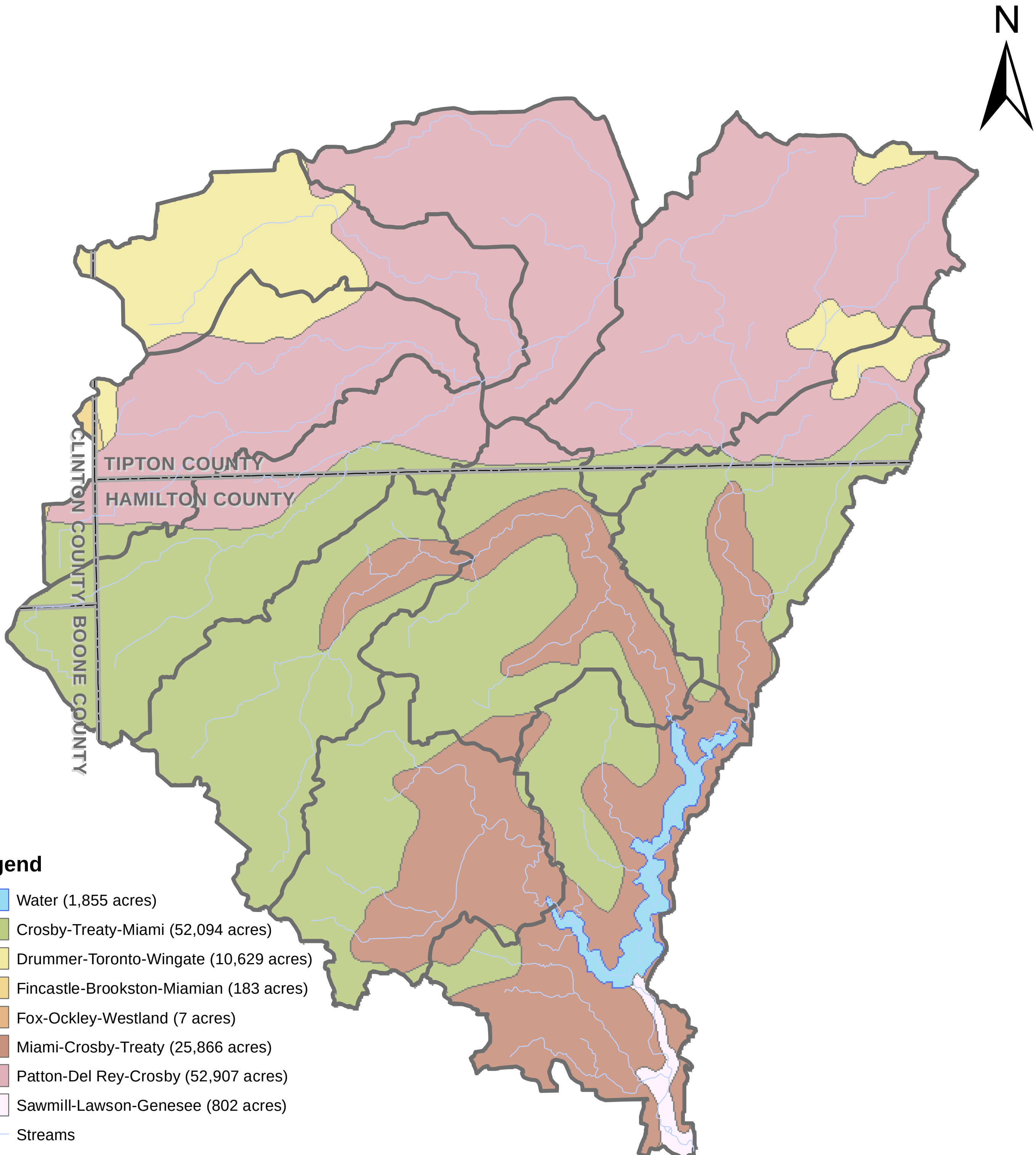
The IDEM Ground Water Section administers the Wellhead Protection Program, which is a strategy to protect ground water drinking supplies from pollution. The Safe Drinking Water Act and the Indiana Wellhead Protection Rule mandates a wellhead program for all Community Public Water Systems. The Wellhead Protection Programs consists of two phases. Phase I involves the delineation of a Wellhead Protection Area (WHPA), identifying potential sources of contamination, and creating management and contingency plans for the WHPA. Phase II involves the implementation of the plan created in Phase I, and communities are required to report to IDEM how they have protected ground water resources.

In late 1995 the Hamilton County Drainage Board requested the Surveyors Office to form a Task Force to study the County's needs in the area of Wellhead Protection. A fifteen member task force was created which represented all cities and towns and water suppliers, both public and private, within Hamilton County. The group met for the first time in December 1995 and met six times in 1996. The result of the efforts in 1996 was an inter-local agreement between Hamilton County and seven other public and private entities for the delineation of Wellhead Protection Areas in order to comply with the Indiana Wellhead Protection Rule. Cicero, Atlanta, Westfield, Arcadia and Indianapolis Water Company entered into a contract through the original inter-local agreement for the delineation phase of the project. All the communities have since completed wellhead delineations and have completed Phase I Wellhead Protection Plans or are awaiting approval.
Since then, Cicero, Atlanta, Carmel, Arcadia and Hamilton County have enacted Wellhead Ordinances and the other communities are working towards adopting their own. This information will be important during the implementation phases of the plan.

Soil Characteristics

There are many different soil types throughout Indiana based on their unique characteristics. Many counties arrange these soil types by like characteristics into groups, or major soil associations. A soil association is a geographic area consisting of landscapes on which soils are formed. Soil associations are groups of soil types that generally share one or more common characteristics; such as parent material or drainage capability. These soil associations provide general characteristics for the specific soil association, and can be used for conceptual locations of best management practices. Information pertaining to the clay content, permeability and even groundwater characteristics are helpful when identifying locations that are feasible for infiltration practices or other best management practices to improve the water quality within the watershed. It should be noted that soil tests should be performed in the areas where implementation projects are recommended for more project specific detailed information. The major soil associations in the Morse Reservoir/Cicero Creek Watershed are shown in Exhibit 5.

Table 4 includes the major characteristics of the four soil associations that make up the majority (98%) of the watershed.



Legend

- Water (1,855 acres)
- Crosby-Treaty-Miami (52,094 acres)
- Drummer-Toronto-Wingate (10,629 acres)
- Fincastle-Brookston-Miamian (183 acres)
- Fox-Ockley-Westland (7 acres)
- Miami-Crosby-Treaty (25,866 acres)
- Patton-Del Rey-Crosby (52,907 acres)
- Sawmill-Lawson-Genesee (802 acres)
- Streams
- County Boundary
- Cicero Creek Watershed (144,343 acres)

Data Source: Soil Associations in Indiana (US Dept. of Agriculture, publication date 200212)

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TITLE: **Soil Associations Map**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: State Soil Geographic Data Base	PROJECT NO. 09005	EXHIBIT: 5	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

Table 4: Soil Associations		
Name	**Characteristics**	**Acres**
Patton-DelRey-Crosby	Deep, somewhat poorly to poorly drained, nearly level soils	52,907
Crosby-Treaty-Miami	Deep, somewhat poorly drained, nearly level soils	52,094
Miami-Crosby-Treaty	Deep, well drained to somewhat poorly drained, nearly level to strongly sloping soils	25,866
Drummer-Toronto-Wingate	Deep, somewhat poorly drained nearly level soil	10,629

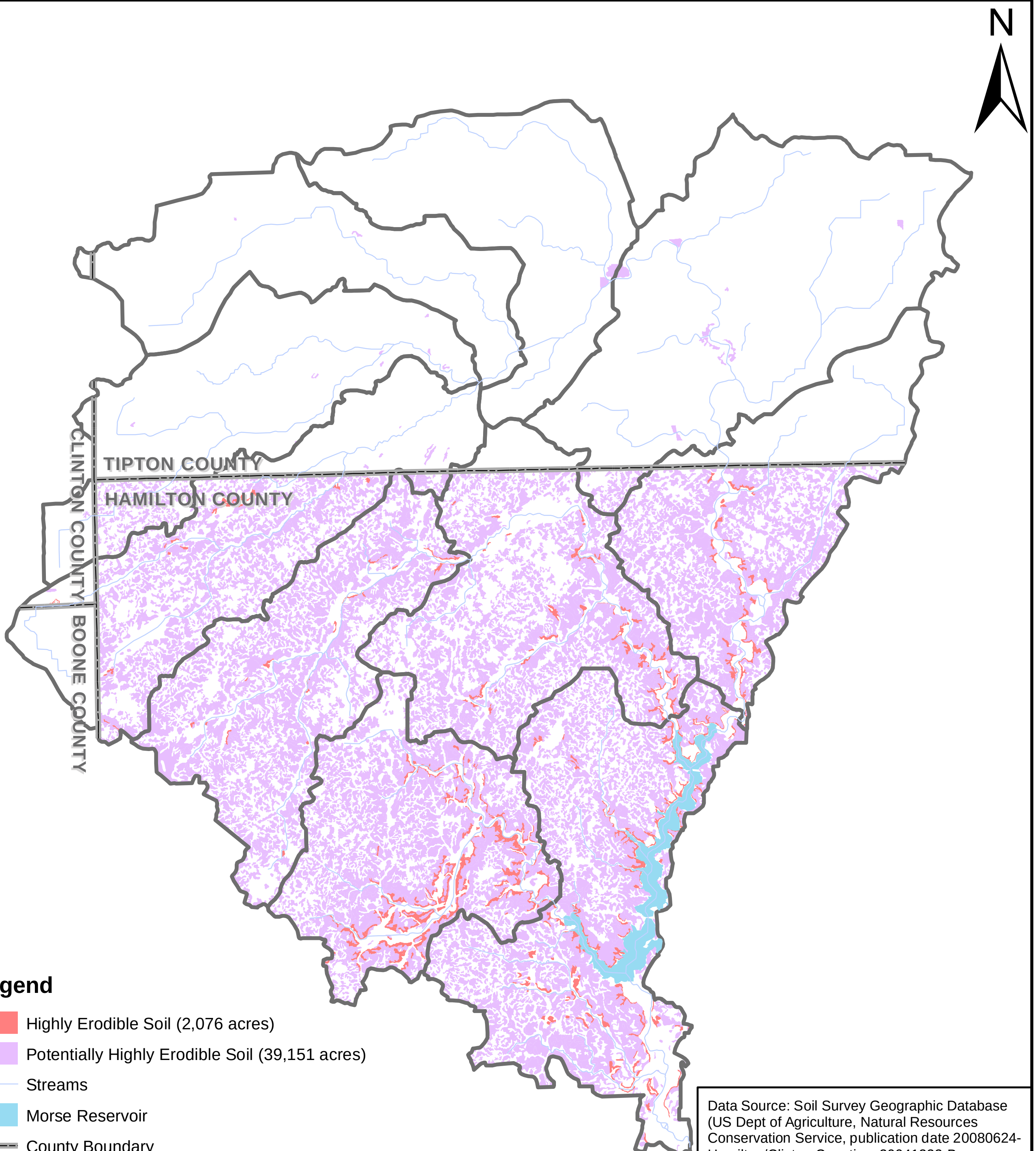
The data source for the Soil Association Map is from the Department of Agriculture Soil Associations in Indiana GIS shapefile with a published date of December 2002. Based on this data and the time it was obtained, the water area is a total of 1,855 acres. This not only includes the reservoir, but some areas outside of the reservoir that were inundated at the time of the data collection.

Highly Erodible Land (HEL)

Erosion is a natural process within stream ecosystems; however excessive erosion negatively impacts the health of the watershed. Erosion throughout the watershed increases sedimentation of the streambeds which impacts the quality of habitat for fish and other organisms. Erosion also impacts water quality as it increases nutrients and decreases water clarity. As water flows over land and enters the stream as runoff it carries pollutants and other nutrients that are attached to the sediment. Sediment suspended in the water blocks light needed by plants for photosynthesis and clogs respiratory surfaces of aquatic organisms. Therefore, erosion also impacts water quality as it increases nutrients and decreases water clarity. Highly erodible soils and potentially highly erodible soils in the Morse Reservoir/Cicero Creek Watershed are mapped in Exhibit 6. The data used to create Exhibit 6 is from the USDA-SCS Indiana Technical Guide Section II-C and was collected from the NRCS offices of Boone, Clinton, Hamilton, and Tipton Counties. A total of approximately 2,076 acres or 1.4% of the watershed is considered highly erodible, while approximately 39,151 acres or 27.1% of the watershed is considered potentially highly erodible. It should be noted that the areas of potentially highly erodible soils appear to be significantly greater in Hamilton County when compared to Tipton, Boone, and Clinton Counties. This discrepancy can be attributed to the difference in the classification of soils between the counties. For example, Crosby soil (CRA) in Hamilton County is considered potentially highly erodible however the same soil in Boone County is considered not highly erodible. Appendix O contains the USDA-SCS Indiana Technical Guide Section II-C documentation obtained for this analysis.

Highly erodible soils are especially susceptible to the erosional forces of wind and water. Wind erosion is common in flat areas where vegetation is sparse or where soil is loose, dry, and finely granulated. Wind erosion damages land and natural vegetation by removing productive top soil from one place and depositing it in another.

In areas with highly erodible soils special care must be taken to insure that land use practices do not result in severe wind or water erosion. Although natural erosion cannot be prevented, the effects of runoff can be moderated so that it does not diminish the health of the watershed.



Legend

- Highly Erodible Soil (2,076 acres)
- Potentially Highly Erodible Soil (39,151 acres)
- Streams
- Morse Reservoir
- County Boundary
- Cicero Creek Watershed (144,343 acres)

Data Source: Soil Survey Geographic Database (US Dept of Agriculture, Natural Resources Conservation Service, publication date 20080624-Hamilton/Clinton Counties, 20041222-Boone County, 20080625-Tipton County) USDA-SCS Indiana Technical Guide Section II-11/87

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TITLE: **Highly Erodible Lands Map**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: NRCS Soil Survey	PROJECT NO. 09005	EXHIBIT: 6	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

Hydric Soils

Soils that remain saturated or inundated with water for a sufficient length of time become hydric through a series of chemical, physical, and biological processes. Once a soil takes on hydric characteristics, it retains those characteristics even after the soil is drained. Approximately 68,748 acres or 47.6% of the soils in the Morse Reservoir/Cicero Creek Watershed are considered hydric (Exhibit 7). All of the mapped soils that are in the portion of Boone County that is located within the watershed are considered hydric based on the soil survey information obtained from the Soil Survey Geographic Database.

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology. Criteria for each of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands. However, a large majority of the soils in the Watershed have been drained for either agricultural production or urban development. Removing the subsurface drainage systems would allow for restoration of these wetland areas.

Septic Tank Suitability

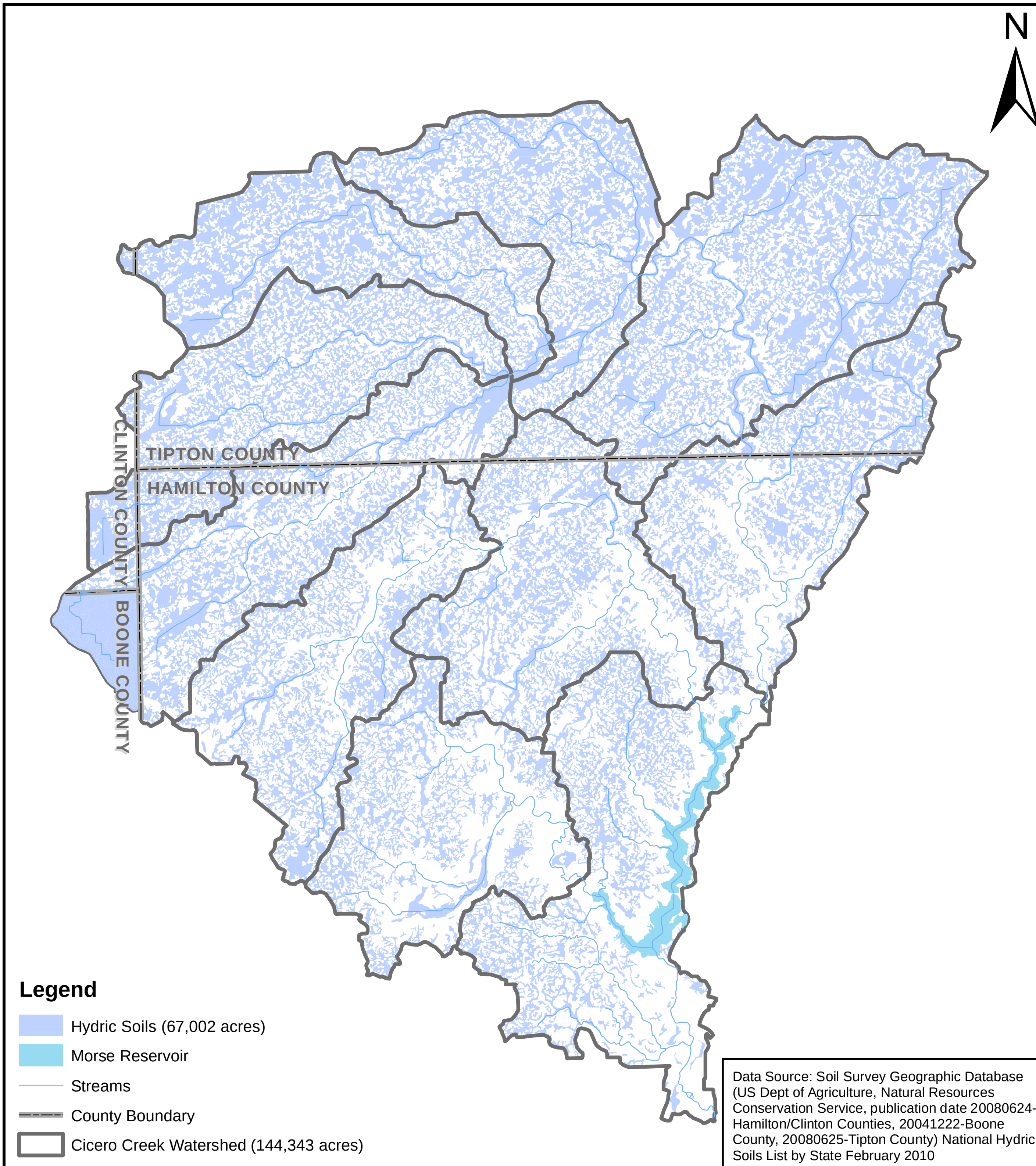
In rural areas, households often depend on septic tank absorption fields. These waste treatment systems require soil characteristics and geology that allow gradual seepage of wastewater into the surrounding soils. Seasonal high water tables, shallow compact till and coarse soils present limitations for septic systems. While system design (e.g. perimeter drains, mound systems or pressure distribution), can often overcome these limitations, sometimes the soil characteristics prove to be unsuitable for any type of traditional septic system.

Heavy clay soils require larger (and therefore more expensive) absorption fields; while sandier, well-drained soils are often suitable for smaller, more affordable gravity-flow trench systems.

The septic disposal system is considered failing when the system exhibits one or more of the following:

1. The system refuses to accept sewage at the rate of design application thereby interfering with the normal use of plumbing fixtures
2. Effluent discharge exceeds the absorptive capacity of the soil, resulting in ponding, seepage, or other discharge of the effluent to the ground surface or to surface waters
3. Effluent is discharged from the system causing contamination of a potable water supply, ground water, or surface water.

Prior to 1990, residential homes on 10 acres or more of land -- and at least 1,000 feet from a neighboring residence -- did not have to comply with any septic system regulations. A new septic code in 1990 fixed this loophole but many of these homes still do not have functioning septic systems. The septic effluent from many of these older homes discharges into field tiles and eventually flows to open ditches. Unfortunately, the high cost of septic repair (typically from $5,000 to $15,000 based on industry standards) has been an impediment to modernization.



Data Source: Soil Survey Geographic Database (US Dept of Agriculture, Natural Resources Conservation Service, publication date 20080624-Hamilton/Clinton Counties, 20041222-Boone County, 20080625-Tipton County) National Hydric Soils List by State February 2010

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TITLE: **Hydric Soils Map**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: NRCS Soil Survey	PROJECT NO. 09005	EXHIBIT: 7	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance, P.O. Box 2065, Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

Individual septic sites must be evaluated on a case-by-case basis to determine septic system suitability. Systems for new construction cannot be placed in the 100-year flood plain and systems for existing homes must be above the 100-year flood elevation.

Exhibit 8 is a map of soil classes related to septic suitability within the watershed. Soils labeled "very limited" indicate that the soil has at least one feature that is unfavorable for septic systems. Approximately 91.5% of the Morse Reservoir/Cicero Creek Watershed is mapped as "very limited" with regards to soils being suitable for septic systems.

Approximately 1.4% of the soils within the watershed are "not rated." These soils have not been assigned a rating class because it is not industry standard to install a septic system in these geographic locations. Soils designated "not limited" were not found in the Morse Reservoir/Cicero Creek Watershed.

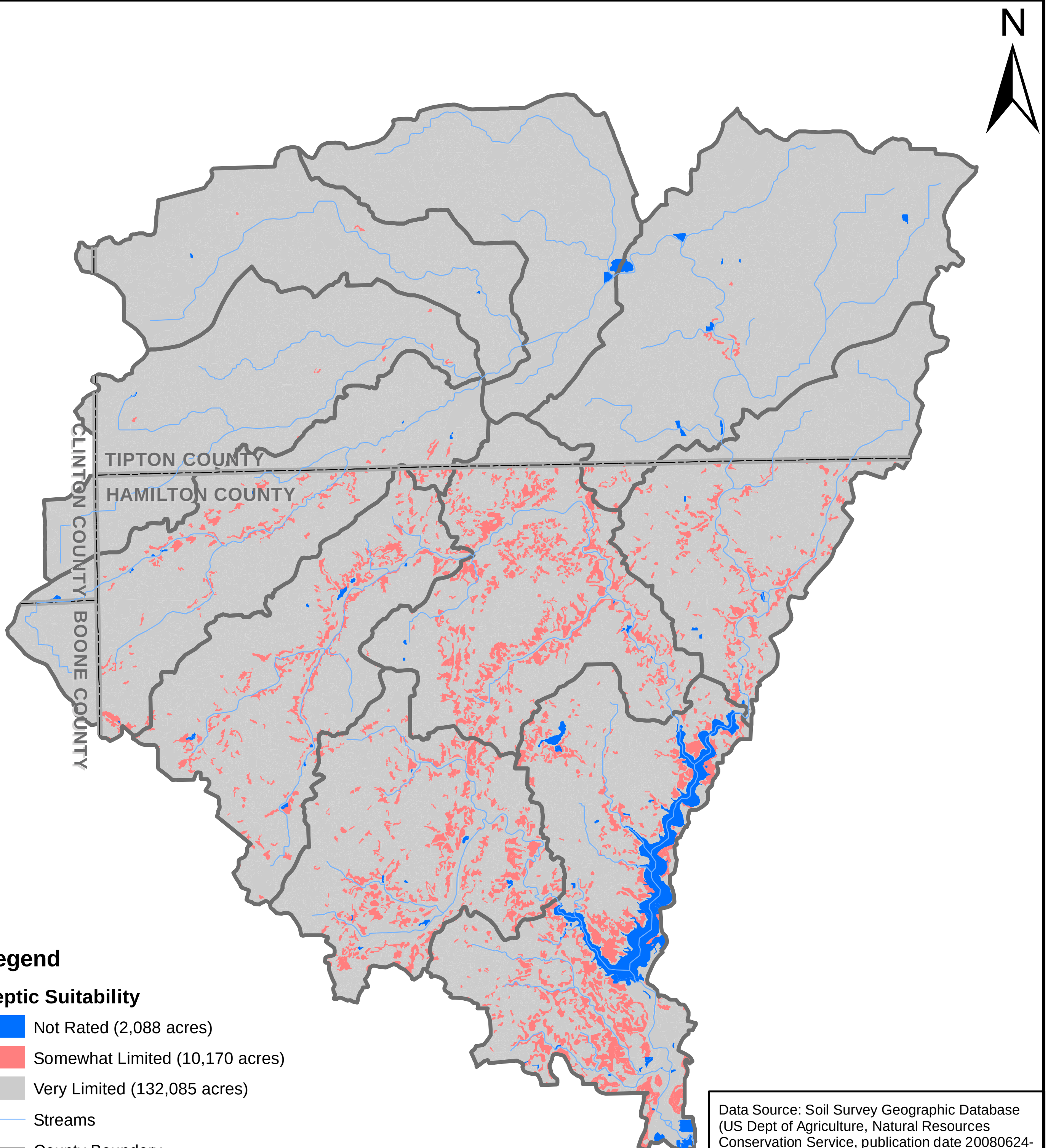
Landuse

The Morse Reservoir/Cicero Creek Watershed consists of approximately 144,343 acres of mixed land use, according to the 2001 National Land Cover Data (NLCD) published by the USGS (Exhibit 9; Table 5). The NLCD 2001 includes nineteen land classifications ranging from cultivated crops to high intensity developed land. In order to utilize the most current available data, the 2008 National Agricultural Imagery Program orthophotography was obtained for Boone, Clinton, and Tipton Counties and the 2008 Hamilton County Orthophotography was obtained for Hamilton County. These aerial images were compared to the NLCD 2001 in order to determine if any changes in land use had occurred. Based on the 2008 aerial, the only landuse changes that had occurred since 2001 were the development of agricultural land into a few residential subdivisions. This change was considered minor to the overall watershed based on the acreage of the subdivisions being less than .1% of the total watershed size.

Table 5: 2001 Watershed Landuse

Landuse Classification	Acres	Percentage
Open Water	1,623	1.12%
Developed, Open Space	9,527	6.60%
Developed, Low Intensity	3,734	2.59%
Developed, Medium Intensity	744	0.52%
Developed, High Intensity	238	0.16%
Deciduous Forest	4,432	3.07%
Evergreen Forest	5	0.00%
Shrub/Scrub	645	0.45%
Grassland/Herbaceous	1,998	1.38%
Pasture Hay	2,069	1.43%
Cultivated Crops	118,803	82.31%
Woody Wetlands	336	0.23%
Emergent Herbaceous	189	0.13%

This watershed has historically been natural areas that were drained and converted for agricultural uses. The area is dominated by agricultural land and based on the 2001 land use information comprises 83.74% (cultivated crops and pasture hay) of its area. Additionally, forests and wetlands comprise 6.38% (open water, forest, shrub/scrub,



Legend

Septic Suitability

- Not Rated (2,088 acres)
- Somewhat Limited (10,170 acres)
- Very Limited (132,085 acres)
- Streams
- County Boundary
- Cicero Creek Watershed (144,343 acres)

Data Source: Soil Survey Geographic Database (US Dept of Agriculture, Natural Resources Conservation Service, publication date 20080624-Hamilton/Clinton Counties, 20041222-Boone County, 20080625-Tipton County) Soil Reports Tabular Data fo Sewage Disposal

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TITLE: **Septic Suitability Map**

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**

BASE LAYER: NRCS Soil Survey

PROJECT NO.: 09005

EXHIBIT: 8

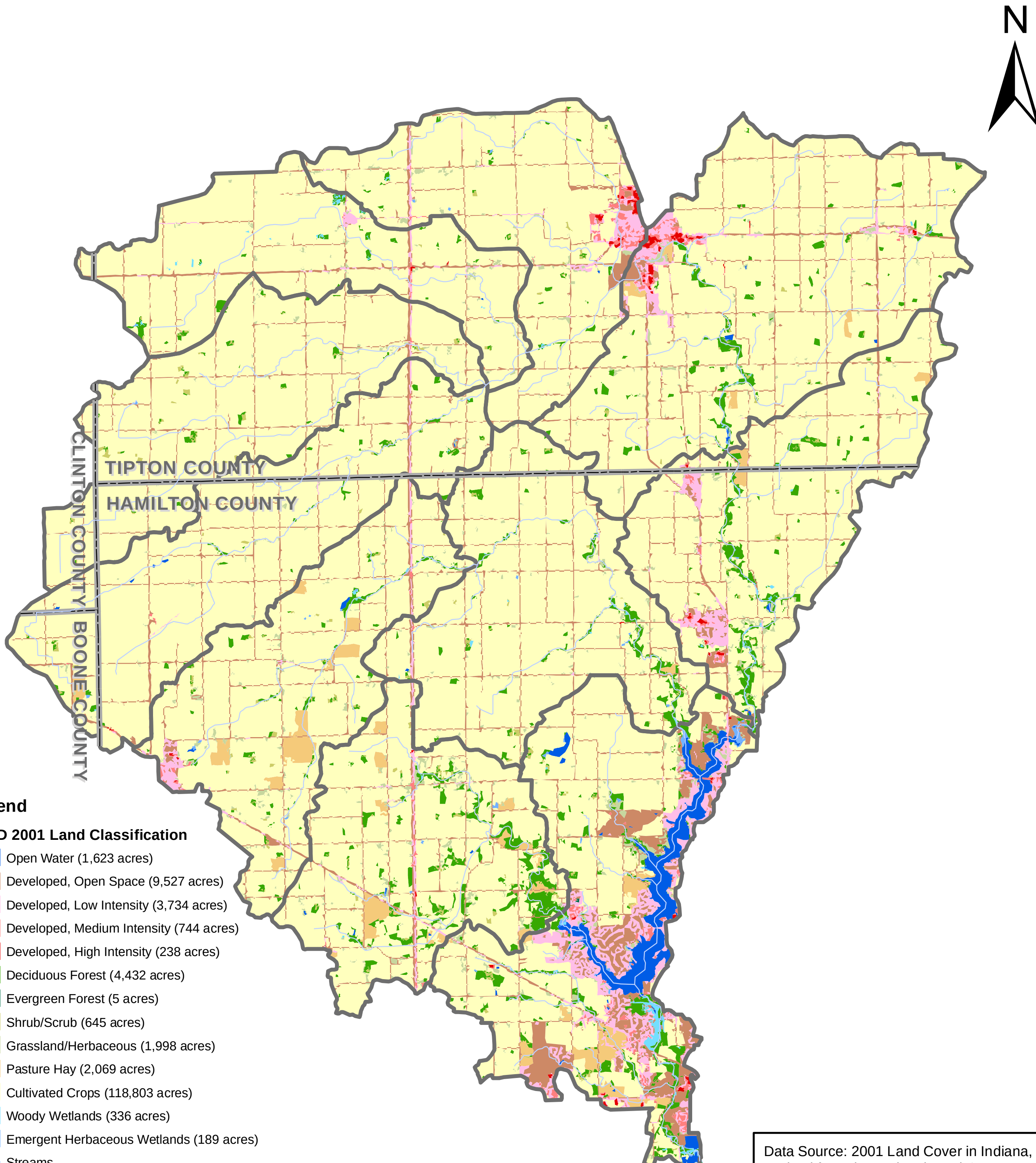
SHEET: 1 OF: 1

CLIENT: Upper White River Watershed Alliance
P.O. Box 2065
Indianapolis, Indiana 46206

QUADRANGLE: N/A

DATE: 09/27/10

SCALE: 1" = 15000'



Legend

NLCD 2001 Land Classification

- Open Water (1,623 acres)
- Developed, Open Space (9,527 acres)
- Developed, Low Intensity (3,734 acres)
- Developed, Medium Intensity (744 acres)
- Developed, High Intensity (238 acres)
- Deciduous Forest (4,432 acres)
- Evergreen Forest (5 acres)
- Shrub/Scrub (645 acres)
- Grassland/Herbaceous (1,998 acres)
- Pasture Hay (2,069 acres)
- Cultivated Crops (118,803 acres)
- Woody Wetlands (336 acres)
- Emergent Herbaceous Wetlands (189 acres)
- Streams
- Cicero Creek Watershed (144,343 acres)
- County Boundary

Data Source: 2001 Land Cover in Indiana, Derived from the National Land Cover Database (Indiana Geological Survey, publication date 20030901)

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TITLE: Landuse Map	PROJECT: Morse Reservoir/Cicero Creek Watershed Management Plan			
BASE LAYER: NLCD 2001	PROJECT NO. 09005	EXHIBIT: 9	SHEET: 1 OF: 1	
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'	

grassland/herbaceous, woody wetlands and emergent herbaceous), and urban and residential lands comprise 9.87% of the watershed. Only 6.38% of the entire watershed is categorized as green space (e.g. forest and wetland areas). As urban areas continue to develop within the watershed, the agencies with regulatory authority should pay careful attention to the characteristics of the existing areas and require (as much as the law allows) that developments incorporate best management practices (including avoidance of significant natural areas, buffers, etc.) within their projects.

Based on a review of the 2010 Google and Bing Maps, there are two obvious areas of the reservoir that are acting as sediment traps. One is the entire reservoir area north of 236th Street (confluence with Cicero Creek) and the other is the entire reservoir area west of Little Chicago Road (confluence with Hinkle Creek) See Appendix N for reservoir aerial images. Both of these areas experience concentrated flows from creeks.

As this water enters the reservoir, the flow stays constant but the area in which the water has to flow is much larger than in the creek corridor. Therefore, based on basic flow calculations (Q=v*A: flow = velocity * area), the velocities seen in the reservoir would be much lower when compared to the velocities experienced in the creek. This lower velocity allows the sediments that are being carried in the creek system to drop out or settle once the water has entered into the reservoir. Bathymetric surveys of these areas would be beneficial to show the amount of sediment that has accumulated over time as well as to have a benchmark to start from to evaluate sediment loads in the future. The survey should include points through the reservoir that show the top of the sediment and the hard pan elevations.

Notable Natural Resources and Recreational Facilities

The Indiana Department of Natural Resources Division of Nature Preserves was contacted to provide any Indiana Natural Heritage Data or related records for all high quality natural communities or natural areas documented within the Morse Reservoir/Cicero Creek Watershed. Their response indicated that there were no known areas within the watershed.

A number of recreational opportunities are scattered throughout the Morse Reservoir/Cicero Creek Watershed. The recreational facilities and parks serve as an opportunity for the public to enjoy the natural landscape within their community as well as learn about valuable natural resources. As shown in Table 6, the Indiana Department of Natural Resources Outdoor Recreational Facilities database indicated that there are nineteen recreational facilities (excluding schools) within the watershed.

Table 6: Recreational Facilities	
Name	**Location**
Arcadia Park	Arcadia
Atlanta Little League Park	Atlanta
Central Park	Carmel
Dolls Park	Atlanta
Goldsmith Community Park	Goldsmith
Hague Road	Noblesville
McGregor Park	Westfield
Morse Park and Beach	Noblesville
Old Overdorf Lake Campground	Sheridan
Red Bridge Park	Cicero
Sheridan Community Center	Sheridan
Tecumseh Park and North Pool	Arcadia
The Wetlands Areas	Noblesville
Tipton 4-H Fairgrounds	Tipton
Tipton City Park	Tipton
Tipton County Family Center	Tipton
Tipton Little League Park	Tipton
Tipton Municipal Golf Course	Tipton
Veteran's Park	Sheridan

Other Planning Efforts

The Morse Reservoir/Cicero Creek Watershed and the Upper White River Watershed have been the focus of scientific research recently, and therefore some watershed planning and monitoring efforts have been ongoing that provide information to this WMP. Additionally, the Morse Reservoir/Cicero Creek Watershed is a developing watershed and the incorporated entities within the watershed have comprehensive plans and stormwater quality management plans that have been approved and are being used to manage growth within these communities. See Table 7 for available planning efforts being completed by the communities/agencies within the watershed. The list of Approved MS4 Communities was created using IDEM Rule 13 List of Designated MS4 Entities Currently Permitted, the SWQMPs were obtained from the community websites, and the information regarding the Long Term Control Plan for the City of Tipton was found in the Bacon/Prairie Ditch WMP.

These planning documents provide a glimpse into the future for potential land use change that may impact the water quality of the watershed. This data is important to incorporate and make our best attempt to look forward with non-point source modeling techniques to predict future conditions. As in many cases, land use is a primary determinant of water quality conditions.

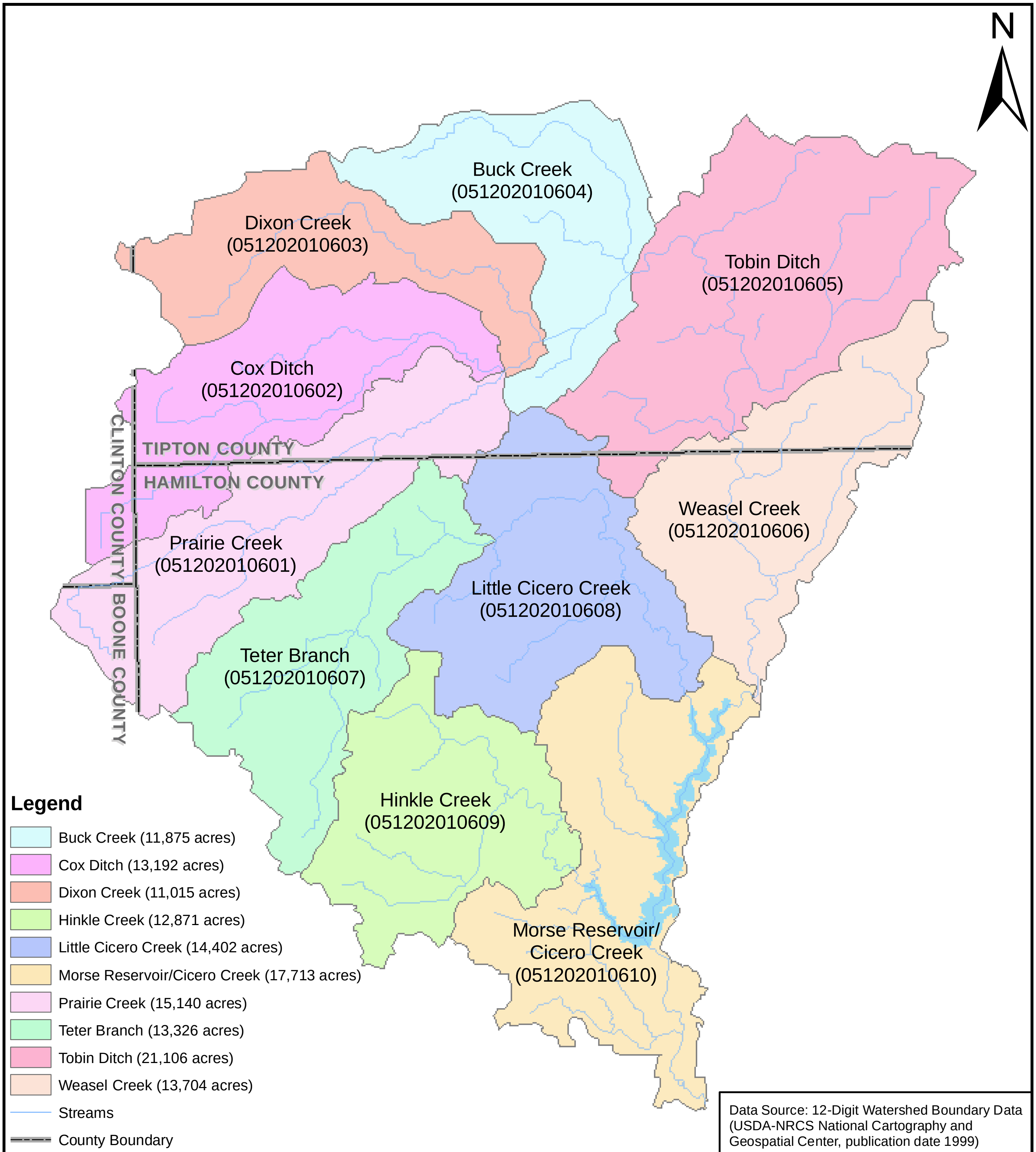
Table 7: Other Planning Efforts		
Watershed Management Plans	**Approved MS4 Communities**	
Little Cicero Creek	Boone County	
Bacon/Prairie Ditch	Hamilton County (SWQMP 1/31/2005)	
Buck Creek/Campbell Ditch	Town of Arcadia	
	Town of Cicero (SWQMP 1/31/2005)	
Comprehensive Plans	City of Noblesville (SWQMP 5/2005)	
Boone County	City of Westfield (SWQMP 2/2/2005)	
Hamilton County		
Town of Cicero	**Long Term Control Plans (for Combined Sewer Overflows)**	
City of Noblesville	Community	No. of CSO's
City of Westfield	City of Noblesville	7
	City of Tipton	8

Part Two of the Watershed Inventory

Hydrologic unit codes (HUCs) were developed by the United States Geological Survey (USGS) in cooperation with the United States Water Resource Council (USWRC) and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Most federal and state agencies use this coding system. HUCs are a way of cataloguing portions of the landscape according to their drainage. Landscape units (watersheds) are nested within each other and described as successively smaller units. The hydrologic code attached to a specific watershed is unique, enabling different agencies to have common terms of reference and agreement on the boundaries of the watershed. These commonly understood boundaries foster understanding of how landscapes function, where water quality problems should be addressed, and who needs to be involved in the planning process. The Morse Reservoir/Cicero Creek Watershed in itself is a 10-digit HUC 0512020106 that, for this project, consists of ten (10) 12-digit Hydrologic Unit Codes or HUCs (Table 8, Exhibit 10).

Table 8: 12-Digit Hydrologic Unit Codes			
Subwatershed Name	**HUC**	**Acres**	**Percentage**
Prairie Creek	051202010601	15,140	10.49%
Cox Ditch	051202010602	13,192	9.14%
Dixon Creek	051202010603	11,015	7.63%
Buck Creek	051202010604	11,875	8.23%
Tobin Ditch	051202010605	21,106	14.62%
Weasel Creek	051202010606	13,704	9.49%
Teter Branch	051202010607	13,326	9.23%
Little Cicero Creek	051202010608	14,402	9.98%
Hinkle Creek	051202010609	12,871	8.92%
Morse Reservoir/Cicero Creek	051202010610	17,713	12.27%

Available water quality, biological and landuse information was collected for the watershed. This information was then analyzed on a subwatershed (HUC 12) scale in order to prioritize and rank the subwatersheds relative to one another. A list of the data and studies utilized for this Watershed Management Plan are detailed below, however the results/analysis are discussed in the respective 12-digit HUC subwatershed sections.



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TITLE: **Subwatershed Map**

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**

BASE LAYER: HUC 12 Boundaries

PROJECT NO.: 09005

EXHIBIT: 10

SHEET: 1 OF: 1

CLIENT: Upper White River Watershed Alliance
P.O. Box 2065
Indianapolis, Indiana 46206

QUADRANGLE: N/A

DATE: 09/27/10

SCALE: 1" = 15000'

Available Data and Studies

Little Cicero Creek Watershed Management Plan

The Hamilton County Surveyor's Office obtained an IDEM Section 319 grant to complete a Watershed Management Plan for the Little Cicero Watershed. The project included two 14-digit HUCs, the Bennett Ditch/Taylor Creek subwatershed (13,449 acres) and the Teter Branch subwatershed (13,324) which are included in the 12-digit HUC 051202010608 Little Cicero Creek Subwatershed. There are six main streams within the project area: Jay Ditch, Symons Ditch, Ross Ditch, Bennett Ditch, Taylor Creek and Little Cicero Creek.

Jay Ditch, Symons Ditch and Ross Ditch were identified in the WMP as being critical for having the most degraded water quality while contributing the highest pollutant loads to the watershed. The Little Cicero Creek Watershed Management Plan was completed in February of 2007.

This report was used only for comparison purposes as the methodologies used for determining pollutant loads and ultimately the critical areas was based on limited data.

Bacon/Prairie Ditch Watershed Management Plan

The Bacon/Prairie Ditch Watershed Management Plan was obtained through the Upper White River Watershed Alliance website. The Tipton County Soil and Water Conservation District was the project coordinator for the Bacon/Prairie Ditch Watershed Management Plan (HUC 05120201080060). This watershed is located in the south central portion of Tipton County, is approximately 12,423 acres and is a part of the 12-digit Tobin Ditch Subwatershed. The Plan included analyses on Stone Hinds Ditch, Schlater Ditch, Ressler Ditch, Sowers Ditch and Cicero Creek. This watershed is approximately 87% cropland with the majority of corn being conventional tilled and beans being no till.

Five priority water quality issues were identified as a result of the plan.

1. Combined Sewer Overflows (CSO's)
2. Septic Systems
3. Streambank Erosion
4. Agricultural/Residential Chemical Runoff
5. Industrial Discharges

The plan was submitted to IDEM for comments in May of 2003.

Buck Creek/Campbell Ditch Watershed Management Plan

A copy of the Buck Creek/Campbell Ditch Watershed Management Plan was not obtainable and therefore a summary of this WMP is not included.

IDEM 303(d) List

The IDEM Assessment Branch evaluates all the data they collect to develop the 305(b) report, and the 303(d) list. The 305(b) report is a document that summarizes the quality of surface waters throughout Indiana and the designated uses of these waters. Evaluations are based on different stream segments or lakes, and are discussed in the context of watersheds. To complete the evaluation, IDEM considers not only the data they collect, but data collected by other entities as long as that data meets the rigorous quality controls that IDEM uses in the collection and analysis of their own data. Other data that does not meet these standards may be used informally to validate data that does meet the quality controls.

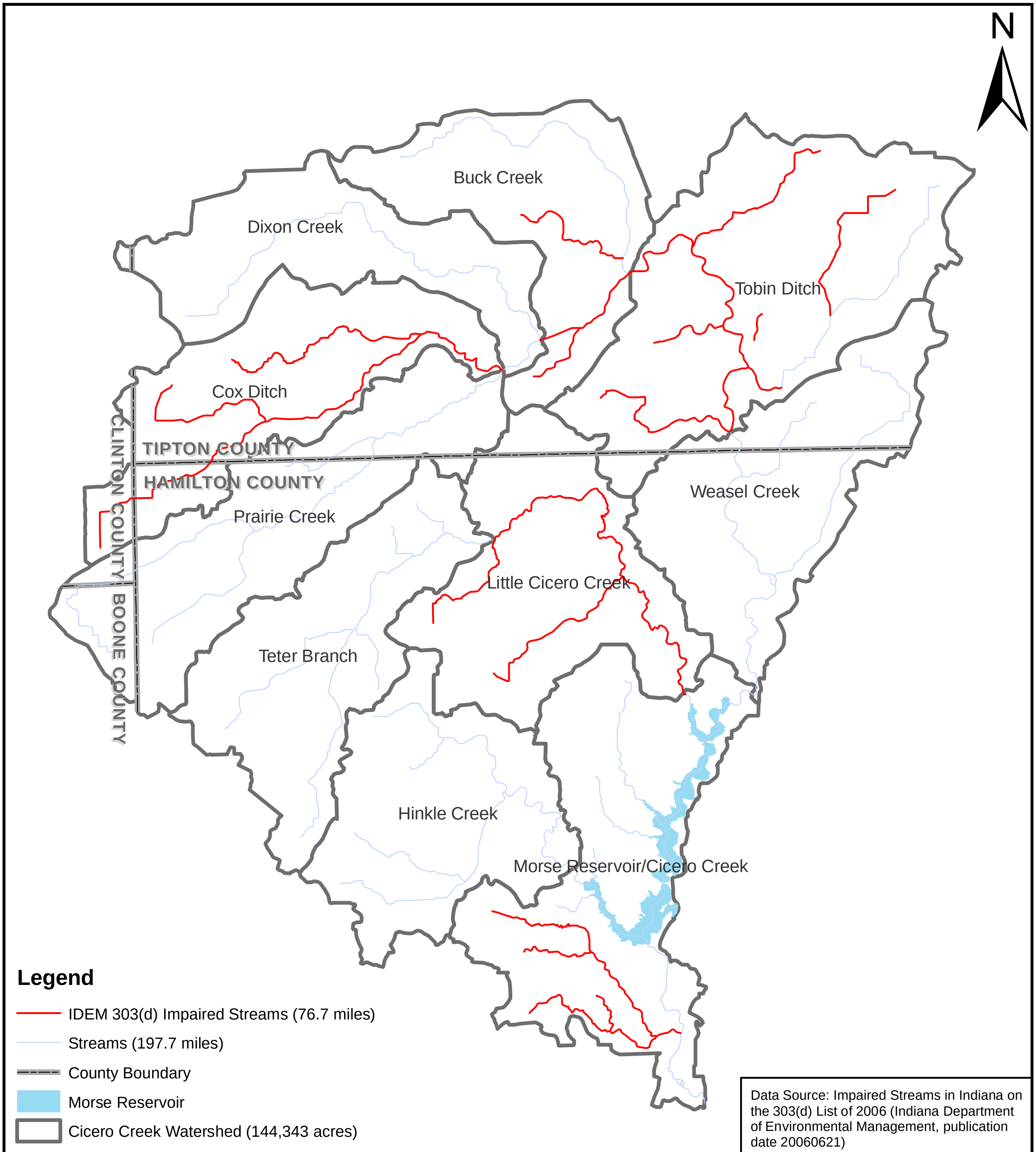
Section 303(d) of the 1972 Federal Clean Water Act (CWA) requires each state to identify those waters that do not meet the state's water quality targets for designated uses. These streams are to be listed on the State's 303(d) list of impaired waters. For such waters, the State is required to establish total maximum daily loads (TMDLs) to meet the state water quality targets. As defined by IDEM, a TMDL established under section 303(d) of the federal Clean Water Act, is a calculation of the maximum amount of pollutant that a waterbody can receive and still meet water quality targets, and allocates pollutant loadings among point and non-point sources.

To determine if a waterbody should be listed on Indiana's 303(d) list, the IDEM Assessment Branch has developed a surface water quality monitoring strategy to assess the quality of Indiana's ambient waters. The goals of this monitoring strategy are: measure the physical, chemical, bacteriological and biological quality of the aquatic environment in all river basins and identify factors responsible for impairment; assess the impact of human and other activities on the surface water resource; identify trends through the analysis of environmental data; and provide environmental quality assessment to support water quality management programs. Known impairments in this watershed are specified in Part Two of the Watershed Inventory: Subwatershed Summaries.

Once data is collected, waterbodies are evaluated by a team of water-quality professionals within IDEM to determine if the waterbodies meet the water-quality standards set by the State, and that all designated uses are met. If a stream fails to meet these requirements, as outlined in the 303(d) listing methodology, the waterbody is considered impaired and must be listed on the 303(d) list, and a TMDL developed to address the problem. Draft TMDLs have been determined for pollutants that do not already have state regulated targets. This information is provided within the appropriate pollutant section within this plan. The streams that have been evaluated by IDEM and were determined to be impaired streams are shown on Exhibit 11. The 303(d) list indicates that the streams within the watershed are impaired for nutrients, *E.coli* algae, and impaired biotic communities. The reservoir is impaired for algae, taste/odor and PCBs in fish tissue. These Impaired streams are also shown on the subwatershed exhibits as well as a summary of the specific streams within each subwatershed are impaired. It should be noted that if a stream is not listed on the 303(d) list it may be impaired; however the data (or lack thereof) does not indicate the impairment at the time of publication.

IDEM Water Quality Sampling

Available water quality data from the Indiana Department of Environmental Management (IDEM) for the Morse Reservoir/Cicero Creek Watershed between 1992 and 2006 was obtained and evaluated to determine where water-quality problems were noted in the watershed (Appendix F).



Data Source: Impaired Streams in Indiana on the 303(d) List of 2006 (Indiana Department of Environmental Management, publication date 20060621)

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TITLE: **IDEM 303(d) Impaired Streams Map**

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**

BASE LAYER: 303(d) Impaired Streams

PROJECT NO.: 09005

EXHIBIT: 11

SHEET: 1 OF: 1

CLIENT: Upper White River Watershed Alliance
P.O. Box 2065
Indianapolis, Indiana 46206

QUADRANGLE: N/A

DATE: 09/27/10

SCALE: 1" = 15000'

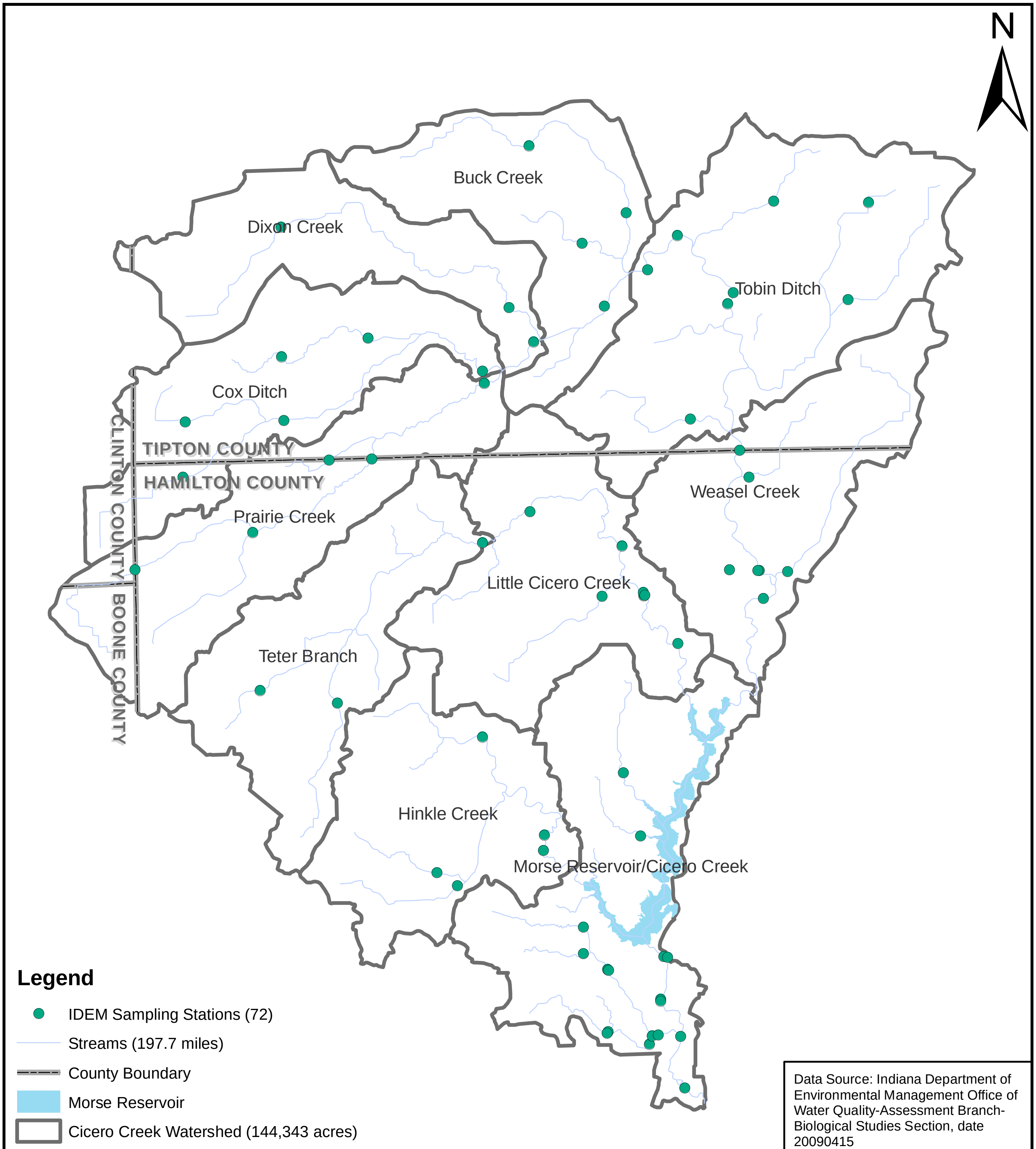
The IDEM data available within the watershed is listed below.

- 1991, 1996, 2001, 2006 Fish Tissue
- 1992, 2001 Macroinvertebrates
- 1996, 2001 Sediment Bio
- 1996 Synoptic
- 1996 Watershed
- 1999 - 2009 Fixed Station
- 2001 Cicero Creek Assessment
- 2001, 2006 Corvallis
- 2001 Corvallis Biological
- 2001 *E. coli* – Upper WFWR
- 2001 W Fk White River in Hamilton Co Assessment
- 2006 Corvallis *E. coli*
- 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL

It should be noted that five IDEM sampling locations were within Morse Reservoir. Four sampling locations were identified in the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL study with data analyzed only for *E. coli*. One sampling location was noted in the 2001 *E. coli* – Upper WFWR Study and dissolved oxygen, temperature, pH, specific conductivity, turbidity and *E. coli* were analyzed at this location. The information associated with these locations was omitted in the data analysis portion of the WMP as it is reservoir specific and does not accurately depict water quality within the subwatershed. This information is, however, included in the Appendix for information and future use purposes.

The IDEM studies included 72 sampling locations throughout the watershed (see large exhibit in Appendix F). Not all samples within the subwatersheds were equally distributed. For example, Teter Branch is represented by only three IDEM sampling locations with information on *E.coli* only. In comparison, the Morse Reservoir/Cicero Creek subwatershed has 17 IDEM sampling locations, 15 of which are downstream of the reservoir and therefore do not provide a complete understanding of the water quality impairments that may be affecting the reservoir. Each subwatershed exhibit contains the locations of all sampling sites within the subwatershed for comparison purposes. The data that was analyzed included field data, general chemistry data and metals data where available. In comparison to the CIWRP data, the IDEM data was all inclusive without a differentiation between base flow or storm flow events. Therefore, an overall average approach of this data was used in order to get a better depiction of how the watershed actually functions at any given time. Site locations were spread throughout the watershed as shown on Exhibit 12 and the data was analyzed on a subwatershed scale as detailed in each subwatershed section.

Several water quality parameters which have standard targets associated with them were screened to determine which subwatersheds demonstrated impairments or degradations. The water quality parameters evaluated from the historical data set and their suggested targets are listed below with a detailed explanation of the parameter and the impairment that it may indicate. All parameters were summarized as means for comparison to water quality targets and other subwatersheds.



Data Source: Indiana Department of Environmental Management Office of Water Quality-Assessment Branch-Biological Studies Section, date 20090415

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TITLE: **IDEM Sampling Stations**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: IDEM Sampling Locations	PROJECT NO. 09005	EXHIBIT: 12	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

Dissolved Oxygen – Dissolved oxygen is the gaseous form of oxygen and is essential for respiration of aquatic organisms (e.g. fish and plants). Dissolved oxygen enters water by diffusion from the atmosphere and as a byproduct of photosynthesis by algae and plants. Oxygen saturation in water would equal 100% if equilibrium were reached. Values greater than 100% saturation indicate photosynthetic activity within the water or highly turbulent water. Large amounts of dissolved oxygen in the water indicate excessive algae growth. Dissolved oxygen is consumed by respiration of aquatic organisms and during bacterial decomposition of plant and animal matter. Levels of Dissolved Oxygen less than 4 mg/L and greater than 12 mg/L exceed the water quality target for Dissolved Oxygen as described in Indiana Administrative Code (IAC) 327 IAC 2-1.5-8.

Escherichia coli (E. coli) – *E. coli* is a member of the fecal coliform group of bacteria. When this organism is detected within water samples, it is an indication of fecal contamination. *E. coli* is an indigenous fecal flora of warm-blooded animals. Contributions of detectable *E. coli* colonies may appear within water samples due to the input from human or animal waste. Failing septic tanks and wildlife are some known sources of *E. coli* impairments in waterbodies. Common sources of animal waste are agricultural feedlots (pigs, cattle, etc.), pet waste, or bird waste (such as Canada geese or gulls). Rain storm events or snow melts frequently wash waste and the associated *E. coli* into surface water systems. Rain storm events that exceed the capacity of local sewer systems result in combined sewer overflows that can also be a source of *E. coli*. Land use within the Morse Reservoir Watershed is predominately agricultural and requires drain tiles due to soil type. Field tiles are not sources of *E. coli* but they can carry *E. coli* from land applied manure and runoff from the fields and pastures. The single sample state standard in Indiana for *E. coli* according to Indiana Administrative Code (IAC) 327 IAC 2-1-6 is 235 CFU/100 mL. The measure of CFU per 100 mL means the count of colony forming units (CFU) that exist in 100 milliliters of water.

After 2000 IDEM began using the Most Probable Number (MPN) method instead of CFU for measuring *E. coli.* Based on a study performed by the Department of Statistical Science at Duke University, estimating procedures for MPN and CFU have intrinsic variability and are subject to additional uncertainty arising from minor variations in experimental protocol. It has been observed empirically that the standard multiple-tube fermentation (MTF) decimal dilution analysis MPN procedure is more variable than the membrane filtration CFU procedure, and that MTF derived MPN estimates are somewhat higher on average than CFU estimates, on split samples from the same water bodies.

Nitrogen – Nitrogen is an essential nutrient for organism growth. Nitrogen can enter water bodies from the air and as inorganic nitrogen and ammonia for use by bacteria, algae and larger plants. The four common forms of nitrogen are:

- Nitrite (NO2-) – is an intermediate oxidation state of nitrogen, both in the oxidation of ammonia to nitrate and in the reduction of nitrate. Nitrite is a negative charged ionized form of nitrogen (anion).
- Nitrate (NO3-) – Nitrate generally occurs in surface runoff from agricultural fields and can also be conveyed through some groundwater systems. In excessive amounts, it contributes to the illness known as methemoglobinemia in infants. Nitrate is a negative charged ionized form of nitrogen (anion).

- Ammonia (NH3) and Ammonium (NH4+ or simply NH4) – Ammonia has a polar charge and can be toxic to fish. Ammonium is a positive charged ionized form (cation) and is considered nontoxic. Ammonia is present naturally in surface waters. Bacteria produce ammonia as they decompose dead plant and animal matter. The concentration of ammonia is generally low in groundwater because it adheres to soil particles and clays and does not leach readily from soils. It can also be found in some areas with industrial discharges.
- Organic nitrogen (TKN) – is defined functionally as organically bound nitrogen in the trinegative oxidation state. Organic nitrogen includes nitrogen found in plants and animal materials, which includes such natural materials as proteins and peptides, nucleic acids and urea. In the analytical procedures, Total Kjeldahl Nitrogen (TKN) determines both organic nitrogen and ammonia. TKN is determined in the same manor as organic nitrogen with the exception that the ammonia is not driven off before the digestion step.

Levels of Nitrate and Nitrite greater than 10 mg/L exceed the water quality target for those waters designated as a drinking water source for Nitrate and Nitrite as described in Indiana Administrative Code (IAC) 327 IAC 2-1-6. However, for this analysis, levels above 1.6 mg/L were evaluated as the US EPA nutrient criterion for this eco-region.

pH (Acidic and Alkaline) – The pH of a water body reflects the hydrogen ion activity in the water body. pH is defined as the –log [H+]. A low pH signifies an acidic medium (lethal effects of most acids begin to appear at pH = 4.5) while a high pH signifies an alkaline medium (lethal effects of most alkalis begin to appear at pH = 9.5). Neutral pH is 7. The actual pH of a water sample indicates the buffering capacity of that water body. Levels of pH less than 6 and greater than 9 exceed the water quality target for pH as described in Indiana Administrative Code (IAC) 327 IAC 2-1.5-8. pH values can change rapidly when algae is present. Algae removes dissolve carbon dioxide during photosynthesis. Carbon dioxide is acidic and therefore this process will cause pH values to rise.

Phosphorus – Phosphorus is an essential nutrient for organism growth. Phosphorus can be found in dissolved and sediment-bound forms. However, phosphorus is often locked up in all plant life, including algae. In the watershed, phosphorus is found in fertilizers and in human and animal wastes. The availability of phosphorus determines the growth and production of algae and makes it a limiting nutrient in the system. Levels of Total Phosphorus greater than 0.3 mg/L exceed the IDEM statewide draft TMDL target, while levels above 0.076 mg/L exceed the US EPA recommended water quality target. For this analysis, subwatersheds were evaluated based on EPA's recommended target.

Total Suspended Solids (TSS) – Total suspended solids is a water quality measurement which refers to the portion of total solids retained by a filter, where as total dissolved solids (TDS) refers to the portion that passes through the filter. The principal factors affecting separation of TSS and TDS are the type of filter holder, pore size, porosity, area, and thickness of the filter and the physical nature, particle size, and amount of material deposited on the filter. Measurements of TSS can vary widely in watershed streams based on stream flow at the time of sampling. TSS measurements and modeling are frequently used to represent sediment loading. Levels of TSS greater than 30 mg/L exceed the IDEM statewide draft TMDL target.

Atrazine – Atrazine is an herbicide used to stop pre- and post-emergence broadleaf and grassy weeds in major agricultural crops, especially corn. Atrazine is the most widely used herbicide in conservation tillage systems, which are designed to prevent soil erosion. It may also be used in conventional tillage applications. Its use is controversial due to its effects on nontarget species, such as on amphibians, and because of widespread contamination of waterways and drinking water supplies. There are also thought to be implications for human birth defects, low birth weights and menstrual problems. Levels of Atrazine greater than 0.003 mg/L exceed the US EPA drinking water standards.

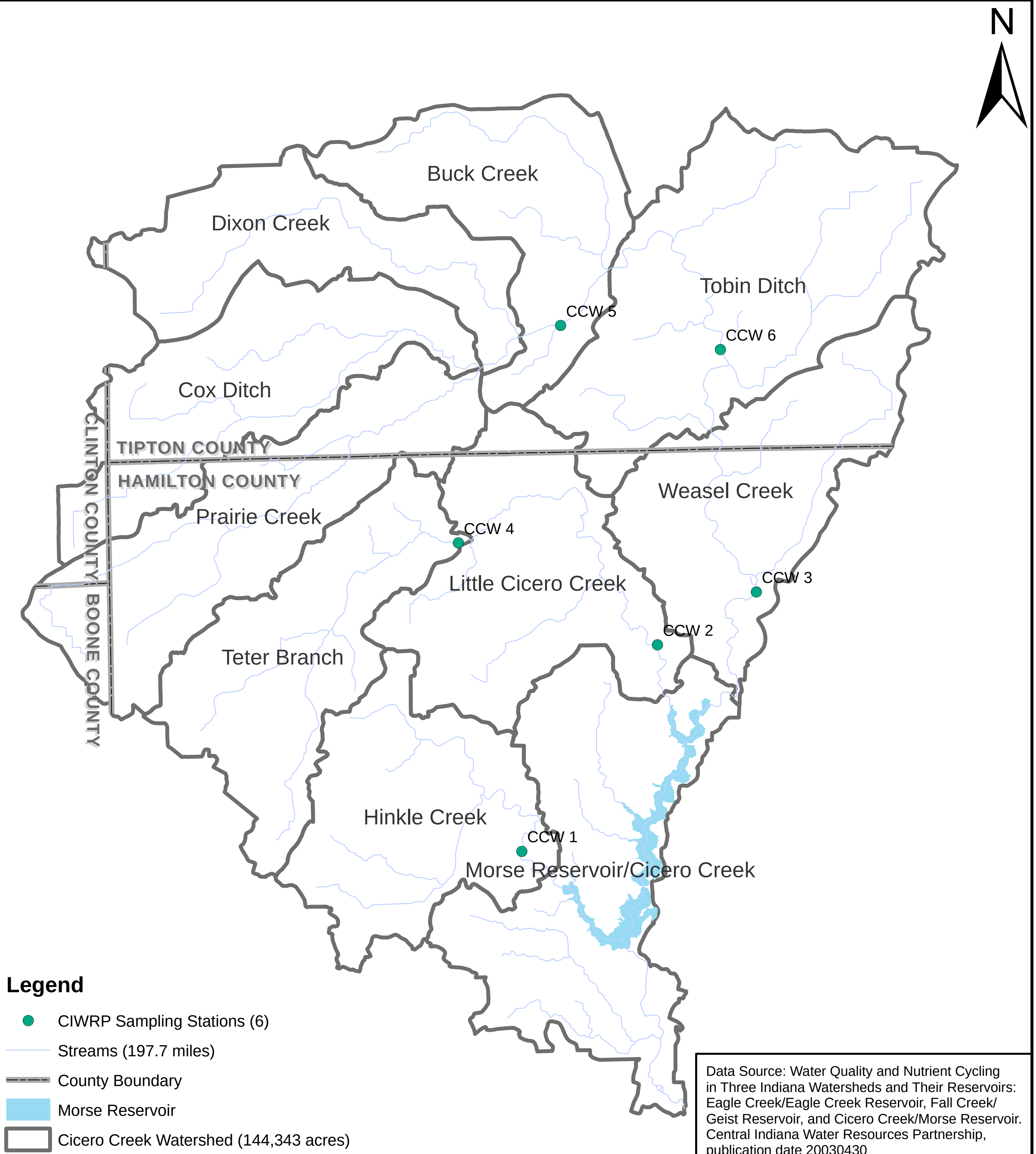
Central Indiana Water Resources Partnership (CIWRP) Studies

Central Indiana Water Resources Partnership is a long-term research and development partnership between IUPUI's Center for Earth and Environmental Sciences (CEES) and Veolia Water Indianapolis, LLC. In 2003, CIWRP completed a study encompassing Morse Reservoir and the Cicero Creek watershed (Appendix G). Water quality samples were collected within the watershed during seasonal base and event flow throughout 2003 at locations shown on Exhibit 13. Data collected for the CIWRP study was obtained for analysis for this watershed management plan.

The CIWRP Study included six sampling locations within the Morse Reservoir/Cicero Creek Watershed. Based on the sampling locations, not all subwatersheds could be defined by a sample location. In order to use this data for subwatershed comparisons, some subwatersheds were grouped together and represented by a single sampling site. Several water quality parameters which have standard targets associated with them were screened to determine which subwatersheds demonstrated impairments or degradations. All parameters were summarized as means for comparison to water quality targets and other subwatersheds.

Based on the information obtained for the CIWRP 2009 Research Program website, CIWRP also continues to do blue-green algae research within Morse Reservoir which recently has included documentation on the occurrence of taste and odor compounds as well as cyanotoxins. Exposure to a blue-green algae during recreational activities such as swimming, wading, and water-skiing may lead to rashes, skin, eye irritation, and other uncomfortable effects such as nausea, stomach aches, and tingling in fingers and toes.

There are three main goals for this continued research: 1) to document algal community composition and abundance; 2) to determine the relationship between physical and chemical reservoir conditions and algal community structure and abundance; and 3) to document the occurrence of cyanobacterial toxins and taste and odor compounds. Results of the 2008 study provided important information regarding differences and similarities of phytoplankton community structure and the occurrence of cyanotoxins and taste and odor metabolites in the reservoir. A summary of the 2008 research project as well as the presentation given by Dr. Lenore Tedesco, Nicolas Clercin (CEES) and Mark Gray (Veolia Water) on the findings specifically in Morse Reservoir can be found in Appendix G. The Morse Reservoir study sites included seven sites. All seven sites were evaluated for water



Data Source: Water Quality and Nutrient Cycling in Three Indiana Watersheds and Their Reservoirs: Eagle Creek/Eagle Creek Reservoir, Fall Creek/ Geist Reservoir, and Cicero Creek/Morse Reservoir. Central Indiana Water Resources Partnership, publication date 20030430

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TITLE: **CIWRP Sampling Stations**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: CIWRP Sampling Locations	PROJECT NO. 09005	EXHIBIT: 13	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

quality parameters and two of these sites were evaluated for algal toxins. Samples were collected 11 times from May to November.

V3 Reservoir Shoreline Investigation

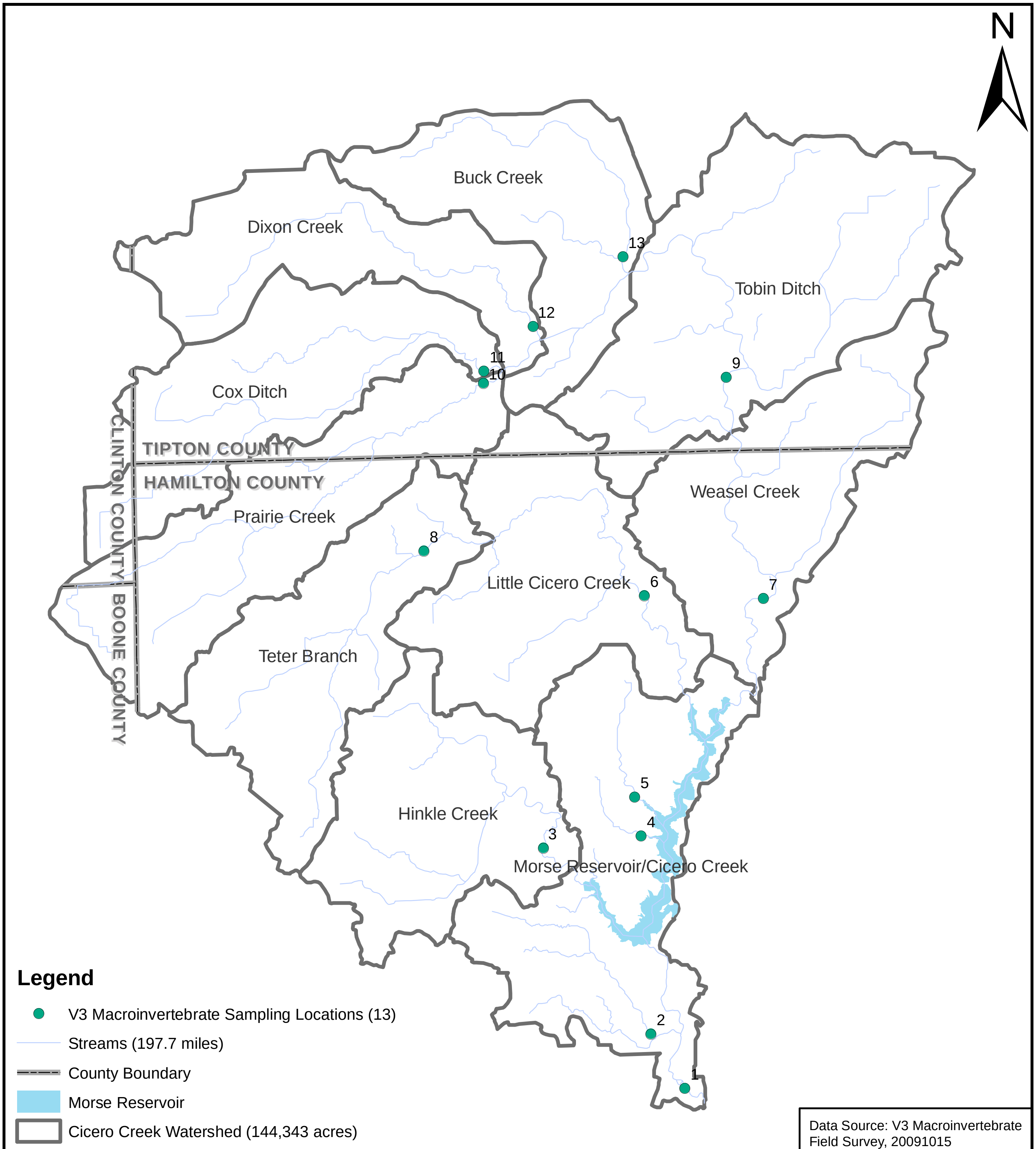
V3 completed at Reservoir Shoreline Investigation of Morse Reservoir in June 2009, using both field observations and aerial photography. During the survey, areas of unprotected shoreline were identified in order to gain an understanding of where erosion may be a concern as well as areas that can be included in implementation projects. Unprotected areas ranged from naturally eroding shoreline (e.g. tree coverage prohibiting vegetation growth with solid root mass for stabilization) to lack of sediment and erosion control measures causing eroded shoreline due to construction activities (e.g. Rule 5 violations). All other areas were considered unprotected as they all have the potential for erosion. An exhibit showing the areas of unprotected shoreline is included in Appendix K along with a copy of the field notes. Specific areas of erosion were not identified in this exhibit as the entire reservoir was not field verified and this information could not be ascertained from an aerial photograph.

V3 Biological Sampling

V3 completed a macroinvertebrate study in October 2009 in order to obtain a watershed wide view of the health of the streams based on biological data. As stated in IDEM's Surface Water Quality Assessment Program – Macroinvertebrate Community Assessment Program objectives, any biological community assessment is a measurement of an ecosystem and how it responds to environmental stresses and gives an overall picture of the conditions, at the point being assessed. When conducted in conjunction with chemical analysis of specific water quality parameters and aquatic habitat quality, this information can provide a complete and comprehensive understanding of the ecological quality of the watershed.

Thirteen stations within the Morse Reservoir/Cicero Creek Watershed were evaluated (Appendix H). Station 14, located on Turkey Creek in Tipton County, was used as the high quality reference station outside the watershed for comparative analysis. Sampling locations were chosen based on ease of access from bridge crossings and spatial locations throughout the watershed and were generally located at the most downstream location within each subwatershed. Prairie Creek, Cox Ditch, Dixon Creek, Buck Creek, Tobin Ditch, Weasel Creek, Teter Branch, Little Cicero Creek and Hinkle Creek subwatersheds all had one V3 sampling location. Morse Reservoir/Cicero Creek subwatershed had four V3 sampling locations.

Table 9 indicates the locations of each sample site. Sample locations are shown on Exhibit 14 and on each individual subwatershed exhibit.



Data Source: V3 Macroinvertebrate Field Survey, 20091015

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TITLE:	**V3 Macroinvertebrate Sampling Stations**
PROJECT:	**Morse Reservoir/Cicero Creek Watershed Management Plan**
BASE LAYER:	V3 Macro Sampling Locations
CLIENT:	Upper White River Watershed Alliance, P.O. Box 2065, Indianapolis, Indiana 46206
PROJECT NO.	09005
EXHIBIT:	14
SHEET:	1 OF: 1
QUADRANGLE:	N/A
DATE:	09/27/10
SCALE:	1" = 15000'

Table 9: V3 Macroinvertebrate Sampling Stations		
Station #	**Stream Name**	**Location**
1	Cicero Creek	River Avenue and 160th Street
2	East Fork Sly Run	Oakmont and SR 32
3	Hinkle Creek	216th Street and Hinkle Creek Rd
4	Cicero Creek	Royal Pine and Cedar
5	Bear Slide Creek	226th Street and Schulley
6	Little Cicero Creek	266th Street and Gwinn Rd
7	Cicero Creek	Mount Pleasant and 266th Street
8	Little Cicero Creek	276th Street and I-31
9	Cicero Creek	CR 450 S
10	Prairie Creek	CR 500 W
11	Cicero Creek	CR 500 W
12	Dixon Creek	CR 400 W
13	Buck Creek	CR 200 S
14*	Turkey Creek (Tipton County)	SR 213 and CR 650 N

Table 10 is provided to show what other samples or observations (e.g. IDEM, CIWRP or Windshield Survey) were taken/made at the V3 sampling locations. This information will help to compare the biological data to the water chemistry data where applicable as needed for implementation of the plan.

Table 10: V3 Sample Locations vs. Other Sampling Locations			
Station #	**IDEM**	**CIWRP**	**Windshield Survey**
1	Y	N	Y
2	Y	N	N
3	Y	Y	Y
4	Y	N	N
5	N	N	N
6	Y	N	Y
7	Y	N	Y
8	N	N	N
9	N	N	Y
10	Y	N	Y
11	Y	N	Y
12	N	N	Y
13	N	N	N

Macroinvertebrate monitoring followed the US EPA Rapid Bioassessment Protocol single habitat, family level approach method. The single habitat approach involves sampling riffle/run areas within the sampling reach. A composite sample was made from two kick samples. The collected organisms were sorted and identified to the family level using appropriate field guides. In addition, macroinvertebrate vouchers were sent to Purdue University to verify that all taxon identifications are correct. This collection procedure provides representative macroinvertebrate fauna from riffle/run substrate in the sampling reach.

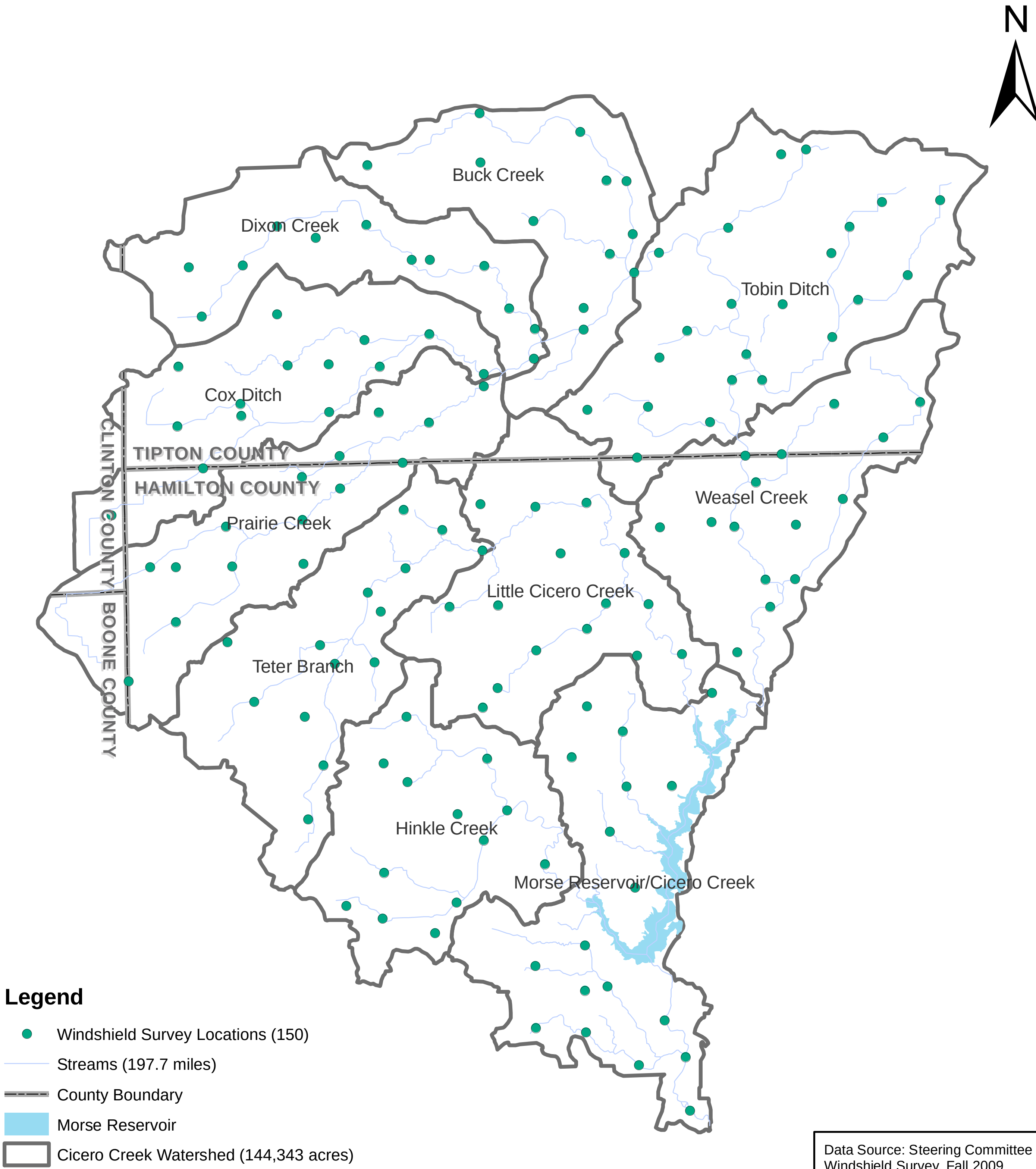
Macroinvertebrate data was analyzed based on IDEM's Macroinvertebrate Index of Biotic Integrity (mIBI) protocols that are consistent with IDNR LARE and US EPA collection procedures. The mIBI is designed to assess biotic integrity directly through ten metrics which evaluate a macroinvertebrate community's species richness, evenness, composition, and density within the stream. These metrics include the family-level HBI (Hilsenhoff's Family Biotic Index), number of taxa, number of individuals, Percent Dominant Taxa, EPT index, EPT count, EPT count to total number of individuals, EPT count to Chironomid count, Chironomid count, and number of individuals per number of squares sorted. Values for the ten metrics are compared with corresponding ranges and a rating of 0, 2, 4, 6, or 8 is assigned to each metric. A final score of 0 – 2 is a severely impaired stream, 2 – 4 is moderately impaired, 4 – 6 is slightly impaired and 6 – 8 is not impaired for biological quality. The average of these ratings gives a total mIBI score. When more than one data set was available, the mIBI scores were summarized as means for comparison to other subwatersheds. The mIBI impairments for each subwatershed vary and were not included in the main WMP document; however, site specific impairment information is included in the Appendix.

Windshield Survey

A windshield survey is a type of watershed assessment conducted by an observer traversing the watershed in a motorized vehicle. Real time data is then collected at predetermined stream crossings and accessible locations. Survey locations were split up per subwatershed based on the size of the subwatershed with a total of 100 waterway crossing points and 50 land points. The locations of the waterway crossing points were determined based on ease of access to the streams at roadway crossings (e.g. bridge and/or culvert crossings). The locations of the land points were also determined based on ease of access and were generally located at roadway crossings within the subwatershed. As shown in Exhibit 15, all of the locations identified for windshield survey analysis are spread out throughout each subwatershed in order to provide an overall representation of the subwatershed. The Windshield Survey index maps that show each survey location and its number/label are included in Appendix I.

Observations were made during October/November 2009 by Steering Committee volunteers. Observations including general site information (e.g. location and weather), land use, land odor, evidence of best management practices, water color/appearance, water odor, evidence of algae, streambank erosion, stream buffers & type, in stream debris, available shade/stream cover and in stream habitat were recorded for 150 locations throughout the watershed (Exhibit 15) on standardized survey forms (Appendix I). While all of this information is valid for an overall understanding of the subwatershed, five of the major parameters (animal access, tillage type, streambank erosion, stream buffers and in-stream debris) were used as a part of the subwatershed assessments and the identification of subwatershed priority areas and specific source critical areas. The remainder of the information obtained during the windshield survey should be reevaluated during the feasibility phases of plan implementation.

Example of Rip-Rap Stabilized Streambank



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TITLE: **Windshield Survey Stations**

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**

BASE LAYER: Windshield Survey Locations

PROJECT NO. 09005

EXHIBIT: 15

SHEET: 1 OF: 1

CLIENT: Upper White River Watershed Alliance
P.O. Box 2065
Indianapolis, Indiana 46206

QUADRANGLE: N/A

DATE: 09/27/10

SCALE: 1" = 15000'

Streambank erosion is a natural process within a stream system; however erosion is often accelerated through alterations to the natural system (e.g. changes in landuse, animal access to streams, etc). This accelerated erosion can contribute high sediment loads to the receiving stream, which is a concern due both to the impacts of the sediment itself, and of the contaminants that often bind with, or otherwise reside in the sediment. Suspended sediment is a component of the amount of particulate matter in the water column and contributes to increases in the total suspended solids values, making it more difficult and often times impossible for fish and aquatic macroinvertebrates to live. The sediment itself can smother aquatic habitat and therefore negatively affect the aquatic flora and fauna. Sediment can also transport nutrients, especially phosphorus that tends to adhere to sediment particles causing excess algal growth leading to the large swings in DO. Streambank erosion was assessed on a subwatershed scale at each of the waterway crossing points. Identification of streambank erosion was broken up into the following categories: absent, stabilized (rip-rap, coir log, etc.), present > 3 feet tall and present < 3 feet tall.

Example of Absent Stream Buffer

Stream buffers are areas of natural vegetation between a surface water body and the surrounding land use. Buffers were only identified as adequate if they were at least ten feet in width. As shown on the example picture, Absent Buffers are those where the agricultural land or development is farmed/built up to the top of the stream bank leaving no possibility of runoff from being filtered through a grassed or treed area before entering the stream. Runoff from the surrounding land may carry sediment and organic matter, and plant nutrients and pesticides that are either bound to the sediment or dissolved in the water. Buffers provide water quality protection by reducing the amount of pollutants in the runoff before it enters the water body. Constructed filter strips can also provide localized erosion protection and habitat for wildlife. Stream buffers were assessed on a subwatershed scale at each of the waterway crossing points. Identification of buffers was broken up into the following categories: absent, present > 50 feet and present (minimum 10 feet) < 50 feet. In areas of agricultural drain tile, the effectiveness of stream buffers can be lower than in areas without these drainage systems especially for contaminants that are transported largely as dissolved load such as nitrate and certain pesticides, including Atrazine.

In-stream debris was also noted during the windshield survey. In-stream debris can inhibit wildlife and aquatic habitat, increase flooding risks, and introduce additional pollutants. This information is valuable for the purposes of determining public education opportunities. Debris was assessed on a subwatershed scale based on the presence and type of debris (trash, deposits, log jam, etc) identified during the windshield survey. Animal access was assessed on a subwatershed scale based on the presence of animals or indicators of access.

Example of Animal Access to Stream

Nonpoint Source Pollution Modeling

Nonpoint source pollution is a type of pollution generated from diffused sources in both public and private domains. As defined by EPA, the pollution from nonpoint sources originates from urban runoff, construction activities, manmade modification of hydrologic regime of a watercourse (e.g. retention, detention, channelization, etc.), silviculture, mining, agriculture, irrigation return flows, solid waste disposal, atmospheric deposition, stream bank erosion, and individual or zonal sewage disposal. Therefore, nonpoint pollution sources have their origin in a wide spectrum of public and private activities and, when not known or properly controlled, could affect, in a large percentage, the water quality in a certain area.

Since runoff from the rainfall flows over or through the land and collects pollutants and nutrients prior to entering waterways, the overall characteristics and land use types of a watershed greatly influences the water quality. Each land use type includes the cumulative effects of various land covers, and natural and man-made activities. Therefore, each land use type can have an adverse affect on water quality, by contributing different pollutant amounts and concentrations. The cumulative effect of this pollution throughout the watershed represents the contribution of nonpoint source pollution.

Nonpoint source pollution management is highly dependent on hydrologic simulation models, and use of computer modeling is often the only viable means of providing useful input information for adopting the best management decisions. As previously mentioned, the nonpoint pollution sources are generated by activities that are spatially distributed on the analyzed watershed or study area. Due to this spatial distribution of nonpoint pollution sources, the computation models used to study pollutant transport and stream bank erosion require large amounts of data for analysis in even a small watershed.

For the Morse Reservoir/Cicero Creek Watershed, a tabular based non-point source pollution loading model was used to assess the nonpoint source pollution of three main pollutant parameters (Total Nitrogen, Total Phosphorus and Total Sediment) that have been identified as elements of concern by both stakeholders and water sampling events (Appendix L). This model is known as the Spreadsheet Tool for Estimating Pollutant Load (STEPL). STEPL employs simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs).

For each subwatershed, the annual nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff water as influenced by factors such as the land use distribution and management practices. The annual sediment load (sheet and rill erosion only) is calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using the known BMP efficiencies.

The STEPL model was executed for each HUC 12 subwatershed within the Morse Reservoir/Cicero Creek Watershed. It should be noted that all computation models have assumptions and limitations. Therefore, the provided analytical results may not represent the exact pollution loads. In these conditions, even if the results are relative, they still can provide useful information for targeting and prioritizing subwatersheds for Best Management Practices (BMPs).

It is also important to note that the above presented nonpoint source modeling does not specifically include bank erosion and mass wasting, which can contribute additional pollutant loads of sediment, nitrogen, and phosphorus. However, certain landuses within the model have input values that incorporate some bank erosion that is typical for that land practice.

NPDES Permitted Facilities & Confined Feeding Operations

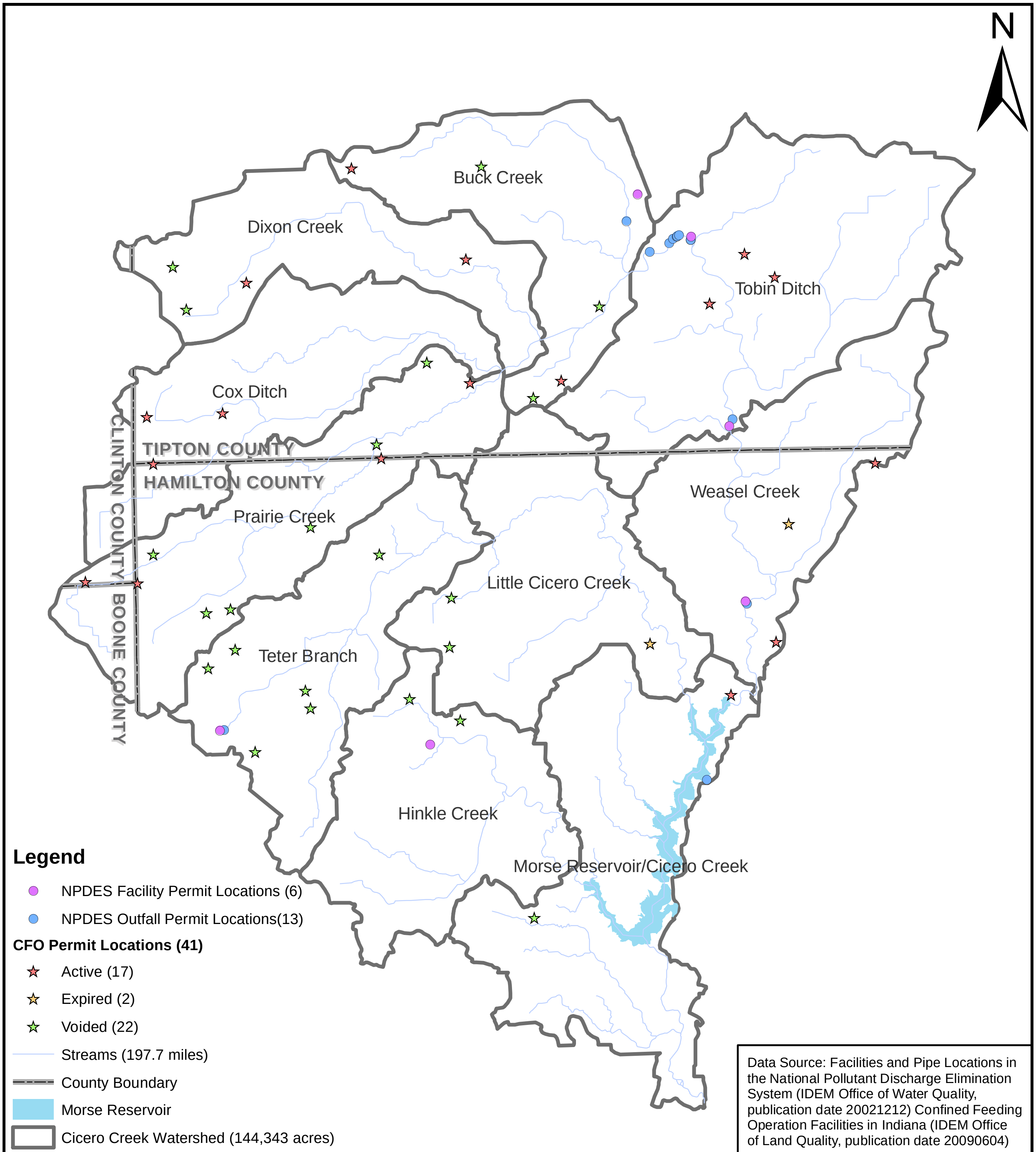
The National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Records for NPDES facilities and Confined Feeding Operations within the watershed were obtained from IDEM (Exhibit 16) and are analyzed on a subwatershed scale. The CFO compliance information obtained from IDEM did not include the type of operation for all of the CFOs within the watershed. Therefore, this information was not provided in the plan, however all obtained data is included on the Appendices CD. The permit status of the CFO is provided on Exhibit 16 as well as on each individual subwatershed exhibit and in each subwatershed section in the Subwatershed Summary.

Based on information obtained from IDEM, the State of Indiana's efforts to control the direct discharge of pollutants to waters of the State were inaugurated by the passage of the Stream Pollution Control Law of 1943. The vehicle currently used to control direct discharges to waters of the State is the NPDES Permit Program. This was made possible by the passage of the Federal Water Pollution Control Act Amendments of 1972 (also referred to as the Clean Water Act). These permits place limits on the amount of pollutants that may be discharged to waters of the State by each discharger. These limits are set at levels protective of both the aquatic life in the waters which receive the discharge and protective of human health.

There are several different types of permits that are issued in the NPDES permitting program including Municipal, Semi-Public or State (sanitary-type discharger); Industrial (wastewater generated in producing a product); and Wet Weather/Storm Water-related (wastewater resulting from precipitation coming in contact with a substance which is either dissolved or suspended in the water).

The purpose of the NPDES permit is to control the point source discharge of pollutants into the waters of the State such that the quality of the water of the State is maintained in accordance with the standards contained in 327 IAC 2. The NPDES permit requirements must ensure that, at a minimum, any new or existing point source must comply with technology-based treatment requirements that are contained in 327 IAC 5-5-2. According to 327 IAC 5-2-2, "Any discharge of pollutants into waters of the State as a point source discharge, except for exclusions made in 327 IAC 5-2-4, is prohibited unless in conformity with a valid NPDES permit obtained prior to discharge." This is the most basic principal of the NPDES permit program.

The majority of NPDES permits have existed since 1974. This means that most of the permit writing is for permit renewals. Approximately 10% of each year's workload is attributed to new permits, modifications and requests for estimated limits. NPDES permits are designed



Data Source: Facilities and Pipe Locations in the National Pollutant Discharge Elimination System (IDEM Office of Water Quality, publication date 20021212) Confined Feeding Operation Facilities in Indiana (IDEM Office of Land Quality, publication date 20090604)

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TITLE: **NPDES Permit Locations**

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**

BASE LAYER: NPDES Permitted Locations

CLIENT: Upper White River Watershed Alliance
P.O. Box 2065
Indianapolis, Indiana 46206

PROJECT NO.	EXHIBIT:	SHEET: 1 OF: 1
09005	16	
QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

to be re-issued every five years but are administratively extended in full force and effect indefinitely if the permittee applied for a renewal before the current permit expires.

Confined Feeding Operations (CFOs) are also considered a point source requiring an NPDES permit. Indiana law defines a confined feeding operation as any animal feeding operation engaged in the confined feeding of at least 300 cattle, or 600 swine or sheep, or 30,000 fowl. IDEM regulates these confined feeding operations. The animals raised in confined feeding operations produce manure and wastewater which is collected and stored in pits, tanks, lagoons and other storage devices. The manure is then applied to area fields as fertilizer. When stored and applied properly, this beneficial reuse provides a natural source of nutrients for crop production. It also lessens the need for fuel and other resources that are used in the production of commercial fertilizer. Confined feeding operations, however, can also pose environmental concerns, including manure leakage or spillage from storage pits, lagoons or tanks; and improper application of manure to the land. These environmental concerns are manifest as excessive nutrients, especially nitrogen and phosphorus, and bacterial contamination (*E. coli*).

CFOs within the watershed were categorized based on their permitted status – active, expired or voided. An active CFO indicates that the farm has a current approval, the manure management plan is up to date and the farm can operate. An expired CFO indicates that the farm did not start construction within two years of their approval date, so their approval expired. A voided CFO indicates that the farm has closed or gone beneath the numbers required to be in the CFO program. The CFO information obtained from IDEM included permits that date as back to 1998 and are as recent as 2009. The CFO compliance information obtained from IDEM did not include the type of operation for all of the CFOs within the watershed. Therefore, this information was not provided in the plan, however all obtained data is included in the Appendix. The permit status of the CFO is provided on the NPDES Permit Locations exhibit as well as on each individual subwatershed exhibit and in each subwatershed section in the Subwatershed Summary.

Indiana Clean Lakes Program

The Indiana Clean Lakes Program was created in 1989 as a program within IDEM's Office of Water Management. The program is administered through a grant to Indiana University's School of Public and Environmental Affairs. The program is a comprehensive, statewide public lake management program focusing on public information and education, technical assistance, volunteer lake monitoring, lake water quality assessment and coordination with other state and federal lake programs.

Sampling information for Morse Reservoir is available through the Indiana Clean Lakes Program for the years 1991, 1996 and 2002. The sampling location had a maximum depth of 13.7m and secchi depths were measured at 1m, 1.1m and 0.9m in 1991, 1996, and 2002 respectively. This information along with the Chlorophyll a and Phosphorus readings indicate that the reservoir is considered eutrophic based on EPAs trophic index protocols.

IDEM *Cylindrospermopsis raciborskii* Report

The Distribution and Abundance of Cylindrospermopsis raciborskii (C. raciborskii) in Indiana Lakes and Reservoirs report was prepared by the Indiana University School of Public and Environmental Affairs program and was administered by the Indiana Department of

Environmental Management Office of Water Quality through the Clean Water Act Section 205(j) funds.

A sample was collected from Morse Reservoir during routine lake assessments through the Indiana Clean Lakes Program in August of 2002. The sample measured 19,640 cells/ml of *C. raciborskii* which is in the relatively mild and/or low probability of adverse health effects category. As mentioned in the report, the extent of this study was limited and should not be considered an all inclusive report on *C. raciborskii* in the Morse Reservoir. This information does however express that the overall health of the reservoir and that it is conducive to producing this potentially toxic alga.

IDEM Mid-water Planktonic Invertebrate Report

The purpose of this study was driven by the Eagle Creek fish kill in 2000 and was completed to determine the relative abundance of the populations of light responsive zooplankton within Eagle Creek, Morse and Geist Reservoirs. This study was completed to determine if the fish kill within the Eagle Creek Reservoir also had an impact on the zooplankton abundance not to determine the cause of the fish kill. Geist and Morse Reservoirs were used as control reservoirs to compare results to and not to determine the overall health of the reservoirs.

Three samples were taken within the Morse Reservoir, one sample at the upper end of the reservoir (shallow end sample), one in the middle and one at the downstream end of the reservoir (mid and deep end samples). Out of the three reservoirs, Morse had the highest number of collected zooplankton (18,622). The abundance of zooplankton, if detailed sample analysis was completed at a lower taxonomic level, would provide a better indication of reservoir health in that they are a food base for vertebrate and invertebrate predators.

US Filter/Indianapolis Water (Veolia Water)

Bi-weekly sampling near Morse Reservoir has been conducted since October of 2002. Three sampling sites are located at Little Chicago Road at Hinkle Creek, 226th Street at Bear Slide Creek, and Mt. Pleasant at Big Cicero Creek. Samples are collected biweekly for cations, anions, total phosphorus, alkalinity, turbidity and pH. This data was not included in the WMP analysis; however it may be useful during implementation to determine the downstream impact of Best Management Practices in the upper reaches of the watershed.

Subwatershed Summary

The following sections break down the water quality information obtained for the WMP by subwatershed. Sample locations from the previously mentioned available data and studies are provided on a detailed exhibit for each subwatershed. Sample locations from these studies may occur at the same site with the symbols overlapping (symbols were chosen in order to determine whether the icons were overlapping). For clarification on individual study sites, the overall watershed maps should be consulted (Exhibits 12-15). A comparison of the subwatersheds is provided at the end of this section as a way to understand the differences in water quality parameters from one subwatershed to another.

In general, the overall characteristics and land use types of a watershed greatly influences the water quality since runoff from rainfall flows over or through the land and collects pollutants and nutrients prior to entering waterways. The IDEM data included 79 stations within the watershed that analyzed *E.coli*, Nitrate+Nitrite, Total Phosphorus, Total Suspended Solids and Turbidity. The CIWRP Study included six sampling locations within the Morse Reservoir/Cicero Creek Watershed and analyzed *E.coli*, Nitrate+Nitrite, Total Phosphorus, Total Suspended Solids and Turbidity. The turbidity data in the Subwatershed Summary sections is included for information purposes only. Turbidity specific information was excluded from the subwatershed summaries and rankings based on comments/recommendations from the Steering Committee during the preparation of the WMP.

Based on the CIWRP sampling locations, not all subwatersheds could be defined by a sample location. In order to use the CIWRP data for subwatershed comparisons, some subwatersheds were grouped together and represented by a single CIWRP sampling site. CIWRP water quality samples were collected within the watershed during seasonal base and event flow. In comparison to the CIWRP data, the IDEM data was all inclusive without a differentiation between base flow or storm flow events. Therefore, an overall average approach of this data was used in order to get a better depiction of how the watershed actually functions at any given time. Depending on the pollutant, both types of samples can result in elevated values. For example, the *E.coli* values shown in the subwatershed tables are extremely elevated when compared to the IDEM data. This is a major concern in the watershed and is reflected so in the problems and goals described later in the WMP.

Nonpoint source pollution modeling is a quantitative way to evaluate the effects of land use on water quality for comparison purposes. A nonpoint source pollution model was created for the WMP. The results are provided in Table 11 and in Part Three of the Watershed Inventory. This information was not provided in each subwatershed summary since all computation models have assumptions and limitations and therefore may not represent the exact pollution loads. In these conditions, even if the results are relative, they still can provide useful information for targeting and prioritizing subwatersheds for Best Management Practices (BMPs). Part Three of the Watershed Inventory explores the relationships of nonpoint source modeling among all 10 of the subwatersheds.

Table 11: NPS Modeling Summary

Subwatershed	N Load (lb/ac/yr)	P Load (lb/ac/yr)	Sediment Load (t/ac/yr)
Prairie Creek	5.58	1.13	0.36
Cox Ditch	5.59	1.15	0.37
Dixon Creek	5.66	1.17	0.39
Buck Creek	5.74	1.16	0.37
Tobin Ditch	5.47	1.08	0.32
Weasel Creek	5.48	1.13	0.34
Teter Branch	5.64	1.11	0.35
Little Cicero Creek	5.48	1.12	0.35
Hinkle Creek	5.30	1.04	0.32
Morse Reservoir/ Cicero Creek	5.20	0.96	0.27

NPDES permits and locations of Confined Feeding Operations can also be indicative of the land use and the subsequent water quality of a subwatershed. Records for NPDES facilities and Confined Feeding Operations within the watershed were obtained from IDEM and are analyzed on a subwatershed scale. The CFO compliance information obtained from IDEM did not include the type of operation for all of the CFOs within the watershed. Therefore, this information was not provided in the plan, however all obtained data is included on the Appendices CD. The permit status of the CFO is provided in each subwatershed section where appropriate in the Subwatershed Summary.

Prairie Creek Subwatershed

The Prairie Creek Subwatershed (HUC 12 – 051202010601) encompasses portions of Hamilton, Boone, Clinton, and Tipton Counties as shown in Exhibit 17. The subwatershed covers approximately 15,140 acres and includes Prairie Creek, Endicott Ditch, Pearce Ditch and McKinzie Ditch.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Prairie Creek Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that none of the streams within the subwatershed are impaired. It should be noted that if a stream is not listed on the 303(d) list it may be impaired; however the data (or lack thereof) does not indicate the impairment at the time of publication.

A total of 5 IDEM water quality sampling stations are located within the Prairie Creek Subwatershed. Available IDEM data at these stations included sampling from the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.

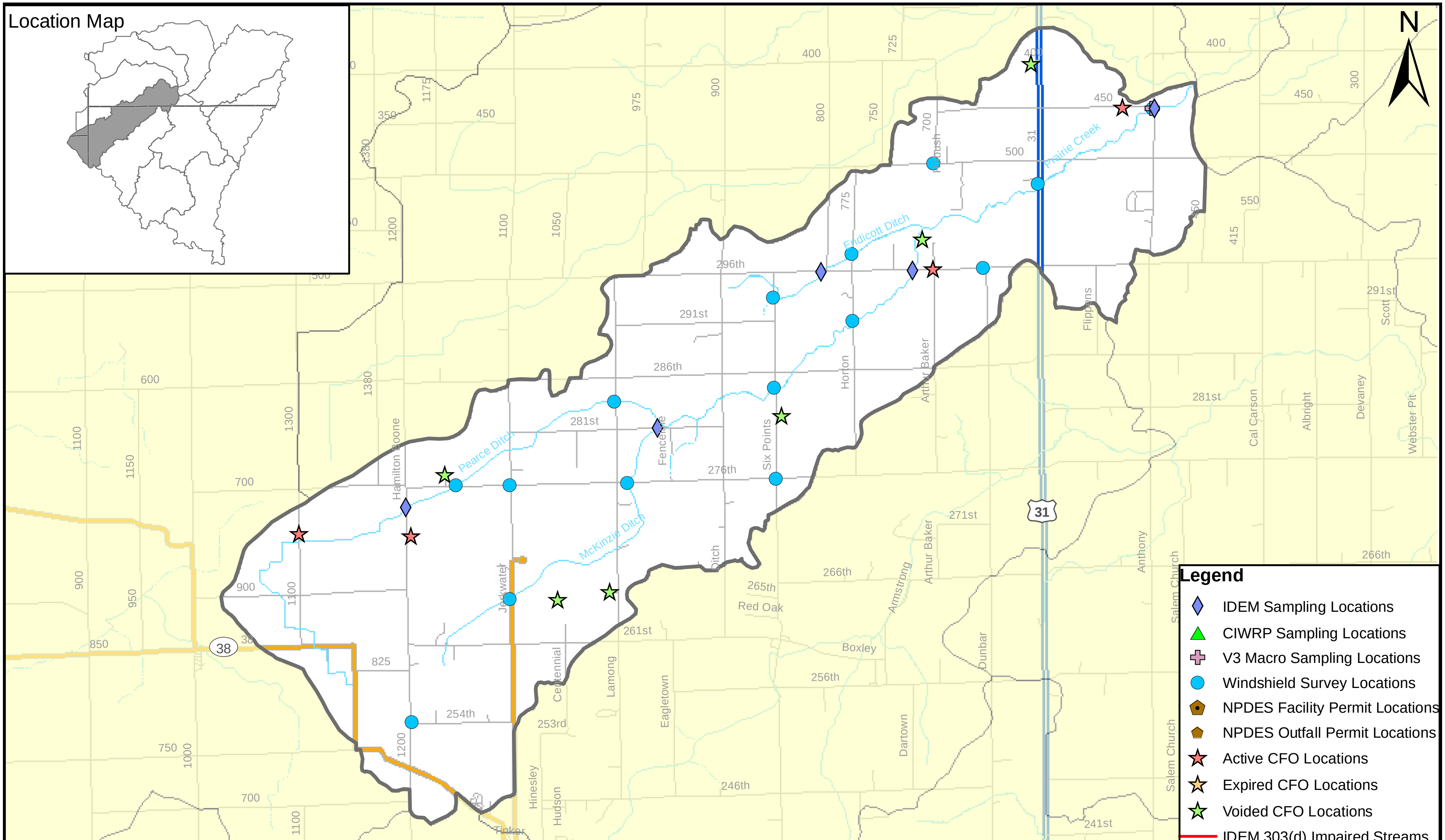
No CIWRP sampling sites were located within the Prairie Creek subwatershed; therefore it was grouped with the Cox Ditch, Dixon Creek, and Buck Creek subwatersheds and represented by site CCW5.

Table 12 summarizes the IDEM and CIWRP sampling mean value of each parameter for all of the data screened and the corresponding water quality target.

Table 12: Prairie Creek IDEM and CIWRP Water Quality Sampling Summary

Water Quality Parameter	IDEM Mean Value	CIWRP Mean Value	Water Quality Target
Dissolved Oxygen	Not Sampled	11.6 mg/L	between 4.0 and 12.0 mg/L
E. coli	822 CFU/100mL	1886 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	Not Sampled	7.5 mg/L	1.6 mg/L
pH	Not Sampled	7.7	between 6.0 and 9.0
Total Phosphorus	Not Sampled	0.152 mg/L	0.076 mg/L
TSS	Not Sampled	40.1 mg/L	30.0 mg/L
Turbidity	Not Sampled	75.3 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Prairie Creek subwatershed consistently tests higher than the water quality targets in *E. coli*, Nitrate + Nitrite, Total Phosphorus and TSS. Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.



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TITLE:	**Prairie Creek Subwatershed (HUC-12: 051202010601) Map**
BASE LAYER:	StreetMap USA
CLIENT:	Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
PROJECT NO.: 09005	EXHIBIT: 17	SHEET: 1 OF: 1
QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 7000'

Landuse Information
Landuse within the Prairie Creek Subwatershed consists primarily of agricultural uses. The Sheridan Airport is located in the southwest portion of the subwatershed.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 10 stream crossing sites and 5 land/field sites within the Prairie Creek Subwatershed. Observations including streambank erosion, lack of stream buffers, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 13 below.

Table 13: Prairie Creek
Windshield Survey Summary

Parameter	Observations
Streambank Erosion	1/10 sites with erosion >3’ 0/10 sites with erosion <3’
Stream Buffers	2/10 sites with no buffers 4/10 sites with buffers <50’
In-stream Debris	0/10 sites with debris
Animal Access	1/10 site with animal access
Conventional Till	3/15 sites under conventional till

The number, type, and compliance records of all NPDES permits were obtained and analyzed for each subwatershed. The Prairie Creek subwatershed contains four active confined feeding operations and six voided CFOs. There were two violations reported for the CFOs within the subwatershed based on the inspection reports obtained from IDEM. One violation was reported in 2008 for lack of manure testing and record keeping and the other was reported in 2009 for lack of record keeping.

Habitat/Biological Information
V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 10), located at the crossing of Prairie Creek on County Road 500 W in Tipton County, was analyzed within the Prairie Creek Subwatershed.

The calculated mIBI score of 4.2 indicates that the Prairie Creek Subwatershed is slightly impaired for macroinvertebrate communities. One IDEM sampling station and a windshield survey site were located in the vicinity of the macroinvertebrate station. The windshield survey did not include any information on the presence or quality of habitat at the site however notes taken during the macroinvertebrate sampling indicated that significant filamentous algae growth was covering rock substrate that could provide habitat for macroinvertebrate specie. This would indicate that the slight impairment seen in the macroinvertebrate community is not likely caused due to lack of habitat. At the IDEM sampling station, *E. coli* was the only water quality parameter analyzed. Levels of *E. coli* at this station average 619.4 CFU/100mL which does exceed the water quality target. Therefore, it is difficult to conclude if the slight impairment to the macroinvertebrate community is due solely to the water chemistry at the site since only *E.coli* was measured and no other water chemistry parameters. Detailed analysis for each station can be found in Appendix H.

Cox Ditch Subwatershed

The Cox Ditch Subwatershed (HUC 12 – 051202010602) is located primarily in Tipton County with small portions in Clinton and Hamilton Counties as shown in Exhibit 18. The subwatershed encompasses approximately 13,192 acres and includes Cicero Creek, Cox Ditch, Christy Ditch, Leander Boyle Ditch, Matthews Ditch and Kigin Ditch.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Cox Ditch Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that approximately 19.4 miles of streams within the subwatershed are impaired for nutrients, algae and impaired biotic communities, which includes every stream within the subwatershed.

A total of 6 IDEM water quality sampling stations are located within the Cox Ditch Subwatershed. Available IDEM data at these stations included sampling from the 2001 Corvallis Study, the 2006 Corvallis and 2006 Corvallis *E. coli* Studies and the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.

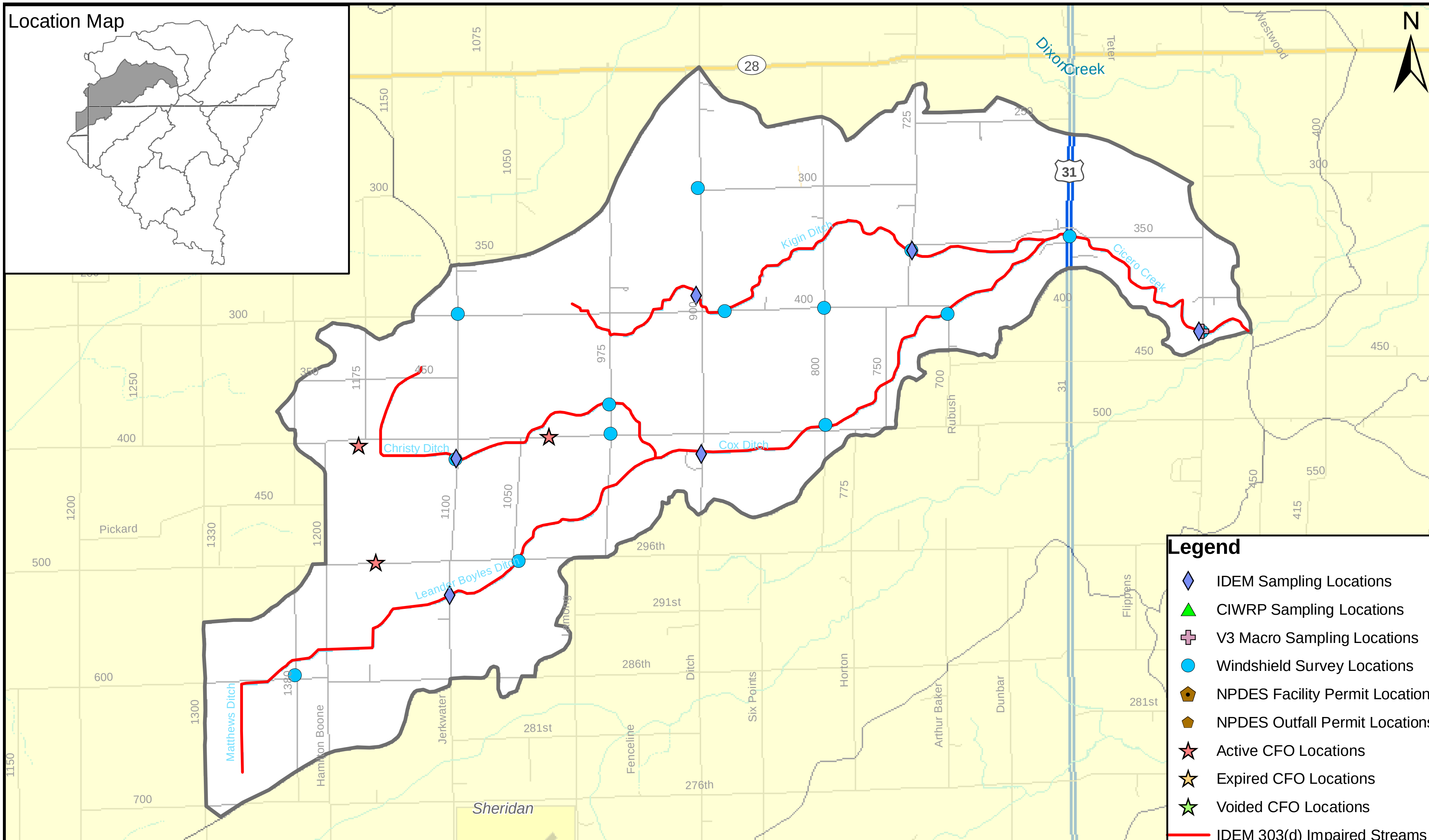
No CIWRP sampling sites were located within the Cox Ditch subwatershed; therefore it was grouped with the Prairie Creek, Dixon Creek, and Buck Creek subwatersheds and represented by the site CCW5.

Table 14 summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 14: Cox Ditch IDEM and CIWRP Water Quality Sampling Summary

Water Quality Parameter	IDEM Mean Value	CIWRP Mean Value	Water Quality Target
Dissolved Oxygen	10.1 mg/L	11.6 mg/L	between 4.0 and 12.0 mg/L
E. coli	638 CFU/100mL	1886 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	7.4 mg/L	7.5 mg/L	1.6 mg/L
pH	7.8	7.7	between 6.0 and 9.0
Total Phosphorus	0.103 mg/L	0.152 mg/L	0.076 mg/L
TSS	27.7 mg/L	40.1 mg/L	30.0 mg/L
Turbidity	32.2 NTU	75.3 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Cox Ditch subwatershed consistently tests higher than the water quality targets in *E. coli*, Nitrate + Nitrite and Total Phosphorus. TSS tested higher than the water quality targets in the CIWRP Study however it tested lower in the IDEM data. This is likely due to the fact that the CIWRP data specifically targeted some high flow events when TSS is known to be higher. Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.



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TITLE:	**Cox Ditch Subwatershed (HUC-12: 051202010602) Map**
BASE LAYER:	StreetMap USA
CLIENT:	Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
PROJECT NO.: 09005	EXHIBIT: 18	SHEET: 1 OF: 1
QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 6000'

Landuse Information
Landuse within the Cox Ditch Subwatershed consists primarily of agricultural uses.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 9 stream crossing sites and 5 land/field sites within the Cox Ditch Subwatershed. Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 15 below.

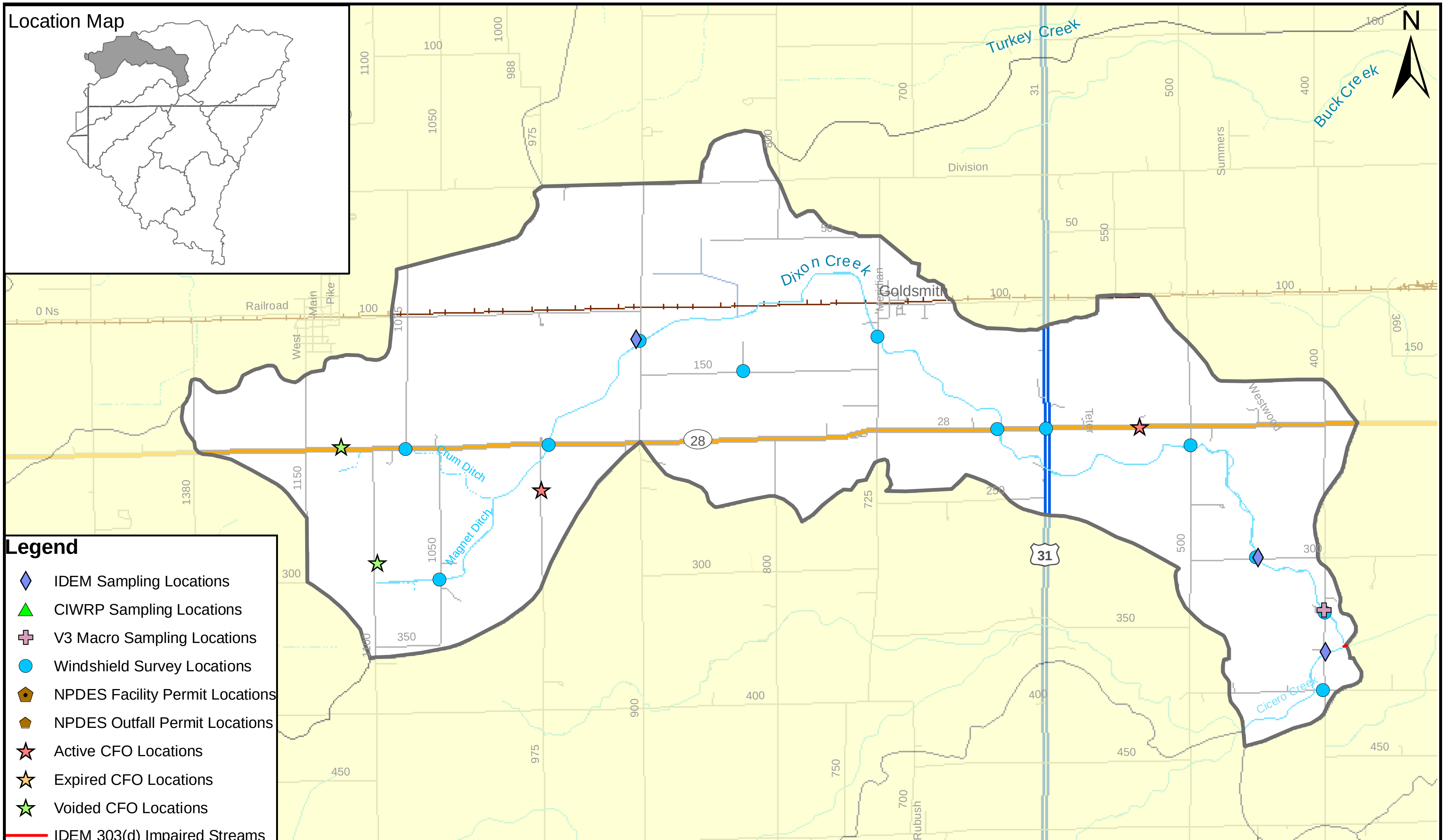
Table 15: Cox Ditch Windshield Survey Summary	
Parameter	**Observations**
Streambank Erosion	1/9 site with erosion >3’ 0/9 sites with erosion <3'
Stream Buffers	2/9 sites with no buffers 3/9 sites with buffers <50’
In-stream Debris	1/9 site with debris
Animal Access	1/9 site with animal access
Conventional Till	0/14 sites under conventional till

The Cox Ditch subwatershed contains three active confined feeding operations. There were no violations reported for the CFOs within the subwatershed based on the inspection reports obtained from IDEM.

Habitat/Biological Information
V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 11), located at the crossing of Cicero Creek on County Road 500 W in Tipton County, was analyzed within the Cox Ditch Subwatershed.

The calculated mIBI score of 3.8 indicates that the Cox Ditch Subwatershed is moderately impaired for macroinvertebrate communities. One IDEM sampling station and a windshield survey site were located in the vicinity of the macroinvertebrate station. The windshield survey indicated that adequate habitat was available for macroinvertebrates in the form of underwater trees roots, sufficient cover, and the absence of erosion. This would indicate that the moderate impairment seen in the macroinvertebrate community is not likely caused by lack of habitat. At the IDEM sampling station, *E. coli* was the only water quality parameter analyzed. Levels of E. coli at this station average 291.3 CFU/100mL which do exceed the water quality target. Therefore, it is difficult to conclude if the moderate impairment to the macroinvertebrate community is due solely to the water chemistry at the site since only *E.coli* was measured and no other water chemistry parameters. Detailed analysis for each station can be found in Appendix H.

Dixon Creek Subwatershed
The Dixon Creek Subwatershed (HUC 12 – 051202010603) is located primarily in Tipton County with a small portion in Clinton County as shown in Exhibit 19. The subwatershed



TITLE:	PROJECT:
Dixon Creek Subwatershed (HUC-12: 051202010603) Map	**Morse Reservoir/Cicero Creek Watershed Management Plan**

BASE LAYER:	PROJECT NO.:	EXHIBIT:	SHEET: 1 OF: 1
StreetMap USA	09005	19	

CLIENT:	QUADRANGLE:	DATE:	SCALE:
Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	N/A	09/27/10	1" = 5500'

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encompasses approximately 11,015 acres and includes Cicero Creek, Dixon Creek, Crum Ditch and Magnet Ditch.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Dixon Creek Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that none of the streams within the subwatershed are impaired. It should be noted that if a stream is not listed on the 303(d) list it may be impaired; however the data (or lack thereof) does not indicate the impairment at the time of publication.

A total of 3 IDEM water quality sampling stations are located within the Dixon Creek Subwatershed. Available IDEM data at these stations included sampling from the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.

No CIWRP sampling sites were located within the Dixon Creek subwatershed; therefore it was grouped with the Prairie Creek and Cox Ditch Creek subwatersheds and represented by the site CCW5.

Table 16 below summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 16: Dixon Creek IDEM and CIWRP Water Quality Sampling Summary			
Water Quality Parameter	**IDEM Mean Value**	**CIWRP Mean Value**	**Water Quality Target**
Dissolved Oxygen	Not Sampled	11.6 mg/L	between 4.0 and 12.0 mg/L
E. coli	329 CFU/100mL	1886 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	Not Sampled	7.5 mg/L	1.6 mg/L
pH	Not Sampled	7.7	between 6.0 and 9.0
Total Phosphorus	Not Sampled	0.152 mg/L	0.076 mg/L
TSS	Not Sampled	40.1 mg/L	30.0 mg/L
Turbidity	Not Sampled	75.3 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Dixon Creek subwatershed consistently tests higher than the water quality targets in *E. coli*, Nitrate + Nitrite, Total Phosphorus and TSS. Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.

Landuse Information

Landuse within the Dixon Creek Subwatershed consists primarily of agricultural uses. A small area of low intensity development is concentrated in the central portion of the watershed associated with the town of Goldsmith.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 8 stream crossing sites and 4 land/field sites within the Dixon Creek Subwatershed. Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 17.

Table 17: Dixon Creek Windshield Survey Summary	
Parameter	**Observations**
Streambank Erosion	3/8 sites with erosion >3' 0/8 sites with erosion <3'
Stream Buffers	1/8 site with no buffers 1/8 site with buffers <50'
In-stream Debris	1/8 site with debris
Animal Access	0/8 sites with animal access
Conventional Till	1/12 site under conventional till

The Dixon Creek subwatershed contains two active confined feeding operations and two voided CFOs. There were no violations reported for the CFOs within the subwatershed based on the inspection reports obtained from IDEM.

Habitat/Biological Information

V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 12), located at the crossing of Dixon Creek on County Road 400 W in Tipton County, was analyzed within the Dixon Creek Subwatershed.

The calculated mIBI score of 3.4 indicates that the Dixon Creek Subwatershed is moderately impaired for macroinvertebrate communities. One windshield survey site was located in the vicinity of the macroinvertebrate station. The windshield survey did not include any information on presence or quality of habitat at the site however notes taken during the macroinvertebrate sampling indicated that erosion at the site causes a silty substrate which would provide poor habitat for macroinvertebrates. This indicates that the moderate impairment seen in the macroinvertebrate community is likely caused by lack of quality habitat. However, no water chemistry information is available at this location; therefore there is insufficient data to determine if the moderate impairment is also due to the water chemistry at the site. Detailed analysis for each station can be found in Appendix H.

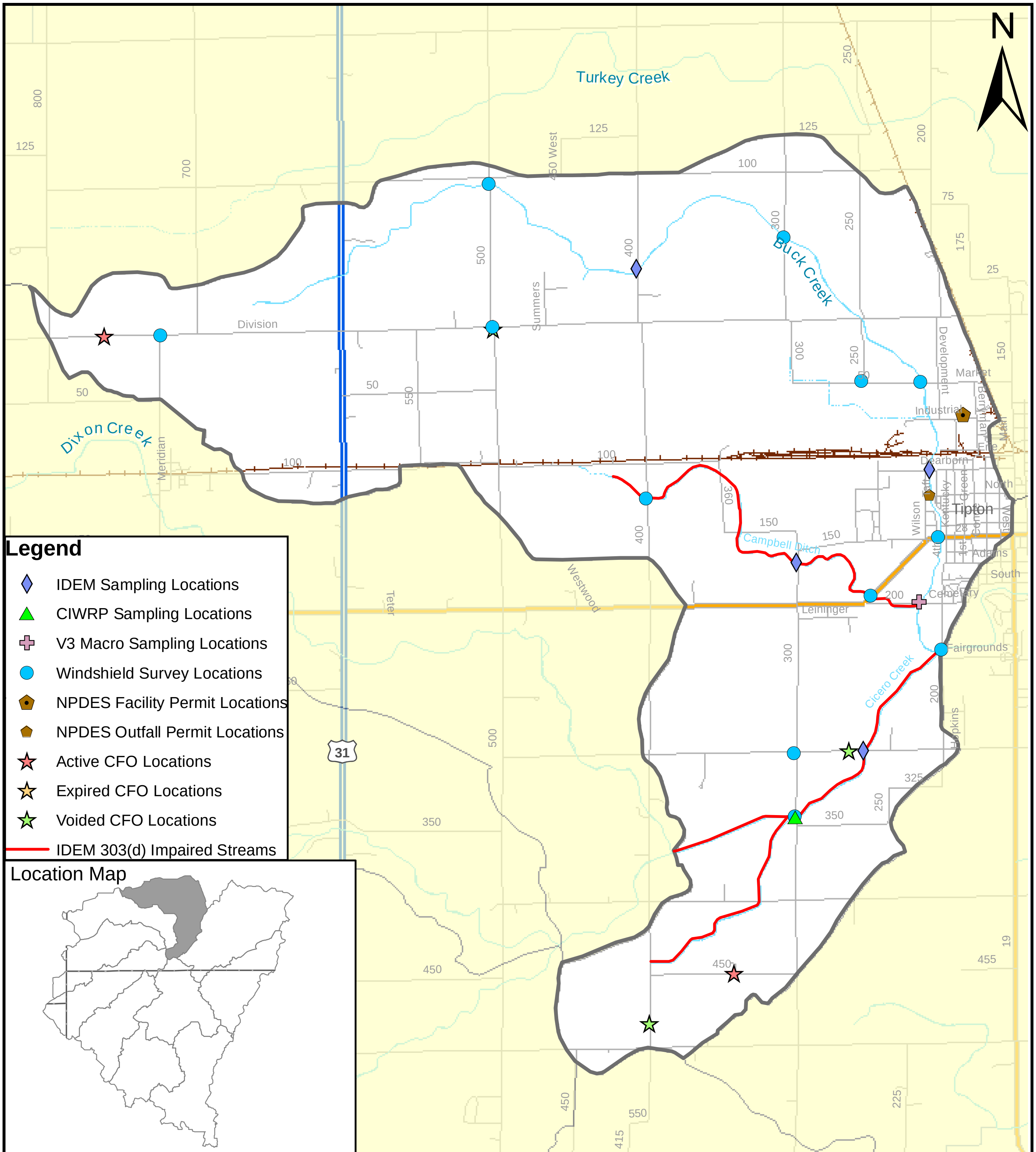
Buck Creek Subwatershed

The Buck Creek Subwatershed (HUC 12 – 051202010604) is located within Tipton County as shown in Exhibit 20. The subwatershed encompasses approximately 11,875 acres and includes Cicero Creek, Buck Creek and Campbell Ditch.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Buck Creek Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that approximately 7.0 miles of streams (Campbell Ditch and Cicero Creek) within the subwatershed are impaired for *E. coli*.

A total of 4 IDEM water quality sampling stations are located within the Buck Creek Subwatershed. Available IDEM data at these stations included sampling from the 1996



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TITLE:	**Buck CreekSubwatershed Map (HUC-12: 051202010604)**
PROJECT:	**Morse Reservoir/Cicero Creek Watershed Management Plan**
BASE LAYER:	StreetMap USA
CLIENT:	Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206
PROJECT NO.	09005
EXHIBIT:	20
SHEET:	1 OF: 1
QUADRANGLE:	N/A
DATE:	09/27/10
SCALE:	1" = 5000'

Synoptic Study, the 2001 *E. coli*- WFWR Study and the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.

One CIWRP sampling site was located within the Buck Creek subwatershed; however it was located within the upstream reaches of the watershed. Therefore, the Buck Creek subwatershed was combined with the Tobin Ditch subwatershed and represented by the site CCW6. Table 18 below summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 18: Buck Creek IDEM and CIWRP Water Quality Sampling Summary			
Water Quality Parameter	**IDEM Mean Value**	**CIWRP Mean Value**	**Water Quality Target**
Dissolved Oxygen	10.9 mg/L	11.2 mg/L	between 4.0 and 12.0 mg/L
E. coli	2464 CFU/100mL	2462 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	Not Sampled	7.1 mg/L	1.6 mg/L
pH	8.1	7.7	between 6.0 and 9.0
Total Phosphorus	0.097 mg/L	0.172 mg/L	0.076 mg/L
TSS	74.8 mg/L	60.0 mg/L	30.0 mg/L
Turbidity	16.8 NTU	149.0 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Buck Creek subwatershed consistently tests higher than the water quality targets in *E. coli*, Nitrate + Nitrite, Total Phosphorus and TSS. Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.

Landuse Information

Landuse within the Buck Creek Subwatershed consists primarily of agricultural uses. Low and medium intensity development is concentrated in the eastern portion of the subwatershed associated with Tipton.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 8 stream crossing sites and 4 land/field sites within the Buck Creek Subwatershed. Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 19 below.

Table 19: Buck Creek Windshield Survey Summary	
Parameter	**Observations**
Streambank Erosion	0/8 sites with erosion >3’ 0/8 sites with erosion <3’
Stream Buffers	0/8 sites with no buffers 0/8 sites with buffers <50’
In-stream Debris	0/8 sites with debris
Animal Access	0/8 sites with animal access
Conventional Till	2/12 sites under conventional till

The Buck Creek subwatershed contains two active confined feeding operations and three voided CFOs. There was one violation reported for the CFOs within the subwatershed based on the inspection reports obtained from IDEM. The violation was reported in 2007 for lack of record keeping.

There are 2 NPDES permits active within the Buck Creek subwatershed. The Tipton Wastewater Treatment Plant, permit number IN0021474, is located at 909 East Jefferson Street in Tipton. The facility is located outside of the subwatershed; however one permitted outfall is located within the Buck Creek subwatershed. According to compliance records, there have been no formal enforcement actions within the last 5 years; however there have been 9 noted effluent exceedances within the last 3 years. These exceedances were reported for pH, *E. coli*, Nitrogen and Total Suspended Solids. D.C. Coaters Inc, permit number INP000106, is located at 550 West Industrial Drive in Tipton. According to compliance records for the facility, there has been no formal enforcement action within the last 5 years; effluent exceedance records for the last 3 years were not available for this facility.

Habitat/Biological Information

V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 13), located at the crossing of Buck Creek on County Road 200 S in Tipton County, was analyzed within the Buck Creek Subwatershed.

The calculated mIBI score of 6.4 indicates that the Buck Creek Subwatershed is not impaired for macroinvertebrate communities. Detailed analysis for each station can be found in Appendix H.

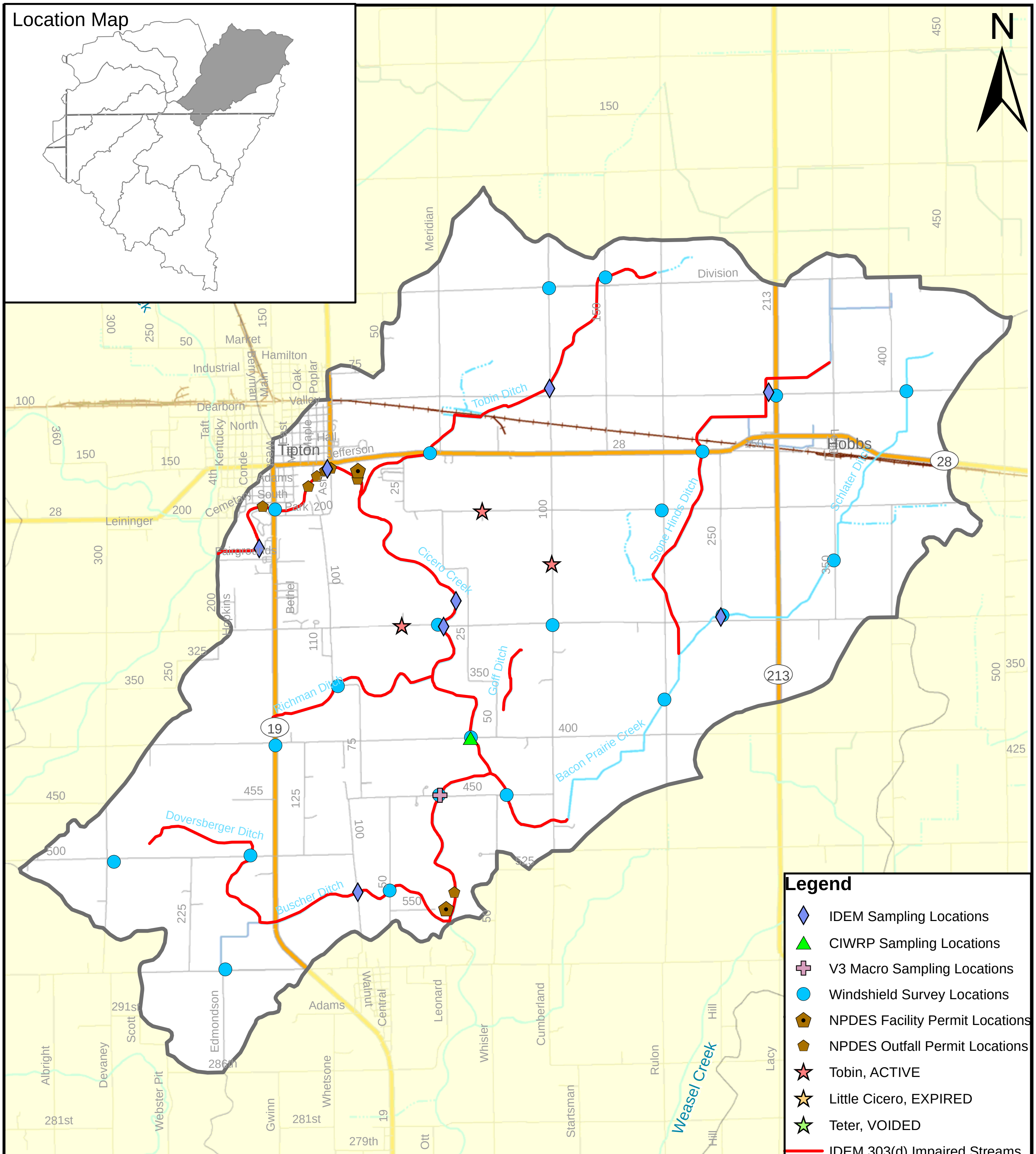
Tobin Ditch Subwatershed

The Tobin Ditch Subwatershed (HUC 12 – 051202010605) is located primarily in Tipton County with a small portion in Hamilton County as shown on Exhibit 21. The subwatershed encompasses approximately 21,106 acres and includes Cicero Creek, Buscher Ditch, Doversberger Ditch, Bacon Prairie Creek, Stone Hinds Ditch, Schlater Ditch, Goff Ditch, Richman Ditch and Tobin Ditch.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Tobin Ditch Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that approximately 22.3 miles of streams (Stone Hinds Ditch, Goff Ditch, Tobin Ditch, Cicero Creek, Richman Ditch, Doversberger Ditch, Buscher Ditch and a portion of Bacon Prairie Creek) within the subwatershed are impaired for *E. coli*.

A total of 8 IDEM water quality sampling stations are located within the Tobin Ditch Subwatershed. Available IDEM data at these stations included sampling from the 1996 Watershed Study, the 2001 *E. coli*- WFWR Study, the 2006 Corvallis and 2006 Corvallis *E. coli* Studies and the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.



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Title:	**Tobin Ditch Subwatershed Map (HUC-12: 051202010605)**
Base Layer:	StreetMap USA
Client:	Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206
Project:	**Morse Reservoir/Cicero Creek Watershed Management Plan**
Project No.	09005
Exhibit:	21
Sheet:	1 of: 1
Quadrangle:	N/A
Date:	09/27/10
Scale:	1" = 6500'

One CIWRP sampling site was located within the Tobin Ditch subwatershed. The Buck Creek subwatershed was combined with the Tobin Ditch subwatershed and represented by the site CCW6.

Table 20 below summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 20: Tobin Ditch IDEM and CIWRP Water Quality Sampling Summary			
Water Quality Parameter	**IDEM Mean Value**	**CIWRP Mean Value**	**Water Quality Target**
Dissolved Oxygen	10.4 mg/L	11.2 mg/L	between 4.0 and 12.0 mg/L
E. coli	1046 CFU/100mL	2462 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	7.1 mg/L	7.1 mg/L	1.6 mg/L
pH	8.1	7.7	between 6.0 and 9.0
Total Phosphorus	0.118 mg/L	0.172 mg/L	0.076 mg/L
TSS	13.5 mg/L	60.0 mg/L	30.0 mg/L
Turbidity	17.2 NTU	149.0 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Tobin Ditch subwatershed consistently tests higher than the water quality targets in *E. coli*, Nitrate + Nitrite and Total Phosphorus. TSS tested higher than the water quality targets in the CIWRP Study; however it was lower than the standards based on the IDEM data. Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.

Landuse Information

Landuse within the Tobin Ditch Subwatershed consists primarily of agricultural uses. Low and medium intensity development is concentrated in the western portion of the subwatershed associated with Tipton and a small area of low intensity development is concentrated in the northeastern portion of the subwatershed associated with the town of Hobbs.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 15 stream crossing sites and 7 land/field sites within the Tobin Ditch Subwatershed. Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 21.

Table 21: Tobin Ditch Windshield Survey Summary	
Parameter	**Observations**
Streambank Erosion	3/15 sites with erosion >3' 0/15 sites with erosion <3'
Stream Buffers	3/15 sites with no buffers 3/15 sites with buffers <50'
In-stream Debris	2/15 sites with debris
Animal Access	0/15 sites with animal access
Conventional Till	2/22 sites under conventional till

The Tobin Ditch subwatershed contains three active confined feeding operations. There were no violations reported for the CFOs within the subwatershed based on the inspection reports obtained from IDEM.

There are 2 NPDES permits active within the Tobin Ditch subwatershed. The Tipton Wastewater Treatment Plant, permit number IN0021474, is located at 909 East Jefferson Street in Tipton. The facility and seven outfalls are located within the Tobin Ditch subwatershed. According to compliance records, there have been no formal enforcement actions within the last 5 years; however there have been 9 noted effluent exceedances within the last 3 years. These exceedances were reported for pH, *E. coli*, Nitrogen and Total Suspended Solids. The Atlanta Wastewater Treatment Plant, permit number IN0022306, is located at 38 E 550 S in Atlanta. According to compliance records for the facility, there has been no formal enforcement action within the last 5 years; however there have been 5 noted effluent exceedances within the last 3 years. These exceedances were reported for pH and Nitrogen.

Habitat/Biological Information

V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 9), located at the crossing of Cicero Creek on County Road 450 S in Tipton County, was analyzed within the Tobin Ditch Subwatershed.

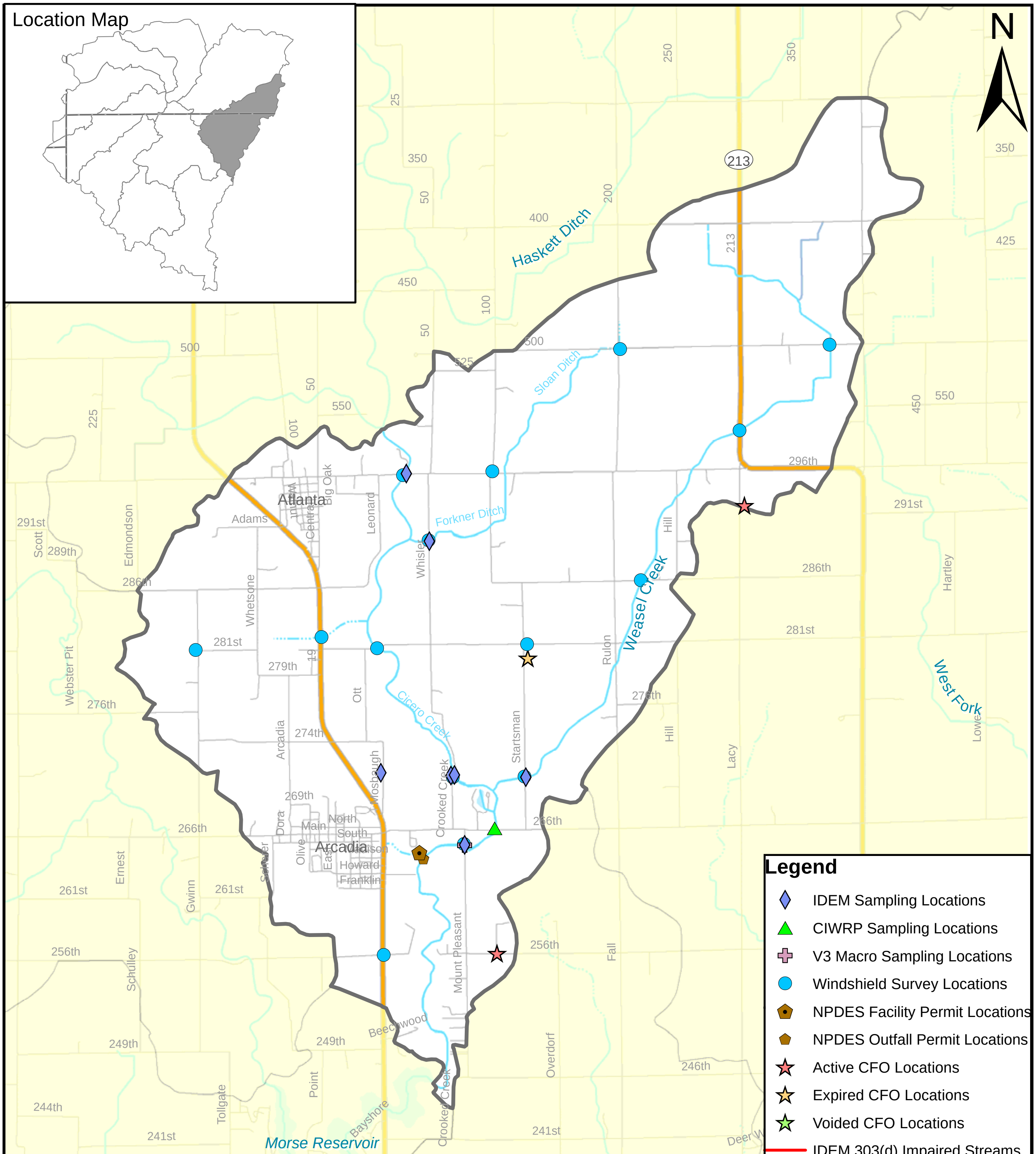
The calculated mIBI score of 6.2 indicates that the Tobin Ditch Subwatershed is not impaired for macroinvertebrate communities. Detailed analysis for each station can be found in Appendix H.

Weasel Creek Subwatershed

The Weasel Creek Subwatershed (HUC 12 – 051202010606) is located within Tipton and Hamilton Counties as shown in Exhibit 22. The subwatershed encompasses approximately 13,704 acres and includes Cicero Creek, Weasel Creek, Forkner Ditch and Sloan Ditch.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Weasel Creek Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that none of the streams within the subwatershed are impaired. It should be noted that if a stream is not listed on the 303(d) list it may be impaired; however the data (or lack thereof) does not indicate the impairment at the time of publication.



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TITLE:	**Weasel Creek Subwatershed Map (HUC-12:051202010606)**
PROJECT:	**Morse Reservoir/Cicero Creek Watershed Management Plan**
BASE LAYER:	StreetMap USA
CLIENT:	Upper White River Watershed Alliance, P.O. Box 2065, Indianapolis, Indiana 46206
PROJECT NO.	09005
EXHIBIT:	22
SHEET:	1 OF: 1
QUADRANGLE:	N/A
DATE:	09/27/10
SCALE:	1" = 6000'

A total of 7 IDEM water quality sampling stations are located within the Weasel Creek subwatershed. Available IDEM data at these stations included sampling from the 1996 Synoptic Study, the 1999-2009 Fixed Station Study, the 2001 *E. coli* Study and the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.

One sampling site is located within the Weasel Creek subwatershed, CCW3.

Table 22 below summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 22: Weasel Creek IDEM and CIWRP Water Quality Sampling Summary			
Water Quality Parameter	**IDEM Mean Value**	**CIWRP Mean Value**	**Water Quality Target**
Dissolved Oxygen	9.9 mg/L	10.6 mg/L	between 4.0 and 12.0 mg/L
E. coli	2041 CFU/100mL	4566 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	6.1 mg/L	5.7 mg/L	1.6 mg/L
pH	8.1	7.7	between 6.0 and 9.0
Total Phosphorus	0.109 mg/L	0.180 mg/L	0.076 mg/L
TSS	27.9 mg/L	27.2 mg/L	30.0 mg/L
Turbidity	29.9 NTU	70.4 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Weasel Creek subwatershed consistently tests higher than the water quality targets in *E. coli*, Nitrate + Nitrite and Total Phosphorus. TSS, Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.

Landuse Information

Landuse within the Weasel Creek Subwatershed consists primarily of agricultural uses. Several areas of deciduous forest are located along the corridor of Cicero Creek. Low and medium intensity development is concentrated in the northwestern portion of the subwatershed associated with Atlanta, and in the southwestern portion of the subwatershed associated with Arcadia.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 10 stream crossing sites and 5 land/field sites within the Weasel Creek Subwatershed.

Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 23.

Table 23: Weasel Creek Windshield Survey Summary	
Parameter	**Observations**
Streambank Erosion	1/10 sites with erosion >3' 0/10 sites with erosion <3'
Stream Buffers	2/10 sites with no buffers 1/10 site with buffers <50'
In-stream Debris	2/10 sites with debris
Animal Access	1/10 site with animal access
Conventional Till	3/15 sites under conventional till

The Weasel Creek subwatershed contains two active confined feeding operations and one expired CFO. There was one violation reported for the CFOs within the subwatershed based on the inspection reports obtained from IDEM. The violation was reported in 2006, 2007 and 2008 for an exceedance in nitrogen and ammonia levels.

There is one NPDES permit active within the Weasel Creek subwatershed. The Arcadia Wastewater Treatment Plant, permit number IN0021334, is located at 9099 E 266th Street in Arcadia. The facility and one outfall are located within the Weasel Creek subwatershed. According to compliance records, there have been no formal enforcement actions within the last 5 years; however there have been 19 noted effluent exceedances within the last 3 years. These exceedances were reported for Chlorine, *E. coli*, Nitrogen, Dissolved Oxygen, Phosphorus and Total Suspended Solids.

Habitat/Biological Information

V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 7), located at the crossing of Cicero Creek at Mount Pleasant and 266th Street in Hamilton County, was analyzed within the Weasel Creek Subwatershed.

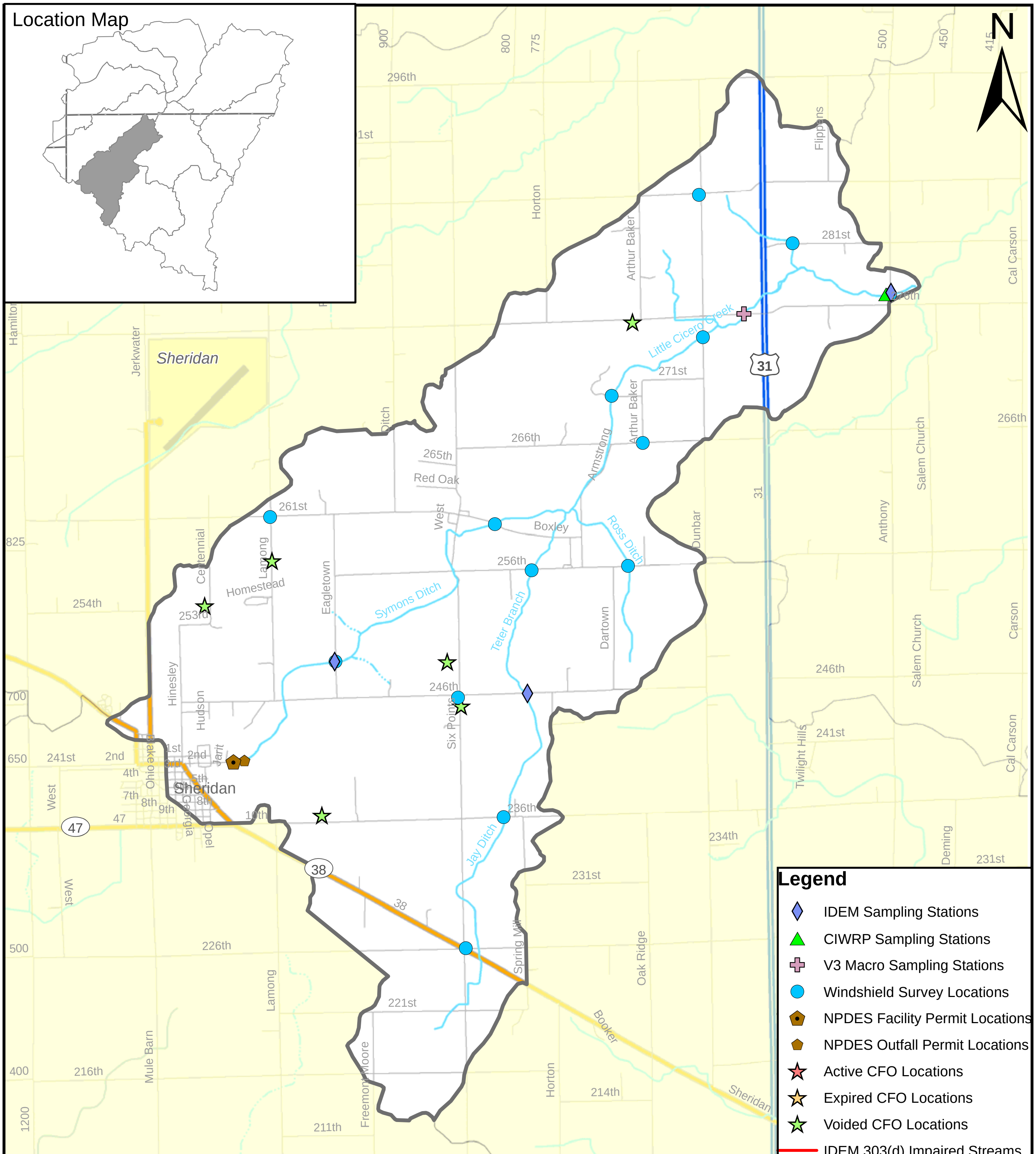
The calculated mIBI score of 6.8 indicates that the Weasel Creek Subwatershed is not impaired for macroinvertebrate communities. Detailed analysis for each station can be found in Appendix H.

Teter Branch Subwatershed

The Teter Branch Subwatershed (HUC 12 – 051202010607) is located primarily in Hamilton County with a small portion in Tipton County as shown on Exhibit 23. The subwatershed encompasses approximately 13,326 acres and includes Little Cicero Creek, Ross Ditch, Teter Branch, Jay Ditch and Symons Ditch.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Teter Branch Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that none of the streams within the subwatershed are impaired. It should be noted that if a stream is not listed on the 303(d) list it may be impaired; however the data (or lack thereof) does not indicate the impairment at the time of publication.



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TITLE: **Teter Branch Subwatershed Map (HUC-12: 051202010607)**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: StreetMap USA	PROJECT NO. 09005	EXHIBIT: 23	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 6000'

A total of 3 IDEM water quality sampling stations are located within the Teter Branch subwatershed. Available IDEM data at these stations included sampling from the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.

One sampling site is located within the Teter Branch subwatershed, CCW4.

Table 24 below summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 24: Teter Branch IDEM and CIWRP Water Quality Sampling Summary			
Water Quality Parameter	**IDEM Mean Value**	**CIWRP Mean Value**	**Water Quality Target**
Dissolved Oxygen	Not Sampled	11.8 mg/L	between 4.0 and 12.0 mg/L
E. coli	2585 CFU/100mL	1572 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	Not Sampled	4.4 mg/L	1.6 mg/L
pH	Not Sampled	7.8	between 6.0 and 9.0
Total Phosphorus	Not Sampled	0.204 mg/L	0.076 mg/L
TSS	Not Sampled	26.5 mg/L	30.0 mg/L
Turbidity	Not Sampled	32.4 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Teter Branch subwatershed consistently tests higher than the water quality targets in *E. coli*, Nitrate + Nitrite and Total Phosphorus. TSS, Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.

Landuse Information

Landuse within the Teter Branch Subwatershed consists primarily of agricultural uses. Low and medium intensity development is concentrated in the southwestern portion of the subwatershed associated with Sheridan.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 9 stream crossing sites and 5 land/field sites within the Teter Branch Subwatershed.

Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 25.

Table 25: Teter Branch Windshield Survey Summary	
Parameter	**Observations**
Streambank Erosion	5/9 sites with erosion >3’ 1/9 site with erosion <3’
Stream Buffers	1/9 site with no buffers 4/9 site with buffers <50’
In-stream Debris	3/9 sites with debris
Animal Access	3/9 sites with animal access
Conventional Till	3/14 sites under conventional till

The Teter Branch subwatershed contains no active confined feeding operations, however there are 6 voided CFOs located within the watershed.

There is one NPDES permit active within the Teter Branch subwatershed. The Sheridan Wastewater Treatment Plant, permit number IN0031071, is located at 801 E 2nd Street in Sheridan. The facility and one outfall are located within the Teter Branch subwatershed. According to compliance records, there have been no formal enforcement actions within the last 5 years and there have been no noted effluent exceedances within the last 3 years.

Habitat/Biological Information

V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 8), located at the crossing of Little Cicero Creek at 276th Street and State Road 31 in Hamilton County, was analyzed within the Teter Branch Subwatershed.

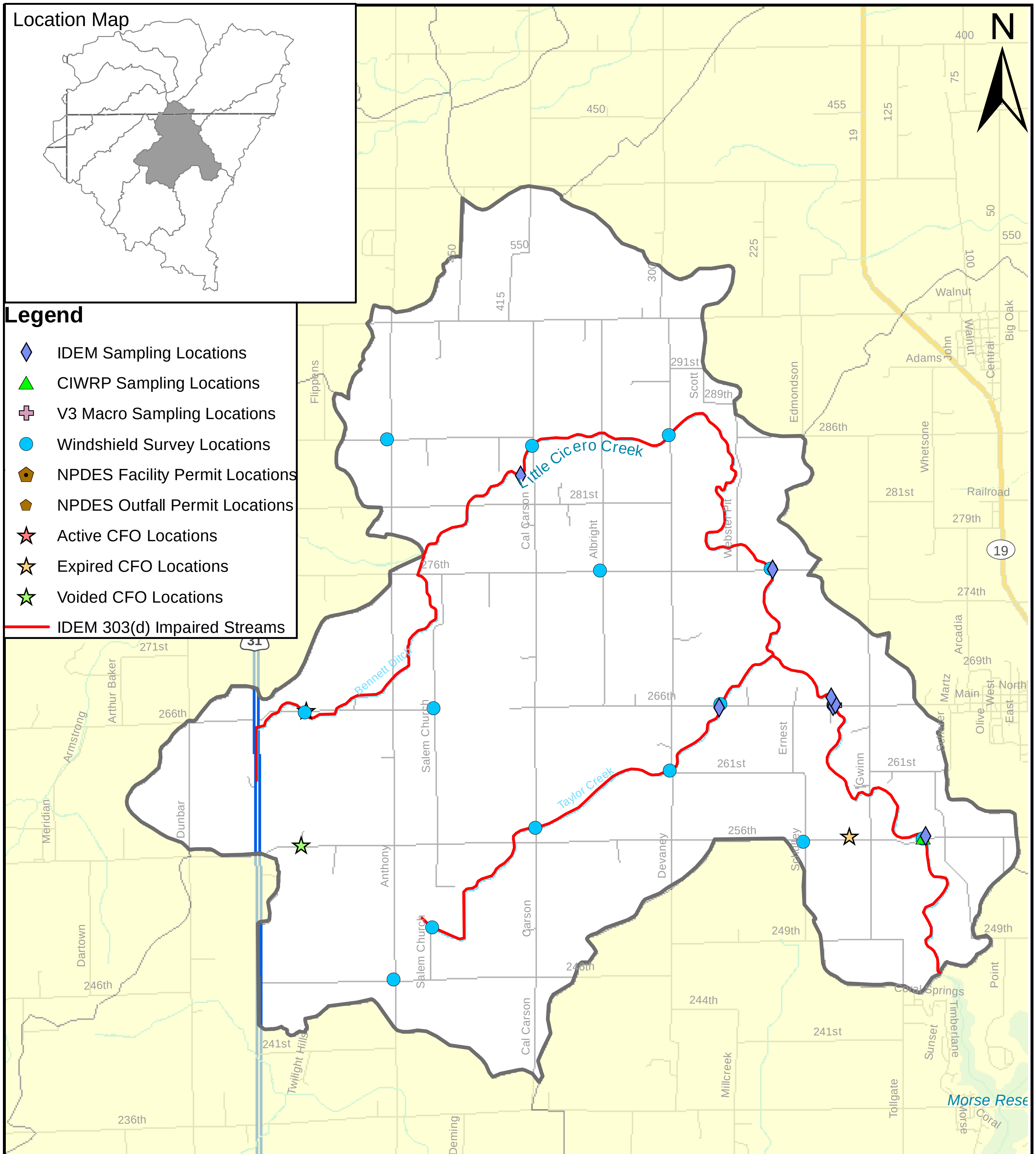
The calculated mIBI score of 4.0 indicates that the Teter Branch Subwatershed is slightly impaired for macroinvertebrate communities. No additional sampling sites were located within the vicinity of the macroinvertebrate station. However, notes taken during the macroinvertebrate sampling indicated the presence of a silty substrate which would provide poor habitat for macroinvertebrates. This indicates that the slight impairment seen in the macroinvertebrate community is likely caused by lack of quality habitat. No water chemistry information is available at this location; therefore there is insufficient data to determine if the slight impairment is also due to the water chemistry at the site. Detailed analysis for each station can be found in Appendix H.

Little Cicero Creek Subwatershed

The Little Cicero Creek Subwatershed (HUC 12 – 051202010608) is located primarily in Hamilton County with a small portion in Tipton County as shown in Exhibit 24. The subwatershed encompasses approximately 14,402 acres and includes Little Cicero Creek, Taylor Creek and Bennett Ditch.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Little Cicero Creek Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that approximately 15.9 miles of streams within the subwatershed are impaired for *E. coli*. This includes all of the streams within the subwatershed.



V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: **Little Cicero Creek Subwatershed Map (HUC-12: 051202010608)**

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**

BASE LAYER: StreetMap USA

CLIENT: Upper White River Watershed Alliance
P.O. Box 2065
Indianapolis, Indiana 46206

PROJECT NO.	EXHIBIT:	SHEET: 1 OF: 1
09005	24	
QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 5500'

A total of 7 IDEM water quality sampling stations are located within the Little Cicero Creek subwatershed. Available IDEM data at these stations included sampling from the 1996 Synoptic Study, the 2001 Corvallis and 2001 *E. coli* – Upper WFWR Studies and the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.

One sampling site is located within the Little Cicero Creek subwatershed, CCW2.

Table 26 below summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 26: Little Cicero Creek IDEM and CIWRP Water Quality Sampling Summary			
Water Quality Parameter	**IDEM Mean Value**	**CIWRP Mean Value**	**Water Quality Target**
Dissolved Oxygen	9.3 mg/L	11.0 mg/L	between 4.0 and 12.0 mg/L
E. coli	3934 CFU/100mL	2771 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	7.9 mg/L	6.2 mg/L	1.6 mg/L
pH	8.0	7.8	between 6.0 and 9.0
Total Phosphorus	0.792 mg/L	0.186 mg/L	0.076 mg/L
TSS	46.4 mg/L	32.9 mg/L	30.0 mg/L
Turbidity	32.4 NTU	36.3 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Little Cicero Creek subwatershed consistently tests higher than the State standard for *E. coli*, and water quality targets for Nitrate + Nitrite, Total Phosphorus and TSS. Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.

Landuse Information

Landuse within the Little Cicero Creek Subwatershed consists primarily of agricultural uses. Several areas of deciduous forest are located along the corridor of Little Cicero Creek.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 10 stream crossing sites and 5 land/field sites within the Little Cicero Creek Subwatershed.

Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 27.

Table 27: Little Cicero Creek Windshield Survey Summary	
Parameter	**Observations**
Streambank Erosion	3/10 sites with erosion >3’ 3/10 sites with erosion <3’
Stream Buffers	3/10 sites with no buffers 2/10 sites with buffers <50’
In-stream Debris	6/10 sites with debris
Animal Access	3/10 sites with animal access
Conventional Till	9/15 sites under conventional till

The Little Cicero Creek subwatershed contains no active confined feeding operations; however there are 2 voided CFOs and 1 expired CFO located within the watershed.

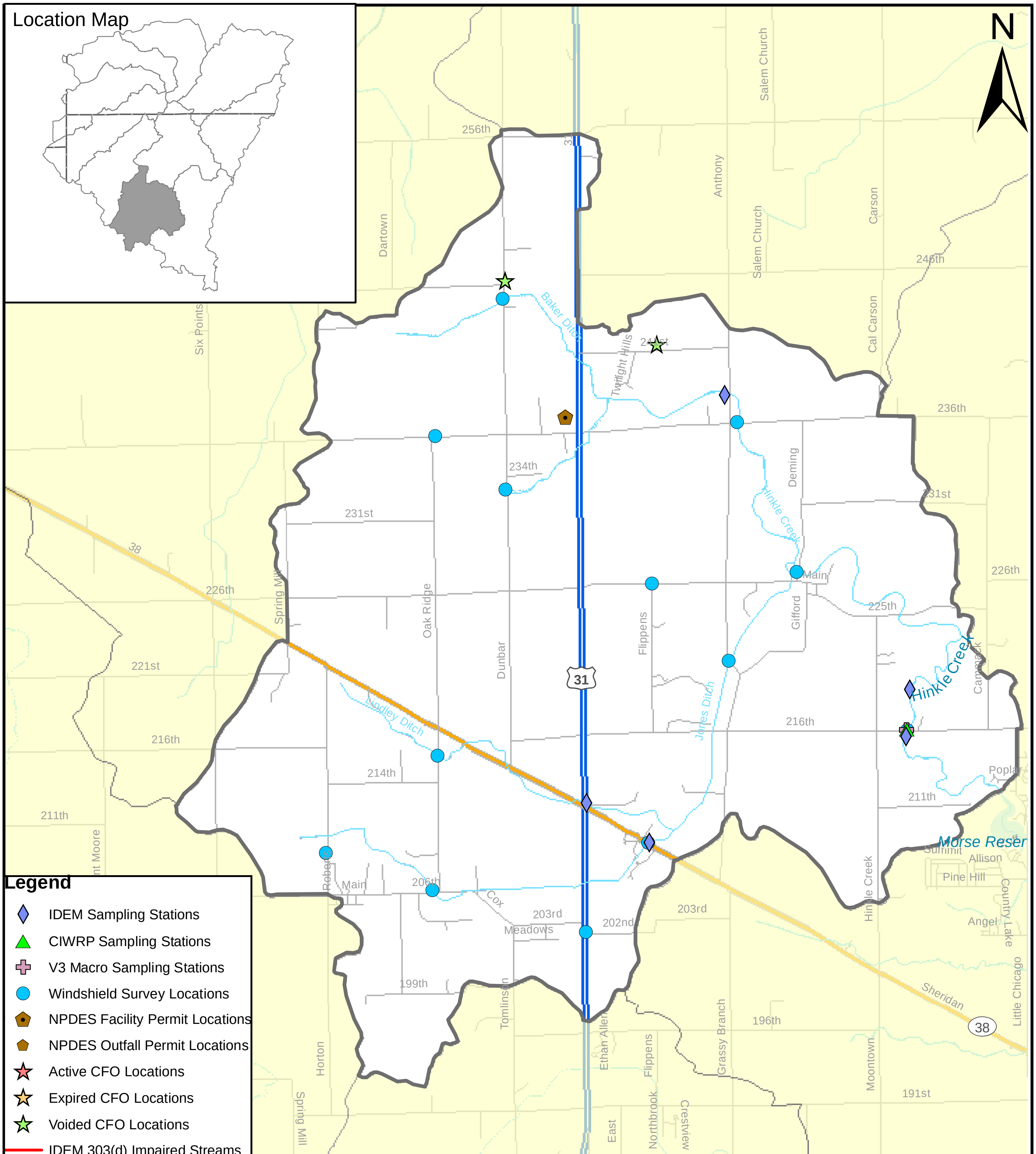
There are no other NPDES permits active within the Little Cicero Creek subwatershed.

Habitat/Biological Information
V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 6), located at the crossing of Little Cicero Creek at 266th Street and Gwinn Road in Hamilton County, was analyzed within the Little Cicero Creek Subwatershed.

The calculated mIBI score of 3.0 indicates that the Little Cicero Creek Subwatershed is moderately impaired for macroinvertebrate communities. Two IDEM sampling stations and a windshield survey site were located in the vicinity of the macroinvertebrate station. The windshield survey indicated that adequate habitat was available for macroinvertebrates in the form of underwater tree roots, sufficient cover, and deep and shallow areas. This would indicate that the moderate impairment seen in the macroinvertebrate community is not likely caused by lack of habitat. At the IDEM sampling station *E. coli*, TSS and Phosphorus were analyzed. Levels of *E. coli* at this station average 635.3 CFU/100mL, TSS averages 47.2 mg/L and Phosphorus averages 0.15 mg/L. All of these values exceed the water quality targets indicating the moderate impairment may be caused by the poor water chemistry at the site. Detailed analysis for each station can be found in Appendix H.

Hinkle Creek Subwatershed
The Hinkle Creek Subwatershed (HUC 12 – 051202010609) is located in Hamilton County as shown in Exhibit 25. The subwatershed contains approximately 12,871 acres and includes Hinkle Creek, Jones Ditch, Lindley Ditch and Baker Ditch.

Water Quality Information
According to the IDEM 305(b) list, the streams within the Hinkle Creek Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use. The 303(d) list indicates that none of the streams within the subwatershed are impaired. It should be noted that if a stream is not listed on the 303(d) list it may be impaired; however the data (or lack thereof) does not indicate the impairment at the time of publication.



V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: **Hinkle Creek Subwatershed Map (HUC-12: 051202010609)**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**
BASE LAYER: StreetMap USA	PROJECT NO. 09005
CLIENT: Upper White River Watershed Alliance, P.O. Box 2065, Indianapolis, Indiana 46206	EXHIBIT: 25
	SHEET: 1 OF: 1
	QUADRANGLE: N/A
	DATE: 09/27/10
	SCALE: 1" = 5000'

A total of 5 IDEM water quality sampling stations are located within the Hinkle Creek subwatershed. Available IDEM data at these stations included sampling from the 2001 Corvallis and 2001 *E. coli* – Upper WFWR Studies and the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study.

One sampling site is located within the Hinkle Creek subwatershed, CCW1.

Table 28 summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 28: Hinkle Creek IDEM and CIWRP Water Quality Sampling Summary			
Water Quality Parameter	**IDEM Mean Value**	**CIWRP Mean Value**	**Water Quality Target**
Dissolved Oxygen	8.5 mg/L	11.5 mg/L	between 4.0 and 12.0 mg/L
E. coli	1919 CFU/100mL	4810 CFU/100mL	235 CFU/100mL
Nitrate + Nitrite	7.3 mg/L	2.7 mg/L	1.6 mg/L
pH	8.1	7.6	between 6.0 and 9.0
Total Phosphorus	0.186 mg/L	0.334 mg/L	0.076 mg/L
TSS	23.7 mg/L	32.9 mg/L	30.0 mg/L
Turbidity	14.4 NTU	32.8 NTU	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Hinkle Creek subwatershed consistently tests higher than the water quality targets in *E. coli*, Nitrate + Nitrite and Total Phosphorus. TSS tested higher than the water quality targets in the CIWRP Study however it tested lower in the IDEM data. Dissolved Oxygen and pH fall within the acceptable ranges and therefore are not a concern for this subwatershed.

Landuse Information

Landuse within the Hinkle Creek Subwatershed consists primarily of agricultural uses. Several areas of deciduous forest are located along the corridor of Hinkle Creek.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 9 stream crossing sites and 4 land/field sites within the Hinkle Creek Subwatershed.

Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 29.

Table 29: Hinkle Creek Windshield Survey Summary	
Parameter	**Observations**
Streambank Erosion	3/9 sites with erosion >3' 1/9 site with erosion <3'
Stream Buffers	1/9 site with no buffers 8/9 sites with buffers <50'
In-stream Debris	6/9 sites with debris
Animal Access	3/9 sites with animal access
Conventional Till	0/13 sites under conventional till

The Hinkle Creek subwatershed contains no active confined feeding operations; however there are 2 voided CFOs located within the watershed.

There is one NPDES permit active within the Hinkle Creek subwatershed. The Gas America Hinkle Creek Wastewater Treatment Plant, permit number IN0059943, is located at 1650 E 236th Street in Noblesville. According to compliance records, there have been no formal enforcement actions within the last 5 years; however there have been 9 noted effluent exceedances within the last 3 years. These exceedances were reported for Chlorine, *E. coli*, Nitrogen and Dissolved Oxygen.

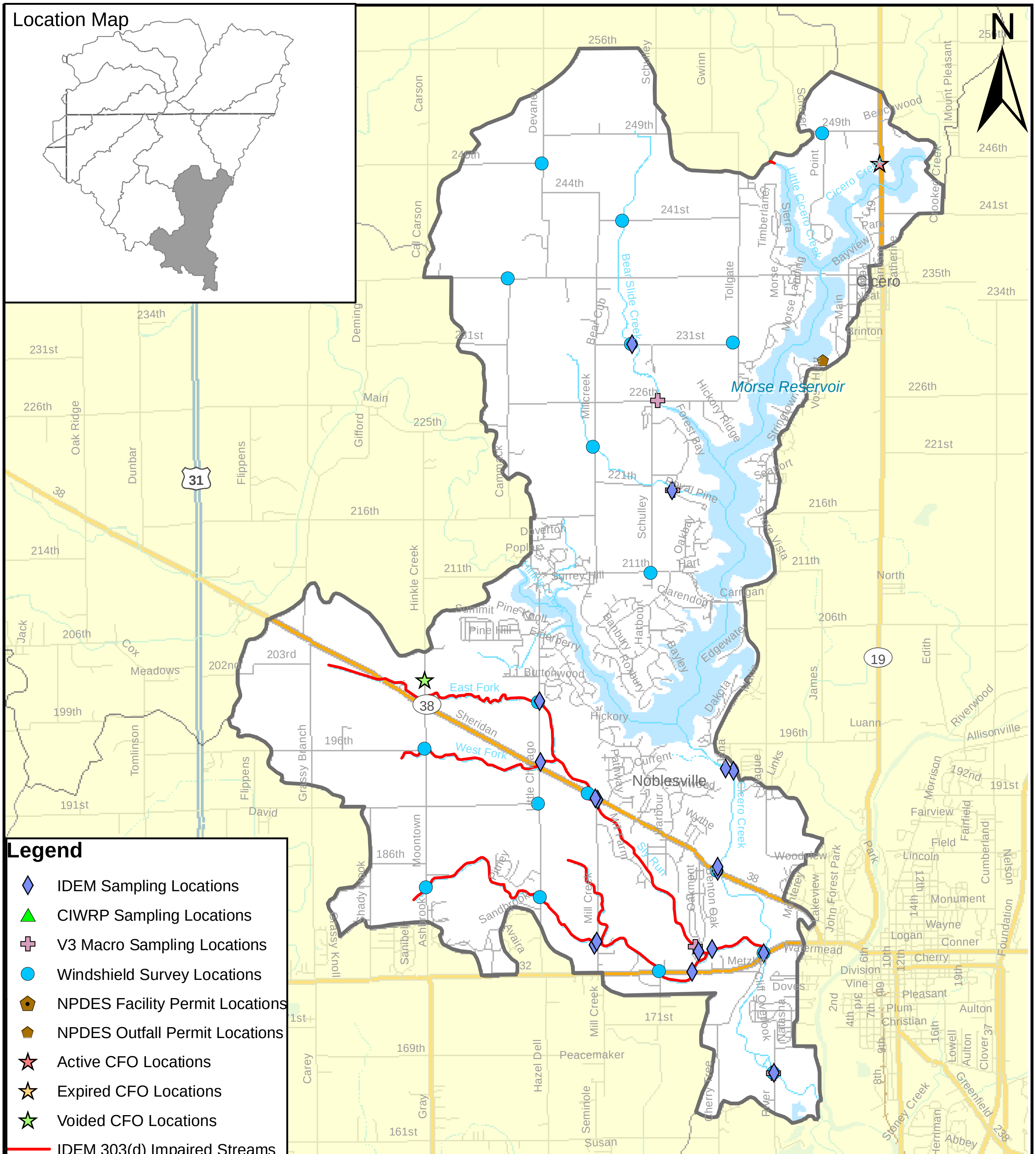
Habitat/Biological Information

V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. One station (Station 3), located at the crossing of Cicero Creek at Royal Pine and Cedar Road in Hamilton County, was analyzed within Hinkle Creek Subwatershed.

The calculated mIBI score of 4.0 indicates that the Hinkle Creek Subwatershed is slightly impaired for macroinvertebrate communities. One IDEM sampling station, one CIWRP sampling station and a windshield survey site were located in the vicinity of the macroinvertebrate station. The windshield survey indicated that adequate habitat was available for macroinvertebrates in the form of underwater tree roots, sufficient cover, and deep and shallow areas which indicates that slight impairment seen in the macroinvertebrate community is not likely caused by lack of habitat. At the IDEM sampling station, *E. coli* was the only water quality parameter analyzed. Levels of *E. coli* at this station average 384.8 CFU/100mL which does exceed the water quality target. At the CIWRP sampling station *E. coli*, TSS, Nitrogen and Phosphorus were all analyzed. Levels of *E. coli* at this station average 4809.7 CFU/100mL, TSS averages 32.9 mg/L, Nitrogen averages 2.7 mg/L and Phosphorus averages 0.3 mg/L. All of these values exceed the water quality targets indicating the slight impairment may be caused by the poor water chemistry at the site. Detailed analysis for each station can be found in Appendix H.

Morse Reservoir/Cicero Creek Subwatershed

The Morse Reservoir/Cicero Creek Subwatershed (HUC 12 – 051202010610) is located in Hamilton County as shown in Exhibit 26. The subwatershed contains approximately 17,713 acres and includes Cicero Creek, West Fork, East Fork, Sly Run, Hinkle Creek, Bear Slide Creek



V3 Companies
7325 Janes Avenue
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630.724.9202 fax
www.v3co.com

TITLE: **Morse Reservoir/Cicero Creek Subwatershed Map (HUC-12: 051202010610)**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: StreamMap USA	PROJECT NO. 09005	EXHIBIT: 26	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 6500'

and Little Cicero Creek. Morse Reservoir is located along the eastern portion of the subwatershed.

Water Quality Information

According to the IDEM 305(b) list, the streams within the Morse Reservoir/Cicero Creek Subwatershed are designated for Recreational, Fishable, and Aquatic Life Use and the reservoir itself is also designated as a Drinking Water source. The 303(d) list indicates that approximately 11.8 miles of streams (West Fork, East Fork, and Sly Run) within the subwatershed are impaired for *E. coli* and the reservoir is impaired for Algae, Taste/Odor and PCBs in Fish Tissue.

A total of 24 IDEM water quality sampling stations are located within the Morse Reservoir/Cicero Creek subwatershed. Available IDEM data at these stations included sampling from the 1996 Synoptic Study, the 2001 Cicero Creek Assessment, 2001 Corvallis and 2001 *E. coli* – Upper WFWR Studies and the 2006 IDEM *E.coli* sampling data for future Cicero Creek TMDL Study. It should be noted that there are some IDEM sampling locations within the reservoir itself. These sites were not analyzed with the stream sampling data as the in-lake and stream sampling analyses are not comparable to each other.

The 2003 CIWRP Study included six sampling locations within the 10-digit HUC 0512020106 Morse Reservoir/Cicero Creek Watershed. There are no sampling locations within this subwatershed. The 2008 Morse Reservoir Blue-Green Algae Study include seven sampling locations in the reservoir. Samples were collected 11 times from May to November. This data was not analyzed as it is reservoir specific, but is included in Appendix G for information purposes.

Table 30 below summarizes the IDEM and CIWRP sampling mean value of each parameter screened and the corresponding water quality target.

Table 30: Morse Reservoir/Cicero Creek IDEM and CIWRP Water Quality Sampling Summary

Water Quality Parameter	IDEM Mean Value	CIWRP Mean Value	Water Quality Target
Dissolved Oxygen	8.7 mg/L	Not Sampled	between 4.0 and 12.0 mg/L
E. coli	1030 CFU/100mL	Not Sampled	235 CFU/100mL
Nitrate + Nitrite	6.1 mg/L	Not Sampled	1.6 mg/L
pH	8.0	Not Sampled	between 6.0 and 9.0
Total Phosphorus	0.074 mg/L	Not Sampled	0.076 mg/L
TSS	9.6 mg/L	Not Sampled	30.0 mg/L
Turbidity	8.3 NTU	Not Sampled	10.4 NTU
Atrazine	Not Sampled	Not Sampled	0.003 mg/L

Based on the available water quality information, the Morse Reservoir/Cicero Creek subwatershed consistently tests higher than the water quality targets in *E. coli* and Nitrate + Nitrite. Dissolved Oxygen, pH, Total Phosphorus and TSS fall within the acceptable ranges and therefore are not concerns for this subwatershed.

Landuse Information

Landuse within the Morse Reservoir/Cicero Creek Subwatershed consists primarily of agricultural uses however significant development is also located within the subwatershed. Medium and high intensity development is concentrated along the eastern edge of the subwatershed associated with Cicero and Noblesville.

During October/November 2009, the Steering Committee volunteers conducted a windshield survey at 150 site locations within the Morse Reservoir/Cicero Creek Watershed. This windshield survey included 12 stream crossing sites and 6 land/field sites within the subwatershed. Observations including streambank erosion, stream buffers, debris, animal access and fields under conventional till were recorded for each site and the results are summarized in Table 31 below.

Table 31: Morse Reservoir/Cicero Creek Windshield Survey Summary

Parameter	Observations
Streambank Erosion	7/12 sites with erosion >3' 3/12 site with erosion <3'
Stream Buffers	1/12 site with no buffers 9/12 sites with buffers <50'
In-stream Debris	10/12 sites with debris
Animal Access	0/12 sites with animal access
Conventional Till	5/20 sites under conventional till

The Morse Reservoir/Cicero Creek subwatershed contains one active confined feeding operation and one voided CFO located within the watershed. There was one violation reported for the CFOs within the subwatershed based on the inspection reports obtained from IDEM. The violation was reported in 2004 for lack of record keeping and lagoon freeboard markers.

There is 1 NPDES permit active within the Morse Reservoir/Cicero Creek subwatershed. The Cicero Municipal Wastewater Treatment Plant, permit number IN0022586, is located at 1159 Stringtown Pike in Cicero. The facility is located outside of the subwatershed; however one permitted outfall is located within the Morse Reservoir/Cicero Creek subwatershed. According to compliance records, there have been no formal enforcement actions within the last 5 years; however there have been 13 noted effluent exceedances within the last 3 years. These exceedances were reported for BOD, *E. coli* and Total Suspended Solids.

Habitat/Biological Information

V3 completed a macroinvertebrate study in October 2009 that included thirteen stations within the Morse Reservoir/Cicero Creek Watershed. Four stations were analyzed within Morse Reservoir/Cicero Creek Subwatershed.

The calculated mIBI score for the station located on Cicero Creek at River Avenue and 160th Street in Hamilton County (Station 1) was 5.4 indicating a slight impairment. The calculated mIBI score for the station located on East Fork Sly Run at Oakmont and State Road 32 in Hamilton County (Station 2) was 4.6 indicating a slight impairment. The calculated mIBI score for the station located on an unnamed tributary at Royal Pine Lane and Cedar Lane in

Hamilton County (Station 4) was 3.0 indicating a moderate impairment. And the calculated mIBI score for the station located on Bear Slide Creek at 226th Street and Schulley Road in Hamilton County (Station 5) was 5.0 indicating a slight impairment.

The mean mIBI score of 4.5 indicates that the Morse Reservoir/Cicero Creek Subwatershed is slightly impaired for macroinvertebrate communities. One IDEM sampling station and one windshield survey site were located in the vicinity of macroinvertebrate station number 1. The windshield survey indicated that adequate habitat was available for macroinvertebrates in the form of underwater tree roots, sufficient cover, and deep and shallow areas. This would indicate that the slight impairment seen in the macroinvertebrate community is not likely caused by lack of habitat. At the IDEM sampling station, *E. coli* was the only water quality parameter analyzed. Levels of *E. coli* at this station average 951.6 CFU/100mL which does exceed the water quality target. Therefore, it is difficult to conclude if the slight impairment to the macroinvertebrate community is due solely to poor water quality at the site since only *E.coli* was measured and no other water chemistry parameters.

One IDEM sampling station was located in the vicinity of macroinvertebrate station number 2. At the IDEM sampling station, *E. coli* was the only water quality parameter analyzed. Levels of *E. coli* at this station average 473.7 CFU/100mL which does exceed the water quality target. Therefore, it is difficult to conclude if the slight impairment to the macroinvertebrate community is due solely to poor water quality at the site since only *E.coli* was measured and no other water chemistry parameters.

One IDEM sampling station was located in the vicinity of macroinvertebrate station number 4. At the IDEM sampling station, *E. coli* was the only water quality parameter analyzed. Levels of *E. coli* at this station average 1397.5 CFU/100mL which does exceed the water quality target. Therefore, it is difficult to conclude if the slight impairment to the macroinvertebrate community is due solely to poor water quality at the site since only *E.coli* was measured and no other water chemistry parameters. However, notes taken during the macroinvertebrate sampling indicated the presence of leaf litter which would provide poor habitat for macroinvertebrates. This indicates that the moderate impairment seen in the macroinvertebrate community may be caused by lack of quality habitat.

No additional sampling sites were located within the vicinity of macroinvertebrate station number 5. No habitat or water chemistry information is available at this location; therefore there is insufficient data to determine the cause of the slight impairment. Detailed analysis for each station can be found in Appendix H.

Part Three of the Watershed Inventory

Watershed Inventory Summary and Ranking

As detailed in Part Two of the Watershed Inventory, available water quality, biological and landuse information was analyzed on a subwatershed (HUC 12) scale. The following tables with subwatershed rankings summarize the data that was analyzed and presented in Part Two of the Watershed Inventory for easy comparison between the subwatersheds.

In order to gain an understanding of the relationships between the subwatersheds and identify the areas of highest concern, a ranking system was established. Ranking was assigned based on each data set with the most impacted subwatershed (subwatershed of the greatest concern) receiving the lowest score (e.g. 1). The scores were then averaged based on the number of data sets that were available for that subwatershed and the lowest average scoring subwatershed received the lowest overall score (e.g. 1). Therefore a subwatershed with a ranking of 1 is the lowest ranked subwatershed meaning it is the worst ranked subwatershed for that specific data set/pollutant and is of highest concern. A subwatershed with a ranking of 10 is the highest ranked subwatershed meaning it is the best ranked subwatershed for that specific data set/pollutant. A value of NR, or Not Ranked, is given for those subwatersheds where the parameter or pollutant was not collected or sampled. Specific ranking methodologies are explained for each table.

It should be noted that average (overall) ranks were provided for the IDEM Water Quality Sampling Summary, CIWRP Studies Summary and NPS Modeling Summary due to the amount of data that was obtained for these studies. The V3 Biological Data, Windshield Survey Data and NPDES Permits Summary information was not averaged so not to dilute this information due to the importance of each of these parameters. This methodology was discussed and agreed to during the Steering Committee meetings.

Water Quality Information

The IDEM 303(d) Summary information is ranked based on the number of impairments per subwatershed. For example, Morse Reservoir/Cicero Creek had four types of impairments; the highest number of impairments compared to the other subwatersheds and therefore was ranked 1 for this data set. Cox Ditch had 3 impairments and therefore ranked second. Buck Creek, Tobin Ditch and Little Cicero Creek each had one impairment and were therefore third in the rankings for the IDEM 303(d) Summary.

Table 32: IDEM 303(d) Summary		
Subwatershed	**IDEM 303(d) Impairments**	**IDEM 303(d) Ranking**
Prairie Creek	Not Listed	**NR**
Cox Ditch	IBC, Nutr, Algae	**2**
Dixon Creek	Not Listed	**NR**
Buck Creek	*E. coli*	**3**
Tobin Ditch	*E. coli*	**3**
Weasel Creek	Not Listed	**NR**
Teter Branch	Not Listed	**NR**
Little Cicero Creek	*E. coli*	**3**
Hinkle Creek	Not Listed	**NR**
Morse Reservoir/ Cicero Creek	*E. coli*, Algae, Taste/Odor, PCBs in fish tissue	**1**

The IDEM Water Quality Sampling Summary information is ranked for each impairment based on the value of the impairment (e.g. Buck Creek had the third highest value for *E. coli*). For example, for TSS the highest value of 74.8 is in Buck Creek and therefore Buck Creek is ranked 1 for TSS. The ranking for the impairments were then averaged to determine an overall rank for the IDEM water quality information. The Overall IDEM WQ Rank left column was determined based on adding each impairment rank and dividing by the number of times it was ranked. For example, Prairie Creek has a total rank of 8 (8 for *E. coli* and no other rankings for the other impairments). Therefore, 8 divided by the number of times it was ranked (1) is 8. Similarly, Cox Ditch has a total rank of 20 (9+2+5+4) and was ranked for all 4 impairments. Therefore, Cox Ditch has an Overall IDEM Rank of 5 (20/4). The right column of the Overall IDEM WQ Rank is ranking the left column from 1 to 10 (1 being the worst case and 10 being the best case).

Table 33: IDEM Water Quality Sampling Summary										
Subwatershed	***E. coli* (CFU/100ml)**		**Nitrate + Nitrite (mg/L)**		**Total Phosphorus (mg/L)**		**TSS (mg/L)**		**Overall IDEM WQ Rank**	
	Value	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**		
Prairie Creek	822	8	--	NR	--	NR	--	NR	8	**9**
Cox Ditch	638	9	7.4	2	0.103	5	27.7	4	5	**7**
Dixon Creek	329	10	--	NR	--	NR	--	NR	10	**10**
Buck Creek	2464	3	--	NR	0.097	6	74.8	1	3.33	**3**
Tobin Ditch	1046	6	7.1	4	0.118	3	13.5	6	4.75	**6**
Weasel Creek	2041	4	6.1	5	0.109	4	27.9	3	4	**5**
Teter Branch	2585	2	--	NR	--	NR	--	NR	2	**2**
Little Cicero Creek	3934	1	7.9	1	0.792	1	46.4	2	1.25	**1**
Hinkle Creek	1919	5	7.3	3	0.186	2	23.7	5	3.75	**4**
Morse Reservoir/ Cicero Creek	1030	7	6.1	5	0.074	7	9.6	7	6.75	**8**

The methodology behind the ranking system for the CIWRP Studies Summary is the same as the ranking system used for Table 33: IDEM Water Quality Sampling Summary.

Table 34: CIWRP Studies Summary										
Subwatershed	*E. coli* (CFU/100ml)		Nitrate + Nitrite (mg/L)		Total Phosphorus (mg/L)		TSS (mg/L)		Overall CIWRP WQ Rank	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank		
Prairie Creek	1886	5	7.5	1	0.152	6	40.1	2	3.5	**3**
Cox Ditch	1886	5	7.5	1	0.152	6	40.1	2	3.5	**3**
Dixon Creek	1886	5	7.5	1	0.152	6	40.1	2	3.5	**3**
Buck Creek	2462	4	7.1	2	0.172	5	60.0	1	3	**2**
Tobin Ditch	2462	4	7.1	2	0.172	5	60.0	1	3	**2**
Weasel Creek	4566	2	5.7	4	0.180	4	27.2	4	3.5	**3**
Teter Branch	1572	6	4.4	5	0.204	2	26.5	5	4.5	**4**
Little Cicero Creek	2771	3	6.2	3	0.186	3	32.9	3	3	**2**
Hinkle Creek	4810	1	2.7	6	0.334	1	32.9	3	2.75	**1**
Morse Reservoir/ Cicero Creek	--	NR	--	NR	--	NR	--	NR	--	**NR**

According to the IDEM 303(d) list, five of the subwatersheds do not meet their designated uses. This is supported by the data compiled from IDEM water quality studies and the CIWRP 2003 study. *E. coli* standards were exceeded in all subwatersheds, with Hinkle Creek being the greatest contributor in the CIWRP study and Little Cicero Creek in the IDEM data. Nitrate + Nitrite and phosphorus levels were also exceeded in the majority of the subwatersheds, with Little Cicero Creek being the largest contributor of both in the IDEM data. Hinkle Creek is the largest contributor of phosphorus in the CIWRP study, while Prairie Creek, Cox Ditch, and Dixon Creek tie for the largest contributor of Nitrate + Nitrite. Total sediment loads were analyzed based on the total suspended solids in the samples. Total suspended solid levels were exceeded in seven of the ten subwatersheds based on the CIWRP data, however only 2 subwatersheds exceeded the targets based on the IDEM data. Buck Creek was the largest contributor in the IDEM data, with Buck Creek and Tobin Ditch tied in the CIWRP data.

Habitat/Biological Information

The V3 Biological Sampling Summary ranking is a straight rank based on the mIBI Score for each subwatershed. A subwatershed with a ranking of 1 is the lowest ranked subwatershed meaning it is the worst ranked subwatershed based on mIBI score and is of highest concern. A subwatershed with a ranking of 10 is the highest ranked subwatershed meaning it is the best ranked subwatershed based on mIBI score.

Table 35: V3 Biological Sampling Summary		
Subwatershed	**mIBI Score**	**V3 Bio Ranking**
Prairie Creek	4.2	**5**
Cox Ditch	3.8	**3**
Dixon Creek	3.4	**2**
Buck Creek	6.4	**8**
Tobin Ditch	6.2	**7**
Weasel Creek	6.8	**9**
Teter Branch	4.0	**4**
Little Cicero Creek	3.0	**1**
Hinkle Creek	4.0	**4**
Morse Reservoir/ Cicero Creek	4.5	**6**

Landuse Information

Windshield survey observations were made during October/November 2009 by Steering Committee volunteers. Observations including general site information (e.g. location and weather), land use, land odor, evidence of best management practices, water color/appearance, water odor, evidence of algae, streambank erosion, stream buffers & type, in stream debris, available shade/stream cover and in stream habitat were recorded for 150 locations throughout the watershed on standardized survey forms. It was determined by the Steering Committee to collect as much data as possible at all of these sites. While all of this information is valid for an overall understanding of the subwatershed, only the five major parameters (streambank erosion, stream buffers, in-stream debris, conventional till and livestock access) were used as a part of the subwatershed assessments, the identification of subwatershed priority areas and specific source critical areas as these parameters help verify the water quality data and BMP recommendations. The results of the survey are summarized in Table 36. The remainder of the information obtained during the windshield survey should be reevaluated during the feasibility phases of plan implementation.

Streambank erosion was broken up into the following categories: absent, stabilized (rip-rap, coir log, etc.), present > 3 feet tall and present < 3 feet tall. Absent and stabilized streambanks are not considered to be a concern and therefore were not included in the subwatershed summaries or rankings. However, the data is included in Appendix I for information purposes. Stream buffers were broken up into the following categories: absent, present > 50 feet and present (minimum 10 feet) < 50 feet. Stream buffers that were categorized as present>50 feet are not considered to be a concern and therefore were not included in the subwatershed summaries or rankings. However, the data is included in Appendix I for information purposes. Absent and stabilized streambanks are not considered to be a concern or reason for impairment and therefore were not included in the subwatershed summaries or rankings. However, the data is included in Appendix I for information purposes. No, there isn't an overall ranking column for the Windshield Survey Summary ranking table. It was discussed during the Steering Committee meetings to not do an overall average as it would dilute the importance of the parameters summarized in this table. In-stream debris, conventional till and livestock access were evaluated based on the number of sites identified. The Windshield Survey Summary ranking is a straight rank based on the Value for each parameter.

Table 36: Windshield Survey Summary										
Subwatershed	**Streambank Erosion (sites with >3ft/<3ft)**		**Stream Buffer (sites with absent/ insufficient)**		**In-Stream Debris (number of sites)**		**Conventional Till (number of sites)**		**Livestock Access (number of sites)**	
	Value	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
Prairie Creek	1/0	6	2/4	3	0	6	3	3	1	2
Cox Ditch	1/0	6	2/3	4	1	5	0	6	1	2
Dixon Creek	3/0	5	1/1	9	1	5	1	5	0	3
Buck Creek	0/0	7	0/0	10	0	6	2	4	0	3
Tobin Ditch	3/0	5	3/3	1	2	4	2	4	0	3
Weasel Creek	1/0	6	2/1	5	2	4	3	3	1	2
Teter Branch	5/1	2	1/4	8	3	3	3	3	3	1
Little Cicero Creek	3/3	3	3/2	2	6	2	9	1	3	1
Hinkle Creek	3/1	4	1/8	7	6	2	0	6	3	1
Morse Reservoir/ Cicero Creek	7/3	1	1/9	6	10	1	5	2	0	3

Morse Reservoir/Cicero Creek had the largest number of instances for both streambank erosion and in-stream debris. Tobin Ditch had the largest number of sites with inadequate stream buffers, while Little Cicero Creek had the highest frequency of areas under conventional till. Little Cicero Creek, Teter Branch, and Hinkle Creek all tied for the largest numbers of direct livestock access.

The NPS Modeling Summary ranking is the same as the ranking system used for Table 33: IDEM Water Quality Sampling Summary.

Table 37: NPS Modeling Summary								
Subwatershed	**N Load (lb/ac/yr)**		**P Load (lb/ac/yr)**		**Sediment Load (t/ac/yr)**		**Overall NPS Modeling Rank**	
	Value	**Rank**	**Value**	**Rank**	**Value**	**Rank**		
Prairie Creek	5.58	5	1.13	4	0.36	3	4	**4**
Cox Ditch	5.59	4	1.15	3	0.37	2	3	**3**
Dixon Creek	5.66	2	1.17	1	0.39	1	1.33	**1**
Buck Creek	5.74	1	1.16	2	0.37	2	1.67	**2**
Tobin Ditch	5.47	7	1.08	7	0.32	6	6.67	**7**
Weasel Creek	5.48	6	1.13	4	0.34	5	5	**6**
Teter Branch	5.64	3	1.11	6	0.35	4	4.33	**5**
Little Cicero Creek	5.48	6	1.12	5	0.35	4	5	**6**
Hinkle Creek	5.30	8	1.04	8	0.32	6	7.33	**8**
Morse Reservoir/ Cicero Creek	5.20	9	0.96	9	0.27	7	8.33	**9**

Buck Creek was the largest contributor of nitrogen loading (pounds per acre) according to the nonpoint source modeling results. Compared to Morse Reservoir/Cicero Creek (the lowest contributor), the percent difference was only 9.9% showing that all subwatersheds contribute a similar amount of nitrogen based on landuse information. Phosphorus loading showed a similar trend with Dixon Creek being the largest contributor, only 19.7% different than Morse Reservoir/Cicero Creek the lowest contributor. More variability was seen with the sediment loading results with a 37.3% difference between the largest and lowest contributors, Dixon Creek and Morse Reservoir/Cicero Creek, respectively.

The NPDES Permits Summary ranking is a straight rank based on the Value for each parameter.

Table 38: NPDES Permits Summary

Subwatershed	CFOs (violations active/expired/void)		NPDES Outfalls (Exceedances)	
	Value	Rank	Value	Rank
Prairie Creek	2 vio. 4/0/6	1	No outfalls	NR
Cox Ditch	0 vio. 3/0/0	3	No outfalls	NR
Dixon Creek	0 vio. 2/0/2	4	No outfalls	NR
Buck Creek	1 vio. 2/0/3	2	6- *E.coli*, 1-N, 1-TSS	3
Tobin Ditch	0 vio. 3/0/0	3	6-*E.coli*, 5-N, 1-TSS	1
Weasel Creek	1 vio. 2/1/0	2	1-*E.coli*, 7-N, 1-P, 3-TSS	1
Teter Branch	0 vio. 0/0/6	6	No exceedances	5
Little Cicero Creek	0 vio. 0/1/2	5	No outfalls	NR
Hinkle Creek	0 vio. 0/0/2	7	2-*E.coli*, 2-N	4
Morse Reservoir/ Cicero Creek	1 vio. 1/0/1	2	1-*E.coli*, 10-TSS	2

Prairie Creek has the largest number of confined feeding operations, whereas Tobin Ditch has the largest number of facilities and outfalls permitted through the NPDES program.

Current Water Quality Impairment

The current water quality impairment category includes all pertinent available water quality studies and quantitative data that were utilized in this analysis. It should be noted that not all available data for the watershed was used in the analysis. This data is easily compared to standard water quality targets and therefore easily used to gage the current health of the subwatersheds. Table 39 identifies the rankings of the subwatersheds based on the current water quality impairments.

The left column of the Current Rank for the Current Water Quality Impairment Ranking is based on the total of each parameter ranking divided by the number of times it was ranked. For example, Weasel Creek has a Current Rank of 5.67 which correlates to (3+5+9)/3. The right column is a straight ranking based on the left column. A subwatershed with a ranking of 1 is the lowest ranked subwatershed meaning it is the worst ranked subwatershed based on the Current Water Quality Impairment and is of highest concern. A subwatershed with a ranking of 10 is the highest ranked subwatershed meaning it is the best ranked subwatershed and a value of NR, or Not Ranked, is given for those subwatersheds where the parameter or pollutant was not collected or sampled.

Table 39: Water Quality Impairment Ranking

Subwatershed	IDEM 303(d)	CIWRP WQ	IDEM WQ	V3 Bio	WATER QUALITY RANK	
Prairie Creek	NR	3	9	5	5.67	**8**
Cox Ditch	2	3	7	3	3.75	**4**
Dixon Creek	NR	3	10	2	5	**7**
Buck Creek	3	2	3	8	4	**5**
Tobin Ditch	3	2	6	7	4.5	**6**
Weasel Creek	NR	3	5	9	5.67	**8**
Teter Branch	NR	4	2	4	3.33	**3**
Little Cicero Creek	3	2	1	1	1.75	**1**
Hinkle Creek	NR	1	4	4	3	**2**
Morse Reservoir/Cicero Creek	1	NR	8	6	5	**7**

Land Use and Industrial Impairments and Concerns

The land use and industrial impairments and concerns category includes land use and social based data. This data is not easily compared to water quality targets but can be helpful in determining the chances of ongoing or future water quality impairments. Table 40 includes a summary of the rankings from the Windshield Survey Summary (Table 36), the NPS Modeling Summary (Table 37) and the NPDES Permits Summary (Table 38) then ranks each subwatershed based on those rankings. The two columns of rankings under the Land Use Rank column were determined in the same manner as the Water Quality Rank columns in Table 39.

Table 40: Land Use and Industrial Impairments and Concerns Ranking										
Subwatershed	**NPS Modeling**	**Stream Erosion**	**Stream Buffer**	**In-Stream Debris**	**Conven-tional Till**	**Live-stock Access**	**CFOs**	**NPDES Facilities**	**LAND USE RANK**	
Prairie Creek	4	6	3	6	3	2	1	NR	3.57	**4**
Cox Ditch	3	6	4	5	6	2	3	NR	4.14	**7**
Dixon Creek	1	5	9	5	5	3	4	NR	4.57	**8**
Buck Creek	2	7	10	6	4	3	2	3	4.63	**9**
Tobin Ditch	7	5	1	4	4	3	3	1	3.5	**3**
Weasel Creek	6	6	5	4	3	2	2	1	3.63	**5**
Teter Branch	5	2	8	3	3	1	6	5	4.13	**6**
Little Cicero Creek	6	3	2	2	1	1	5	NR	2.89	**1**
Hinkle Creek	8	4	7	2	6	1	7	4	4.88	**10**
Morse Reservoir/ Cicero Creek	9	1	6	1	2	3	2	2	3.25	**2**

Overall Subwatershed Ranking

Once the subwatersheds were ranked based on the two established criteria, an overall ranking was assigned. Table 41 illustrates the results of the overall rankings. The right column of the Overall Rank is ranking the left column from 1 to 10 (1 being the worst case and 10 being the best case).

Table 41: Overall Subwatershed Ranking				
Subwatershed	**Water Quality Rank**	**Land Use Rank**	**OVERALL RANK**	
Prairie Creek	8	4	6	**4**
Cox Ditch	4	7	5.5	**3**
Dixon Creek	7	8	7.5	**7**
Buck Creek	5	9	7	**6**
Tobin Ditch	6	3	4.5	**2**
Weasel Creek	8	5	6.5	**5**
Teter Branch	3	6	4.5	**2**
Little Cicero Creek	1	1	1	**1**
Hinkle Creek	2	10	6	**4**
Morse Reservoir/Cicero Creek	7	2	4.5	**2**

Overall the inventory identified the Little Cicero Creek Subwatershed as showing the highest level of current water quality impairments.

Analysis of Stakeholder Concerns

As discussed in Section 1, stakeholder concerns were gathered at the public meetings. The Watershed Inventory provided a means of verifying these concerns or in some cases developing additional concerns. Further discussion on which concerns the steering committee wanted to focus on occurred during the October and November Steering Committee meetings. Table 42 lists these concerns and identifies which concerns are supported by evidence from the Watershed Inventory (windshield survey, IDEM Data, CIWRP data, V3 Biological Survey, etc.) and which concerns will be focused on by the group. This table helps verify which concerns are supported by the collected data versus what is perception, what evidence there is for each concern, whether the concern is quantifiable, and whether the concern is outside the project's scope. For example, streambank erosion was a concern identified during both public meetings. This concern is supported by data based on the water crossing windshield survey locations that identified severe erosion (greater than 3 feet) or moderate erosion (less than 3 feet but had evidence of erosion) throughout the watershed and therefore shows the linkage between the concerns and the windshield survey data (as well as the other data sources evaluated as a part of this WMP).

Table 42: Analysis of Stakeholder Concerns					
Concern	**Supported by Data?**	**Evidence**	**Quanti-fiable?**	**Outside Scope?**	**Group Focus?**
Silt Inputs from watershed into Morse Reservoir	Yes	Aerial photograph review and brought up during Steering & Public Meetings	Yes	No	Yes
Stormwater after rain event	Yes	IDEM, CIWRP Data (*E. coli*, N, P, TSS)	Yes	No	Yes
Big Cicero erosion	Yes	Windshield Survey	Yes	No	Yes
Water clarity	Yes	IDEM, CIWRP Data (N, P, TSS)	Yes	No	Yes
Polluted runoff – nonpoint source pollution	Yes	IDEM, CIWRP Data (*E. coli*, N, P, TSS)	Yes	No	Yes
Failing septic systems impact to water quality	No	Not enough data to specify exact source	No	No	Yes
Streambank deterioration caused by severe erosion	Yes	Windshield Survey	Yes	No	Yes
E. coli in Little Cicero	Yes	IDEM, CIWRP Data (*E. coli*)	Yes	No	Yes
Landfill leaking	No	None, brought up during Public Meeting	No	Yes	No
Leaking of oil and gas while using reservoir for recreational purposes	No	None, brought up during Public Meeting	No	Yes	No
Phosphorus	Yes	IDEM, CIWRP Data (P)	Yes	No	Yes
Brown water	Yes	IDEM, CIWRP Data (N, P, TSS)	Yes	No	Yes
Debris in curbs and grates	No	None, brought up during Public Meeting	No	Yes	No
Grass clippings/litter in water	No	None, brought up during Public Meeting	No	Yes	No
Conflict between water quality and production agriculture	No	None, brought up during Public Meeting	No	No	Yes
Nutrient management	Yes	IDEM, CIWRP Data (N, P)	Yes	No	Yes
Subsurface drainage	No	None, brought up during Public Meeting	No	Yes	No
Ditch maintenance	Yes	Windshield Survey	Yes	No	Yes
Farming in Tipton County increase sediment & nutrients to watershed	No	None, brought up during Public -Meeting	No	No	Yes
Atrazine	No	None, brought up during Public Meeting	Yes	No	Yes
Buffer areas	Yes	Windshield Survey	Yes	No	Yes
Manure management	Yes	Windshield Survey	Yes	Yes	Yes
Livestock access to surface water within the watershed	Yes	Windshield Survey	Yes	No	Yes
Combined sewer overflows – Tipton County	Yes	EPA NPDES Compliance Records	Yes	No	No
Cost of streambank maintenance	No	None, brought up during Public Meeting	No	Yes	No

Table 42: Analysis of Stakeholder Concerns, cont.					
Concern	**Supported by Data?**	**Evidence**	**Quanti-fiable?**	**Outside Scope?**	**Group Focus?**
Water level	No	None, brought up during Public Meeting	No	Yes	No
Water quality pre & post development	Yes	IDEM, CIWRP Data (N, P, TSS)	Yes	No	Yes
Silt from construction sites	Yes	IDEM, CIWRP Data (TSS)	Yes	No	Yes
Runoff from construction sites	Yes	IDEM, CIWRP Data (TSS)	Yes	No	Yes
Building zoning restriction	No	None, brought up during Public Meeting	No	Yes	No
Construction Site erosion control	Yes	IDEM, CIWRP Data (TSS)	Yes	No	Yes
Residential fertilizer use	Yes	IDEM, CIWRP Data (N, P)	Yes	No	Yes
Need for dredging	No	None, brought up during Public Meeting	Yes	Yes	Yes
Construction clearing	No	None, brought up during Public Meeting	No	Yes	No
Streambank erosion	Yes	Windshield Survey	Yes	No	Yes
Habitat degradation	Yes	Windshield Survey, mIBI	Yes	No	Yes
Streambank stabilization	Yes	Windshield Survey	Yes	No	Yes
Canada geese waste impact on water quality	No	None, brought up during Public Meeting	No	Yes	No
Big Cicero habitat degradation	Yes	Windshield Survey	Yes	No	Yes
Increase in Canada geese population	No	None, brought up during Public Meeting	No	Yes	No
Safety of using Morse Reservoir recreationally	No	None, brought up during Public Meeting	No	Yes	No
Flooding	No	None, brought up during Public Meeting	No	Yes	No
Wastewater package plants	Yes	EPA NPDES Compliance Records	Yes	No	No
Fish consumption advisories/safety	Yes	IDEM 303d List	Yes	Yes	No
Effectiveness of Indianapolis drinking water treatment	No	None, brought up during Public Meeting	No	Yes	No
Odor/taste of water	Yes	IDEM 303d List	Yes	Yes	No
Wastewater treatment plant operation/lime in water	Yes	NPDES Permit Compliance	Yes	Yes	No
How to prioritize numerous watershed concerns for maximum improvement	No	None, brought up during Public Meeting	No	No	Yes
Need for water storage reservoir by Anderson	No	None, brought up during Public Meeting	No	Yes	No
Education and outreach of watershed issues	No	None, brought up during Public Meeting	No	No	Yes
Cooperation/communication between counties	No	None, brought up during Public Meeting	No	Yes	Yes
Changing public perception of stormwater as a bi-product	No	None, brought up during Public Meeting	No	No	Yes

Table 42: Analysis of Stakeholder Concerns, cont.					
Concern	**Supported by Data?**	**Evidence**	**Quanti-fiable?**	**Outside Scope?**	**Group Focus?**
Stewardship quality/too few interested parties within watershed	No	None, brought up during Public Meeting	No	No	Yes
Public concern over blue-green algae	Yes	CIWRP Data	Yes	No	Yes
Skin irritation/toxin	Yes	CIWRP Data	Yes	Yes	Yes
Safety of using water for irrigation due to presence of blue-green algae	No	None, brought up during Public Meeting	No	Yes	Yes
Effectiveness of algae treatments	No	None, brought up during Public Meeting	No	Yes	No

It should be noted that TSS readings from the watershed do not necessarily indicate silt inputs into the reservoir. Deposition may occur prior to entry to the reservoir, therefore without actual reservoir silt data, it cannot be stated that this concern is supported by data.

It should be noted that Nitrogen and Phosphorus are both essential nutrients for organism growth, the concern stated at the public meeting included sediment and algae in the streams. The presence of excess N & P can be indicative of excess algae which would cause water clarity issues.

Section 3 – Identify Problems

Group Concerns

The results of the Watershed Inventory and stakeholder concern analysis in Section 2 indicate that the group concerns can be described in four general areas. Table 43 lists the concerns that the group will focus on and the problem associated with each group. Some concerns are listed in several problem groups as they cover a wide variety of issues.

Table 43: Concerns and Associated Problems

Concern	Problem Category
-How to prioritize numerous watershed concerns for maximum improvement -Education and outreach of watershed issues -Changing public perception on stormwater as a bi-product -Stewardship quality/too few interested parties within watershed -Public concern over blue-green algae -Safety of using water for irrigation due to presence of blue-green algae	Public Participation/Education and Outreach
-Stormwater after rain event -Water clarity -Polluted runoff – nonpoint source pollution -Failing septic systems impact to water quality -Phosphorus -Brown water -Conflict between water quality and production agriculture -Nutrient management -Farming in Tipton County increase sediment and nutrients to watershed -Atrazine -Buffer areas -Residential fertilizer use -Livestock access to surface water within the watershed -Habitat degradation -Big Cicero habitat degradation -Public concern over blue-green algae -Skin irritation/toxin -Safety of using water for irrigation due to presence of blue-green algae	Stream & Reservoir Nutrient Levels
-Stormwater after rain event -Water clarity -Polluted runoff – nonpoint source pollution -Failing septic systems impact to water quality -*E. coli* in Little Cicero -Brown water -Buffer areas -Livestock access to surface water within the watershed -Habitat degradation -Big Cicero habitat degradation -Manure management	*E. coli* Levels

Table 43: Concerns and Associated Problems, cont.	
Concern	**Problem Category**
-Silt inputs from watershed into Morse Reservoir -Stormwater after rain event -Big Cicero erosion -Water clarity -Polluted runoff – nonpoint source pollution -Streambank deterioration caused by severe erosion -Brown water -Ditch maintenance -Buffer areas -Livestock access to surface water within the watershed -Water quality pre and post construction -Silt from construction sites -Runoff from construction sites -Erosion control at construction sites -Streambank erosion -Habitat degradation -Streambank stabilization -Big Cicero habitat degradation -Need for dredging	Erosion and Sedimentation within the Watershed & Reservoir

Problem Statements

Problem statements were developed during the planning process in an effort to link watershed concerns with existing and historical water quality data and the four major concern categories. Following each problem statement is a brief synopsis on how the data analyzed within the Watershed Inventory correlates with the identified problem.

It should be noted that there were originally six problem statements which separated the stream and reservoir issues (e.g. nutrients and sediment). In order to limit the amount of information that would be repeated from one problem statement to the next, the nutrient and sediment problem statements for streams and the reservoir were combined into one problem statement.

Public Participation/Education and Outreach

Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.

The data analyzed during the Watershed Inventory does not directly correlate to the Public Participation/Education and Outreach problem statement. It is difficult to measure the impacts of the lack of knowledge on a specific pollutant of concern; however conversations at the public meeting and steering committee meetings validated the concern.

Stream & Reservoir Nutrient Levels

Agriculture and typical urban area practices (e.g. lawn care, pet waste disposal, erosion control during construction…etc.) within the watershed contributes a significant amount of pollutants, thereby contributing to the frequent exceedances of water quality targets and growth of algae within the reservoir.

IDEM water quality data and the CIWRP study both verified the exceedances of nutrient concentrations and directly correlate to the problem statement. According to the CIWRP data, all subwatersheds exceeded the Nitrate + Nitrite target of 1.6 mg/L by at least 69%, while in the IDEM data 6 subwatersheds (no data available for four subwatersheds) exceeded the target by at least 281%. Similarly, the phosphorus target of 0.076 mg/L was exceeded in all subwatersheds according to the CIWRP data by at least 97% and 6 subwatersheds exceeded the target by at least 28% in the IDEM data(no data available for three subwatersheds). Approximately 88% of the sampling points do drain to or from the reservoir. During the subwatershed analysis, the average of data points was used to determine the impairments of the subwatersheds relative to each other. Rather than reanalyzing the data, the reservoir and agricultural nutrient levels are assumed to be the same within the problem statements.

E. coli Levels

E. coli levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.

IDEM water quality data and the CIWRP study both verified the exceedances of *E. coli* levels and directly correlate to the problem statement. According to the CIWRP data, all subwatersheds exceeded the *E. coli* target of 235 CFU/100mL by at least 569%, while in the IDEM data all subwatersheds exceeded the target by at least 40%.

Erosion and Sedimentation within the Watershed & Reservoir

Soil erosion and sedimentation within the watershed is degrading the water quality/quantity and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed.

IDEM water quality data and the CIWRP study both verified the exceedances of total suspended solids and directly correlate to the problem statement. According to the CIWRP data, seven subwatersheds exceeded the TSS target of 30 mg/L by at least 10% (no data available for one subwatershed), while in the IDEM data two subwatersheds exceeded the target by 55% (no data available for three subwatersheds).

Review of the Google and Bing aerials showed very distinctive areas at the confluences of Cicero Creek and Hinkle Creek where the reservoir is functioning as a sediment trap. Further analysis specific to sediment issues with in the reservoir (e.g. current and future bathymetric surveys, feasibility of BMPs immediately upstream of the reservoir to reduce sediment loads, sediment removal plans, TSS sampling etc.) should be completed as a part of implementing this plan and as a way to track the effectiveness of any BMP projects that focus on sediment reduction.

Section 4 – Identify Causes, Sources and Load Reductions

Potential Causes & Sources

A cause is an event, agent, or series of actions that produces an effect. In the context of a watershed management plan, the effect is the problem. Potential causes were identified for each problem statement based on the information summarized in the Watershed Inventory in Section 2. Where applicable, potential causes were related to specific pollutant parameters identified during the Watershed Inventory. A source is an activity, material or structure that results in nonpoint source pollution. Potential sources were identified for each problem statement based on the information analyzed in the Watershed Inventory in Section 2. Table 44 lists the potential causes and sources for each problem. For causes and sources that did not have IDEM, CIWRP or other agency collected data as backup, the information was obtained during the Steering Committee meetings, Public meetings or during the windshield survey.

Table 44: Potential Causes & Sources

Problem Statement	Potential Causes	Potential Sources
Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.	-Lack of public awareness -Lack of unified approach -Lack of perceived benefits/ impacts -Lack of interest -Lack of time and commitment -Lack of media coverage/ educational material	- N/A, not applicable for administrative or social problems
Agriculture and typical urban area practices (e.g. lawn care, pet waste disposal, erosion control during construction…etc.) within the watershed contributes a significant amount of pollutants, thereby contributing to the frequent exceedances of water quality targets and growth of algae within the reservoir.	-Application of fertilizers that include Phosphorus -Over application of fertilizers for its specific use -Timing of application of fertilizers -Unsewered communities -Lack of septic maintenance -Undersized/old combined sewer systems -Improper disposal of yard waste -Lack of manure management -Lack of adequate buffers -Livestock access to ditches/streams -Improper disposal of pet/Canada goose waste -Municipal sludge management	-Residential lawns that drain directly to the reservoir with no or inadequate buffers -Conventionally tilled agricultural fields that drain directly to ditches/streams with no or inadequate buffers -Areas where live stock have direct access to streams -Areas with inadequate buffers -Communities with Combined Sewers and Overflows into ditches/streams -Communities with no sewer systems and direct discharges to ditches/streams

Table 44: Potential Causes & Sources, cont.		
Problem Statement	**Potential Causes**	**Potential Sources**
E. coli levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.	-Illegal or improper septic systems -Inadequately functioning septic systems -Unsewered communities -Undersized/old combined sewer systems -Improper disposal of pet/Canada goose waste -Livestock access to ditches/streams -Lack of manure management -Lack of adequate buffers -Exceedances in NPDES permitted discharges	-Locations with improperly maintained septic systems -Communities with Combined Sewers and Overflows into ditches/streams -Communities with no sewer systems and direct discharges to ditches/streams -Areas with inadequate buffers -Locations where pet/Canada goose waste is disposed of directly into the reservoir -Confined Feeding Operations -Areas where live stock have direct access to streams -Areas with inadequate buffers -Locations of NPDES permitted facilities not in compliance
Soil erosion and sedimentation within the watershed is degrading the water quality/quantity and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed.	-Agricultural land/row crop production -Lack of temporary erosion control on construction sites -Lack of Rule 5 enforcement -Frequency of ditch maintenance -Lack of infiltration due to increased impervious areas -Streambank erosion -Livestock access to streams -Areas with inadequate stream buffers	-Conventionally tilled agricultural fields with no or inadequate buffers -Locations where on-going developments/construction sites have inadequate temporary erosion control measures -Locations where non-active construction sites have inadequate permanent erosion control measures -Ditches/streams that are frequently dredged/maintained

It should be noted that a non-active construction site is considered to be a site that has been hydrologically altered (e.g. trees have been cleared, topsoil/vegetation has been stripped) and the site is just bare ground with no permanent erosion control measures in place.

Pollutant Loading

Current Loading Calculation Methodology

Nitrate + Nitrite, Total Phosphorus, *E. coli* and Total Suspended Solids were identified as potential issues for several of the problem statements. In order to determine the extent of the current problem, current loads must be determined for comparison to target or known water quality targets.

There are several ways to estimate the current pollutant loads in a watershed, including nonpoint source modeling and actual sampling data. Both sources of information are available for the Morse Reservoir/Cicero Creek Watershed. With the extent of water quality data available from IDEM and CIWRP, it was determined that the most accurate estimate for pollutant loads would incorporate the available water quality data rather than the modeling results.

Two data sets, IDEM (1996-2009) and CIWRP (2003), sampled for Nitrate + Nitrite, Total Phosphorus, *E. coli* and TSS. Instead of averaging these two data sets together, the most recent data available for each subwatershed was used for the calculations. The IDEM data included sampling dating back to 1996, however, each subwatershed contained sampling locations as recent as 2006 therefore the most recent data for each parameter within the subwatershed was utilized for the loading calculation. The entire list of available IDEM data/reports obtained is included in the Available Data and Studies section of the WMP. The mean value of each parameter was then calculated on a subwatershed-wide scale. For the purposes of a watershed management plan, the pollutant loads need to be calculated in either pounds per year or tons per year. Since the water quality data was provided in units of mg/L and CFU/100mL, a flow rate was needed for the conversion. There is one USGS gaging station located within the Morse Reservoir/Cicero Creek Watershed. The station, number 03349510, is located on Cicero Creek at Arcadia. Average annual flow data is available for this station from 2004-2008. At the gage site, the drainage area is 131 square miles and the average annual flow is 171.3 cfs. This flow was scaled to each subwatershed. IDEMs load calculation tool was then used to estimate the loads based on the flow and concentration data.

Target Loads

The target loads were identified based on known water quality guidelines or standards for each pollutant. These standards typically reference a concentration, therefore as described above, IDEMs load calculation tool was used to estimate the target loads based on the flow and standard concentration data.

The single sample state standard in Indiana for *E. coli* is 235 CFU/100 mL.

Levels of Total Nitrate and Nitrite greater than 10 mg/L exceed the water quality target for Nitrate and Nitrite as described in the Indiana Administrative Code (IAC). However, for this analysis, a target of 1.6 mg/L was identified as the EPA nutrient criterion for this ecoregion.

Levels of Total Phosphorus greater than 0.3 mg/L exceed the IDEM statewide draft TMDL target, while levels above 0.076 mg/L exceed the EPA recommended water quality targets. For this analysis, EPA's recommended target was used as the target.

Levels of TSS greater than 30 mg/L exceed the IDEM statewide draft TMDL target.

Load Reductions

Once the current loads and the target loads of each pollutant were determined, the required load reduction to meet the targets was calculated. Tables 45-48 show the current, target and reduction loads of *E. coli*, Nitrate+Nitrite, Total Phosphorus and Total Suspended Solids within the watershed.

Table 45: *E. coli* Pollutant Loading

Subbasin	Flow Rate (cfs)	Current Loading		Target Loading		Reduction Needed
		Concentration (CFU/100mL)	Load (CFU/year)	Concentration (CFU/100mL)	Load (CFU/year)	Load (CFU/year)
Prairie Creek	30.9	822	$2.3x10^{14}$	235	$6.5x10^{13}$	$1.6x10^{14}$ (71.4%)
Cox Ditch	27.0	638	$1.5x10^{14}$	235	$5.7x10^{13}$	$9.7x10^{13}$ (63.2%)
Dixon Creek	22.5	329	$6.6x10^{13}$	235	$4.7x10^{13}$	$1.9x10^{13}$ (28.6%)
Buck Creek	24.3	2464	$5.3x10^{14}$	235	$5.1x10^{13}$	$4.8x10^{14}$ (90.5%)
Tobin Ditch	43.1	1046	$4.0x10^{14}$	235	$9.0x10^{13}$	$3.1x10^{14}$ (77.5%)
Weasel Creek	28.0	2041	$5.1x10^{14}$	235	$5.9x10^{13}$	$4.5x10^{14}$ (88.5%)
Teter Branch	27.2	2585	$6.3x10^{14}$	235	$5.7x10^{13}$	$5.7x10^{14}$ (90.9%)
Little Cicero Creek	29.4	3934	$1.0x10^{15}$	235	$6.2x10^{13}$	$9.7x10^{14}$ (94.0%)
Hinkle Creek	26.3	1919	$4.5x10^{14}$	235	$5.5x10^{13}$	$4.0x10^{14}$ (87.8%)
Morse Reservoir/Cicero Creek	36.2	864	$2.8x10^{14}$	235	$7.6x10^{13}$	$2.0x10^{14}$ (72.8%)

Table 46: Nitrate+Nitrite Pollutant Loading						
Subbasin	**Flow Rate (cfs)**	**Current Loading**		**Target Loading**		**Reduction Needed**
		Concentration (mg/L)	**Load (lb/year)**	**Concentration (mg/L)**	**Load (lb/year)**	**Load (lb/year)**
Prairie Creek	30.9	7.5	456000	1.6	97200	358800 (78.7%)
Cox Ditch	27.0	7.4	393200	1.6	85000	308200 (78.4%)
Dixon Creek	22.5	7.5	332000	1.6	70800	261200 (78.7%)
Buck Creek	24.3	7.1	339400	1.6	76600	262800 (77.5%)
Tobin Ditch	43.1	7.1	602000	1.6	135600	466400 (77.5%)
Weasel Creek	28.0	6.1	336000	1.6	88200	247800 (73.8%)
Teter Branch	27.2	4.4	235400	1.6	85600	149800 (63.6%)
Little Cicero Creek	29.4	6.2	358600	1.6	92600	266000 (74.2%)
Hinkle Creek	26.3	2.7	139800	1.6	82800	57000 (40.7%)
Morse Reservoir/Cicero Creek	36.2	6.1	436400	1.6	114000	322400 (73.8%)

Table 47: Total Phosphorus Pollutant Loading						
Subbasin	**Flow Rate (cfs)**	**Current Loading**		**Target Loading**		**Reduction Needed**
		Concentration (mg/L)	**Load (lb/year)**	**Concentration (mg/L)**	**Load (lb/year)**	**Load (lb/year)**
Prairie Creek	30.9	0.152	9200	0.076	4600	4600 (50.0%)
Cox Ditch	27.0	0.103	5400	0.076	4000	1400 (26.2%)
Dixon Creek	22.5	0.152	6800	0.076	3400	3400 (50.0%)
Buck Creek	24.3	0.172	8200	0.076	3600	4600 (55.8%)
Tobin Ditch	43.1	0.118	10000	0.076	6400	3600 (35.6%)
Weasel Creek	28.0	0.109	6000	0.076	4200	1800 (30.3%)
Teter Branch	27.2	0.204	11000	0.076	4000	7000 (62.7%)
Little Cicero Creek	29.4	0.186	10800	0.076	4400	6400 (59.1%)
Hinkle Creek	26.3	0.334	17200	0.076	4000	13200 (77.2%)
Morse Reservoir/Cicero Creek	36.2	0.074	5200	0.076	5400	N/A (0.0%)

Table 48: Total Suspended Solids Pollutant Loading						
Subbasin	**Flow Rate (cfs)**	**Current Loading**		**Target Loading**		**Reduction Needed**
		Concentration (mg/L)	**Load (ton/year)**	**Concentration (mg/L)**	**Load (ton/year)**	**Load (ton/year)**
Prairie Creek	30.9	40.1	1219.0	30.0	912.0	307 (25.2%)
Cox Ditch	27.0	27.7	735.8	30.0	796.9	N/A (0.0%)
Dixon Creek	22.5	40.1	887.6	30.0	664.0	223.6 (25.2%)
Buck Creek	24.3	60.0	1434.3	30.0	717.2	717.1 (50.0%)
Tobin Ditch	43.1	13.5	572.4	30.0	1272.0	N/A (0.0%)
Weasel Creek	28.0	27.9	768.5	30.0	826.4	N/A (0.0%)
Teter Branch	27.2	26.5	709.1	30.0	802.8	N/A (0.0%)
Little Cicero Creek	29.4	32.9	951.6	30.0	867.7	83.9 (8.8%)
Hinkle Creek	26.3	32.9	851.2	30.0	776.2	75.0 (8.8%)
Morse Reservoir/Cicero Creek	36.2	9.6	341.9	30.0	1068.4	N/A (0.0%)

Section 5 – Set Goals and Identify Critical Areas

Goal Statements

Based on the identified concerns and possible sources, goal statements were developed for each problem statement. Implementation of policies and programs to meet these goal statements will improve watershed management in the Morse Reservoir/Cicero Creek Watershed. The goal statements indicate the ultimate goal for a specific project. In some cases this goal may not be attainable in the short term; therefore there is also a list of long term objectives included with each goal. Short term implies efforts will begin implementation in the years 0-5 and long term implies years 6-20. Timeframes for the objectives listed under each problem statement is provided in Section 7 – Action Register and Schedule in the Task Column. The goal statements themselves are typically the overall long term goal. It should be noted that some objectives may relate to several goal statements, they are listed in each applicable category.

Public Participation/Education and Outreach

Problem Statement: Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.

Goal Statement: Develop and implement an education and outreach program within the watershed by 2031 (20 years).

Short Term Objectives:

- Effectively share and communicate past, current and future activities within the watershed
- Educate stakeholders within the watershed on the function of a watershed and their impacts to water quality
- Educate homeowners in urban communities about the use of fertilizers
- Coordinate efforts with the UWRWA, local MS4s, high schools, FFA/4-H groups, and any other education and outreach efforts being conducted within the watershed
- Work with Indiana Wildlife Federation on efforts to educate on and reduce the use of fertilizers containing phosphorus
- Educate stakeholders using septic systems about the importance of septic system maintenance

Long Term Objectives:

- Continue viable and effective short term objectives
- Educate agricultural stakeholders about the use of Atrazine and its impacts to water quality
- Utilize examples or pilot programs/demonstration projects for educational purposes
- Review education and outreach program within the watershed and continue development and implementation of the program

Stream & Reservoir Nutrient Levels

Problem Statement: Agriculture and typical urban area practices (e.g. lawn care, pet waste disposal, erosion control during construction…etc.) within the watershed contributes a significant amount of pollutants, thereby contributing to the frequent exceedances of water quality targets and growth of algae within the reservoir.

Goal Statement: Reduce the nutrient loads so that there are no exceedances of EPAs suggested targets for Nitrate + Nitrite of 1.6 mg/L and Total Phosphorus of 0.076mg/L by 2031 (20 years).

Short Term Objectives:

- Educate the agricultural stakeholders on the importance of reduced application of fertilizers and the urban/residential stakeholders on use of low phosphorus or no phosphorus fertilizers
- Educate local, regional, and state officials on the need for regulations for urban areas (specifically for phosphorus)
- Partner with NRCS, SWCDs, MS4s, Indiana State Department of Agriculture and County Boards to promote and implement cost share and/or education programs
- Promote and implement agricultural BMPs that will reduce nutrient levels in the watershed (e.g. alternative watering systems, buffer/filter strips, exclusionary fencing, conservational tillage, reforestation, stream restoration, wetland restoration, etc.)
- Promote and implement urban BMPs that will reduce nutrient levels in the watershed (e.g. filtration basins, pervious pavement, bioretention practices, etc.)

Long Term Objectives:

- Continue viable and effective short term objectives
- Educate and work with point discharges (CFOS, NPDES permitted facilities) to reduce their nutrient loads
- Establish a monitoring program or group to collect samples

E. coli Levels

Problem Statement: *E. coli* levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.

Goal Statement: Reduce *E. coli* concentrations to meet the state standard of 235 CFU/100mL by 2031 (20 years).

Short Term Objectives:

- Educate stakeholders using septic systems about the importance of septic system maintenance
- Encourage urban/residential stakeholders to properly dispose pet and/or Canada goose waste
- Partner with NRCS, SWCDs, MS4s, Indiana Department of Agriculture and County Boards to promote and implement cost share and/or education programs
- Promote and implement agricultural BMPs that will reduce *E.coli* levels in the watershed (e.g. alternative watering systems, buffer/filter strips, exclusionary fencing, wetland restoration, etc.)

- Educate the public and stakeholders on the benefits of manure management practices

Long Term Objectives:
- Continue viable and effective short term goals
- Educate and work with point dischargers to reduce the amount of *E. coli* runoff from point sources, package plants, CFOs and CSOs
- Establish a monitoring program or group to collect samples

Proper disposal of pet and wildlife waste was a significant concern of the Steering Committee as it relates to waste which occurs on residential lawns around the reservoir. Wildlife waste was specifically referenced to the Canada goose waste being disposed of directly in the reservoir. Therefore an education program would encourage the proper disposal of this waste.

Erosion and Sedimentation within the Watershed & Reservoir

Problem Statement: Soil erosion and sedimentation within the watershed is degrading the water quality/quantity and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed.

Goal Statement: Reduce sediment loads to meet the IDEM statewide draft TMDL target of 30 mg/L for TSS by 2031 (20 years).

Short Term Objectives:
- Research cost effective ways to measure sediment change within the reservoir
- Research/evaluate the need and effectiveness of a sediment removal program
- Partner with NRCS, SWCDs, MS4s and County Boards to promote and implement cost share and/or education programs in order to reduce erosion from agricultural lands
- Promote and implement agricultural BMPs that will reduce TSS levels in the watershed (e.g. alternative watering systems, buffer/filter strips, exclusionary fencing, grassed waterways, naturalized stream buffers, conservational tillage, reforestation, stream restoration, wetland restoration, etc.)
- Promote and implement urban BMPs that will reduce nutrient levels in the watershed (e.g. filtration basins, infiltration trenches, naturalized detention basins, pervious pavement, rain barrels, rain gardens, bioretention practices, etc.)

Long Term Objectives:
- Continue viable and effective short term objectives
- Measure sediment change within the reservoir
- Encourage enforcement of erosion control practices associated with the issuance of Rule 5 construction permits
- Establish a monitoring program or group to collect samples

Monitoring the change in the sediment levels within the reservoir can be handled in a variety of ways. For example, one option could be to focus on the reservoir confluence with Hinkle Creek, as it is one of the areas that has an obvious sediment problem, and coordinate with land owners in that subwatershed to implement sediment reducing BMPs. Based on the

Streambank Erosion Critical Areas exhibit, there are at least 3 waterway crossing locations with greater than 3 feet of eroded streambanks in the Hinkle Creek subwatershed. Therefore, stream restoration or buffer/filter strip projects would be great in aiding in the reduction of sediment in this subwatershed and ultimately to the reservoir. Typically, a sediment removal plan can not be implemented unless the source has been identified and resolved. The ultimate decision on how to proceed with monitoring the sediment levels in the reservoir should be made by the Steering Committee as they are implementing the WMP.

It is difficult to put a cost to something without knowing the exact scope of the sediment removal project. However, in general, dredging costs vary greatly depending on the need for dewatering, access, disposal site location, and the type of dredging. Industry standards would suggest that hydraulic dredging can cost anywhere from $10-$20 per cubic yard and $12 to $35 per cubic yard for mechanical dredging. If there is a known project with a scope, it would be best to get bids from multiple contracts that specialize in this type of work.

Indicators

Indicators are measurable parameters or criteria which can used to determine the progress being made toward achieving a goal. Indicators were developed for each goal and objective. Some indicators may be appropriate for several categories and are listed for each applicable goal. As the watershed management plan is being implemented, it is anticipated that additional indicators will be identified; therefore this list is not intended to be comprehensive. Table 49 lists the indicators and the goals to which they are linked. An Education/Outreach Menu was developed by the UWRWA and V3 and is included in Appendix M. This menu includes various media for education and outreach. Since it is unknown at this time the preferred methods of outreach, several indicators refer to this menu in addition to specific outreach tools.

Table 49: Goals and Indicators	
Goal	**Indicators**
Develop and implement an education and outreach program within the watershed	-Number of updates to website -Number of newspaper/newsletter articles or other media communications -Number of brochures/educational materials distributed or field days organized -Number of programs and ideas utilized from the Education/Outreach Menu
Reduce the nutrient loads so that there are no exceedances of EPAs suggested targets for Nitrate + Nitrite of 1.6 mg/L and Total Phosphorus of 0.076mg/L.	-Observed Nitrate + Nitrite and Total Phosphorus concentrations -Number or stream miles of improved/created buffer zones and associated load reductions -Number of agricultural fields utilizing cover crops, conservation tillage, or other BMPs and associated load reductions -Number of urban BMPs installed (e.g. pond shoreline plantings, rain gardens) and associated load reductions -Nutrient loadings from point dischargers
Reduce *E. coli* concentrations to meet the state standard of 235 CFU/100mL	-Observed *E. coli* concentrations -Number or stream miles of stabilized streambanks and associated load reductions -Number of direct animal access points eliminated and associated load reductions -Number or stream miles of improved/created buffer zones and associated load reductions -*E. coli* loadings from point dischargers
Reduce sediment loads to meet the IDEM statewide draft TMDL target of 30 mg/L for TSS.	-Number of agricultural fields utilizing conservation tillage, cover crops or other BMPs and associated load reductions -Number or stream miles of improved/created buffer zones and associated load reductions -Number of inspections and/or enforcement actions on construction sites with Rule 5 permits -Number or stream miles of stabilized streambanks and associated load reductions -Number of direct animal access points eliminated and associated load reductions -Change in sediment amount in reservoir

Critical Areas

Critical areas are defined as areas where project implementation can remediate current water quality impairments or reduce the impact of future water quality impairments. The critical areas within the Morse Reservoir/Cicero Creek watershed were identified based on the Watershed Inventory, the identified problems and the goals of the Watershed Management Plan. Critical areas were split into two categories: Subwatershed Priority Areas and Specific Source Critical areas.

High Priority Subwatersheds

The Subwatershed Critical Areas were chosen based on the Watershed Inventory Rankings. Based on the Watershed Inventory, the lowest/worst ranked subwatersheds are the most impaired based on all of the available data. Projects within these subwatersheds would provide the greatest water quality benefit. The top four ranked subwatersheds were identified as the High Priority Subwatersheds.

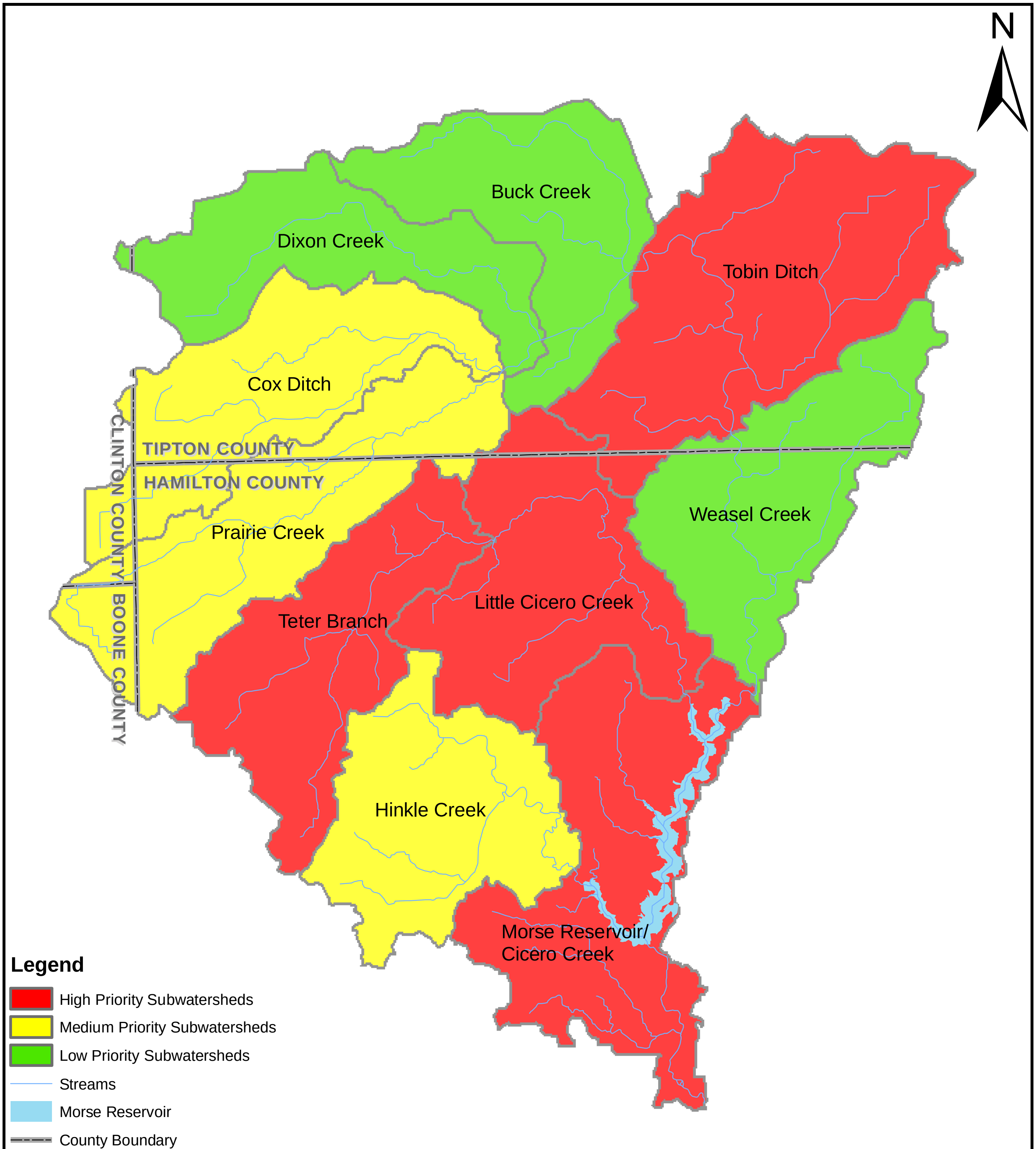
Since the watershed management plan is a living document, the intent is not to limit projects to only the High Priority Areas as these may become less critical as the plan is implemented. In an effort to prioritize work, the remaining six subwatersheds were also categorized as medium priority or low priority. The intent of this ranking is that if all projects are implemented in the High Priority Areas, then a medium subwatershed should be evaluated for project implementation. Exhibit 27 shows the priority subwatershed areas and the ranking of the remaining subwatersheds.

Little Cicero Creek Subwatershed

As discussed in the Watershed Inventory in Section 2, the Little Cicero Creek Subwatershed shows the highest level of current water quality impairment and the highest level of land use and industrial impairments based on the available data. The Little Cicero Creek Subwatershed exceeded the State standard for *E. coli* and water quality targets for Nitrate + Nitrite, Phosphorus and TSS according to the CIWRP study and the IDEM data and needs reductions of 94%, 74.2%, 59.1% and 8.8% respectively to meet the target loads set for the subwatershed.

Little Cicero Creek also contained the poorest macroinvertebrate ratings per V3's sampling analysis. During the windshield survey, 3 of the 10 stream sites showed areas of streambank erosion that exceeded 3 feet (see Exhibit 30), 3 sites showed areas with no stream buffers (see Exhibit 29), 6 locations had in-stream debris, conventional tillage practices were seen in 9 of the 15 locations (see Exhibit 31) and 3 locations had the possibility of direct animal access (see Exhibit 28). Based on these findings and as outlined in Part Three of the Watershed Inventory (Watershed Ranking tables and summaries), the Little Cicero Creek Subwatershed is a High Priority Subwatershed Area for Best Management Practice implementation.

As this subwatershed is 89% agricultural with no significant urban areas, the BMPs suggested in Table 51 for the Little Cicero Creek subwatershed are agricultural/rural focused and are beneficial in reducing pollutant loadings for more than one impairment.



V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: **Subwatershed Priority Areas**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: HUC-12 Watershed Boundaries	PROJECT NO. 09005	EXHIBIT: 27	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance, P.O. Box 2065, Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

The windshield survey information showed that there at least 3 locations within the subwatershed where animals could access streams. Implementation of alternative watering systems as well as exclusionary fencing and eliminating the potential for animals to have direct access to the streams will reduce pollutant loadings within the subwatershed. For example, the load reduction needed for *E. coli* in this subwatershed is 94% in order to meet the target loads. Implementation of the exclusionary fencing alone provides a 90% reduction in *E. coli* for area tributary to the fencing based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Exclusionary fencing also provides 70% removal of TSS, 60% of Phosphorus and 65% of Nitrogen.

Similarly, the windshield survey results showed that the subwatershed has at least 3 sites with no stream buffers or evidence of streambank erosion greater than 3 feet in depth. The subwatershed has approximately 16 miles of major stream corridor (Little Cicero Creek, Bennett Ditch and Taylor Creek) which doesn't include the minor tributaries or other regulated drains within the subwatershed. Therefore, there is great potential for implementation of buffer/filter strips, reforestation along streams and stream restoration within the subwatershed as a best management practice for reducing, Nitrate+Nitrite, Total Phosphorus and TSS.

Since the subwatershed is 89% agricultural land with at least 9 locations from the windshield survey showing conventional tillage practices, promoting no-till or reduced till (conservation tillage) practices within this subwatershed would also help to reduce TSS and Nitrate+Nitrite loadings. Based on the information obtained from the Hamilton County SWCD, approximately 49% of corn fields in the County operate using conventional tillage practices. Nutrient/Waste Management plans would also be a beneficial BMP for reduction of all pollutants.

Approximately 39.7% of the subwatershed is mapped as having hydric soils. These areas would be conducive for wetland restoration, which has the potential to reduce pollutant loads by 80% for sediment and *E. coli*, 55% for phosphorus and 45% for nitrogen.

Based on this information, BMP implementation projects are very feasible within the Little Cicero Creek subwatershed. However, specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind.

Tobin Ditch Subwatershed

The Tobin Ditch Subwatershed shows a moderate level of current water quality impairment (ranked sixth) and a high level of land use and industrial impairments (ranked third) based on the available data. The Tobin Ditch Subwatershed exceeded the State standard for *E. coli* and water quality targets for Nitrate + Nitrite, Phosphorus and TSS in the CIWRP study and exceeded the State standard for *E. coli* and water quality targets for Nitrate + Nitrite and Phosphorus in the IDEM data. Reductions of 77.5%, 77.5%, and 35.6% are needed for *E. coli*, Nitrate + Nitrite, and Phosphorus respectively to meet the target loads set for the subwatershed. The current loading of TSS within this subwatershed meets the target, therefore no reduction is necessary.

During the windshield survey, 3 of the 15 stream sites showed areas of streambank erosion that exceeded 3 feet (see Exhibit 30), 6 sites showed areas with no or inadequate stream buffers (see Exhibit 29), 2 locations had in-stream debris and conventional tillage practices were seen in 2 of the locations (see Exhibit 31) within the Tobin Ditch subwatershed. Based on these findings and as outlined in Part Three of the Watershed Inventory (Watershed Ranking tables and summaries), the Tobin Ditch Subwatershed is a High Priority Subwatershed for Best Management Practice implementation.

The Tobin Ditch subwatershed is approximately 87% agricultural with urban areas concentrated in the western portion of the subwatershed associated with Tipton, a small area in the northeastern portion associated with the town of Hobbs, and a small area in the southern portion associated with the Town of Atlanta. Therefore, the BMPs suggested in Table 51 for this subwatershed are agricultural/rural and urban focused and are beneficial in reducing pollutant loadings for more than one impairment.

The subwatershed is critical for *E. coli.* The City of Tipton Municipal Sewer Treatment Plant has an outfall permit for eight locations within the Tobin Ditch subwatershed. Similarly, the Town of Atlanta Municipal Sewer Treatment Plant has a permit for one outfall within the subwatershed. Based on the obtained information, there were six *E.coli*, five N and one TSS exceedances reported for these outfalls. There are also three active CFOs located within the subwatershed. All of these could be potential sources for elevated *E. coli* levels. More specifically, combined sewer overflows at the outfall locations and improperly maintained waste management plans contribute pollutants into the ditches/streams. Even though there are no Urban BMPs that show a benefit for reducing *E. coli*, the potential for wetland restoration within the subwatershed is feasible due to 57.9% of the subwatershed being mapped with hydric soils. Wetland restoration has the potential to reduce pollutant loads by 80% for sediment and *E. coli*, 55% for phosphorus and 45% for nitrogen.

Although the windshield survey did not show any locations where animals could access streams, the subwatershed is 87% agricultural with three active CFOs and the subwatershed is critical for *E. coli* indicating that there may be animal access locations that were not observed during the survey. Implementation of alternative watering systems as well as exclusionary fencing and eliminating the potential for animals to have direct access to the streams will reduce pollutant loadings within the subwatershed. For example, the load reduction needed for *E. coli* in this subwatershed is 77.5% in order to meet the target loads. Implementation of the exclusionary fencing alone provides a 90% reduction in *E. coli* for area tributary to the fencing based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Exclusionary fencing also provides 70% removal of TSS, 60% of Phosphorus and 65% of Nitrogen.

The windshield survey results showed that the subwatershed has at least 9 sites with inadequate stream buffers or evidence of streambank erosion greater than 3 feet in depth. The subwatershed has approximately 28 miles of major stream corridor (Cicero Creek, Buscher Ditch, Doversberger Ditch, Bacon Prairie Creek, Stone Hinds Ditch, Schlater Ditch, Goff Ditch, Richman Ditch and Tobin Ditch) which doesn't include the minor tributaries or other regulated drains within the subwatershed. Therefore, there is great potential for implementation of buffer/filter strips, reforestation along streams and stream restoration within the subwatershed as a best management practice for reducing *E. coli*, Nitrate+Nitrite, Total Phosphorus and TSS.

Since the subwatershed is 87% agricultural land with at least 2 locations from the windshield survey showing conventional tillage practices, promoting no-till or reduced till (conservation tillage) practices within this subwatershed would also help to reduce TSS and Nitrate+Nitrite loadings. Based tillage information from Tipton County for 1996-2007, approximately 43% of cultivated fields in the County operate using conventional tillage practices. Nutrient/Waste Management plans would also be a beneficial BMP for reduction of all pollutants.

Approximately 57.9% of the subwatershed is mapped as having hydric soils. These areas would be conducive for wetland restoration, which has the potential to reduce pollutant loads by 80% for sediment and *E. coli*, 55% for phosphorus and 45% for nitrogen.

The Tobin Ditch Subwatershed includes a portion of the City of Tipton, Town of Hobbs and Town of Atlanta. Urban runoff is often a significant source of nonpoint source pollution within a watershed. The implementation of BMPs such as bioretention practices, filtration basins, and pervious pavement within urban areas has the potential to significantly reduce the pollutant loadings within the watershed. For example, the load reduction needed for Nitrate+Nitrite in this subwatershed is 77.5% in order to meet the target loads. Installation of pervious pavement has the potential to reduce Nitrate+Nitrite loads tributary to the pavement by 85% based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Therefore, this practice propagated throughout the watershed has the potential to significantly reduce nonpoint source pollution loadings.

Based on this information, BMP implementation projects are very feasible within the Tobin Ditch subwatershed. However, specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind.

Teter Branch Subwatershed

The Teter Branch Subwatershed shows a high level of current water quality impairment (ranked third) and a moderate level of land use and industrial impairments (ranked sixth) based on the available data. The Teter Branch Subwatershed exceeded the State standard for *E. coli* and the water quality targets for Nitrate + Nitrite and Phosphorus in the CIWRP study and exceeded the State standards for *E. coli* in the IDEM data (Nitrate + Nitrite, Phosphorus, and TSS information was not available from the IDEM data). Reductions of 90.9%, 63.6% and 62.7% are needed for *E. coli*, Nitrate + Nitrite, and Phosphorus respectively to meet the target loads set for the subwatershed. The current loading of TSS within this subwatershed meets the target, therefore no reduction is necessary.

During the windshield survey, 5 of the 9 stream sites showed areas of streambank erosion that exceeded 3 feet (see Exhibit 30), 5 sites showed areas with no or inadequate stream buffers (see Exhibit 29), 3 locations had in-stream debris and conventional tillage practices were seen in 3 of the locations (see Exhibit 31) within the Teter Branch subwatershed. Based on these findings and as outlined in Part Three of the Watershed Inventory (Watershed Ranking tables and summaries), the Teter Branch Subwatershed is a High Priority Subwatershed for Best Management Practice implementation.

The Teter Branch subwatershed is approximately 88% agricultural with urban areas concentrated in the southwestern portion of the subwatershed associated with Sheridan. Therefore, the BMPs suggested in Table 51 for this subwatershed are agricultural/rural and urban focused and are beneficial in reducing pollutant loadings for more than one impairment.

The windshield survey information showed that there at least 3 locations within the subwatershed where animals could access streams. Implementation of alternative watering systems as well as exclusionary fencing and eliminating the potential for animals to have direct access to the streams will reduce pollutant loadings within the subwatershed. For example, the load reduction needed for Phosphorus in this subwatershed is 62.7% in order to meet the target loads. Implementation of the stream restoration alone provides a 75% reduction in Phosphorus based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Stream restoration also provides 75% removal of TSS and 75% of Nitrogen.

The windshield survey results also showed that the subwatershed has at least 10 sites with inadequate stream buffers or evidence of streambank erosion greater than 3 feet in depth. The subwatershed has approximately 17 miles of major stream corridor (Little Cicero Creek, Ross Ditch, Teter Branch, Jay Ditch and Symons Ditch) which doesn't include the minor tributaries or other regulated drains within the subwatershed. Therefore, there is great potential for implementation of buffer/filter strips, reforestation along streams and stream restoration within the subwatershed as a best management practice for reducing Nitrate+Nitrite, Total Phosphorus and TSS.

Since the subwatershed is 88% agricultural land with at least 3 locations from the windshield survey showing conventional tillage practices, promoting no-till or reduced till (conservation tillage) practices within this subwatershed would also help to reduce Nitrate+Nitrite loadings. Based on the information obtained from the Hamilton County SWCD, approximately 49% of corn fields in the County operate using conventional tillage practices. Nutrient/Waste Management plans would also be a beneficial BMP for reduction of all pollutants.

Approximately 41.2% of the subwatershed is mapped as having hydric soils. These areas would be conducive for wetland restoration, which has the potential to reduce pollutant loads by 80% for sediment and *E. coli*, 55% for phosphorus and 45% for nitrogen.

The Teter Branch Subwatershed includes a portion of the Town of Sheridan. Urban runoff is often a significant source of nonpoint source pollution within a watershed. The implementation of BMPs such as bioretention practices, filtration basins, naturalized detention basins and pervious pavement within urban areas has the potential to significantly reduce the pollutant loadings within the watershed. For example, the load reduction needed for Nitrate+Nitrite in this subwatershed is 63.6% in order to meet the target loads. Installation of bioretention has the potential to reduce Nitrate+Nitrite loads tributary to the pavement by 65% based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Therefore, this practice propagated throughout the watershed has the potential to significantly reduce nonpoint source pollution loadings.

Based on this information, BMP implementation projects are very feasible within the Teter Branch subwatershed. However, specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind.

Morse Reservoir/Cicero Creek Subwatershed

The Morse Reservoir/Cicero Creek Subwatershed shows a moderate level of current water quality impairment (ranked seventh) and a high level of land use and industrial impairments (ranked second) based on the available data. The Morse Reservoir/Cicero Creek Subwatershed exceeded the targets of *E. coli* and Nitrate + Nitrite in the IDEM data (no CIWRP data was available for this subwatershed). Reductions of 72.8% and 73.8% are needed for *E. coli* and Nitrate + Nitrite, respectively to meet the target loads set for the subwatershed. The current loading of Phosphorus and TSS within this subwatershed meet the target, therefore no reduction is necessary. It should be noted that the majority of the sampling stations within this subwatershed are located downstream of the reservoir.

During the windshield survey, 7 of the 12 stream sites showed areas of streambank erosion that exceeded 3 feet (see Exhibit 30), 10 sites showed areas with no or inadequate stream buffers (see Exhibit 29), 10 locations had in-stream debris and conventional tillage practices were seen in 5 of the locations (see Exhibit 31) within the Morse Reservoir/Cicero Creek subwatershed. Based on these findings and as outlined in Part Three of the Watershed Inventory (Watershed Ranking tables and summaries), the Morse Reservoir/Cicero Creek Subwatershed is a High Priority Subwatershed for Best Management Practice implementation.

The Morse Reservoir/Cicero Creek subwatershed is approximately 54% agricultural with urban areas concentrated along the eastern edge of the subwatershed associated with Cicero and Noblesville. Therefore, the BMPs suggested in Table 51 for this subwatershed are agricultural/rural and urban focused and are beneficial in reducing pollutant loadings for more than one impairment.

The subwatershed is critical for *E. coli.* The Town of Cicero has one permitted outfall location. There was one *E.coli* and 10 TSS exceedances reported for this outfall based on the information obtained from IDEM. Similarly, the City of Noblesville has a Long Term Control plan for combined sewer overflows (there are no known locations within this subwatershed). There are also one active and one voided CFO located within the subwatershed. All of these could be potential sources for elevated *E. coli* levels. More specifically, combined sewer overflows at the outfall locations and improperly maintained waste management plans contribute pollutants into the ditches/streams. Even though there are no Urban BMPs that show a benefit for reducing *E. coli*, the potential for wetland restoration within the subwatershed is feasible due to 27.1% of the subwatershed being mapped with hydric soils. Wetland restoration has the potential to reduce pollutant loads by 80% for sediment and *E. coli*, 55% for phosphorus and 45% for nitrogen.

Although the windshield survey did not show any locations within the subwatershed where animals could access streams, the subwatershed is 54% agricultural lands and is critical for *E. coli* indicating that there may be animal access locations that were not observed during the survey. Implementation of alternative watering systems as well as exclusionary fencing and eliminating the potential for animals to have direct access to the streams will reduce pollutant loadings within the subwatershed. For example, the load reduction needed for *E. coli* in this subwatershed is 72.8% in order to meet the target loads. Implementation of the exclusionary fencing alone provides a 90% reduction in *E. coli* for area tributary to the fencing based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Exclusionary fencing also provides 70% removal of TSS, 60% of Phosphorus and 65% of Nitrogen.

The windshield survey results showed that the subwatershed has at least 8 sites with no stream buffers or evidence of streambank erosion greater than 3 feet in depth. The subwatershed has approximately 35 miles of major stream corridor (Cicero Creek, West Fork, East Fork, Sly Run, Hinkle Creek, Bear Slide Creek and Little Cicero Creek) which doesn't include the minor tributaries or other regulated drains within the subwatershed. Therefore, there is great potential for implementation of buffer/filter strips, reforestation along streams and stream restoration within the subwatershed as a best management practice for reducing *E. coli*, Nitrate+Nitrite, Total Phosphorus and TSS.

Since the subwatershed is 54% agricultural land with at least 5 locations from the windshield survey showing conventional tillage practices, promoting no-till or reduced till (conservation tillage) practices within this subwatershed would also help to reduce Nitrate+Nitrite loadings. Based on the information obtained from the Hamilton County SWCD, approximately 49% of corn fields in the County operate using conventional tillage practices. Nutrient/Waste Management plans would also be a beneficial BMP for reduction of all pollutants.

The Morse Reservoir/Cicero Creek Subwatershed includes portions of the Town of Cicero and the City of Noblesville. Urban runoff is often a significant source of nonpoint source pollution within a watershed. The implementation of BMPs such as bioretention practices, filtration basins, naturalized detention basins, naturalized stream buffers, rain barrels/rain gardens and pervious pavement within urban areas has the potential to significantly reduce the pollutant loadings within the watershed. For example, the load reduction needed for Nitrate+Nitrite in this subwatershed is 73.8% in order to meet the target loads. Installation of pervious pavement has the potential to reduce Nitrate+Nitrite loads tributary to the pavement by 85% based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Therefore, this practice propagated throughout the watershed has the potential to significantly reduce nonpoint source pollution loadings.

Based on this information and the fact that Morse Reservoir is a part of the drinking water supply system for the Indianapolis Water Company's White River Water Treatment Facility, BMP implementation projects are very feasible within the Morse Reservoir/Cicero Creek subwatershed. However, specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind.

Medium Priority Subwatersheds

The Cox Ditch, Prairie Creek and Hinkle Creek Subwatersheds are all considered Medium Priority areas.

Cox Ditch

The Cox Ditch Subwatershed shows a moderate level of current water quality impairment (ranked fourth) and a moderate level of land use and industrial impairments (ranked seventh) based on the available data. The Cox Ditch subwatershed exceeded the State standard for *E. coli* and the water quality targets for Nitrate + Nitrite, Phosphorus and TSS in the CIWRP study and exceeded the State standards for *E. coli* and the water quality targets for Nitrate + Nitrite and Phosphorus in the IDEM data. Reductions of 63.2%, 78.4% and 26.2% are needed for *E. coli*, Nitrate + Nitrite, and Phosphorus respectively to meet the target loads set for the subwatershed.

During the windshield survey, 1 of the 9 stream sites showed areas of streambank erosion that exceeded 3 feet (see Exhibit 30), 5 sites showed areas with no or inadequate stream buffers (see Exhibit 29), 1 location had in-stream debris within the Cox Ditch subwatershed. Based on these findings and as outlined in Part Three of the Watershed Inventory (Watershed Ranking tables and summaries), the Cox Ditch Subwatershed is a Medium Priority Subwatershed for Best Management Practice implementation.

The Cox Ditch subwatershed is approximately 93% agricultural. Therefore, the BMPs suggested in Table 51 for this subwatershed are agricultural/rural focused and are beneficial in reducing pollutant loadings for more than one impairment.

The windshield survey information showed that there is at least 1 location within the subwatershed where animals could access streams. Implementation of alternative watering systems as well as exclusionary fencing and eliminating the potential for animals to have direct access to the streams will reduce pollutant loadings within the subwatershed. For example, the load reduction needed for *E. coli* in this subwatershed is 63.2% in order to meet the target loads. Implementation of the exclusionary fencing alone provides a 90% reduction in *E. coli* for area tributary to the fencing based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Exclusionary fencing also provides 70% removal of TSS, 60% of Phosphorus and 65% of Nitrogen.

The windshield survey results also showed that the subwatershed has at least 6 sites with inadequate stream buffers or evidence of streambank erosion greater than 3 feet in depth. The subwatershed has approximately 20 miles of major stream corridor (Cicero Creek, Cox Ditch, Christy Ditch, Leander Boyle Ditch, Matthews Ditch and Kigin Ditch) which doesn't include the minor tributaries or other regulated drains within the subwatershed. Therefore, there is great potential for implementation of buffer/filter strips, reforestation along streams and stream restoration within the subwatershed as a best management practice for reducing *E. coli*, Nitrate+Nitrite, Total Phosphorus and TSS.

Even though the windshield survey did not show any locations practicing conventional tillage, the subwatershed is 93% agricultural land. Promoting no-till or reduced till (conservation tillage) practices within this subwatershed would also help to reduce Nitrate+Nitrite loadings. Based tillage information from Tipton County for 1996-2007, approximately 43% of cultivated fields in the County operates using conventional tillage practices. Nutrient/Waste Management plans would also be a beneficial BMP for reduction of all pollutants.

Approximately 55.0% of the subwatershed is mapped as having hydric soils. These areas would be conducive for wetland restoration, which has the potential to reduce pollutant loads by 80% for sediment and *E. coli*, 55% for phosphorus and 45% for nitrogen.

Based on this information, BMP implementation projects are very feasible within the Cox Ditch subwatershed. However, specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind.

Prairie Creek

The Prairie Creek Subwatershed shows a low level of current water quality impairment (ranked eighth) and a moderate level of land use and industrial impairments (ranked fourth). The Prairie Creek subwatershed exceeded the State standard for *E. coli* and the water quality targets for Nitrate + Nitrite, Phosphorus and TSS in the CIWRP study and exceeded the State standards for *E. coli* in the IDEM data (Nitrate + Nitrite, Phosphorus, and TSS information was not available from the IDEM data). Reductions of 71.4%, 78.7%, 50.0% and 25.2% are needed for *E. coli*, Nitrate + Nitrite, Phosphorus and TSS respectively to meet the target loads set for the subwatershed.

During the windshield survey, 1 of the 10 stream sites showed areas of streambank erosion that exceeded 3 feet (see Exhibit 30), 6 sites showed areas with no or inadequate stream buffers (see Exhibit 29), and conventional tillage practices were seen in 3 of the locations (see Exhibit 31) within the Prairie Creek subwatershed. Based on these findings and as outlined in Part Three of the Watershed Inventory (Watershed Ranking tables and summaries), the Prairie Creek Subwatershed is a Medium Priority Subwatershed for Best Management Practice implementation.

The Prairie Creek subwatershed is approximately 92% agricultural. Therefore, the BMPs suggested in Table 51 for this subwatershed are agricultural/rural focused and are beneficial in reducing pollutant loadings for more than one impairment.

The windshield survey information showed that there is at least 1 location within the subwatershed where animals could access streams. Implementation of alternative watering systems as well as exclusionary fencing and eliminating the potential for animals to have direct access to the streams will reduce pollutant loadings within the subwatershed. For example, the load reduction needed for *E. coli* in this subwatershed is 71.4% in order to meet the target loads. Implementation of the exclusionary fencing alone provides a 90% reduction in *E. coli* for area tributary to the fencing based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Exclusionary fencing also provides 70% removal of TSS, 60% of Phosphorus and 65% of Nitrogen.

The windshield survey results also showed that the subwatershed has at least 7 sites with inadequate stream buffers or evidence of streambank erosion greater than 3 feet in depth. The subwatershed has approximately 19 miles of major stream corridor (Prairie Creek, Endicott Ditch, Pearce Ditch and McKinzie Ditch) which doesn't include the minor tributaries or other regulated drains within the subwatershed. Therefore, there is great potential for implementation of buffer/filter strips, reforestation along streams and stream restoration within the subwatershed as a best management practice for reducing *E. coli*, Nitrate+Nitrite, Total Phosphorus and TSS.

Since the subwatershed is 92% agricultural land with at least 3 locations from the windshield survey showing conventional tillage practices, promoting no-till or reduced till (conservation tillage) practices within this subwatershed would also help to reduce Nitrate+Nitrite loadings. Based on the information obtained from the Hamilton County SWCD, approximately 49% of corn fields in the County operate using conventional tillage practices. Nutrient/Waste Management plans would also be a beneficial BMP for reduction of all pollutants.

Approximately 54.4% of the subwatershed is mapped as having hydric soils. These areas would be conducive for wetland restoration, which has the potential to reduce pollutant loads by 80% for sediment and *E. coli*, 55% for phosphorus and 45% for nitrogen.

Based on this information, BMP implementation projects are very feasible within the Prairie Creek subwatershed. However, specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind.

Hinkle Creek

The Hinkle Creek Subwatershed shows a high level of current water quality impairment (ranked second) and a low level of land use and industrial impairments (ranked tenth). The Hinkle Creek subwatershed exceeded the State standard for *E. coli* and the water quality targets for Nitrate + Nitrite, Phosphorus and TSS in the CIWRP study and exceeded the State standards for *E. coli* and the water quality targets for Nitrate + Nitrite and Phosphorus in the IDEM data. Reductions of 87.8%, 40.7%, 77.2% and 8.8% are needed for *E. coli*, Nitrate + Nitrite, Phosphorus and TSS respectively to meet the target loads set for the subwatershed.

During the windshield survey, 3 of the 9 stream sites showed areas of streambank erosion that exceeded 3 feet (see Exhibit 30), 9 sites showed areas with no or inadequate stream buffers (see Exhibit 29), and 10 locations had in-stream debris within the Hinkle Creek subwatershed. Based on these findings and as outlined in Part Three of the Watershed Inventory (Watershed Ranking tables and summaries), the Hinkle Creek Subwatershed is a Medium Priority Subwatershed for Best Management Practice implementation.

The Hinkle Creek subwatershed is approximately 81% agricultural. Therefore, the BMPs suggested in Table 51 for this subwatershed are agricultural/rural focused and are beneficial in reducing pollutant loadings for more than one impairment.

The windshield survey information showed that there is are at least 3 locations within the subwatershed where animals could access streams. Implementation of alternative watering systems as well as exclusionary fencing and eliminating the potential for animals to have direct access to the streams will reduce pollutant loadings within the subwatershed. For example, the load reduction needed for *E. coli* in this subwatershed is 87.8% in order to meet the target loads. Implementation of the exclusionary fencing alone provides a 90% reduction in *E. coli* for area tributary to the fencing based on Table 50 Best Management Practice Load Reduction Summary in Section 6. Exclusionary fencing also provides 70% removal of TSS, 60% of Phosphorus and 65% of Nitrogen.

The windshield survey results also showed that the subwatershed has at least 9 sites with inadequate stream buffers or evidence of streambank erosion greater than 3 feet in depth. The subwatershed has approximately 18 miles of major stream corridor (Hinkle Creek, Jones Ditch, Lindley Ditch and Baker Ditch) which doesn't include the minor tributaries or other regulated drains within the subwatershed. Therefore, there is great potential for implementation of buffer/filter strips, reforestation along streams and stream restoration within the subwatershed as a best management practice for reducing *E. coli*, Nitrate+Nitrite, Total Phosphorus and TSS.

Even though the windshield survey did not show any locations practicing conventional tillage, the subwatershed is 81% agricultural land. Promoting no-till or reduced till (conservation tillage) practices within this subwatershed would also help to reduce Nitrate+Nitrite loadings. Based on the information obtained from the Hamilton County SWCD, approximately 49% of corn fields in the County operate using conventional tillage practices. Nutrient/Waste Management plans would also be a beneficial BMP for reduction of all pollutants.

Approximately 31.7% of the subwatershed is mapped as having hydric soils. These areas would be conducive for wetland restoration, which has the potential to reduce pollutant loads by 80% for sediment and *E. coli*, 55% for phosphorus and 45% for nitrogen.

Based on this information, BMP implementation projects are very feasible within the Hinkle Creek subwatershed. However, specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind.

Lower Priority Subwatersheds

The Buck Creek, Dixon Creek and Weasel Creek Subwatersheds are all considered Low Priority areas.

The Buck Creek Subwatershed shows a moderate level of current water quality impairment (ranked fifth) and a low potential for future water quality impairment (ranked ninth). The Dixon Creek Subwatershed shows a moderate level of current water quality impairment (ranked seventh) and a low potential for future water quality impairment (ranked eighth). And the Weasel Creek Subwatershed shows a low level of current water quality impairment (ranked eighth) and a moderate potential for future water quality impairment (ranked fifth).

Specific Source Critical Areas

Sources that would reduce loading of several pollutants of concern or address several identified problems at once if modified or eliminated were designated Specific Source Critical Areas. The specific source critical areas are found throughout the watershed and not confined to a specific subwatershed. These critical areas can and do overlap the Subwatershed Critical Areas. However, problem areas in the lowest ranking subwatersheds cannot be addressed until the high and medium priority areas have been addressed. The locations of the Specific Source Critical Areas were identified during the Windshield Survey, completed as part of the Watershed Inventory. The windshield survey only covered a finite number of locations within the watershed, so instances and locations of these sources may not be specifically identified, but are still considered critical areas.

Livestock Access
All areas in the watershed where livestock have direct access to the stream are identified as being critical.

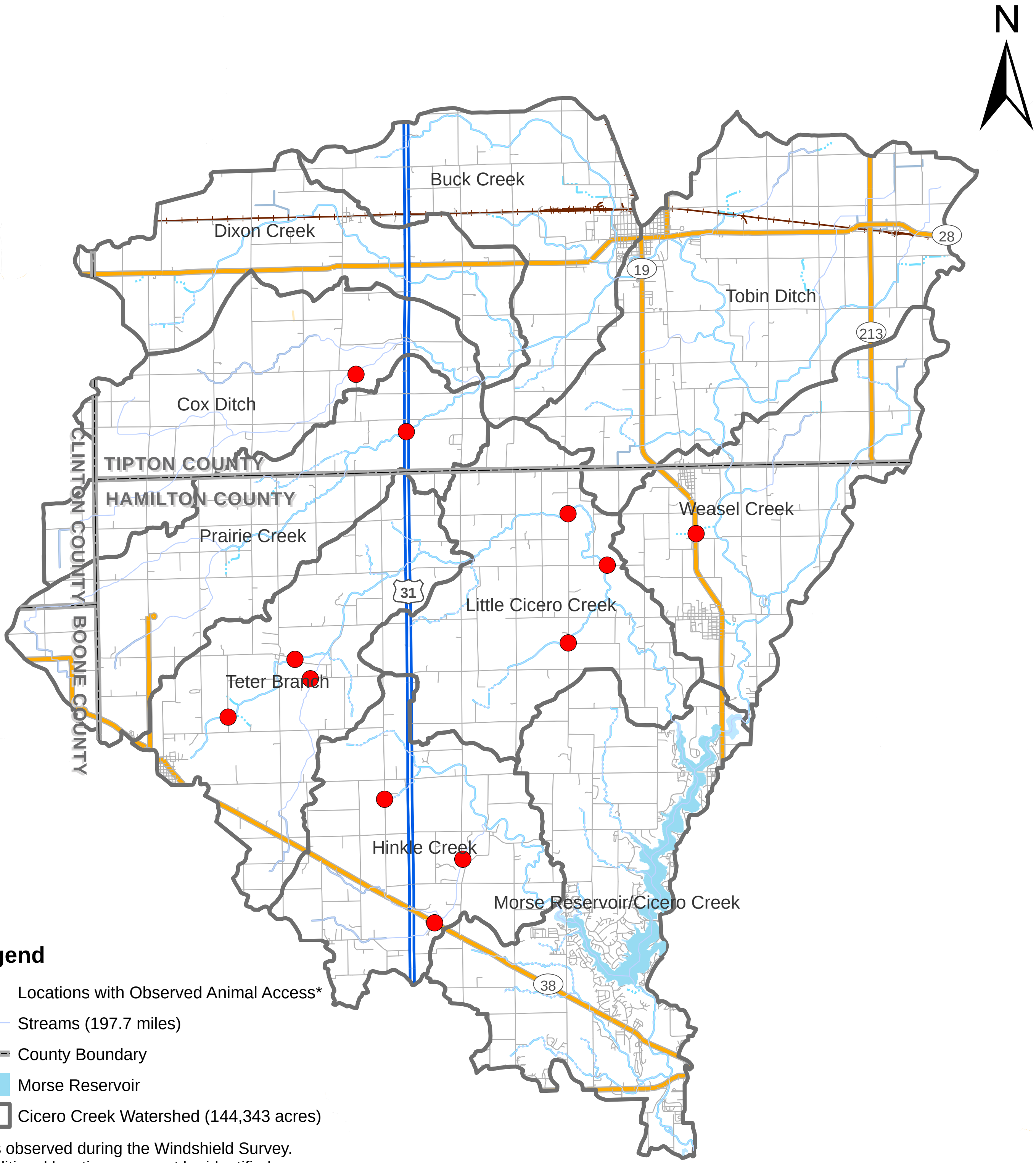
Animal access within the stream can inhibit wildlife and aquatic habitat, increase flooding risks, and introduce additional pollutants. Animal waste is a large source of *E. coli* and when animals have access to the stream, *E. coli* is directly introduced to the stream. As livestock walk down the streambanks, existing vegetation can be dislodged enabling streambank erosion, thus introducing sediment and nutrients to the water. Exhibit 28 shows the locations where direct animal access was identified during the windshield survey. As stated previously, the windshield survey only covered a finite number of locations within the watershed, so all instances and locations of direct animal access may not be specifically identified, but are still considered critical areas.

Absent or Insufficient Stream Buffers
All areas where stream buffers are absent or insufficient are identified as being critical.

Stream buffers are areas of either planted or natural vegetation between a surface water body the surrounding land. Runoff from the surrounding land may carry sediment and organic matter, and plant nutrients and pesticides that are either bound to the sediment or dissolved in the water. The buffers provide water quality protection by reducing the amount of pollutants in the runoff before it enters the water body. Filter strips can also provide localized erosion protection and habitat for wildlife. Exhibit 29 shows the locations where absent or insufficient stream buffers were identified during the windshield survey. Buffers were identified as absent if they were less than ten feet in width. Insufficient stream buffers were identified as buffers with more than 10 feet but less than 50 feet of grass or treed area. As stated previously, the windshield survey only covered a finite number of locations within the watershed, so instances and locations of absent or insufficient buffers may not be specifically identified throughout the watershed, but are still considered critical areas.

Excessive Streambank Erosion
All areas where excessive streambank erosion is occurring are identified as being critical.

Accelerated erosion can contribute high sediment loads to receiving streams, which is a concern due both to the impacts of the sediment itself, and of the contaminants that often bind with, or otherwise reside in the sediment. The sediment itself can smother aquatic habitat and therefore negatively affect the aquatic flora and fauna. Sediment can also transport nutrients, especially phosphorus that tends to adhere to sediment particles causing excess algal growth leading to large swings in DO. Exhibit 30 shows the locations where excessive streambank erosion was identified during the windshield survey. Identification of streambank erosion was broken up into the following categories: absent, stabilized (rip-rap,



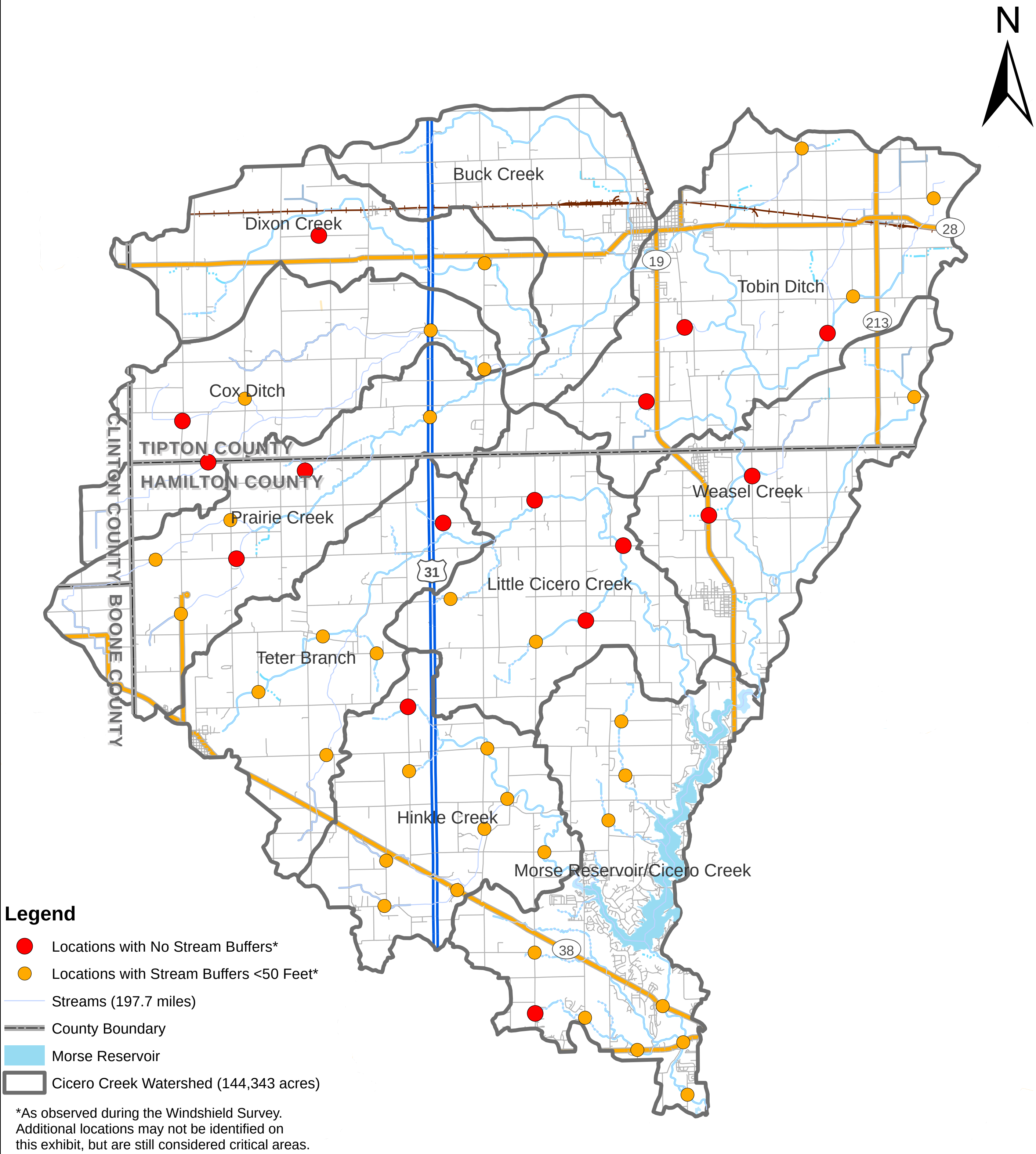
Legend

- Locations with Observed Animal Access*
- Streams (197.7 miles)
- County Boundary
- Morse Reservoir
- Cicero Creek Watershed (144,343 acres)

*As observed during the Windshield Survey. Additional locations may not be identified on this exhibit, but are still considered critical areas.

V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: **Livestock Access Critical Area Exhibit**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: HUC-12 Watershed Boundaries	PROJECT NO. 09005	EXHIBIT: 28	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'



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7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

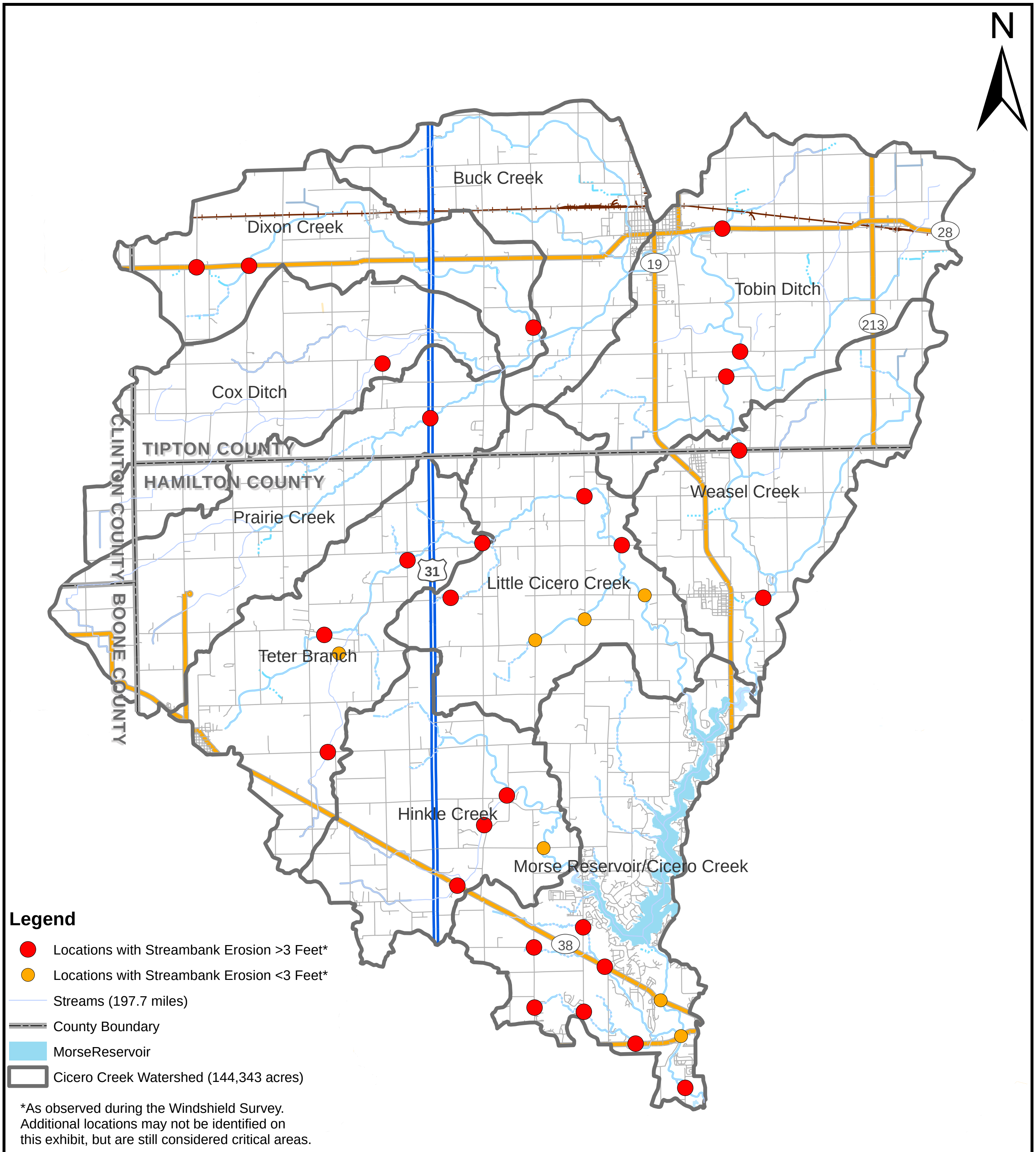
TITLE: **Stream Buffers Critical Area Exhibit**

PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**

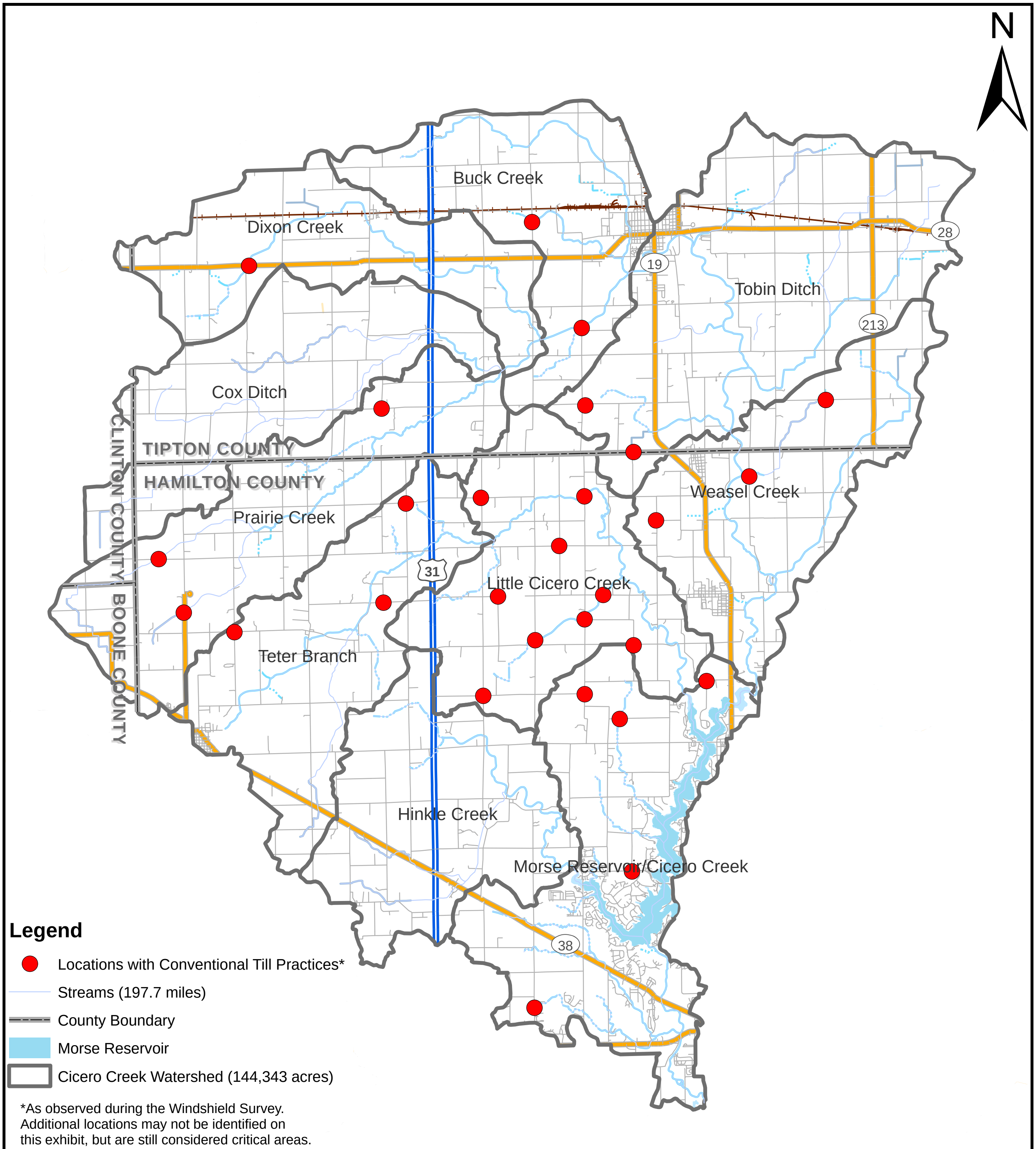
BASE LAYER: HUC-12 Watershed Boundaries

CLIENT: Upper White River Watershed Alliance
P.O. Box 2065
Indianapolis, Indiana 46206

PROJECT NO.	EXHIBIT:	SHEET: 1 OF: 1
09005	29	
QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'



V3 Companies 7325 Janes Avenue Woodridge, IL 60517 630.724.9200 phone 630.724.9202 fax www.v3co.com	TITLE: **Streambank Erosion Critical Area Exhibit**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
	BASE LAYER: HUC-12 Watershed Boundaries	PROJECT NO. 09005	EXHIBIT: 30	SHEET: 1 OF: 1
	CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'



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630.724.9202 fax
www.v3co.com

TITLE: **Conventional Till Critical Area Exhibit**	PROJECT: **Morse Reservoir/Cicero Creek Watershed Management Plan**		
BASE LAYER: HUC-12 Watershed Boundaries	PROJECT NO. 09005	EXHIBIT: 31	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 09/27/10	SCALE: 1" = 15000'

coir log, etc.), present > 3 feet tall and present < 3 feet tall. Excessive streambank erosion are those areas with greater than 3 feet tall of erosion. As stated previously, the windshield survey only covered a finite number of locations within the watershed, so instances and locations of excessive streambank erosion may not be specifically identified, but are still considered critical areas.

Agricultural Areas Practicing Conventional Till

All agricultural areas where conventional till is practiced are identified as being critical. Conventionally tilled fields can all contribute NPS pollution to the watershed. Fields within a closer proximity to open ditches or streams may contribute more NPS pollution. Targeting all conventionally tilled fields will reduce the pollutant loading. Direct work with land owners will be required as the next step toward implementation to gain a number of fields that will convert to conservation tillage practices within a subwatershed.

Conservation till and no till practices reduce the amount of runoff leaving a field. Crop residue protects the soil surface and allows water to infiltrate. As the amount of runoff is reduced and the velocities of runoff leaving the agricultural area are reduced, the amount of sediment, nutrients and pesticides carried in the runoff are reduced. Conventional till does not retain any crop residue and therefore contributes a large amount of sediment, nutrients and pesticides with an increased runoff rate. Exhibit 31 shows the locations where conventional till was identified during the windshield survey. As stated previously, the windshield survey only covered a finite number of locations within the watershed, so instances and locations of conventional till may not be specifically identified, but are still considered critical areas.

Section 6 – Choose Measures/BMPs to Apply

BMPs

The watershed restoration and management techniques described in this section, when applied to the Morse Reservoir/Cicero Creek Watershed, can help achieve the watershed goals and objectives to decrease the concentrations of sediment and nutrient loads as identified in this WMP. The Steering Committee was provided a draft list of BMPs based on the impairments within the watershed and the measures that would improve the water quality within the watershed. Comments were received to add measures that some stakeholders had experience either implementing or educating landowners within the watershed. The selected measures and BMPs for improvement are categorized as Agricultural/Rural and Urban BMPs as well as Preventative Measures. While not all of the BMPs are being recommended at this point in the plan preparation, these BMPs may become important to have incorporated into the plan as the plan is updated and for future implementation opportunities. The Preventative Measures section is provided as potential recommendations for education and outreach focused implementation. The following BMP summaries are typical BMPs and are provided as a reference and generally describe each measure and its design components, it is not meant to be all inclusive list but only a guide.

To choose an appropriate BMP, it is essential to determine in advance the objectives to be met by the BMP and to calculate the cost and related effectiveness of alternative BMPs. Once a BMP has been selected, expertise is needed to insure that the BMP is properly installed, monitored, and maintained over time.

Agricultural/Rural BMPs

Agricultural/Rural BMPs are implemented on agricultural lands for the purpose of protecting water resources, protecting aquatic wildlife habitat, and protecting the land resource from degradation. These practices control the delivery of nonpoint source pollutants to receiving water resources by first minimizing the pollutants available.

Agricultural/Rural BMPs include:

- Alternative Watering System
- Buffer/Filter Strips
- Cover Crops
- Grassed Waterways
- Infiltration Trenches
- No-Till/Reduced Till (Conservation Tillage)
- Nutrient/Waste Management
- Rotational Grazing/Exclusionary Fencing
- Two Stage Ditches
- Stream Restoration
- Wetland Restoration
- Reforestation

Alternative Watering System

Alternative watering systems (e.g. nose pumps or gravity flow systems) protect surface water by eliminating livestock's direct access to the stream. Providing an alternative watering source for livestock reduces soil erosion and sedimentation and improves surface water quality by reducing *E. coli* concentrations and nutrient loading. Alternative watering systems help to provide additional bank stabilization and assist in the preservation of riparian buffers through a reduction in compaction.

Buffer/Filter Strips

Creating and maintaining buffers along stream and river channels and lakeshores increases open space and can reduce some of the water quality and habitat degradation effects associated with increased imperviousness and runoff in the watershed. Buffers provide hydrologic, recreational, and aesthetic benefits as well as water quality functions, and wildlife habitat. TSS, phosphorus, and nitrogen are at least partly removed from water passing through a naturally vegetated buffer. *E. coli* concentrations are also reduced with buffers. The percentage of pollutants removed depends on the pollutant load, the type of vegetation, the amount of runoff, and the character of the buffer area. The most effective buffer width can vary along the length of a channel. Adjacent land uses, topography, runoff velocity, and soil and vegetation types are all factors used to determine the optimum buffer width. Buffers need to be a minimum of 30 feet wide to be eligible for most USDA programs. The greater the width of the buffer, the pollutant removal efficiency will be greater. Education is important in teaching farmers what options they have for funding. Several state and federal programs exist to provide incentives for maintaining riparian buffers. The Wetlands Reserve Program (WRP) makes funding available for the purchase and restoration of wetlands and riparian buffer connections between wetlands.

A filter strip is an area of permanent herbaceous vegetation situated between environmentally sensitive areas and cropland, grazing land, or otherwise disturbed land. Filter strips reduce TSS, particulate organic matter, sediment adsorbed contaminants, and dissolved contaminant loadings in runoff to improve water quality. Filter strips also restore or maintain sheet flow in support of a riparian forest buffer, and restore, create, and enhance herbaceous habitat for wildlife and beneficial insects.

Filter strips should be permanently designated plantings to treat runoff and should not be part of the adjacent cropland's rotation. Overland flow entering the filter strip should be primarily sheet flow. If there is concentrated flow, it should be dispersed so that it creates sheet flow. Filter strips cannot be installed on unstable channel banks that are eroding due to undercutting of the toe bank. Permanent herbaceous vegetation should consist of a single species or a mixture of grasses, legumes and/or other forbs (an herbaceous plant other than a grass) adapted to the soil, climate, and farm chemicals used in adjacent cropland. Filter strips must be properly maintained so that they function properly.

Filter strips should be located to reduce runoff and increase infiltration and groundwater recharge throughout the watershed. Filter strips should also be strategically placed to intercept contaminants, thereby enhancing the water quality in the watershed. Filter strip sizes should be adjusted to accommodate planting, harvesting, and maintenance equipment.

Filter strip widths greater than that needed to achieve a 30 minute flow-through time at ½-inch depth will not likely improve the effectiveness of the strip in addressing water quality concerns created by TSS, particulate organics, and sediment adsorbed contaminants. Like buffers; filter strips decrease TSS and nutrient loading, reduce *E. coli* concentrations, and increase open space. Education will help to teach farmers where these practices should be applied and sources of possible funding. Implementation of filter strips is part of the Conservation Reserve Program and assistance may be provided to eligible projects.

Cover Crops

Cover crops can be legumes or grasses, including cereals, planted or volunteered vegetation established prior to or following a harvested crop primarily for seasonal soil protection and nutrient recovery. Cover crops protect soil from erosion decreasing sediment concentrations in the creek and recover/recycle phosphorus in the root zone. They are grown seasonally.

Cover crops are established during the non-crop period, usually after the crop is harvested, but can be interseeded into a crop before harvest by aerial application or cultivation. Cover crops reduce phosphorus transport by reducing soil erosion and runoff. Both wind and water erosion move soil particles that have phosphorus attached. Sediment that reaches water bodies may release phosphorus into the water. The cover crop vegetation recovers plant-available phosphorus in the soil and recycles it through the plant biomass for succeeding crops. The soil tilth also benefits from the increase of organic material added to the surface. Growing vegetation promotes infiltration, and roots enhance percolation of water supplied to the soil. This reduces surface runoff. Runoff water can wash soluble phosphorus from the surface soil and crop residue and carry it off the field.

Grassed Waterways

Grassed waterways are natural or constructed channels established for transport of concentrated flow at safe velocities using adequate channel dimensions and proper vegetation. They are generally broad and shallow by design to move surface water across farmland without causing soil erosion. Grassed waterways are used as outlets to prevent rill and gully formation. The vegetative cover slows the water flow, minimizing channel surface erosion. When properly constructed, grassed waterways can safely transport large water flows downslope. These waterways can also be used as outlets for water released from contoured and terraced systems and from diverted channels. This BMP can reduce sediment concentrations of nearby waterbodies and pollutants in runoff. The vegetation improves the soil aeration and water quality due to its nutrient removal through plant uptake and absorption by soil. The waterways can also provide wildlife corridors and allows more land to be natural areas.

Infiltration Trenches

Infiltration trenches are excavated trenches backfilled with a coarse stone aggregate and biologically active organic matter. Infiltration trenches allow temporary storage of runoff in the void space between the aggregate and help surface runoff infiltrate into the surrounding soil. Phosphorus from agricultural areas is primarily from animal manure either directly washing into streams and rivers or washing off from farm fields. Soil infiltration trenches can be especially beneficial as concrete feed-lots, barns, confined livestock areas, CFOs, and other agricultural areas can carry excess food and waste materials towards the adjacent stream through stormwater runoff. Installing soil infiltration trenches where runoff is concentrated will maximize the benefit of contaminant removal.

No-till/Reduced Till Conservation Practices

This practice manages the amount, orientation, and distribution of crop and other plant residues on the soil surface year-round, while growing crops planted in narrow slots or tilled, residue free strips previously untilled by full-width inversion implements. The purpose of this conservation practice is to reduce sheet and rill erosion thereby promoting improved water quality by reducing sediment and nutrient loading in the waterways. Additional benefits of this practice are to reduce wind erosion, to maintain or improve soil organic matter content and tilth, to conserve soil moisture, to manage snow, to increase plant available moisture or reduce plant damage from freezing or desiccation, and to provide food and escape cover for wildlife. This technique includes tillage and planting methods commonly referred to as no-till, zero till, slot plant, row till, direct seeding, or strip till.

Residue management is when loose residues are left on the field, and then uniformly distributed on the soil surface to minimize variability in planting depth, seed germination, and emergence of subsequently planted crops. When combines or similar machines are used for harvesting, they are equipped with spreaders capable of distributing residue over at least 80% of the working width. No-till or strip till may be practiced continuously throughout the crop sequence, or may be managed as part of a system which includes other tillage and planting methods such as mulch till. Production of adequate amounts of crop residues is necessary for the proper functioning of this conservation practice and can be enhanced by selection of high residue producing crops and crop varieties in the rotation, use of cover crops, and adjustment of plant populations and row spacings.

Maintaining a continuous no-till system will maximize the improvement of soil organic matter content. Also, when no-till is practiced continuously, soil reconsolidation provides additional resistance to sheet and rill erosion. The effectiveness of stubble to trap snow or reduce plant damage from freezing or desiccation increases with stubble height. Variable height stubble patterns may be created to further increase snow storage.

Nutrient/Waste Management

Nutrient management is the management of the amount, source, placement, form, and timing of the application of plant nutrients and soil amendments to minimize the transport of applied nutrients into surface water or groundwater. Nutrient management seeks to supply adequate nutrients for optimum crop yield and quantity, while also helping to sustain the physical, biological, and chemical properties of the soil.

Nutrient management plans are generally developed with assistance from NRCS. A nutrient budget for nitrogen, phosphorus, and potassium is developed considering all potential sources of nutrients including, but not limited to, animal manure, commercial fertilizer, crop residue, and legume credits. Realistic yields are based on soil productivity information, potential yield, or historical yield data based on a 5-year average. Nutrient management plans specify the form, source, amount, timing, and method of application of nutrients on each field in order to achieve realistic production levels while minimizing transport of nutrients to surface and/or groundwater.

Animal waste is a major source of pollution to waterbodies. To protect the health of aquatic ecosystems and meet water quality targets, manure must be safely managed. Good management of manure keeps livestock healthy, returns nutrients to the soil, improves pastures and gardens, and protects the environment, specifically water quality. Poor manure management may lead to sick livestock, unsanitary and unhealthy conditions for humans and other organisms, and increased insect and parasite populations. Proper management of animal waste can be done by implementing BMPs, through safe storage, by application as a fertilizer, and through composting. Proper manure management can effectively reduce *E. coli* concentrations, nutrient levels and sedimentation. Manure management can also be addressed in education and outreach to encourage farmers to participate in this BMP.

Rotational Grazing and Exclusionary Fencing

Intensive grazing management is the division of pastures into multiple cells that receive a short but intensive grazing period followed by a period of recovery of the vegetative cover. Pasture management practices that include the use of rotational grazing systems are beneficial for water and soil quality. Systems that include the riparian area as a separate pasture are beneficial because livestock access to these areas is controlled to limit the impact on the riparian plant communities.

The impacts of livestock grazing within riparian areas include manure and urine deposited directly into or near surface waters where leaching and runoff can transport nutrients and pathogens into the water. Unmanaged grazing may accelerate erosion and sedimentation into surface water, change stream flow, and destroy aquatic habitats. Improper grazing can reduce the capacity of riparian areas to filter contaminates, shade aquatic habitats, and stabilize stream banks.

A livestock exclusion system is a system of permanent fencing (board, barbed, etc) installed to exclude livestock from streams and areas, not intended for grazing. This will reduce erosion, sediment, and nutrient loading, and improve the quality of surface water. Education and outreach programs focusing on rotational grazing and exclusionary fencing are important in the success of this BMP.

Two Stage Ditches

Water, when confined to a channel such as a stream or ditch, has the potential to cause great destruction. If there is too much water moving through an undersized area of land, then there is nowhere for it to go but to rush out of its barriers. Bank erosion, scouring, and flooding are good indicators that there is problem with how the water is drained from the soil. Researchers have been working on a type of in-stream restoration called the two-stage ditch that has proven to help solve these problems.

The design of a two-stage ditch incorporates a floodplain zone, called benches, into the ditch by removing the ditch banks roughly 2-3 feet about the bottom for a width of about 10 feet on each side. This allows the water to have more area to spread out on and decreases the velocity of the water. This not only improves the water quality, but also improves the biological conditions of the ditches where this is located.

The benefits of a two-stage ditch over the typical agricultural ditch include both improved drainage function and ecological function. The two-stage design improves ditch stability by reducing water flow and the need for maintenance, saving both labor and money. It also has the potential to create and maintain better habitat conditions. Better habitats for both terrestrial and marine species are a great plus when it comes to the two-stage ditch design. The transportation of sediment and nutrients is decreased considerably because the design allows the sorting of sediment, with finer silt depositing on the benches and courser material forming the bed.

Stream Restoration

Stream restoration techniques are used to improve stream conditions so they more closely mimic natural conditions. For urban stream reaches, restoration to natural conditions may not be possible or feasible. For instance, physical constraints due to adjacent development may limit the ability to re-meander a stream. In addition, the natural stream conditions may not be able to accommodate the increased volume of flow from the developed watershed.

Even in cases where restoring the stream to its natural condition is not possible, the stream can still be naturalized and improved by reestablishing riparian buffers, performing stream channel maintenance, stabilizing streambanks using bioengineering techniques, and, where appropriate, by removing manmade dams and installing pool/riffle complexes. Stream restoration projects may be one component of floodplain restoration projects, and can be supplemented with trails and interpretive signs, providing recreational and educational benefits to the community.

Wetland Restoration

Because agriculture and urbanization have destroyed or degraded many of the remaining wetlands in the Morse Reservoir/Cicero Creek, wetland enhancement projects are necessary to improve the diversity and function of these degraded wetlands. The term enhancement refers to improving the functions and values of an existing wetland. Converted wetland/field sites (or sites that were formerly wetlands but have now been converted to other uses) can also be restored to provide many of their former wetland benefits. Wetland restoration is the process of establishing a wetland on a site that is not currently a wetland, but once was prior to conversion. Restoring wetlands can address many of the concerns of the Morse Reservoir/Cicero Creek Stakeholders. Wetlands have the ability to reduce *E. coli* concentrations, nutrient loading, TSS concentrations, and flood damage. Wetlands can be used to teach landowners about their importance with respect to plants and animals and also increases the amount of open space in the watershed.

Wetland functional values vary substantially from wetland to wetland; they receive special consideration because of the many roles they play. Because of the wetland protection laws currently in place, the greatest impact on wetlands from future development in the Morse Reservoir/Cicero Creek will likely be a shift in the types of wetlands. Often in mitigation projects, various types of marshes, wet prairies, and other wetlands are filled and replaced elsewhere, usually with existing open water wetlands. This replacement may lead to a shift in the values served by the wetland communities due to a lack of diversity of wetland types. The wetland restorations that are proposed in the Morse Reservoir/Cicero Creek should include a variety of different wetland types to increase the diversity of wetlands in the watershed. The restoration of wetlands can decrease flood damage by providing new stormwater storage areas, will improve water quality by treating stormwater runoff, and will create new plant and wildlife habitat. In addition to these values, wetlands can be part of regional greenways or trail networks. They can be constructed with trails to allow the public to explore them more easily, and they can be used to educate the public through signs, organized tours, and other techniques. Wetland restorations are an exceptional way to meet multiple objectives within a single project.

Reforestation

Reforestation is the restocking of existing forests and woodlands which have been depleted. Reforestation can be used to improve the quality of human life by soaking up pollution and dust from the air and rebuild natural habitats and ecosystems.

Urban BMPs

For the past two decades the rate of land development across the country has been more than two times greater than the rate of population growth. The increased impervious surface associated with this development will increase stormwater volume and degrade water quality, which will harm the overall watershed.

The best way to mitigate stormwater impacts from new developments is to use Urban BMPs to treat, store, and infiltrate runoff onsite before it can affect water bodies downstream. Innovative site designs that reduce imperviousness and smaller-scale low impact development practices dispersed throughout a site are excellent ways to achieve the goals of reducing flows and improving water quality.

The Urban BMPs include:

- Bioretention Practices
- Filtration Basin
- Naturalized Detention Basin
- Naturalized Stream Buffer
- Pervious Pavement
- Rain Barrels/Gardens
- Infiltration Trench
- Stream Restoration

Bioretention Practices

Bioretention practices (including bioinfiltration or biofiltration) are primarily used to filter runoff stored in shallow depressions by utilizing plant uptake and soil permeability. This practice utilizes combinations of flow regulation structures, a pretreatment grass channel or other filter strip, a sand bed, a pea gravel overflow treatment drain, a shallow ponding area, a surface organic mulch layer, a planting soil bed, plant material, a gravel underdrain system, and an overflow system to promote infiltration. Bioinfilitration systems such as swales are used to treat stormwater runoff from small sites such as driveways, parking lots, and roadways. They provide a place for stormwater to settle and infiltrate into the ground. Biofiltration swales are a relatively low cost means of treating stormwater runoff for small sites typifying much of the urban environment, such as parking, roadways, driveways, and similar impervious features. They provide areas for stormwater to slow down and pollutants to be filtered out. Careful attention to location and alignment of swales can lend a pleasing aesthetic quality to sites containing them.

In general, bioretention practices are highly applicable to residential uses in community open space or private lots. The bioretention system is very appropriate for treatment of parking lot runoff, roadways where sufficient space accommodates off-line implementation, and pervious areas such as golf courses. This BMP is not recommended for highly urbanized settings where impervious surfaces comprise 95% or more of the area due to high flow events and limited storage potential. This BMP can address most of the WMP goals including; reducing concentration of sediments and nutrients. Bioretention practices can also decrease flooding by storing stormwater and increase open space.

Filtration Basin

Filtration basins provide pollutant removal (including TSS, nutrients, and *E. coli*) and reduce volume of stormwater released from the basin. These basins utilize sand filters or engineered soils to filter stormwater runoff through a sand or engineered soil layer within an underdrain system that conveys the treated runoff to a detention facility or to the ultimate point of discharge. The filtration system consists of an inlet structure, sedimentation chamber, sand/engineered soil layer, underdrain piping, and liner to protect against infiltration.

Naturalized Detention Basins

Naturalized wet-bottom detention basins are used to temporarily store runoff and release it at a reduced rate. Naturalized wet-bottom detention basins are better than traditional detention basins because they encourage water infiltration, and thereby recharge groundwater tables. Native wetland and prairie vegetation also help to improve water quality by trapping sediment and other pollutants found in runoff, and are aesthetically pleasing. Naturalized wet-bottom detention basins can be designed as either shallow marsh systems with little or no open water or as open water ponds with a wetland fringe and prairie side slopes.

Naturalized Stream Buffer

Creating and maintaining buffers along stream and river channels and lakeshores increases open space and can reduce some of the water quality and habitat degradation effects associated with increased imperviousness and runoff in the watershed. Buffers provide hydrologic, recreational, and aesthetic benefits as well as water quality functions, and wildlife habitat. Sediment, phosphorus, and nitrogen are at least partly removed from water passing through a naturally vegetated buffer. The percentage of pollutants removed depends on the pollutant load, the type of vegetation, the amount of runoff, and the character of the buffer area. The most effective buffer width can vary along the length of a channel. Adjacent land uses, topography, runoff velocity, and soil and vegetation types are all factors used to determine the optimum buffer width. Buffers need to be a minimum of 30 feet wide to be eligible for most USDA programs. Other specific requirements for regulated drains should be determined during the feasibility stages of utilizing this practice.

Pervious Pavement

Pervious pavement has the approximate strength characteristics of traditional pavement but allows rainfall and runoff to percolate through it. This decreases sediment concentrations and flood damage in the watershed by slowing the water from entering the streams. The key to the design of these pavements is the elimination of most of the fine aggregate found in conventional paving materials. Pervious pavement options include porous asphalt and pervious concrete. Porous asphalt has coarse aggregate held together in the asphalt with sufficient interconnected voids to yield high permeability. Pervious concrete, in contrast, is a discontinuous mixture of Portland cement, coarse aggregate, admixtures, and water that also yields interconnected voids for the passage of air and water. Underlying the pervious pavement is a filter layer, a stone reservoir, and filter fabric. Stored runoff gradually drains out of the stone reservoir into the subsoil.

Modular pavement consists of individual blocks made of pervious material such as sand, gravel, or sod interspersed with strong structural material such as concrete. The blocks are typically placed on a sand or gravel base and designed to provide a load-bearing surface that is adequate to support personal vehicles, while allowing infiltration of surface water into the underlying soils. They usually are used in low-volume traffic areas such as overflow parking lots and lightly used access roads. An alternative to pervious and modular pavement for parking areas is a geotextile material installed as a framework to provide structural strength. Filled with sand and sodded, it provides a completely grassed parking area.

Rain Barrels/Gardens

A rain barrel is a container that collects and stores rainwater from your rooftop (via your home's disconnected downspouts) for later use on your lawn, garden, or other outdoor uses. Rainwater stored in rain barrels can be useful for watering landscapes, gardens, lawns, and trees. Rain is a naturally soft water and devoid of minerals, chlorine, fluoride, and other chemicals. In addition, rain barrels help to reduce peak volume and velocity of stormwater runoff to streams and storm sewer systems.

Rain gardens are small-scale bioretention systems that be can be used as landscape features and small-scale stormwater management systems for single-family homes, townhouse units, and some small commercial development. These units not only provide a landscape feature for the site and reduce the need for irrigation, but can also be used to provide stormwater depression storage and treatment near the point of generation. These systems can be integrated into the stormwater management system since the components can be optimized to maximize depression storage, pretreatment of the stormwater runoff, promote evapotranspiration, and facilitate groundwater recharge. The combination of these benefits can result in decreased flooding due to a decrease in the peak flow and total volume of runoff generated by a storm event. In addition, these features can be designed to provide a significant improvement in the quality of the stormwater runoff. These units can also be integrated into the design of parking lots and other large paved areas, in which case they are referred to as bioretention areas.

Infiltration Trenches

Infiltration trenches are excavated trenches backfilled with a coarse stone aggregate and biologically active organic matter. Infiltration trenches allow temporary storage of runoff in the void space between the aggregate and help surface runoff infiltrate into the surrounding soil. Infiltration trenches remove fine sediment and the pollutants associated with them. Soil infiltration trenches can be effective at reducing sediment concentrations and nutrient loading. Soluble pollutants can be effectively removed if detention time is maximized. The degree to which soluble pollutants are removed is dependent primarily on holding time, the degree of bacterial activity, and chemical bonding with the soil. The efficiency of the trench to remove pollutants can be increased by increasing the surface area of the trench bottom. Infiltration trenches can provide full control of peak discharges for small sites. They provide groundwater recharge and may augment base stream flow.

Stream Restoration

Stream restoration techniques are used to improve stream conditions so they more closely mimic natural conditions. For urban stream reaches, restoration to natural conditions may not be possible or feasible. For instance, physical constraints due to adjacent development may limit the ability to re-meander a stream. In addition, the natural stream conditions may not be able to accommodate the increased volume of flow from the developed watershed.

Even in cases where restoring the stream to its natural condition is not possible, the stream can still be naturalized and improved by reestablishing riparian buffers, performing stream channel maintenance, stabilizing streambanks using bioengineering techniques, and, where appropriate, by removing manmade dams and installing pool/riffle complexes. Stream restoration projects may be one component of floodplain restoration projects, and can be supplemented with trails and interpretive signs, providing recreational and educational benefits to the community.

Preventative Measures

Conservation Design Developments

The goal of conservation design development is to protect open space and natural resources for people and wildlife, while at the same time allowing development to continue. Conservation design developments designate half or more of the buildable land area as undivided permanent open space. They are density neutral, allowing the same density as in conventional developments, but that density is realized on smaller areas of land by clustering buildings and infrastructure. In addition to clustering, conservation design developments incorporate natural riparian buffers and setbacks for streams, wetlands, other waterbodies, and adjacent agricultural.

The first and most important step in designing a conservation development is to identify the most essential lands to preserve in conservation areas. This will require coordination with local officials and the community as this practice is commonly added into ordinances and future planning efforts. Natural features including streams, wetlands, lakes, steep slopes, mature woodlands, native prairie, and meadow (as well as significant historical and cultural features) are included in conservation areas. Clustering is a method for preserving these areas. Clustered developments allow for increased densities on less sensitive portions of a site, while preserving the remainder of the site in open space for conservation and recreational uses (such as trails, soccer or ball fields).

Clustering can be achieved in a planned unit development (PUD) or planned residential development (PRD). PUDs contain a mix of zoning classifications that may include commercial, residential, and light industrial uses, all of which are blended together. Well-designed PUDs usually locate residences and offices within walking distance of each other to reduce traffic. Planned residential developments (PRDs) apply similar concepts to residential developments.

Greenways and Trails

Greenways can provide a large number of functions and benefits to nature and the public. For plants and animals, greenways provide habitat, a buffer from development, and a corridor for migration. Greenways located along streams include riparian buffers that protect water quality by filtering sediments and nutrients from surface runoff and stabilizing streambanks. By buffering the stream from adjacent developed land use, riparian greenways offset some of the impacts associated with increased impervious surface in a watershed. Maintaining a good riparian buffer can mitigate the negative impacts of approximately 5% additional impervious surface in the watershed.

Greenways also provide long, linear corridors with options for recreational trails. Trails along the river provide watershed stakeholders with an opportunity to exercise and enjoy the outdoors. Trails allow users to see and access the river, thereby connecting people to their river and the overall watershed. Trails can also be used to connect natural areas, cultural and historic sites and communities, and serve as a safe transportation corridor between work, school, and shopping destinations.

Techniques for establishing greenways and trails involve the development of a plan that proposes general locations for greenways and trails. In the case of trails, the plan also identifies who the users will be and provides direction on trail standards. Plans can be developed at the community and/or county level, as well as regionally, statewide, and in a few cases, at the national level. Public and stakeholder input are crucial for developing successful greenway and trail plans.

Several techniques can be used for establishing greenways and trails. Greenways can remain in private ownership, they can be purchased, or easements can be acquired for public use. If the lands remain in private ownership, greenway standards can be developed, adopted, and implemented at the local level through land use planning and regulation. Development rights for the greenway can be purchased from private landowners where regulations are unpopular or not feasible.

If the greenways will include trails for public use, the land for trails is usually purchased and held by a public agency such as a forest preserve district or local park system. In some cases, easements will be purchased rather than purchasing the land itself. Usually longer trail systems are built in segments, and completing connections between communities depends heavily on the level of public interest in those communities.

In new developing areas, the local planning authority can require trails. Either the developer or the community can build the trails. In some cases, the developer will voluntarily plan and build a trail connection through the development and use this as a marketing tool to future homebuyers. In other cases, the local planning authority may require the developer to donate an easement for the trail. To install trails through already developed areas, land can be purchased by a community agency with a combination of local, state, and federal funds.

Impediments to land purchase can significantly slow up trail connections in already established areas.

Protected Ownership

There are several options for land transfer ranging from donation to fee simple land purchase. Donations can be solicited and encouraged through incentive programs. Unfortunately, while preferred by money-strapped conservation programs, land donations are often not adequate to protect high priority sites. A second option is outright purchase (or fee simple land purchase). Outright purchase is frequently the least complicated and most permanent protection technique, but is also the most costly. A conservation easement is a less expensive technique than outright purchase that does not require the transfer of land ownership but rather a transfer of use rights. Conservation easements might be attractive to property owners who do not want to sell their land at the present time, but would support perpetual protection from further development. Conservation easements can be donated or purchased.

Protecting Open Space and Natural Areas

Several techniques can be used for protecting natural areas and open space in both public and private ownership. The first step in the process is to identify and prioritize properties for protection. The highest priority natural areas should be permanently protected by the ownership or under the management of public agencies or private organizations dedicated to land conservation. Other open space can be protected using conservation design development techniques, and is more likely to be managed by homeowner associations.

Septic Tank Maintenance and Repair

Septic, or on-site waste disposal systems, are the primary means of sanitary flow treatment in the unincorporated parts of the Morse Reservoir/Cicero Creek Watershed. Because of the prohibitive cost of providing centralized sewer systems to many areas, septic tank systems will remain the primary means of treatment into the future. Annual maintenance of septic systems is crucial for their operation, particularly the annual removal of accumulated sludge. The cost of replacing failed septic tanks is about $5,000-$15,000 per unit based on industry standards.

Property owners are responsible for their septic systems under the regulation of the County Health Department. When septic systems fail, untreated sanitary flows are discharged into open watercourses that pollute the water and pose a potential public health risk. Septic systems discharging to the ground surface are a risk to public health directly through body contact or contamination of drinking water sources, provide conditions favorable to insect vectors such as flies and mosquitoes, and contribute significant amounts of nitrogen and phosphorus to the watershed. Therefore, it is imperative for homeowners not to ignore septic failures. If plumbing fixtures back up or will not drain, the system is failing. Funding for this practice is limited.

Threatened and Endangered (T&E) Species Protection

Threatened and endangered species are those plant and animal species whose survival is in peril. Both the federal government and the state of Indiana maintain lists of species that meet threatened or endangered criteria within their respective jurisdictions. Threatened species are those that are likely to become endangered in the foreseeable future. Federally endangered species are those that are in danger of extinction throughout all or a significant portion of their range. A state-endangered species is any species that is in danger of extinction as a breeding species in Indiana.

Considerations in protecting endangered species include making sure there is sufficient habitat available - food, water, and "living sites" (For animals, this means areas for making nests and dens and evading predators. For plants, it refers to availability of preferred substrate and other desirable growing conditions.); providing corridors for those species that need to move between sites; and protecting species from impacts due to urbanization.

Several techniques can be used to protect T&E species. One technique is to acquire sites where T&E species occur. Purchase and protection of the site where the species is located (with adequate surrounding buffer) may be sufficient to protect that population. In some instances it is not feasible or possible to buy the needed land. Where the site and buffer area is not available for purchase, where an animal's range is too large of an area (or migrates between sites), or where changes in hydrology or pollution from outside the site affect the species, other techniques must be used to protect the T&E species.

Developing a resource conservation or management plan for the species and habitat of concern is the next step. Resource plans consider the need for buffer areas and habitat corridors, and consider watershed impacts from hydrology changes or pollutant loadings. The conservation plan will include recommendations for management specific to the species and its habitat, whether located on private or public lands. The conservation plan will guide both the property owner and the local unit of government that plans and permits adjacent land uses and how to manage habitat to sustain the species.

Wetland Enhancement and Protection

Wetlands provide a multitude of benefits and functions. Wetlands improve water quality by removing suspended sediment and dissolved nutrients from runoff. They control the rate of runoff discharged from the watershed and reduce flooding by storing rainfall during storm events. Wetlands also provide habitat for plants and animals including many of those that are threatened and endangered.

Because agriculture and urbanization have destroyed or degraded many of the remaining wetlands in the Morse Reservoir/Cicero Creek Watershed, wetland enhancement projects are necessary to improve the diversity and function of these degraded wetlands. The term enhancement refers to improving the functions and values of an existing wetland. Converted wetland/field sites (or sites that were formerly wetlands but have now been converted to other uses) can also be restored to provide many of their former wetland benefits. Wetland restoration is the process of establishing a wetland on a site that is not currently a wetland, but once was prior to conversion. Wetlands have the ability to reduce nutrient loading, sediment concentrations, and flood damage. Wetlands can be used to teach landowners about their importance with respect to plants and animals and also increases the amount of open space in the watershed.

Best Management Practices Load Reductions

Load reduction calculations were estimated for nitrogen, phosphorus and sediment based on the potential BMPs to be implemented within the Morse Reservoir/Cicero Creek Watershed. The percent reductions for each BMP were based on the review of EPA's Stormwater Menu of BMPs, EPAs National Management Measures to Control Nonpoint Source Pollution from Agriculture, The Nature Conservancy of Indiana, The Center for Watershed Protection and STEPL. The reductions for the Buffer/Filter strips were obtained from STEPL and the rest of the load reductions were obtained from the studies and information mentioned above.

The BMPs listed are typical BMPS and are provided as a reference, it is not meant to be all inclusive list but only a guide. The reductions only apply to the drainage area that is directly tributary to the BMP implemented. Meaning, a BMP is only effective for the drainage area tributary to it and not the areas of the entire subwatershed. Therefore, when trying to evaluate BMPs and their effectiveness for pollutant removal, the tributary drainage area needs to be evaluated as well.

The actual efficiency of each BMP is based on several variables making it difficult to accurately determine the number required to equal the reduction goals (e.g. the location in the watershed, tributary area, soils, etc), therefore specific locations and types of BMPs should be carefully planned out in coordination with the landowners and applicable local, state and federal agencies and with the load reduction needs of the subwatershed in mind. Table 50 shows the expected load reductions and associated costs for each BMP.

The reductions shown in Table 50 are based on the tributary drainage area to the BMP. For example, if you have a tributary drainage area that is 1 acre and you install a buffer/filter strip that is 5 acres, you will reduce the loads for that 1 acre tributary drainage area by 65%, 75% and 70% for TSS, P and N respectively. And the approximate cost for the buffer/filter strip will be $25,000 to $50,000 (5 acres * $5,000/acre and $10,000/acre).

Table 50: Best Management Practice Load Reduction Summary					
Agricultural/Rural Best Management Practices					
	Estimated Load Reductions				
BMP/Measure	**Sediment**	**Phosphorus**	**Nitrogen**	***E. coli***	**Cost**
Alternative Watering System	80%	78%	75%	N/A	$5,000/EA
Buffer/Filter Strips	65%	75%	70%	N/A	$5,000-$10,000/AC
Cover Crops	40%	45%	40%	N/A	$100/AC
Exclusionary Fencing	70%	60%	65%	90%	$50/Ft
Grassed Waterways	80%	30%	40%	N/A	$5,000-$10,000/AC
Nutrient/Waste Management	60%	90%	80%	85%	$5 - $30/AC
Infiltration Trench	100%	45%	45%	N/A	$10,000-$20,000/AC
No-Till/Reduced Till (Conventional Tillage)	75%	45%	55%	N/A	$20/AC
Reforestation	80%	42%	68%	N/A	$750/AC
Rotational Grazing	40%	20%	20%	N/A	N/A
Stream Restoration	75%	75%	75%	N/A	$100-$250/Ft
Two-Stage Ditches	38%	33%	17%	N/A	$15-$20/Ft
Wetland Restoration	80%	55%	45%	80%	$5,000-$10,000/AC
Urban Best Management Practices					
	Estimated Load Reductions				
BMP/Measure	**Sediment**	**Phosphorus**	**Nitrogen**	***E. coli***	**Cost**
Bioretention Practices	40%	80%	65%	N/A	$10,000-$20,000/AC
Filtration Basin	75%	65%	60%	N/A	$10,000-$20,000/AC
Naturalized Detention Basin	80%	55%	35%	N/A	$10,000-$20,000/AC
Naturalized Stream Buffer	75%	45%	40%	N/A	$10,000-$20,000/AC
Pervious Pavement	95%	85%	85%	N/A	$2 - $7/Sq. Ft
Rain Barrels	N/A	N/A	N/A	N/A	$75-$300/Each
Rain Garden	80%	20%	20%	N/A	$10,000-$20,000/AC
Stream Restoration	75%	75%	75%	N/A	$100-$250/Ft
Infiltration Trench	100%	45%	45%	N/A	$10,000-$20,000/AC

Subwatershed Best Management Practice Selection

Table 51 is a breakdown of the selected best management practices for each subwatershed based on the characteristics of the subwatershed that are degrading its water quality. The BMPs listed are typical BMPS and are provided as a reference, it is not meant to be all inclusive list but only a guide. The “Reason for being Critical” column was created based on the subwatershed specific analysis of the land use within the subwatershed, water quality data (IDEM, CIWRP and V3), and the findings of the windshield survey. The water quality parameters that require reduction loads equal to or greater than 50% based on Tables 45-48 were considered to be critical for that subwatershed. Similarly, the windshield survey parameters that ranked 1, 2, or 3 were considered to be critical for that subwatershed.

The “Suggested BMP” column was then created only including the BMPs that would provide better than a 50% reduction based on the information provided in Table 50 for its associated critical impairment. Certain BMPs are suggested for more than one impairment (e.g. Buffer/Filter Strips are suggested for *E.coli*, Nitrate+Nitrite, Total Phosphorus, TSS, Lack of Stream Buffers and Streambank Erosion). The table was created in this way so not to limit the possible projects if a specific impairment is to be targeted for implementation for a specific funding source.

Table 51: BMP Selection		
Critical Area	**Reason for being Critical**	**Suggested BMP**
	High Priority Subwatersheds	
Little Cicero Creek	*E. coli*	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Wetland Restoration
	Nitrate+Nitrite	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
		Reforestation
		Stream Restoration
	Total Phosphorus	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Stream Restoration
		Wetland Restoration
	Livestock Access	Alternative Watering System
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Stream Restoration
	Conventional Tillage Practices	Education and Outreach
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
	In-stream Debris	Education and Outreach
	Lack of Stream Buffers	Education and Outreach
		Buffer/Filter Strips
		Stream Restoration
	Streambank Erosion	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Stream Restoration
		Wetland Restoration

Table 51: BMP Selection, cont.		
Critical Area	**Reason for being Critical**	**Suggested BMP**
High Priority Subwatersheds		
Tobin Ditch	*E. coli*	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Wetland Restoration
	Nitrate+Nitrite	Alternative Watering System
		Bioretention Practices
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Filtration Basin
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
		Pervious Pavement
		Reforestation
		Stream Restoration
	Lack of Stream Buffers	Education and Outreach
		Buffer/Filter Strips
		Stream Restoration
	Livestock Access	Alternative Watering System
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Stream Restoration

Table 51: BMP Selection, cont.		
Critical Area	**Reason for being Critical**	**Suggested BMP**
High Priority Subwatersheds		
Teter Branch	Total Phosphorus	Alternative Watering System
		Bioretention Practices
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Filtration Basin
		Naturalized Detention Basin
		Nutrient/Waste Management
		Pervious Pavement
		Reforestation
		Stream Restoration
		Wetland Restoration
	Nitrate+Nitrite	Alternative Watering System
		Bioretention Practices
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Filtration Basin
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
		Pervious Pavement
		Reforestation
		Stream Restoration
	E. coli	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Wetland Restoration
	Livestock Access	Alternative Watering System
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Stream Restoration
	Conventional Tillage Practices	Education and Outreach
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
	In-stream Debris	Education and Outreach
	Streambank Erosion	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Stream Restoration
		Wetland Restoration

Table 51: BMP Selection, cont.		
Critical Area	**Reason for being Critical**	**Suggested BMP**
High Priority Subwatersheds		
Morse Reservoir/Cicero Creek	*E. coli*	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Wetland Restoration
	Nitrate+Nitrite	Alternative Watering System
		Bioretention Practices
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Filtration Basin
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
		Pervious Pavement
		Reforestation
		Stream Restoration
	Algae	Alternative Watering System
		Bioretention Practices
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Filtration Basin
		Naturalized Detention Basin
		Nutrient/Waste Management
		Pervious Pavement
		Wetland Restoration
	Streambank Erosion	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Naturalized Stream Buffer
		Rain Barrel/Rain Garden
		Stream Restoration
		Wetland Restoration
	In-stream Debris	Education and Outreach
	Conventional Tillage Practices	Education and Outreach
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
	Livestock Access	Alternative Watering System
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Stream Restoration

Table 51: BMP Selection, cont.		
Critical Area	**Reason for being Critical**	**Suggested BMP**
Medium Priority Subwatersheds		
Cox Ditch Prairie Creek Hinkle Creek	Nitrate+Nitrite	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
		Reforestation
		Stream Restoration
	E. coli	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Wetland Restoration
	Total Phosphorus	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Reforestation
		Stream Restoration
		Wetland Restoration
	Livestock Access	Alternative Watering System
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Stream Restoration
	Conventional Tillage Practices	Education and Outreach
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
	Lack of Stream Buffers	Education and Outreach
		Buffer/Filter Strips
		Stream Restoration

Table 51: BMP Selection, cont.		
Critical Area	**Reason for being Critical**	**Suggested BMP**
	Low Priority Subwatersheds	
Weasel Creek Buck Creek Dixon Creek	*E. coli*	Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Wetland Restoration
	Nitrate+Nitrite	Alternative Watering System
		Bioretention Practices
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Filtration Basin
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
		Pervious Pavement
		Reforestation
		Stream Restoration
	TSS	Alternative Watering Systems
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Filtration Basin
		Grassed Waterways
		Nutrient/Waste Management
		Infiltration Trench
		Naturalized Detention Basin
		Naturalized Stream Buffer
		No-Till/Reduced Till (Conservation Tillage
		Pervious Pavement
		Rain Barrel/Rain Garden
		Reforestation
		Stream Restoration
		Wetland Restoration
	Total Phosphorus	Alternative Watering System
		Bioretention Practices
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Filtration Basin
		Naturalized Detention Basin
		Nutrient/Waste Management
		Pervious Pavement
		Stream Restoration
		Wetland Restoration

Table 51: BMP Selection, cont.		
Critical Area	**Reason for being Critical**	**Suggested BMP**
Low Priority Subwatersheds		
Weasel Creek Buck Creek Dixon Creek	Livestock Access	Alternative Watering System
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Stream Restoration
	Conventional Tillage Practices	Education and Outreach
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)
Specific Source Critical Areas		
Livestock Access		Alternative Watering System
		Education and Outreach
		Exclusionary Fencing
		Nutrient/Waste Management
		Stream Restoration
Absent or Insufficient Stream Buffers		Education and Outreach
		Buffer/Filter Strips
		Stream Restoration
Excessive Streambank Erosion		Alternative Watering System
		Buffer/Filter Strips
		Education and Outreach
		Exclusionary Fencing
		Naturalized Stream Buffer
		Rain Barrel/Rain Garden
		Stream Restoration
		Wetland Restoration
Agricultural Areas Practicing Conventional Tillage		Education and Outreach
		Nutrient/Waste Management
		No-till/Reduced Till (Conservation Tillage)

Incentives/Cost Share Opportunities

There are a number of incentive programs to implement BMP projects. Fund sources for wetland protection and restoration, as well as technical assistance, are available from programs at the local, regional, state, and federal levels of government including USEPA Section 319 grants.

U.S. Army Corps of Engineers (USACE) Continuing Authorities Program

At the Federal level, the USACE Continuing Authorities Program (CAP) from Section 206 of the 1996 Water Resources Development Act targets wetland restoration. This section, also known as the "Aquatic Ecosystem Restoration" program gives the USACE the authority to carry out aquatic ecosystem restoration and protection if the projects will improve the quality of the environment, are in the public interest, and are cost effective. The objective of section 206 is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded and more natural condition. The local sponsors of aquatic ecosystem restoration projects are required to contribute 35% towards the total project cost.

U.S Environmental Protection Agency (USEPA) Section 319 Grants

Section 319 of the Clean Water Act provides funding for projects that work to reduce nonpoint source water pollution. IDEM administers funds from the Section 319 program which are used to create watershed management plans, demonstrate new technology, provide education and outreach on pollution prevention, conduct assessments, develop and implement Total Maximum Daily Loads (TMDLs), provide cost share dollars for BMP implementation and provide technical assistance. Organizations that are eligible for funding include nonprofit organizations, universities, and local, State or Federal government agencies. An in-kind or cash match of the total project cost must be provided.

Lake and River Enhancement (LARE) Program

LARE grants are available on a competitive basis for several actions that can address the ecology and management of public lakes, rivers and their watersheds. All grants require a local cost share. The goal of the Division of Fish and Wildlife's Lake and River Enhancement Section is to protect and enhance aquatic habitat for fish and wildlife, to insure the continued viability of Indiana's publicly accessible lakes and streams for multiple uses, including recreational opportunities. This is accomplished through measures that reduce non-point sediment and nutrient pollution of surface waters to a level that meets or surpasses state water quality targets. Funding for the LARE program is provided by an annual fee charged to boat owners. LARE grants are available for preliminary lake studies, engineering feasibility studies of pollution control measures, design engineering of control measures, and performance appraisals of a constructed pollution measure. The projects listed above are considered "traditional" projects and the deadline to submit applications is January 15th. Approved projects are awarded grant money in the month of July. Additionally, LARE sets aside one-third of its annual funds for sediment removal or exotic species control. Land treatment cost share dollars for agricultural practices require the involvement of the County SWCDs as the grant sponsor.

Farm Service Agency (FSA) Programs

Indiana Farm Service Agency (FSA) supports farmers through a variety of Credit and Commodity Programs designed to stabilize and enhance rural landscape. The FSA administers and manages farm commodity, credit, disaster and loan programs, and conservation as laid out by Congress through a network of federal, state and county offices. Programs are designed to improve economic stability of the agricultural industry and to help farmers adjust production to meet demand. Economically, the desired result of these programs is a steady price range for agricultural commodities for both farmers and consumers.

Conservation Reserve Program (CRP)
The CRP is a voluntary program encouraging landowners for long-term conservation of soils, water, and wildlife resources. CRP is the US Department of Agriculture's single largest environmental improvement program and is administered through the Farm Service Agency (FSA) with 10 to 15 year contracts. The goal of the CRP program (and CREP - Conservation Reserve Enhancement Program) is to give incentives to landowners who take frequently flooded and environmentally sensitive land out of crop production and plant specific types of vegetation. Participants earn annual rental payments and sign-up incentives. This program offers up to 90% cost share. Rental payments are boosted by 20% for projects such as installation of riparian buffers and filter strips. Windbreaks, contour buffer strips, and shallow water areas are additional funded practices. The WHIP program is available for private landowners to make improvements for wildlife on their property. This program offers up to 75% cost share. This grant program is competitive and funding depends on the project's ranking compared to others in the state.

Conservation Stewardship Program (CSP)
The Conservation Stewardship Program (CSP) is a voluntary program that encourages agricultural producers to improve conservation systems by improving, maintaining, and managing existing conservation activities and undertaking additional conservation activities. The Natural Resources Conservation Service administers this program and provides financial and technical assistance to eligible producers. CSP is available on Tribal and private agricultural lands and non-industrial private forestland (NIPF) on a continuous application basis.

CSP offers financial assistance to eligible participants through two possible types of payments:

- Annual payment for installing and adopting additional activities; and improving, maintaining, and managing existing activities.
- Supplemental payment for the adoption of resource-conserving crop rotations.

Environmental Quality Incentives Program (EQIP)
EQIP is accommodating to grass-roots conservation and is another voluntary USDA conservation program for farmers faced with threats to soil, water, and related natural resources. Typically EQIP monies will fund 75% of land improvements and installation of conservation practices such as grade stabilization structures, grassed waterways, and filter strips adjacent to water resources (including wetlands). The goal of WRP is to restore and protect degraded wetlands such as farmed wetlands. WRP provides technical and financial assistance to eligible landowners to restore, enhance and protect wetlands. At least 70% of each project area will be restored to natural site conditions to the extent practicable. WRP has three options available: permanent easements, 30-year easements and restoration agreements. The NRCS will reimburse the landowners for easements on the property plus a

portion of the restoration costs based on the type of easement agreed to by the landowner. EQIP and WRP are only applicable to agricultural lands.

Wetlands Reserve Program (WRP)
The WRP is the Nation's premier wetlands restoration program. It is a voluntary program that offers landowners the means and the opportunity to protect, restore, and enhance wetlands on their property. The USDA NRCS manages the program as well as provides technical and financial support to help landowners participate in WRP. Program objectives include: purchasing conservation easements from, or entering into cost-share agreements with willing owners of eligible land, helping eligible landowners, protect, restore, and enhance the original hydrology, native vegetation, and natural topography of eligible lands, restoring and protecting the functions and values of wetlands in the agricultural landscape, helping to achieve the national goal of no net loss of wetlands, and improving the general environment of the country.

The emphasis of the WRP program is to protect, restore and enhance the functions and values of wetland ecosystems to attain: 1) first and foremost, habitat for migratory birds and wetland dependent wildlife, including threatened and endangered species; 2) protection and improvement of water quality; 3) lessen water flows due to flooding; 4) recharge of ground water; 5) protection and enhancement of open space and aesthetic quality; 6) protection of native flora and fauna contributing to the Nation's natural heritage; and 7) contribute to educational and scholarship.

Wildlife Habitat Incentive Program (WHIP)
The Wildlife Habitat Incentive Program (WHIP) is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Through WHIP USDA's Natural Resources Conservation Service provides both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from 5 to 10 years from the date the agreement is signed.

In order to provide direction to the State and local levels for implementing WHIP to achieve its objective, NRCS has established the following national priorities:

- Promote the restoration of declining or important native fish and wildlife habitats.
- Protect, restore, develop or enhance fish and wildlife habitat to benefit at-risk species
- Reduce the impacts of invasive species on fish and wildlife habitats; and
- Protect, restore, develop or enhance declining or important aquatic wildlife species' habitats

WHIP has proven to be a highly effective and widely accepted program across the country. By targeting wildlife habitat projects on all lands and aquatic areas, WHIP provides assistance to conservation minded landowners that are unable to meet the specific eligibility requirements of other USDA conservation programs.

Conservation Reserve Enhancement Program (CREP)
CREP is a federal-state natural resources conservation program that addresses agricultural-related environmental concerns at the state and national level. CREP participants receive

financial incentives to voluntarily enroll in CRP in contracts of 14 to 15 years. Participants remove cropland from agricultural production and convert the land to native grasses, trees and other vegetation. The Indiana CREP is a partnership between USDA and the state of Indiana. The program targets the enrollment of 7,000 acres of land in the Pigeon-Highland, Tippecanoe, and Upper White River watersheds where sediments, nutrients, pesticides and herbicides run off from agricultural land.

The program will improve water quality by creating buffers and wetlands that will reduce agricultural runoff into the targeted watersheds. Installing buffer practices and wetlands will enhance habitat for wildlife, including State and Federally-listed threatened and endangered species. The program will also reduce nonpoint source nutrient losses. The goals of the Indiana CREP are to: 1) enroll 7,000 acres of eligible cropland and marginal pastureland, including frequently flooded lands, into CREP to establish buffer practices and wetlands, 2) protect at least 2,000 linear miles of watercourses by installing buffer practices, 3) reduce by 15 percent the amount of sediment, nutrients and agricultural chemicals entering watercourses within the targeted watersheds, 4) enroll 30 percent of farmed riparian acreage in the watersheds in accordance with statutory and regulatory rules, 5) enroll 8 percent of eligible acres in voluntary state ten-year contract extensions with local Soil and Water Conservation Districts in the Tippecanoe watershed; and 6) enroll 10 percent of eligible acres in voluntary state permanent easements in the Tippecanoe and Upper White River watersheds.

Landowners may enroll any amount of eligible cropland in the federal program and voluntary state 14-15 year contract extensions. State permanent easements allow producers to offer non-cropped acreage when they enroll cropland. Installation of conservation practices must be completed within 12 months of the federal CREP contract effective date. Once enrolled in the CREP program the land cannot be developed (i.e. no permanent structures or roads may be built). Existing abandoned structures and roads may remain if approved by DNR. Landowners must follow the Conservation Plan of Operation and land cannot go back into row crops or agricultural uses. The landowners retain the right to recreational use of their property providing it does not negatively impact the practices or cover established. The state CREP contract is attached to the land deed; thus, a producer who purchases land enrolled in an active state CREP contract is required to participate in the program or refund state money paid to date and incur other penalties.

Section 7 – Action Register and Schedule

Action Register

The success of a watershed management plan can be measured by how readily it is used by its intended audience and how well it is implemented. The Morse Reservoir/Cicero Creek WMP is very ambitious and continued implementation of the plan will require an even greater degree of cooperation and coordination among partners and funding for projects.

The action register is a tool used to easily identify each objective, milestone, estimated cost, and possible partners for easier implementation of the plan. The action register is divided based on the previously identified problem and goal categories. The problem and goal statements are also repeated in these sections for quick reference. It should be noted that some objectives may relate to several problem/goal statements, they are listed in each applicable category.

Public Participation/Education and Outreach

Problem Statement: Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.

Goal Statement: Develop and implement an education and outreach program within the watershed by 2031 (20 years).

Table 52: Public Participation/Education and Outreach Action Register					
Objective		Target Audience	Task	Cost	Possible Partner (PP) and Technical Assistance (TA)
Short Term Objectives (0-5 Years)	Effectively share and communicate past, current and future activities within the watershed	All stakeholders and landowners within the watershed	-Update MWA website on a monthly basis -Link UWRWA Morse page to efforts on MWA website within 6 months	$400/month (Estimated $100/hour for 4 hours a month)	PP – UWRWA TA – UWRWA, Consultant
	Educate stakeholders within the watershed on the function of a watershed and their impacts to water quality	All stakeholders and landowners within the watershed	-Compile a list of publications willing to feature watershed articles and complete within 6 months -Choose the 4 most effective outlets from the Education/Outreach Menu and complete 2 within 1 year	$750 - $8,600 (Estimated $100/hour for 6 hours to compile list and $150 - $8,000 for direct cost of chosen outlets per year)	PP – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR TA – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR, Consultant
	Educate homeowners in urban communities about the use of fertilizers	Homeowners in urban areas	-Choose the 4 most effective outlets from the Education/Outreach Menu and complete 2 within 1 year	$150 - $8,000 (for direct cost of chosen outlets per year)	PP – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR TA – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR, Consultant
	Coordinate efforts with the UWRWA, local MS4s and any other education and outreach efforts being conducted within the watershed	Other groups/ organizations with similar watershed goals	-Identify all Education & Outreach focused organizations and/or committees within the watershed and complete within 6 months -Attend at least one meeting for each organization/committee within the first 3 years -Evaluate the value of the meetings attended for further attendance /coordination	$1,000 - $2,600) (Estimated $100/hour for 6 hours to compile list and 2 hours per meeting for 2-10 meetings)	PP – N/A TA – N/A

Table 52: Public Participation/Education and Outreach Action Register, cont.					
Objective		Target Audience	Task	Cost	Possible Partner (PP) and Technical Assistance (TA)
Short Term, cont.	Work with Indiana Wildlife Federation on efforts to educate on and reduce the use of fertilizers containing phosphorus	Indiana Wildlife Federation	-Identify MWA liaison to coordinate with IWF within first 6 months -Attend at least 1 meeting within 1 year	$200 (Estimated $100/hour for 2 hours)	PP – N/A TA – N/A
	Educate stakeholders using septic systems about the importance of septic system maintenance	Stakeholders and landowners with septic systems	-Choose the most effective outlet from the Education/Outreach Menu within 2 years -Complete chosen Education/Outreach mechanism within 5 years	$150 - $4,000 (for direct cost of chosen outlet)	PP – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR TA – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR, Consultant
Long Term Objectives (6-20 Years)	Continue viable and effective short term objectives				
	Educate agricultural stakeholders about the use of Atrazine and its impacts to water quality	Agricultural landowners and operators	-Choose the most effective outlet from the Education/Outreach Menu -Complete chosen Education/Outreach mechanism	$150 - $4,000 (for direct cost of chosen outlet)	PP – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR TA – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR, Consultant
	Utilize examples or pilot programs/demonstration projects within the watershed for educational purposes	All stakeholders and landowners within the watershed	-Identify existing projects/prioritize eligible projects and complete based on priority	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – UWRWA, MS4s, SWCDs, County Surveyor's TA – UWRWA, MS4s, SWCDs, County Surveyor's, Consultant
	Review education and outreach program within the watershed and continue development and implementation of the program	N/A	-Review tasks and effectiveness at MWA/Sub-Committee Meetings	N/A	PP – N/A TA – N/A

Stream & Reservoir Nutrient Levels

Problem Statement: Agriculture and typical urban area practices (e.g. lawn care, pet waste disposal, erosion control during construction…etc.) within the watershed contributes a significant amount of pollutants, thereby contributing to the frequent exceedances of water quality targets and growth of algae within the reservoir.

Goal Statement: Reduce the nutrient loads so that there are no exceedances of EPAs suggested targets for Nitrate + Nitrite of 1.6 mg/L and Total Phosphorus of 0.076mg/L by 2031 (20 years).

Table 53: Stream & Reservoir Nutrient Levels Action Register

	Objective	Target Audience	Task	Cost	Possible Partner (PP) and Technical Assistance (TA)
Short Term Objectives (0-5 Years)	Educate the agricultural stakeholders on the importance of reduced application of fertilizers and urban/residential stakeholders on the use of low phosphorus or no phosphorus fertilizers	Agricultural /Residential landowners	-Choose the 4 most effective outlets from the Education/Outreach Menu and complete 2 within 1 year	$150 - $8,000 (for direct cost of chosen outlets per year)	PP – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR TA – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR, Consultant
	Educate local, regional, and state officials on the need for regulations for urban areas (specifically for phosphorus)	Local, regional and state officials	-Identify MWA liaison within 1 year -Coordinate with IWF & ILMWG on on-going efforts at the state level within 3 years -Identify avenues to communicate concerns to officials on local and regional level within 3 years	$600 - $1,200 (Estimated $100/hour for 6 to 12 hours of time)	PP – UWRWA, NRCS, SWCDs TA – N/A
	Partner with NRCS, SWCDs, MS4s, ISDA and County Boards to promote and implement cost share and/or education programs	Other groups/ organizations with similar watershed goals	-Identify all local, state and/or federal programs focused on nutrient management within 1 year -Identify eligible project and complete within 5 years	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – IDEM, UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – IDEM, UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant
	Promote and implement agricultural BMPs	Agricultural landowners	-Identify/prioritize eligible projects and complete based on priority	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant
	Promote and implement urban BMPs	Urban/Residen tial landowners	-Identify/prioritize eligible projects and complete based on priority	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant

Table 53: Stream & Reservoir Nutrient Levels Action Register, cont.					
Objective		**Target Audience**	**Task**	**Cost**	**Possible Partner (PP) and Technical Assistance (TA)**
Long Term Objectives (6-20 Years)	Continue viable and effective short term objectives				
	Educate and work with point discharges (CFOS, NPDES permitted facilities) to reduce their nutrient loads	NPDES Permittees	-Identify all currently permitted point dischargers -Research possible regulation changes -Coordinate/educate each point discharger to determine best practices	$800/Permittee (Estimated $100/hour for 8 hours of time)	PP – IDEM TA – IDEM
	Establish a monitoring program or group to collect samples	Other groups/ organizations with similar watershed goals	-Identify any monitoring efforts currently being done within the watershed by other groups -If lack of sufficient data exists from current monitoring efforts, develop program guidelines and begin sampling efforts	$600 (Estimated $100/ hour for 6 hours of identification time) $2,800/ collection event (Estimated $100/ hour for 8 hours of collection time and $200 per sample for analysis of ten samples)	PP – IDEM, Hoosier Riverwatch TA – IDEM. Hoosier Riverwatch

E. coli Levels

Problem Statement: *E. coli* levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.

Goal Statement: Reduce *E. coli* concentrations to meet the state standard of 235 CFU/100mL by 2031 (20 years).

Table 54: *E. coli* Levels Action Register

	Objective	Target Audience	Task	Cost	Possible Partner (PP) and Technical Assistance (TA)
Short Term Objectives (0-5 Years)	Educate stakeholders using septic systems about the importance of septic system maintenance	Stakeholders and landowners with septic systems	-Choose the most effective outlet from the Education/Outreach Menu within 2 years -Complete chosen Education/Outreach mechanism within 5 years	$150 - $4,000 (for direct cost of chosen outlet)	PP – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR TA – UWRWA, MS4s, SWCDs, County Surveyor's, Veolia, IDEM, DNR, Consultant
Short Term Objectives (0-5 Years)	Encourage proper disposal of pet and/or Canada goose waste	Pet and open space owners	-Create a list of potential BMPs for implementation -Choose the 4 most effective outlets from the Education/Outreach Menu and complete 2	$750 - $8,600 (Estimated $100/hour for 6 hours of identification time and $150 - $8,000 for direct cost of chosen outlets per year)	PP – UWRWA, MS4s, County Surveyor's, Veolia TA – UWRWA, MS4s, County Surveyor's, Veolia, Consultant
Short Term Objectives (0-5 Years)	Partner with NRCS, SWCDs, MS4s and County Boards to promote and implement cost share and/or education programs	Other groups/ organizations with similar watershed goals	-Identify all local, state and/or federal programs focused on *E. coli* within 1 year -Identify eligible project and complete within 5 years	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – IDEM, UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – IDEM, UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant
Short Term Objectives (0-5 Years)	Promote and implement agricultural BMPs	Agricultural landowners	-Identify/prioritize eligible projects and complete based on priority	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant
Short Term Objectives (0-5 Years)	Educate the public and stakeholders on the benefits of manure management practices	Agricultural landowners	-Choose the 4 most effective outlets from the Education/Outreach Menu and complete 2 within 5 years	$150 - $8,000 (for direct cost of chosen outlets per year)	PP – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant

Table 54: *E. coli* Levels Action Register, cont.					
Objective		Target Audience	Task	Cost	Possible Partner (PP) and Technical Assistance (TA)
Long Term Objectives (6-20 Years)	Continue viable and effective short term objectives				
	Educate and work with point dischargers to reduce the amount of *E. coli* runoff from point sources, package plants, CFOs and CSOs	NPDES Permittees	-Identify all currently permitted point dischargers -Research possible regulation changes -Coordinate/educate each point discharger to determine best practices	\$800/Permittee (Estimated \$100/hour for 8 hours of time)	PP – IDEM TA – IDEM
	Establish a monitoring program or group to collect samples	Other groups/ organizations with similar watershed goals	-Identify any monitoring efforts currently being done within the watershed by other groups -If lack of sufficient data exists from current monitoring efforts, develop program guidelines and begin sampling efforts	\$600 (Estimated \$100/ hour for 6 hours of identification time) \$2,800/ collection event (Estimated \$100/ hour for 8 hours of collection time and \$200 per sample for analysis of ten samples)	PP – IDEM, Hoosier Riverwatch TA – IDEM. Hoosier Riverwatch

Erosion and Sedimentation within the Watershed & Reservoir

Problem Statement: Soil erosion and sedimentation within the watershed is degrading the water quality/quantity and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed.

Goal Statement: Reduce sediment loads to meet the IDEM statewide draft TMDL target of 30 mg/L for TSS by 2031 (20 years).

Table 55: Erosion and Sedimentation Action Register

Objective		Target Audience	Task	Cost	Possible Partner (PP) and Technical Assistance (TA)
Short Term Objectives (0-5 Years)	Research cost effective ways to measure sediment changes within the reservoir	Other groups/ organizations with similar watershed goals	-Monitor long term changes based on measured sediment change within 5 years	Varies based on amount of sediment removed	PP – IDEM, IDNR TA – IDEM, IDNR
	Research/evaluate the need and effectiveness of a sediment removal program	Other groups/ organizations with similar watershed goals	-Monitor long term changes based on measured sediment change within 5 years	Varies based on amount of sediment removed	PP – IDEM, IDNR TA – IDEM, IDNR
	Partner with NRCS, SWCDs, MS4s and County to promote and implement cost share and/or education programs in order to reduce erosion from agricultural lands	Other groups/ organizations with similar watershed goals	-Identify all local, state and/or federal programs focused on erosion and sediment control within 1 year -Identify eligible project and complete within 5 years	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – IDEM, UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – IDEM, UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant
	Promote and implement agricultural BMPs	Agricultural landowners	-Identify/prioritize eligible projects and complete based on priority	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant
	Promote and implement urban BMPs	Urban/Residen tial landowners	-Identify/prioritize eligible projects and complete based on priority	Varies based on BMP chosen (see Section 6 for estimated costs)	PP – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's TA – UWRWA, NRCS, SWCDs, MS4s, County Surveyor's, Consultant

Table 55: Erosion and Sedimentation Action Register, cont.					
Objective		**Target Audience**	**Task**	**Cost**	**Possible Partner (PP) and Technical Assistance (TA)**
Long Term Objectives (6-20 Years)	Continue viable and effective short term objectives				
	Measure sediment change within the reservoir	Other groups/ organizations with similar watershed goals	-Identify procedures to monitor changes in the amount of sediment within the reservoir -Monitor changes every year	$600 (Estimated $100/ hour for 6 hours of identification time) $400/year (Estimated $100/ hour for 4 hours of monitoring time per year	PP – IDEM, DNR TA – IDEM, DNR
	Encourage enforcement of erosion control practices associated with the issuance of Rule 5 construction permits	Local MS4s and SWCDs	-Identify enforcement officers -Educate public on how to identify potential violators utilizing most effective Education/Outreach outlet -Establish reporting mechanism with enforcement officers	$750 - $4,600 (Estimated $100/hour for 6 hours of identification time and $150 - $4,000 for direct cost of chosen outlet) Cost of reporting mechanism will vary	PP – MS4s, SWCDs TA – MS4s, SWCDs, Consultant
	Establish a monitoring program or group to collect samples	Other groups/ organizations with similar watershed goals	-Identify any monitoring efforts currently being done within the watershed by other groups -If lack of sufficient data exists from current monitoring efforts, develop program guidelines and begin sampling efforts	$600 (Estimated $100/ hour for 6 hours of identification time) $2,800/ collection event (Estimated $100/ hour for 8 hours of collection time and $200 per sample for analysis of ten samples)	PP – IDEM, Hoosier Riverwatch TA – IDEM. Hoosier Riverwatch

Section 8 – Tracking Effectiveness

Evaluating Plan Performance

This Management Plan is meant to be a flexible tool to achieve water quality improvements within the Morse Reservoir/Cicero Creek Watershed. The WMP will be evaluated by assessing the progress made on each of the six goals. The evaluation and adaptation of the plan will be the responsibility of the Steering Committee.

The plan should be evaluated every five years to assess the progress made as well as to revise the plan, if appropriate, based on the progress achieved. The plan will also have a comprehensive review every 15 years. Amendments and changes may be made more frequently as laws change or new information becomes available that will assist in providing a better outlook for the Watershed. As goals are accomplished and additional information is gathered, efforts may need to be shifted to watershed issues of higher priority.

Tracking Strategy

In addition to the official 5 year evaluation and update, the Steering Committee will have a key role in evaluating implementation progress on an annual basis. The Steering Committee will review the status of actions recommended in the Action Register at least once per year and then identify the top priority concerns and actions for the following years focus. The Steering Committee should identify how it will implement the plan (subcommittees, reporting structure, meeting schedule, etc.).

In order to evaluate the implementation progress, a task completion log (Table 56) was completed for all milestones identified in the Action Register. An indicator tracking log (Table 57) was also created to evaluate the overall impact of implementation of the WMP. The indicators based on records maintained by the Steering Committee and in coordination with the partners identified within the Action Register.

Other opportunities for evaluating the status of plan implementation include the completion of quarterly project reports or Steering Committee meeting minutes. Since this plan is a flexible tool, the provided logs are suggestions on ways to evaluate progress; however changes/modifications are anticipated based on usability and changes in priority throughout the implementation of the WMP.

It was assumed that implementation would begin in March 2011. Dates were assigned to each milestone timeframe based on the implementation start date.

Table 56: Task Completion Log		
Task	**Start Date**	**Completion Date**
Monthly (Beginning March 2011)		
Update MWA website on a monthly basis		
6 months (Completed September 2011)		
Link UWRWA Morse page to efforts on MWA website		
Compile a list of publications willing to feature watershed articles		
Identify all Education and Outreach focused organizations/ committees within the watershed		
Identify MWA liaison to coordinate with IWF		
1 year (Completed February 2012)		
Complete 2 Education/Outreach menu items focused on the use of fertilizers and low/no phosphorus products (both urban and agricultural)		
Identify all local, state and/or federal programs focused on nutrient management, erosion control and *E. coli* reduction		
Identify MWA liaison to coordinate with local, regional and state officials for phosphorus regulations		
Complete 2 Education/Outreach Menu items focused on stakeholders and their impact to the watershed		
Attend at least one meeting focused on coordinating efforts with IWF		
Promote and implement agricultural BMPs		
Promote and implement urban BMPs		
2 years (Completed February 2013)		
Promote and implement agricultural BMPs		
Promote and implement urban BMPs		
3 years (Completed February 2014)		
Coordinate with IWF and ILMWG on on-going efforts at the state level		
Identify avenues to communicate phosphorus regulation concerns to officials on local level		
Attend at least one meeting for each educational and outreach organization and evaluate the required efforts for coordination		
Promote and implement agricultural BMPs		
Promote and implement urban BMPs		

Table 56: Task Completion Log, cont.		
Task	**Start Date**	**Completion Date**
5 years (Completed February 2016)		
Identify eligible projects for cost share opportunities in nutrient management/erosion control and *E. coli* reduction and complete at least 1 in each category		
Research long term changes based on measured sediment change within the reservoir		
Complete Education/Outreach Menu items focused on stakeholders with septic systems about the importance of septic maintenance		
Promote and implement agricultural BMPs		
Promote and implement urban BMPs		
Complete 2 Education/Outreach Menu items focused on manure management practices		
6-20 years (March 2016 – December 2030)		
Choose and complete Education/Outreach Menu items focused on agriculture stakeholders about the use of Atrazine and its impacts to water quality		
Identify and complete pilot programs/demonstration projects		
Identify procedures to monitor changes in the amount of sediment within the reservoir		
Review tasks and effectiveness at MWA/Sub Committee Meetings		
Identify all currently permitted point dischargers		
Monitor changes in sediment within the reservoir		
Research possible regulation changes for point dischargers		
Coordinate/educate point dischargers to determine best practices		
Identify erosion control enforcement officers within the watershed		
Educate public on how to identify potential erosion control violators		
Establish reporting mechanism for stream/reservoir nutrient and erosion and sediment control violations		
Identify any monitoring efforts currently being conducted within the watershed by other groups		
If lack of sufficient data exists from current monitoring efforts, develop program guidelines and begin sampling efforts		
Identify procedures to monitor changes in the amount of sediment within the reservoir		

Table 57: Indicator Tracking Log														
Year of Implementation	# of updates to website	# of programs/ideas utilized from Education/Outreach Menu	Change in sediment amount within reservoir	# of agricultural fields that have stopped using Atrazine	# of point dischargers reducing their pollutant loadings	# of observed Nitrate + Nitrite/ Phosphorus loadings above WQ target	# of observed *E. coli* loadings above WQ target	# of stream miles of improved/created buffer zones	# of stream miles of stabilized streambanks	# of miles of exclusionary fencing installed	# of agricultural fields utilizing cover crops, conservation tillage, or other BMPs	# of urban BMPs installed	# of inspections/enforcement actions on Rule 5 permit holders	# of demonstration projects installed
1														
2														
3														
4														
5														
6-10														
11-15														
16-20														

Section 9 – Appendices

Appendix A – Acronyms and Abbreviations

Appendix B – References

Appendix C – Stakeholder Groups and Related Organizations

Appendix D – Steering Committee Meeting Agendas, Sign-In Sheets and Minutes

Appendix E – Public Meeting Agendas and Sign-In Sheets

Appendix F – IDEM Data

Appendix G – CIWRP Data

Appendix H – Macroinvertebrate Data

Appendix I – Windshield Survey Data

Appendix J – NPDES/CFO Compliance

Appendix K – Reservoir Shoreline Investigation

Appendix L – Nonpoint Source Modeling

Appendix M – Education and Outreach Menu

Appendix N – Reservoir Aerial Images

Appendix O - Highly Erodible Land Documentation

Appendix A – Acronyms and Abbreviations

ACOE- Army Corps of Engineers

BFE- Base Flood Elevation
BMP- Best Management Practices

CAP- Continuing Authorities Program
CEES- Center for Earth and Environmental Science
CFO- Confined Feeding Operation
cfs- cubic feet per second
CFU- Colony Forming Units
CIWRP- Central Indiana Water Resources Partnership
CREP- Conservation Reserve Enhancement Program
CRP- Conservation Reserve Program
CSOs- Combined Sewer Overflows
CSP- Conservation Stewardship Program
CWA- Clean Water Act

DO- Dissolved Oxygen

EPA- Environmental Protection Agency
EPT- Ephemeroptera, Plecotera, Trichoptera
EQIP - Environmental Quality Incentives Program

FEMA- Federal Emergency Management Agency
FFA- Future Farmers of America
FIRM- Flood Insurance Rate Maps
FSA- Farm Service Agency

HBI- Hilsenhoff Family Biotic Index
HEL- Highly Erodible Land
HUC- Hydrologic Unit Code

IAC- Indiana Administrative Code
IBC- Impaired Biotic Communities
IBI- Index of Biotic Integrity
IDEM- Indiana Department of Environmental Management
IDNR- Indiana Department of Natural Resources
INDOT- Indiana Department of Transportation
IWF – Indiana Wildlife Federation
IUPUI- Indiana University Purdue University Indianapolis

LARE- Lake and River Enhancement Program

mg/L- milligrams per liter
mIBI- Macroinvertebrate Index of Biotic Integrity
MS4s- Municipal Separate Storm Sewer System
MWA – Morse Waterways Association

N- Total Nitrogen
NLCD- National Land Cover Data
NH3- Ammonia
NH4 - Ammonium
NO2- Nitrite
NO3- Nitrate
NOAA- National Oceanic and Atmospheric Administration
NPDES- National Pollutant Discharge Elimination System
NPS- Nonpoint Source
NRCS- Natural Resource Conservation Service
NTU- Nephelometric Turbidity Units

P- Total Phosphorus
PCB - Polychlorinated Biphenyls
PRD- Planned Residential Developments
PUD- Planned Unit Developments

QHEI- Qualitative Habitat Evaluation Index

STEPL- Spreadsheet Tool for Estimating Pollutant Load
SWCD- Soil & Water Conservation District

T&E- Threatened and Endangered
TDS- Total Dissolved Solids
TKN- Total Kjeldahl Nitrogen
TMDL- Total Maximum Daily Load
TSS- Total Suspended Solids

ug/L- Micrograms per Liter
USDA – United States Department of Agriculture
USGS-United States Geological Survey
USLE- Universal Soil Loss Equation
USWRC – United States Water Resources Council
UWRWA- Upper White River Watershed Alliance

WHIP- Wetland Habitat Incentive Program
WMP- Watershed Management Plan
WRP- Wetland Reserve Program
WWTP – Wastewater Treatment Plant

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Appendix C – Stakeholder Groups and Related Organizations

Stakeholder groups identified within the watershed as well as representatives from the groups that participated on the Steering Committee are listed below.

Boone County Soil and Water Conservation District (SWCD)

Central Indiana Land Trust

- Heather Bacher
- Cliff Chapman

Clinton County Soil and Water Conservation District (SWCD)

City of Noblesville

- Ira Goldfarb
- Mike Hendricks
- Tim Stottlemyer

City of Tipton

City of Westfield

Hamilton County Soil and Water Conservation District (SWCD)

- John South

Indiana Department of Environmental Management (IDEM)

- Bonny Elifritz

Indiana Department of Natural Resources (IDNR)

- Angela Sturdevant

Indiana University Purdue University Indianapolis (IUPUI) – Center for Earty and Environmental Science (CEES)

- Lenore Tedesco

Morse Waterways Association (MWA)

- Roger Goings
- Mike Murphy
- Jim Schneider

Tipton County Soil and Water Conservation District (SWCD)

Tipton County Surveyor

- Jason Henderson
- Amanda Inman

Town of Arcadia

Town of Atlanta

Town of Cicero

Town of Goldsmith

Town of Hobbs

Town of Sheridan

Upper White River Watershed Alliance (UWRWA)

- Jill Hoffman
- Holly Jones

V3 Companies

- Ed Belmonte
- Jessica Dunn
- Carrie Pintar
- Jessica Spurlock
- Greg Wolterstorff

Veolia Water Indianapolis, LLC

- Paul Whitmore

White River Watchers

- Crist Blassaras

Appendix D – Steering Committee Meeting Agendas, Sign-in Sheets & Minutes

Steering Committee Agendas, Sign-In Sheets and Minutes for the Steering Committee Meetings held on the following dates are included in this appendix.

- February 27, 2009
- March 27, 2009
- April 30, 2009
- July 31, 2009
- October 8, 2009
- November 10, 2009
- December 9, 2009

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 3:00 pm Friday, February 27th 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions (approximately 1:00-1:15)

2. Discussion regarding Watershed Management Plan (approximately 1:15-1:55)

    - Cicero Creek Wastershed

    - Baseline/Benchmark Conditions

      Data Sets from IDEM and IUPUI Sampling Efforts

    - Identifying Problems/Causes, Sources, Critical Areas

3. Break (approximately 1:55-2:00)

4. Project Timeframes and Schedule (approximately 2:00-2:10)

5. Updates from Existing Groups Current Efforts (approximately 2:10-2:30)

6. Initial Watershed Plan Public Meeting (approximately 2:30-2:40)

    - Date and Location

    - Introduction of the Study

    - Identifying Stakeholders

    - Obtaining Public Input

7. Steering Committee Meetings (approximately 2:40-2:50)

    - Approaching Desired Target Members

    - Recruitment from Public Meeting

    - Steering Committee Meeting Details (Locations, Times etc)

8. Morse Reservoir Watershed Events, Activities, and Misc. Topics (approximately 2:50-3:00)

    - Outreach

    - FTP site

9. Closing and Adjournment (approximately 3:00)

Morse Waterways Association

Morse/Cicero Creek Watershed Steering Committee Meeting February 27, 2009 Sign-In Sheet

Name	Phone	Email or Address
Ed Belmonte	630-729-6160	EBelmonte@V3co.com
MIKE MURPHY	317 984-4571	MPMURPHY40@GMAIL.COM
Amanda Inman	765-675-8793	deputy_surveyor@yahoo.com
JIM SCHNEIDER	317-517-0527	JAMES.SCHNEIDER@COMCAST.NET
Roger Goings	317-773-5715	roger306@comcast,net
Jill Hoffman	317-891-8820	on file
IRA GOLDFARB	317-770-5136	igoldfarb@noblesville.in.us
CARRIE PINTAR	630-729.6134	cpintar@v3co.com

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 3:00 pm Friday, February 27th 2009
Noblesville Wastewater Utility

AGENDA with Notes

1. Welcome and Introductions – 8 people in attendance, see sign-in sheet

2. Discussion regarding Watershed Management Plan – Carrie Pintar provided the attached presentation regarding the following: Cicero Creek Watershed Background Information, Baseline/Benchmark Conditions; Brief Presentation of the Data Sets from IDEM and IUPUI Sampling Efforts; Ed Belmonte discussed Project requirements of incorporating the existing study results and public input with respect to identifying problems, causes, sources and critical areas.

   Through the discussion, Sheridan was identified as the approximate watershed location where portions downstream are more impaired then portions upstream. Noblesville will be amended to the urban listing. IDEM's lake specialist position has been vacated since the departure of Carol Newhouse, the most recent data set on trophic status is slightly dated but should not be significantly different than current Morse Reservoir characteristics. Mike Murphy pointed out that the Arcadia USGS station appeared active during the summer of 2008. Concerns of sediment accumulations within the reservoir were also discussed.

3. Project Timeframes and Schedule – as the LARE grant applications are due by January 15th (of each year), the draft Cicero Creek Watershed Management Plan will be prepared by December 2009. The IDEM 319 grants are due by September 1st (of each year), the final Cicero Creek Watershed Management Plan will be prepared by July 2010.

4. Updates from Existing Groups Current Efforts – Ira Goldfarb discussed the inserts with Noblesville monthly bills regarding responsible watershed practices. Mike Murphy discussed current outreach and education efforts. Jim Schneider and Roger Goings discussed current activities from the Morse Waterways Association. Amanda Inman discussed current activities from the Tipton County Surveyors office. Jill Hoffmann discussed current activities from the Upper White River Watershed Alliance.

Initial Watershed Plan Public Meeting – The first public meeting will be held on Thursday April 30th. Tuesday April 28th had been discussed but was subsequently changed. Location options include: Red Bridge, South Harbor Clubhouse or the Osprey Pavilion. The second public meeting will be planned for sometime during June and well be held in Tipton County. The focus will be to draw the urban reservoir residents for the first meeting and the rural and agricultural residents for the second meeting.

5. Steering Committee Meeting – the next steering committee meeting is planned for Friday, March 27th at 1:00 pm. The location is planned to be at the Noblesville Wastewater Utility, 197 West Washington Street, in Noblesville.

6. Morse Reservoir Watershed Events, Activities, and Misc. Topics – the Upper White River Watershed Alliance will soon have a website where our steering committee can access an FTP site to share information easily. Ed Belmonte will provide a slide regarding the Watershed Study and the April Public Meeting to Jim Schneider for use at his March 24th Association meeting.

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 3:00 pm Friday, March 27th, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions
2. Current Agency/Organization Purpose, Programs & Objectives
3. Update on MWA March 24th Meeting
4. Break
5. Update on Contract Tasks
    i. Compiling of Historical Information
    ii. Model Nonpoint Source Pollution In Lakes & Subwatersheds
    iii. Create Public Information Handout
6. April Steering Committee Meeting
    i. Date, Location, Time…etc.
7. April Public Meeting
    i. April 30, 2009
    ii. Red Bridge Community Building (NW Side of Reservoir)
    iii. 7:00 p.m.
    iv. V3 update on WMP & UWRWA update on algae study
8. Closing & Adjournment

Morse Waterways Association

Morse/Cicero Creek Watershed Steering Committee Meeting March 27, 2009 Sign-In Sheet

Name	Phone	Email or Address
MIKE MURPHY	317 445 3022	MPMURPHY40@GMAIL.COM
Roger Goings	317 773 5715	roger306@comcast.net
John South	773-1406	john.south@in.nacdnet.net
Ed Belmonte	630-729-6160	EBelmonte@V3co.com
Tim Stottlemyer	317-770-5132	TSTOTTLEMYER@NOBLESVILLE.IN.US
Crist Blassaras	765-644-5073	zorbisfat@comcast.net
Amanda Inman	765-675-1109	deputy_surveyor@yahoo.com
JIM SCHNEIDER	317-517-0527	JAMES.SCHNEIDER@COMCAST.NET
Tami Mihm	916 3424231	tmihm@empowerresults.com
Jessica Dunn	630-~~729~~-6168	jdunn@v3co.com

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 3:00 pm Friday, March 27th, 2009
Noblesville Wastewater Utility

AGENDA with notes

1. Welcome and Introductions – 10 people in attendance, see sign-in sheet.

2. Current Agency/Organization Purpose, Programs & Objectives – current activity updates were provided by: Mike Murphy regarding gaining additional stakeholder involvement, *E. coli* demonstration from River Watch, Outreach to youth organizations (FFA); Roger Goings regarding drought task force, goose control seminar; John South regarding Party Cove Island erosion control, rain gardens, shoreline stabilization, native plantings; Tim Stottlemyer regarding successful grant writing, rain garden implementation, shoreline plantings for HOAs making ponds sustainable, restoring outfalls, eliminating geese, HOA demonstration projects, effective signage, Forest Park pool, permeable pavers, green roof implementation projects, moving downspouts offline of WWTP, harvesting system, MS4 communities, social behavior surveys, raingarden workshops, soccer club raingarden installation; Crist Blassaras regarding water quality improvements, sampling during storm events, nitrate and phosphorus removal measures, geo-locating severe stormwater runoff locations, IDEM meeting discussion; Amanda Inman regarding Big Cicero projects, 269nd log jam removal, 291st sand bar removal, Tipton County residents desires (or lack there of) for implementation projects, CSOs; Jim Schneider regarding MWA March 24th meeting, promoting the April 30th meeting, water quality improvements that residents can implement, BMPs for homeowners; Tami Mihm regarding Upper White River Watershed Alliance's website, social behavior survey success, planting plans on website.

3. Ed Belmonte provided on update on Contract Tasks including: Compiling of Historical Information, Modeling Nonpoint Source Pollution, and project schedule discussion.

4. Public Information Handout distributed by V3 electronically by mid-April to receive comment from Steering Committee and be available for distribution at the public meetings.

5. April Steering Committee Meeting and Public Meeting – the next steering committee meeting will be held on Thursday April 30th from 3pm to 5pm at the Noblesville Wastewater Utility, 197 West Washington Street, Noblesville 46060. The public meeting will also be held on Thursday April 30th from 7pm to 9pm at the Red Bridge Community Building, on the northwest side of the Reservoir. The second public meeting will be held approximately June 15th and will be located in Tipton County.

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
3:00 to 5:00 pm Thursday, April 30, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions
2. Current Agency/Organization Purpose, Programs & Objectives
3. Discussion of Website and Link to FTP Site
4. Update on Watershed Plan Tasks
5. Water Quality 101, informational / refresher
6. May Steering Committee Meetings
    i. Date, Location, Time…etc.
7. Discussion on Public Meeting – April 30th from 7pm to 9pm at the Red Bridge Community Building, on the northwest side of the Morse Reservoir
8. Miscellaneous Issues and Discussion
9. Closing and Adjournment

Upper White River Watershed Alliance
c/o IUPUI – Center for Earth & Environmental Science
723 West Michigan Street, SL118
Indianapolis, IN 46202
317-274-7154

MWA
Morse Waterways Association

Morse/Cicero Creek Watershed Steering Committee Meeting April 30, 2009 Sign-In Sheet

Name	Phone	Email or Address
Jessica Dunn	630-729-6168	jdunn@v3co.com
JIM SCHNEIDER	317-517-0527	JAMES.SCHNEIDER@COMCAST.NET
Paul Whitmore	317-263-6517	paul.whitmore@veoliawaterna.com
Tim Stottlemyer	317-770-5132	TSTOTTLEMYER@NOBLESVILLE.IN.US
Ed Belmonte	630-729-6160	EBelmonte@V3co.com
MIKE MURPHY	317 445 3022	MPMURPHY40@GMAIL.COM
Roger Goings	3177735715	roger306@comcast.net
John South	317-773-1406	jhs@co.hamilton.in.us

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
3:00 to 5:00 pm Thursday, April 30, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions – 9 people in attendance, see sign-in sheet (one individual was not accounted for on sign-in sheet)

2. Current Agency/Organization Purpose, Programs & Objectives - Each Agency/Organization present discussed their objectives, programs and public outreach efforts. This activity will be shortened in subsequent meetings.

3. Discussion of Website and Link to FTP Site - Upper White River Watershed Alliance's website can be accessed by entering http://UWRWA.org then look to the middle of the page within the blue box underneath the large "Are You?" to see the Morse/Cicero Creek SubWatershed.

4. Update on Watershed Plan Tasks - Updated group on the historical information gathered to date, including IDEM's data for water chemistry, fish tissue, sediment contaminants, fish community, macroinvertebrate and associated habitat. Indiana Clean Lakes Program introduced for additional water quality data gathered by professionals and volunteers. Informed group of IDEM's Distribution and Abundance of *Cylindrospermopsis raciborskii* study, IDEM Mid-water plankton invertebrate report, and also on obtaining other reports that were mentioned in the CEES 2003 report.

5. Water Quality 101, informational / refresher - Topics covered included watersheds, succession nature of lakes/sediment deposition, meandering nature of stream /sediment deposition, conductivity, pH, salinity, turbidity, total suspended solids / sediment deposition, nutrients, algae, bacteria, and flooding.

6. May Steering Committee Meetings

    i. Steering Committee Meetings may be moved to every other month.

    ii. Will likely schedule Tipton County Public Meeting through email coordination. Potential location of public meeting at 4-H building. Presentation will focus on benefit to farmers through participating in Morse Watershed Management Plan (flood and contaminant reduction, cost-share programs, etc.).

7. Discussion on Public Meeting – April 30th from 7pm to 9pm at the Red Bridge Community Building, on the northwest side of the Morse Reservoir

8. Miscellaneous Issues and Discussion

9. Closing and Adjournment

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 3:00 pm Friday, July 31, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions
2. Review of Data Collection Effort
    i. Shoreline stabilization survey
    ii. CEES survey review from April 30th public meeting
3. Nonpoint Source Pollution Model
    i. Memo approval process
    ii. Preliminary modeling results
4. Windshield Survey Locations
    i. Discussion of suggested data sheet survey form
    ii. Discussion of suggested location survey points (119 available)
    iii. Acquiring volunteers to implement windshield survey
5. Define Mission, Vision, or Purpose Statement for the Watershed
6. August Public Meeting in Tipton County
7. September 25th Steering Committee Meeting
8. Miscellaneous Issues and Discussion
9. Closing and Adjournment

Get new logo from Jill

Upper White River Watershed Alliance
c/o IUPUI – Center for Earth & Environmental Science
723 West Michigan Street, SL118
Indianapolis, IN 46202
317-274-7154

MWA Morse Waterways Association

Morse/Cicero Creek Watershed Steering Committee Meeting July 31, 2009 Sign-In Sheet

Name	Phone	Email or Address
Tim Stottlemyer	317-770-5132	TSTOTTLEMYER@NOBLESVILLE.IN.US
Jessica Dunn	630-729-6160	JDunn@v3co.com
Crist Blassaras	765-644-5073	zorbisfat@comcast.net
Jill Hoffmann	317-891-8820	jhoffmann@empowerresults.com
Paul Whitmore	317 263-6517	paul.whitmore@veoliawaterna.com
Jim Schneider	317-984-2469	JAMES.SCHNEIDER@COMCAST.NET
Mike Murphy	317 445-3022	mpmurphy40@gmail.com

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 3:00 pm Friday, July 31, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions – 8 people in attendance, see sign-in sheet (one individual was not accounted for on sign-in sheet)

   i. Discussed algal blooms at Geist and Morse Reservoir

   ii. Clean-up day scheduled for August 1st at Morse Reservoir will not be cancelled due to recent blooms.

2. Review of Data Collection Effort

   i. Shoreline stabilization survey was conducted on June 12, 2009. The shoreline was assessed as stabilized or not stabilized. The type of stabilization was noted during the field effort (ex. sheetpile, rip-rap, concrete wall). Areas of erosion and the severity of erosion were recorded. The watershed management plan will recommend stabilization options and the feasibility of installation. Permitting of shoreline is in the process of being standardized as there is confusion over approved stabilization structures. The department of waterworks requires an additional permit as they own a 20 ft easement of the Morse Reservoir shoreline.

   ii. CEES data will be discussed at future steering committee meetings, after V3 and CEES discuss findings.

3. Nonpoint Source Pollution Model

   i. Memo approval process- Memo attached to meeting notes. STEPL was selected for its detailed input options, BMP analysis capabilities, and its ease of multiple subwatershed analyses. STEPL provides estimates for watershed surface runoff; nutrient loads, including nitrogen, phosphorus, and 5-day biological oxygen demand (BOD5); and sediment delivery.

   ii. Preliminary modeling results demonstrate areas of focus and will be calibrated as more data is collected.

4. Windshield Survey Locations

   i. Two page survey form is preferred. Estimate 5 – 8 minutes per station. Edits are to be provided to V3 for inclusion prior to surveys being performed.

   ii. 150 locations throughout watershed with 100 being locations near waterways. Two windshield surveys are suggested to include data during the fall/winter as there is less vegetative cover allowing areas to be more visible.

   iii. Volunteers to implement windshield survey will be coordinated by the Steering Committee. Demonstration of survey procedure and explanation of data sheet will be conducted prior to surveying effort.

5. Define Mission, Vision, or Purpose Statement for the Watershed. Communicate with IDEM desire to use MWA and UWRWA mission/vision as the mission for the Morse Watershed Management Plan. The need statement included in the grant application for the watershed management plan may be used as the mission statement if the MWA and UWRWA mission/vision statement does not meet IDEM requirement/approval.

6. August Public Meeting in Tipton County

   i. Looking at Tuesday through Thursday from 6 – 8 pm for potential dates to hold the public meeting. Would like to coordinate with Tipton County before scheduling.

   ii. Potential location of public meeting at 4-H building. Presentation will focus on benefit to farmers through participating in Morse Watershed Management Plan (flood and contaminant reduction, cost-share programs, etc.).

7. September 25th Steering Committee Meeting

8. Miscellaneous Issues and Discussion

9. Closing and Adjournment

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
3:00 to 5:00 pm Thursday, October 8, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions

2. Tipton County Public Meeting
   i. Concerns with the timing
   ii. Goals for this meeting

3. Update on Project Schedule
   i. Timeframe for completion of Draft Report
   ii. Macroinvertebrate Collection
   iii. Steering Committee Meeting Schedule

4. Windshield Survey
   i. Discuss final survey field sheet
   ii. Discuss survey point locations
   iii. Coordination of volunteers and timeframes for completion

5. Developing Problem Statements
   i. Purpose of Problem Statements and relation to public concerns
   ii. Review of public concerns and baseline data

6. Mission/Vision Statement

7. Miscellaneous Issues and Discussion

8. Closing and Adjournment

<u>Future Meeting Topics</u>
Critical Area Identification
Causes & Sources
Goal Development
9 Minimum Elements

UWRWA Upper White River Watershed Alliance

MWA Morse Waterways Association

Morse/Cicero Creek Watershed Steering Committee Meeting October 8, 2009 Sign-In Sheet

Name	Phone	Email or Address
Bonny Elifritz	317-234-0922	belifrit@idem.in.gov
IRA GOLDFARB	317-770-5136	igoldfarb@noblesville.in
JOHN SOUTH	317-773-2181	john.south@hamiltoncounty.in.gov
MIKE MURPHY	317 445 3022	MFMURPHY40@GMAIL.COM
Carrie Pintar	630-729-6134	cpintar@v3co.com
Paul Whitmore	317 2636517	paul.whitmore@veoliawaterna.com
Angela Sturdevant		
Amanda Inman	765-675-0721	deputy_surveyor@yahoo.com
JIM SCHNEIDER	317 984-2469	JAMES.SCHNEIDER@COMCAST.NET
Roger Goings	317-773-5715	roger306@comcast.net
Jessica Spurlock	630-729-6310	jspurlock@v3co.com
GREG WOLTERSTORFF	630-729-6334	gwolterstorff@v3co.com

Morse Reservoir/Cicero Creek Watershed Management Plan
Steering Committee Meeting
Meeting Minutes

Date:	October 8, 2009	**Time:**	3:00p – 5:00p
Location:	Noblesville Wastewater Utility Building		
V3 Facilitators:	Carrie Pintar, Jessica Spurlock & Greg Wolterstorff		
Attendees:	See Attached Sign In Sheet		
Next Meeting:	Tuesday, November 10, 2009: 1:00p – 4:00p Noblesville WWU		

Action Items from Previous Meetings			
No.	**Action Item**	**Owner**	**Status/Date Completed**
1	N/A		

Key Items Discussed		
No.	**Topic**	**Comments**
1	Tipton County Public Meeting	Discussed presentation approach with Ag folks: why are they there, what is in it for them…etc. Went through presentation and edited based on committee comments.
2	Revised Project Schedule	Discussed dates for upcoming Steering Committee Meetings, completion of the Draft Report for submittal to Committee and DNR, and timing for macro collection. Key dates posted on FTP site under Calendar folder.
3	Windshield Survey	Walked through survey form and edited based on committee comments/questions. Discussed survey point locations (i.e. 150 total - 100 waterway and 50 land) and how they were broken up by subwatershed. Committee members signed up for a subwatershed to complete on their own or to split with other members. Surveys to be completed on own time and submitted to V3 by November 1.
4	Preliminary Data Summary Analysis	V3 distributed handout of preliminary water quality data analyzed to date. Discussed presentation of data in tables and ranking system. Further explanation of numbers needs to be included as well as clarification of the overall rank. Discussed whether or not to include outliers. Bonny (IDEM) suggested leaving the outliers in due to the significance of what that outlier might mean. This will be discussed in more detail on a case by case basis.
5	Mission/Vision Statement	Confirmed with Bonny (IDEM) that using the MWA and UWRWA mission statements meets 319 requirements.
6	Draft Watershed Management Plan	Distributed copies of WMP completed to date. Copy posted on FTP site for further review by Committee.

Action Plan			
No.	**Action Item**	**Owner**	**Target Date**
1	Download Project Calendar with Key Dates to FTP Site	V3	ASAP
2	Revise Windshield Survey Sheet per Committee Comments	V3	ASAP
3	Complete Subwatershed Windshield Survey	Committee Volunteers (see Volunteer Assignments under Windshield Survey folder on FTP Site)	Nov. 1
4	Presentation of Water Quality Data	V3	On-Going with Committee Input

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 4:00 pm Tuesday, November 10, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions

2. Problem Statement Discussion
   i. Review Problem Statements & Combined Statements from Worksheets
   ii. Prioritize Based On: Urgency, Feasibility, Location

3. Causes & Sources Discussion
   i. What are some of the Causes of our Issues in the Watershed?
   ii. What are the Sources?

4. Goals, Objectives & Measurable Milestone Discussion
   i. Where Do We Want to Go and How Do We Want to Get There?
   ii. How Much Improvement do We Want to See?
   iii. How Long Will it Take?
   iv. How Will It Be Measured?

5. Critical Area Discussion

6. Miscellaneous Issues and Discussion

7. Next Meeting: December 9 – Noblesville Wastewater Utility Building 1:00p – 4:00p

8. Closing and Adjournment

UWRWA Upper White River Watershed Alliance

MWA Morse Waterways Association

Morse/Cicero Creek Watershed Steering Committee Meeting November 10, 2009 Sign-In Sheet

Name	Phone	Email or Address
Crist Blassaras	765-644-5073	zorbisfat@comcast.net
Roger Goings	317-773-5715	roger306@comcast.net
JIM SCHNEIDER	317-517-0527	JAMES.SCHNEIDER@COMCAST.NET
MIKE MURPHY	317 984 4571	MPMURPHY40@GMAIL.COM
John South	317 776-2181	john.south@hamiltoncounty.in.gov
Amanda Inman	765-675-2793	deputy-surveyor@yahoo.com
Tim Stottlemyer	317-770-5132	TSTOTTLEMYER@NOBLESVILLE.IN.US
Angela Sturdevant	317-234-4906	asturdevant@dnr.in.gov
Holly Jones	219 622 0286	hjones@empowerresults.com
Greg Wolterstorff	630-729-9200	gwolterstorff@v3co.com
Jessica Spurlock	630-729-9200	jspurlock@v3co.com

GVW NOTES

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 4:00 pm Tuesday, November 10, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions

2. Problem Statement Discussion
   i. Review Problem Statements & Combined Statements from Worksheets
   ii. Prioritize Based On: Urgency, Feasibility, Location

3. Causes & Sources Discussion
   i. What are some of the Causes of our Issues in the Watershed?
   ii. What are the Sources?

4. Goals, Objectives & Measurable Milestone Discussion
   i. Where Do We Want to Go and How Do We Want to Get There?
   ii. How Much Improvement do We Want to See?
   iii. How Long Will it Take?
   iv. How Will It Be Measured?

5. Critical Area Discussion

6. Miscellaneous Issues and Discussion

7. Next Meeting: December 9 – Noblesville Wastewater Utility Building 1:00p – 4:00p

8. Closing and Adjournment

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 4:00 pm Tuesday, November 10, 2009
Noblesville Wastewater Utility
197 West Washington Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions

2. Problem Statement Discussion
   i. Review Problem Statements & Combined Statements from Worksheets
   ii. Prioritize Based On: Urgency, Feasibility, Location

3. Causes & Sources Discussion
   i. What are some of the Causes of our Issues in the Watershed?
   ii. What are the Sources?

4. Goals, Objectives & Measurable Milestone Discussion
   i. Where Do We Want to Go and How Do We Want to Get There?
   ii. How Much Improvement do We Want to See?
   iii. How Long Will It Take?
   iv. How Will It Be Measured?

5. Critical Area Discussion

6. Miscellaneous Issues and Discussion

7. Next Meeting: December 9 – Noblesville Wastewater Utility Building 1:00p – 4:00p

8. Closing and Adjournment

Erosion | Sedimentation

Nutrient Levels

Production Agriculture

Public Participation | Education

Streambank Erosion

E. Coli

Atrazine

Linking Concerns, Problem Statements, Causes and Sources

What are the concerns in the watershed?	Problem Statement	Potential Causes (can be the same as the problem)	Potential Sources (will also help identify critical areas)
-Silt Inputs from Watershed into Morse Reservoir -Stormwater after Rain Event -Big Cicero Erosion -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Brown Water - Subsurface Drainage -Ditch Maintenance -Buffer Areas -Cost of Streambank Maintenance -Water Level -Water Quality Pre- and Post Development -Silt from Construction Sites -Runoff from Construction Sites -Erosion Control at Construction Sites -Need for Dredging -Construction Clearing -Habitat Degradation -Big Cicero Habitat Degradation -Flooding	Excessive soil erosion and sedimentation within the watershed is degrading the water quality and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed.	-TSS levels and turbidity levels exceed water quality standards -Poor habitat evaluation scores	-~~Agricultural land under conventional tillage practices~~ make broader -Construction sites/new development -Streambank erosion -Livestock access to streams -Areas with inadequate stream buffers - Agricultural land/ row crop production - ditch maintenance practices - development w/in watershed (imp. surfaces) - loss of wetlands

		Causes	Sources
-Stormwater after Rain Event -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Failing Septic Systems Impact Water Quality -Landfill Leaking -Phosphorus – Internal Nutrient Loading -Nutrient Management - Subsurface Drainage -Buffer Areas -Manure Management -CSOs in Tipton County -Residential Fertilizer Use -Wastewater Package Plants -Odor/Taste of Water -Public Concern over Blue-Green Algae -Skin Irritation/Toxin	Nutrient concentrations within all subwatersheds frequently exceed the accepted water quality standards thereby aiding the growth of algae within the reservoir.	-Lack of education -Nitrate + nitrite levels and total phosphorus levels exceed water quality standards -Blue Green and Toxic algae levels	-pet waste | wildlife -municipal sludge mang. -Fertilizer application both urban and agricultural -Inadequately functioning septic systems -Combined sewer overflows | SSO's -Residential lawns (particularly close to streams and reservoir) -Improper disposal of yard waste -Areas with inadequate buffers -loss of wetlands -livestock access | manure management.
-Silt Inputs from Watershed into Morse Reservoir -Stormwater after Rain Event -Big Cicero Erosion -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Phosphorus – Internal Nutrient Loading - Conflict between Water Quality and Production Agriculture -Nutrient Management - Subsurface Drainage -Farming in Tipton County increases sediment and nutrients to watershed -Buffer Areas -Manure Management	Production Agriculture within the watershed contributes a significant amount of pollutants	-Nitrate + nitrite levels and total phosphorus levels exceed water quality standards -TSS levels and turbidity levels exceed water quality standards	-Fertilizer application -Areas with inadequate buffers -Agricultural land under conventional tillage practices

		Causes	Sources
-Leaking of Oil and Gas while using the reservoir for Recreational Purposes -Brown Water -Debris in Curbs and Grates -Grass Clippings/Liter in Water -Cost of Streambank Maintenance -Water Quality Pre- and Post Development -Silt from Construction Sites -Runoff from Construction Sites -Erosion Control at Construction Sites -Building/Zoning Restriction -Residential Fertilizer Use -Construction Clearing -Safety of Using Morse Reservoir Recreationally -Wastewater Package Plants -Fish Consumption Advisories/Safety -Effectiveness of Indianapolis Drinking Water Treatment -Odor/Taste of Water -Water Treatment Plant Operation/Lime in Water -How to Maximize Numerous Watershed Concerns for Maximum Improvement -Need for Water Storage Reservoir by Anderson -Education and Outreach of Watershed Issues -Cooperation/Communication between Counties -Changing Public Perception of Stormwater as a Bi-Product -Stewardship Quality/Too Few Interested Parties in Watershed -Public Concern over Blue-Green Algae -Skin Irritation/Toxin -Safety of Using Water for Irrigation Due to Presence of Blue-Green Algae -Effectiveness of Algae Treatmetns	Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.	-drain sewer use -boat practices -Lack of public awareness -Lack of unified approach -~~No effort to~~ increase educate local officials, foundations and other funding sources on the importance of urban BMPs -Lack of interest -Lack of time and commitment -Lack of media coverage/educational material	N/A – none needed for administrative or social problems

-Silt Inputs from Watershed into Morse Reservoir -Stormwater after Rain Event -Big Cicero Erosion -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Streambank Deterioration Caused by Severe Erosion -Brown Water - Subsurface Drainage -Ditch Maintenance -Buffer Areas -Livestock Access to Surface Water within Watershed -Cost of Streambank Maintenance -Water Level -Water Quality Pre- and Post Development -Silt from Construction Sites -Runoff from Construction Sites -Erosion Control at Construction Sites -Need for Dredging -Construction Clearing -Streambank Erosion -Streambank Stabilization -Habitat Degradation -Big Cicero Habitat Degradation -Flooding	Streambank erosion within the watershed is impacting wildlife/aquatic habitat and degrading water quality in the streams and reservoir within the watershed.	-TSS levels and turbidity levels exceed water quality standards -Poor habitat evaluation scores	-Agricultural land under conventional tillage practices -Construction sites/new development -Streambank erosion -Livestock access to streams -Areas with inadequate stream buffers

		Causes	Sources
-Stormwater after Rain Event -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Failing Septic Systems Impact Water Quality -E-Coli in Little Cicero - Subsurface Drainage -Buffer Areas -Livestock Access to Surface Water within Watershed -CSOs in Tipton County -Canada Geese Waste Impact on Water Quality -Increase in Canada Geese Population -Wastewater Package Plants	E. coli levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.	-E. coli levels exceed water quality standards	-illegal | insuff. | improper septic systems -Inadequately functioning septic systems -Combined sewer overflows -Wildlife -Livestock access and manure management / sep. statements -Areas with inadequate buffers -Wastewater facilities (NPDES permits) - pets - package plants
-Stormwater after Rain Event -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Nutrient Management - Subsurface Drainage -Atrazine -Buffer Areas	Concentrations of Atrazine in Morse Reservoir frequently exceed the USEPA standard of 3.0ug/L for drinking water supplies.	-Atrazine levels exceed water quality standards	-Agricultural areas utilizing Atrazine as a pesticide -Areas with inadequate buffers

Linking Concerns, Problem Statements, Causes and Sources

What are the concerns in the watershed?	Problem Statement	Potential Causes (can be the same as the problem)	Potential Sources (will also help identify critical areas)
-Silt Inputs from Watershed into Morse Reservoir -Stormwater after Rain Event -Big Cicero Erosion -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Brown Water - Subsurface Drainage -Ditch Maintenance -Buffer Areas -Cost of Streambank Maintenance -Water Level -Water Quality Pre- and Post Development -Silt from Construction Sites -Runoff from Construction Sites -Erosion Control at Construction Sites -Need for Dredging -Construction Clearing -Habitat Degradation -Big Cicero Habitat Degradation -Flooding	Excessive soil erosion and sedimentation within the watershed is degrading the water quality and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed.	-TSS levels and turbidity levels exceed water quality standards -Poor habitat evaluation scores macro	-Agricultural land under conventional tillage practices -Construction sites/new development -Streambank erosion -Livestock access to streams -Areas with inadequate stream buffers

-Stormwater after Rain Event -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Failing Septic Systems Impact Water Quality -Landfill Leaking -Phosphorus – Internal Nutrient Loading -Nutrient Management - Subsurface Drainage -Buffer Areas -Manure Management -CSOs in Tipton County -Residential Fertilizer Use -Wastewater Package Plants -Odor/Taste of Water -Public Concern over Blue-Green Algae -Skin Irritation/Toxin	Nutrient concentrations within all subwatersheds frequently exceed the accepted water quality standards thereby aiding the growth of algae within the reservoir.	-Nitrate + nitrite levels and total phosphorus levels exceed water quality standards -Blue Green and Toxic algae levels	-Fertilizer application both urban and agricultural -Inadequately functioning septic systems -Combined sewer overflows -Residential lawns (particularly close to streams and reservoir) -Improper disposal of yard waste -Areas with inadequate buffers
-Silt Inputs from Watershed into Morse Reservoir -Stormwater after Rain Event -Big Cicero Erosion -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Phosphorus – Internal Nutrient Loading - Conflict between Water Quality and Production Agriculture -Nutrient Management - Subsurface Drainage -Farming in Tipton County increases sediment and nutrients to watershed -Buffer Areas -Manure Management	Production Agriculture within the watershed contributes a significant amount of pollutants	-Nitrate + nitrite levels and total phosphorus levels exceed water quality standards -TSS levels and turbidity levels exceed water quality standards	-Fertilizer application -Areas with inadequate buffers -Agricultural land under conventional tillage practices

-Leaking of Oil and Gas while using the reservoir for Recreational Purposes -Brown Water -Debris in Curbs and Grates -Grass Clippings/Liter in Water -Cost of Streambank Maintenance -Water Quality Pre- and Post Development -Silt from Construction Sites -Runoff from Construction Sites -Erosion Control at Construction Sites -Building/Zoning Restriction -Residential Fertilizer Use -Construction Clearing -Safety of Using Morse Reservoir Recreationally -Wastewater Package Plants -Fish Consumption Advisories/Safety -Effectiveness of Indianapolis Drinking Water Treatment -Odor/Taste of Water -Water Treatment Plant Operation/Lime in Water -How to Maximize Numerous Watershed Concerns for Maximum Improvement -Need for Water Storage Reservoir by Anderson -Education and Outreach of Watershed Issues -Cooperation/Communication between Counties -Changing Public Perception of Stormwater as a Bi-Product -Stewardship Quality/Too Few Interested Parties in Watershed -Public Concern over Blue-Green Algae -Skin Irritation/Toxin -Safety of Using Water for Irrigation Due to Presence of Blue-Green Algae -Effectiveness of Algae Treatmetns	Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.	INCREASED - AWARENESS OF BOAT BEST PRACTICES -Lack of public awareness -Lack of unified approach -[illegible] educate local officials, foundations and other funding sources on the importance of urban BMPs -Lack of interest -Lack of time and commitment -Lack of media coverage/educational material - DRAIN SEWER USE	N/A – none needed for administrative or social problems

-Silt Inputs from Watershed into Morse Reservoir -Stormwater after Rain Event -Big Cicero Erosion -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Streambank Deterioration Caused by Severe Erosion -Brown Water - Subsurface Drainage -Ditch Maintenance -Buffer Areas -Livestock Access to Surface Water within Watershed -Cost of Streambank Maintenance -Water Level -Water Quality Pre- and Post Development -Silt from Construction Sites -Runoff from Construction Sites -Erosion Control at Construction Sites -Need for Dredging -Construction Clearing -Streambank Erosion -Streambank Stabilization -Habitat Degradation -Big Cicero Habitat Degradation -Flooding	Streambank erosion within the watershed is impacting wildlife/aquatic habitat and degrading water quality in the streams and reservoir within the watershed.	-TSS levels and turbidity levels exceed water quality standards -Poor habitat evaluation scores	-Agricultural land under conventional tillage practices -Construction sites/new development -Streambank erosion -Livestock access to streams -Areas with inadequate stream buffers

-Stormwater after Rain Event -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Failing Septic Systems Impact Water Quality -E-Coli in Little Cicero - Subsurface Drainage -Buffer Areas -Livestock Access to Surface Water within Watershed -CSOs in Tipton County -Canada Geese Waste Impact on Water Quality -Increase in Canada Geese Population -Wastewater Package Plants	E. coli levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.	-E. coli levels exceed water quality standards	-HOUSEHOLD PETS ILLEGAL/ OR IMPROPER -Inadequately functioning septic systems -Combined sewer overflows -Wildlife SEPARATE -Livestock access and manure management -Areas with inadequate buffers -Wastewater facilities (NPDES permits) -PACKAGE PLANTS
-Stormwater after Rain Event -Water Clarity -Polluted Runoff/Nonpoint Source Pollution -Nutrient Management - Subsurface Drainage -Atrazine -Buffer Areas	Concentrations of Atrazine in Morse Reservoir frequently exceed the USEPA standard of 3.0ug/L for drinking water supplies.	-Atrazine levels exceed water quality standards	-Agricultural areas utilizing Atrazine as a pesticide -Areas with inadequate buffers

Linking Concerns, Problem Statements, Goals and Objectives

What are the concerns in the watershed?	Problem Statement	What would you like to see for your watershed? (Goal Statements)	How will we measure progress towards measuring these goals? (Objectives/Indicators)
① Erosion and Sedimentation in Reservoir/Impacts to Habitat and Water Quality	~~Excessive~~ soil erosion and sedimentation within the watershed is degrading the water quality and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed. growth of deposits in res./reduced volume	(TSS) Reduce sediment loads to meet the IDEM draft TMDL target of 30 mg/L.	- measure sediment change in res. ✓Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs in order to reduce erosion from agricultural lands ✓Encourage the use of conservation tillage practices ✓Encourage enforcement of erosion control practices associated with the issuance of Rule 5 permits ✓Stabilize eroded streambanks within the watershed ✓Reduce animal access to streambanks ✓group to measure samples/monitoring program
② Res Nutrient Levels and Impacts to Algae in Reservoir	Nutrient concentrations within all subwatersheds frequently exceed the accepted water quality standards thereby aiding the growth of algae within the reservoir.	Reduce the nutrient loads so that there are no exceedances of Nitrate plus Nitrite of 1.6 mg/L and Total Phosphorus of 0.076 mg/L.	✓Educate the public/stakeholders (urban and agricultural) of the importance of reduced application of fertilizers or use of Low-P/No-P Fertilizers ✓Increase the riparian buffer zones using filter strips and grassed waterways ✓Increase the use of BMPs such as cover crops, conservation tillage, etc ✓Educate/work with point dischargers (CFOs, NPDES facilities & CSO) to reduce their nutrient loads ✓Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs, MS4s, Indiana State Department of Agriculture ✓Educate local/regional/state officials on the need for regulations for urban areas (specifically for Phosphorus)
③ Ag Production Agriculture and Nutrient Management	Production Agriculture within the watershed contributes a significant amount of pollutants	Reduce the amount of pollutants	✓Educate/work with the agricultural stakeholders about the impacts to water quality within the watershed ✓Increase the riparian buffer zones using filter strips and grassed waterways ✓Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs

- gully erosion/grassed waterways

- golf course?

2 problem statements geared towards urban/Agricultural

④ New problem statement — Sediment Removal from Reservoir

4 Public Participation/ Education and Outreach	Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.	Develop and implement an education and outreach program within the watershed.	Utilize examples or pilot programs/demonstration projects -Effectively share/communicate past, current and future activities in the watershed -Educate stakeholders within the watershed on the function of a watershed and the impacts to water quality -Educate homeowners in urban communities about the use of fertilizers -Educate stakeholders using septic systems about the importance of septic system maintenance, -Coordinate efforts with the UWRWA, local MS4s and any other education/outreach efforts being conducted within the watershed -Educate farmers about the use of Atrazine and its impacts to water quality Regional → Geist Watershed | Eagle Creek | 4-H, FFA schools
Add to Streambank Erosion throughout Watershed/Impacts to Habitat and Water Quality	concern 1 Streambank erosion within the watershed is impacting wildlife/aquatic habitat and degrading water quality in the streams and reservoir within the watershed.	Stabilize eroded streambanks within the watershed.	-Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs to stabilize streambanks -Reduce animal access to streambanks -Increase the riparian buffer zones using filter strips and grassed waterways to provide protection for streambanks -Increase the use of BMPs such as cover crops, conservation tillage, etc. to reduce surface runoff and provide protection for streambanks
5 E. Coli samples often exceed safety standards for fishable and swimmable waters	E. coli levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.	Reduce *E. coli* concentrations to meet state standard of 235 CFU/100mL	-Reduce the amount of E. coli runoff from agricultural lands through the encouragement of exclusionary fencing installation -Educate public/stakeholders and implement manure management practices -Educate/work with point dischargers to reduce the amount of E. coli runoff from point sources, failed septic systems, and package plants, municipal WWTP CSO CFOs -Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs MS4s -Increase the riparian buffer zones using filter strips and grassed waterways → break out to public/permitted objective
6 Atrazine levels in watershed streams	Concentrations of Atrazine in Morse Reservoir frequently exceed the USEPA standard of 3.0ug/L for drinking water supplies.	Reduce Atrazine concentrations within Morse Reservoir to not exceed the USEPA standard of 3.0ug/L.	-Reduce the use of Atrazine with education on alternative practices and/or pesticides -Increase riparian buffer zones using filter strips and grassed waterways -Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs

Q: is Atrazine being used?

Linking Concerns, Problem Statements, Goals and Objectives

What are the concerns in the watershed?	Problem Statement	What would you like to see for your watershed? (Goal Statements)	How will we measure progress towards measuring these goals? (Objectives/Indicators)
Erosion and Sedimentation Reservoir/Impacts to Habitat and Water Quality	Excessive soil erosion and sedimentation within the watershed is degrading the water quality and limiting the aesthetics, wildlife habitat, and aquatic health of the streams and reservoir within the watershed.	Reduce sediment loads to meet the IDEM draft TMDL target of 30 mg/L	-Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs in order to reduce erosion from agricultural lands -Encourage the use of conservation tillage practices -Encourage enforcement of erosion control practices associated with the issuance of Rule 5 permits -Stabilize eroded streambanks within the watershed -Reduce animal access to streambanks
Nutrient Levels and Impacts to Algae in Reservoir	Nutrient concentrations within all subwatersheds frequently exceed the accepted water quality standards thereby aiding the growth of algae within the reservoir.	Reduce the nutrient loads so that there are no exceedances of Nitrate plus Nitrite of 1.6 mg/L and Total Phosphorus of 0.076 mg/L.	-Educate the public/stakeholders (urban and agricultural) of the importance of reduced application of fertilizers or use of Low-P/No-P Fertilizers -Increase the riparian buffer zones using filter strips and grassed waterways -Increase the use of BMPs such as cover crops, conservation tillage, etc -Educate/work with point dischargers (CFOs, NPDES facilities) to reduce their nutrient loads -Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs -Educate local/regional/state officials on the need for regulations for urban areas (specifically for Phosphorus)
Production Agriculture and Nutrient Management	Production Agriculture within the watershed contributes a significant amount of pollutants	Reduce the amount of pollutants	-Educate/work with the agricultural stakeholders about the impacts to water quality within the watershed -Increase the riparian buffer zones using filter strips and grassed waterways -Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs

4 Public Participation/ Education and Outreach	Stakeholders in the Morse Reservoir/Cicero Creek Watershed are not knowledgeable about their daily impact on the watershed and its water quality.	Develop and implement an education and outreach program within the watershed.	-Effectively share/communicate past, current and future activities in the watershed -Educate stakeholders within the watershed on the function of a watershed and the impacts to water quality -Educate homeowners in urban communities about the use of fertilizers -Educate stakeholders using septic systems about the importance of septic system maintenance, -Coordinate efforts with the UWRWA, local MS4s and any other education/outreach efforts being conducted within the watershed -Educate farmers about the use of Atrazine and its impacts to water quality
Streambank Erosion throughout Watershed/Impacts to Habitat and Water Quality	Streambank erosion within the watershed is impacting wildlife/aquatic habitat and degrading water quality in the streams and reservoir within the watershed.	Stabilize eroded streambanks within the watershed.	-Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs to stabilize streambanks -Reduce animal access to streambanks -Increase the riparian buffer zones using filter strips and grassed waterways to provide protection for streambanks -Increase the use of BMPs such as cover crops, conservation tillage, etc. to reduce surface runoff and provide protection for streambanks
5 E. Coli samples often exceed safety standards for fishable and swimmable waters	E. coli levels in the watershed regularly exceed the state standard, based on current and historical water quality data results, and often exceed safety standards for recreational use in streams.	Reduce *E. coli* concentrations to meet state standard of 235 CFU/100.	-Reduce the amount of E. coli runoff from agricultural lands through the encouragement of exclusionary fencing installation -Educate public/stakeholders and implement manure management practices -Educate/work with point dischargers to reduce the amount of E. coli runoff from point sources, ~~failed septic systems~~, and package plants -Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs -Increase the riparian buffer zones using filter strips and grassed waterways
6. Atrazine levels in watershed streams	Concentrations of Atrazine in Morse Reservoir frequently exceed the USEPA standard of 3.0ug/L for drinking water supplies	Reduce Atrazine concentrations within Morse Reservoir to not exceed the USEPA standard of 3.0ug/L	-Reduce the use of Atrazine with education on alternative practices and/or pesticides -Increase riparian buffer zones using filter strips and grassed waterways -Partner with NRCS, SWCDs and County Boards to develop cost share and/or education programs

UTILIZE EXAMPLES OF BEST PRACTICES & PILOT PROGRAMS
- CONTINUOUS NO-TILL EXAMPLE IN VICINITY

& GEIST & EAGLE CREEK SCHOOLS AND FHA'S

BECOME ... GOAL IN #1

CFO'S

& WWTP'S

MS4'S

- WORK WITH PUBLIC ON SEPTIC SYSTEMS REPAIR AND MAINTENANCE

7. REMOVE SEDIMENTATION FROM RESERVOIR

Morse Reservoir/Cicero Creek Critical Area Identification

Data was separated out into 2 criteria: Current Water Quality Impairment and Susceptibility to Future Water Quality Impairment

Current Water Quality Impairment

The current water quality impairment data includes actual/quantitative data that is available for the watershed. This data is easily compared to standard water quality limits and used to gage the current health of the subwatersheds. A list of the data used for this comparison is below.

- IDEM 303(d) list
- CIWRP 2003 Study (6 stations)
    - Dissolved Oxygen
    - E. coli
    - pH
    - Nitrate + Nitrite
    - Total Phosphorus
    - Total Suspended Solids
    - Turbidity
- IDEM Water Quality Data (1996-2009: 72 stations)
    - Dissolved Oxygen
    - E. coli
    - pH
    - Nitrate + Nitrite
    - Total Phosphorus
    - Total Suspended Solids
    - Turbidity
- V3 Biological Data (2009)
    - mIBI (macroinvertebrates)

Each subwatershed was ranked based on each data set and then an overall Current Water Quality Impairment ranking was assigned.

Example:

	IDEM 303(d)	CIWRP	IDEM WQ	V3 Bio	OVERALL
Sub 1	2	3	2	1	**2**
Sub 2	1	2	1	2	**1**
Sub 3	3	1	3	3	**3**

Susceptibility to Future Water Quality Impairment

The susceptibility to future water quality impairment data includes land use/social based data that is available for the watershed. This data is not easily compared to water quality limits but can be helpful in determining the chances of ongoing or future water quality problems. A list of the data used for this comparison is below.

- Windshield Survey (should we include stream cover for habitat?)
    - Streambank Erosion
    - Stream Buffers
    - In-Stream Debris
    - Livestock Access
    - Fields under Conventional Till
- Nonpoint Source Pollution Modeling Results

- Nitrogen Loading
- Phosphorus Loading
- Sediment Loading
- NPDES Permits
  - CFOs
  - Facilities/pipes

Each subwatershed was ranked based on each data set and then an overall Susceptibility to Future Water Quality Impairment ranking was assigned.

Example:

	Windshield Survey	NPS Modeling	NPDES Permits	OVERALL
Sub 1	3	2	3	**3**
Sub 2	2	1	1	**1**
Sub 3	1	3	2	**2**

Final Critical Area Identification

Once subwatersheds were ranked based on the 2 criteria, an overall ranking was assigned with highest priority being given to current impairments. The 3 top ranked subwatersheds were then identified as the critical areas.

Example:

	Current WQ Impairment	Susceptibility to Future WQ Impairment	OVERALL CRITICAL AREA RANKING
Sub 1	2	3	**2**
Sub 2	1	1	**1**
Sub 3	3	2	**3**

Additional Critical Areas

Critical areas can also be defined as specific sources anywhere within the project area that are contributing a pollutant of concern. Below is a list of suggested additional "critical areas" to identify in the Watershed Management Plan.

- ~~Residential areas immediately adjacent to a stream or the reservoir~~
- All areas where livestock have direct access to a stream
- All areas where stream buffers are absent or insufficient ←
- All areas where excessive streambank erosion is occurring
- All agricultural areas where conventional till is practiced extensively

- MORSE RESERVOIR / CICERO CREEK SUBWATERSHED.
- EXCESSIVE SEDIMENTATION IN MORSE RESERVOIR ←
- EDUCATION

Morse Reservoir/Cicero Creek Critical Area Identification

Data was separated out into 2 criteria: Current Water Quality Impairment and Susceptibility to Future Water Quality Impairment

Current Water Quality Impairment

The current water quality impairment data includes actual/quantitative data that is available for the watershed. This data is easily compared to standard water quality limits and used to gage the current health of the subwatersheds. A list of the data used for this comparison is below.

- IDEM 303(d) list
- CIWRP 2003 Study (6 stations)
  - Dissolved Oxygen
  - E. coli
  - pH
  - Nitrate + Nitrite
  - Total Phosphorus
  - Total Suspended Solids
  - Turbidity
- IDEM Water Quality Data (1996-2009: 72 stations)
  - Dissolved Oxygen
  - E. coli
  - pH
  - Nitrate + Nitrite
  - Total Phosphorus
  - Total Suspended Solids
  - Turbidity
- V3 Biological Data (2009)
  - mIBI (macroinvertebrates)

Each subwatershed was ranked based on each data set and then an overall Current Water Quality Impairment ranking was assigned.

Example:

	IDEM 303(d)	CIWRP	IDEM WQ	V3 Bio	OVERALL
Sub 1	2	3	2	1	**2**
Sub 2	1	2	1	2	**1**
Sub 3	3	1	3	3	**3**

Susceptibility to Future Water Quality Impairment

The susceptibility to future water quality impairment data includes land use/social based data that is available for the watershed. This data is not easily compared to water quality limits but can be helpful in determining the chances of ongoing or future water quality problems. A list of the data used for this comparison is below.

- Windshield Survey (should we include stream cover for habitat?)
  - Streambank Erosion
  - Stream Buffers
  - In-Stream Debris
  - Livestock Access
  - Fields under Conventional Till
- Nonpoint Source Pollution Modeling Results

zoning/threat from development

- Nitrogen Loading
  - Phosphorus Loading
  - Sediment Loading
- NPDES Permits
  - CFOs
  - Facilities/pipes

Each subwatershed was ranked based on each data set and then an overall Susceptibility to Future Water Quality Impairment ranking was assigned.

Example:

	Windshield Survey	NPS Modeling	NPDES Permits	OVERALL
Sub 1	3	2	3	**3**
Sub 2	2	1	1	**1**
Sub 3	1	3	2	**2**

<u>Final Critical Area Identification</u>

Once subwatersheds were ranked based on the 2 criteria, an overall ranking was assigned with highest priority being given to current impairments. The 3 top ranked subwatersheds were then identified as the critical areas.

Example:

	Current WQ Impairment	Susceptibility to Future WQ Impairment	OVERALL CRITICAL AREA RANKING
Sub 1	2	3	**2**
Sub 2	1	1	**1**
Sub 3	3	2	**3**

<u>Additional Critical Areas</u>

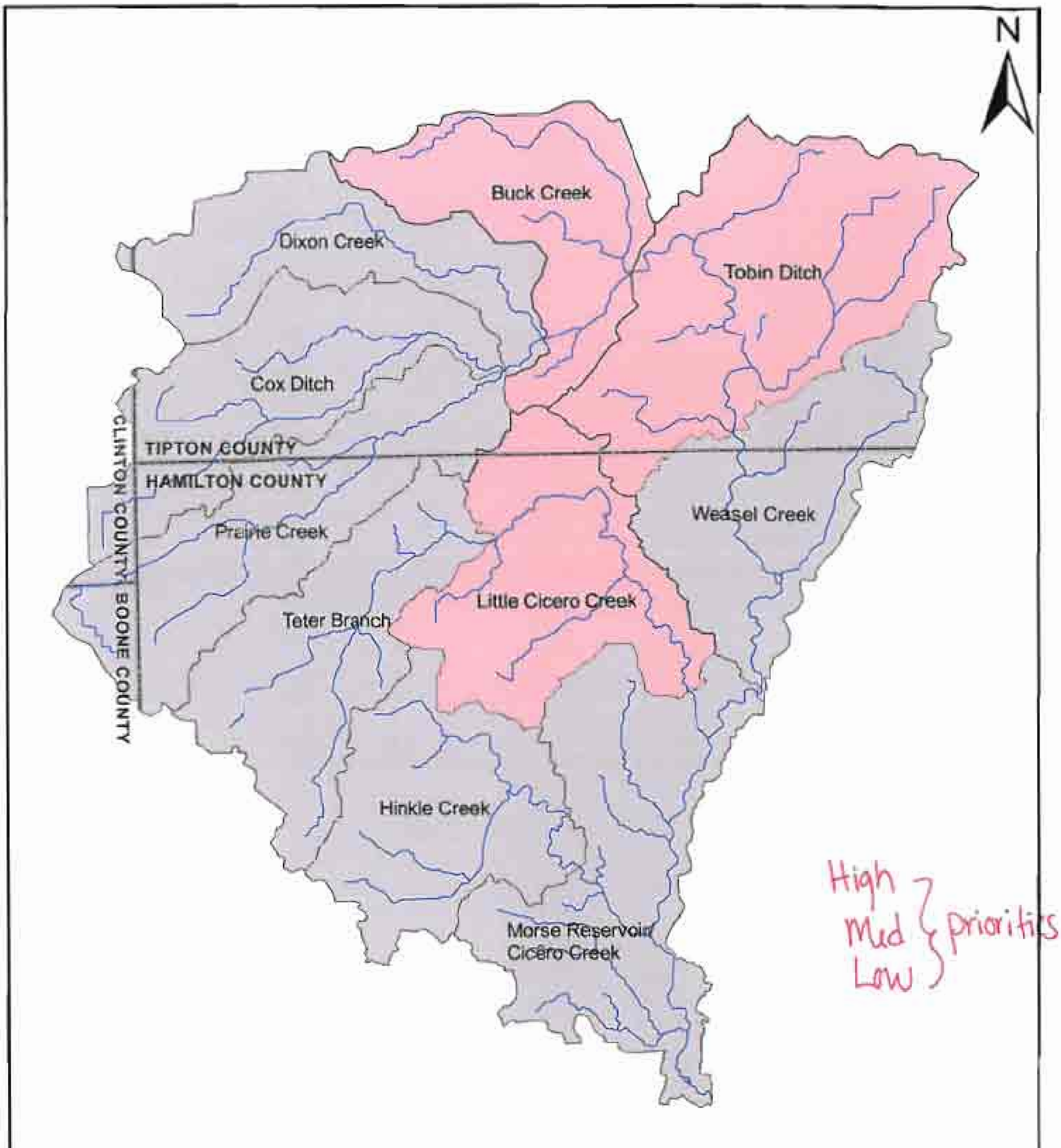
Critical areas can also be defined as specific sources anywhere within the project area that are contributing a pollutant of concern. Below is a list of suggested additional "critical areas" to identify in the Watershed Management Plan.

- ~~Residential areas immediately adjacent to a stream or the reservoir~~
- All areas where livestock have direct access to a stream
- All areas where stream buffers are absent or insufficient
- All areas where excessive streambank erosion is occurring
- All agricultural areas where conventional till is practiced extensively
- Morse Reservoir Subwatershed
- Excessive Sediment
- Education

	Current Water Quality Impairment				
	IDEM 303(d)	CIWRP WQ	IDEM WQ	V3 Bio	CURRENT RANK
Prairie Creek	NR	3	9	3	8
Cox Ditch	2	3	3	3	5
Dixon Creek	NR	3	10	2	6
Buck Creek	3	1	2	7	2
Tobin Ditch	3	1	7	6	3
Weasel Creek	NR	4	6	8	10
Teter Branch	NR	5	5	4	9
Little Cicero Creek	3	6	1	1	1
Hinkle Creek	NR	2	4	4	7
Morse Reservoir/ Cicero Creek	1	NR	8	5	4

	Susceptibility to Future Water Quality Impairment			
	Windshield Survey	NPS Modeling	NPDES Permits	FUTURE RANK
Prairie Creek	6	5	2	5
Cox Ditch	9	3	8	8
Dixon Creek	10	1	9	3
Buck Creek	8	2	4	4
Tobin Ditch	3	8	1	1
Weasel Creek	7	7	3	7
Teter Branch	4	4	5	9
Little Cicero Creek	1	6	10	2
Hinkle Creek	5	9	7	10
Morse Reservoir/ Cicero Creek	2	10	6	6

	Critical Area Ranking		
	Current Rank	Future Rank	OVERALL RANK
Prairie Creek	8	5	7
Cox Ditch	5	8	6
Dixon Creek	6	3	4
Buck Creek	2	4	3
Tobin Ditch	3	1	2
Weasel Creek	10	7	9
Teter Branch	9	9	10
Little Cicero Creek	1	2	1
Hinkle Creek	7	10	8
Morse Reservoir/ Cicero Creek	4	6	5



V3 Companies 7325 Janes Avenue Woodridge, IL 60517 630.724.9200 phone 630.724.9202 fax www.v3co.com	TITLE: Critical Areas Map	PROJECT: Morse Reservoir/Cicero Creek Watershed Management Plan		
	BASE LAYER: N/A	PROJECT NO. 09005	EXHIBIT: XX	SHEET: 1 OF: 1
	CLIENT: Upper White River Watershed Alliance 723 West Michigan Street Indianapolis, Indiana 46202	QUADRANGLE: N/A	DATE: 11/09/09	SCALE: 1" = 15000'

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 4:00 pm Wednesday, December 9, 2009
Noblesville City Hall: Up Stairs Conference Room
16 South 10th Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions
2. U.S. EPA's 9 Elements of Watershed Plans
3. Project Schedule Update
4. Steering Committee Meeting Schedule
5. Grant Applications & Deadlines
6. Morse WMP Comment Discussion
7. Miscellaneous Issues and Discussion
8. Closing and Adjournment

UWRWA Upper White River Watershed Alliance

MWA Morse Waterways Association

Morse/Cicero Creek Watershed Steering Committee Meeting December 9, 2009 Sign-In Sheet

Name	Phone	Email or Address
Jessica Spurlock	630-729-6310	jspurlock@v3co.com
Carrie Pintar	630-729-6134	cpintar@v3co.com
Greg Woltersdorff	630-729-6334	gwoltersdorff@v3co.com
Tim Stottlemyer	317-770-5132	tstottlemyer@noblesville.in.us
Mike Murphy	317 445 3022	mpmurphy40@gmail.com
Crist Blassaras	765-644-5073	zorbisfat@comcast.net
Roger N. Goings	317-773-5715	roger306@comcast.net
Bonny Elifritz	317-234-0922	belifrit@idem.in.gov
John South	317-773-2181	On File
Holly Jones	on file	onfile
Angela Sturdevant	" "	"
Paul Whitmore	317 263 6517	paul.whitmore@veoliawaterna.com

Morse Waterways Association
Cicero Creek Watershed
STEERING COMMITTEE MEETING
1:00 to 4:00 pm Wednesday, December 9, 2009
Noblesville City Hall: Up Stairs Conference Room
16 South 10th Street
Noblesville, Indiana 46060

AGENDA

1. Welcome and Introductions
2. U.S. EPA's 9 Elements of Watershed Plans
3. Project Schedule Update Draft to DNR Dec 16 → next Wed. Need Draft for funding on Jan 15th comments hopefully by end of Jan
4. Steering Committee Meeting Schedule
5. Grant Applications & Deadlines
6. Morse WMP Comment Discussion
7. Miscellaneous Issues and Discussion
8. Closing and Adjournment

Public meeting - mid Feb to mid March

SWCD Dec board meeting - Fri 18th for Lare land treatment grant application

Rec. to use Lare for projects and CREP for land treatment?

Joint application for CREP?

Need BMPs → add need for feasibility study?

Specific practices for grant?

tillage transect info included?

Mike
Jim
Noblesville
} urban

John
Roger
Crist
} Ag

When will we get comments? Be able to incorporate by next week? Esp. overall / large comments.

Appendix E – Public Meeting Agendas & Sign-in Sheets

Agendas and Sign-In Sheets for the Public Meetings held on the following dates are included in this appendix.

- April 30, 2009
- October 8, 2009

Morse Waterways Association
Cicero Creek Watershed
INITIAL PUBLIC MEETING
7:00 to 9:00 pm Thursday, April 30, 2009
Red Bridge Community Building

AGENDA

1. Welcome and Introductions, Jill Hoffman of Upper Whiter River Watershed Alliance & Ed Belmonte of V3 Companies (7:00-7:05)

2. Morse Reservoir and Cicero Creek Watershed Management Plan, Ed Belmonte of V3 Companies (7:05-7:25)

3. Harmful Algal Blooms and the Morse Reservoir, Dr. Lenore Tedesco – Director of the Center for Earth and Environmental Science, Indiana University – Purdue University Indianapolis / Upper Whiter River Watershed Alliance (7:25-7:50)

4. Questions and Discussion (7:50-8:00)

5. Break (8:00-8:05)

6. Public Participation – Water Quality Issues and Concerns from Stakeholder's within the Watershed, Ed Belmonte and Jessica Dunn – V3 & Jill Hoffman of Upper Whiter River Watershed Alliance (8:05-8:55)

7. Thank you for your Participation, Closing and Adjournment (8:55-9:00)

Upper White River Watershed Alliance
c/o IUPUI – Center for Earth & Environmental Science
723 West Michigan Street, SL118
Indianapolis, IN 46202
317-274-7154

MWA
Morse Waterways Association

Morse/Cicero Creek Watershed
Public Meeting
April 30, 2009 Sign-In Sheet

Name	Phone	Email or Address
ED MATUSZEWSKI	984-9147	
Phil Burris	984-5867	
Shirly Bear	984-1345	
Charlie Cambre	984-3475	charlie.cambre@comcast.net
TONY JENSEN		tc.jensen@comcast.net
Lisa Bihl		lbihl@empowerresults.com
SAM ZAJAC	MEMBER MWA	
JIM SCHNEIDER	984-2469	JAMES.SCHNEIDER@COMCAST.NET
Gwen White	234-4407	gwhite@dnr.in.gov
PAUL UTTERBACK	984-2013	
LouAnn Baker	263.6572	louann.baker@veoliawaterna.com
Leroy Teeters		

Upper White River Watershed Alliance
c/o IUPUI – Center for Earth & Environmental Science
723 West Michigan Street, SL118
Indianapolis, IN 46202
317-274-7154

MWA Morse Waterways Association

Morse/Cicero Creek Watershed Public Meeting April 30, 2009 Sign-In Sheet

Name	Phone	Email or Address
Roger Woodruff	984-5208	rogerwoodruff@Maccallister.com
John South	773-1406	jhs@co.hamilton.in.us
Howard Bienstock	439-2679	Howard@RFLLC.net

Upper White River Watershed Alliance
c/o IUPUI – Center for Earth & Environmental Science
723 West Michigan Street, SL118
Indianapolis, IN 46202
317-274-7154

MWA
Morse Waterways Association

Morse/Cicero Creek Watershed
Public Meeting
April 30, 2009 Sign-In Sheet

Name	Phone	Email or Address
K. Duckwall	849-8455	kduckwall@gemarinalimited.com
Scott Bruvers	984-9289	SBRUVERS@AOL.COM
Jim + Diana Jones	984-3675	jfjones65@hotmail.com
Jo Ann Bule	984-9298	jabule2003@yahoo.com
Tim Stottlemyer	317-770-5132	TSTOTTLEMYER@NOBLESVILLE.IN.US
		Judi Schneider
Jim Ku	317-636-4682	wku@hntb.com
Sherrae Davis	317 263-6370	Veolia Water Indpls.

Summary of Concerns from Morse Public Meeting, April 30, 2009		
Concern	**Score Ranking**	**Number of Individuals**
Silt inputs from Watershed into Morse Reservoir	24	8
Education and outreach of Watershed issues	16	7
Conflict between water quality and production agriculture	11	6
Public concern over blue-green algae	11	5
Safety of using Morse Reservoir recreationally	10	4
Stormwater after rain event	7	4
Big Cicero erosion	5	2
Water clarity	5	2
Skin irritation/Toxin	5	3
Polluted runoff - non-point source pollution	4	2
Failing septic systems impact to water quality	3	2
Streambank stabilization	3	1
Cooperation/Communication between counties	3	2
Streambank deterioration caused by severe erosion	2	1
Cost of streambank maintenance	2	1
Canada Geese waste impact on water quality	2	1
Big Cicero habitat degradation	2	1
E. coli in Little Cicero	1	1
Farming in Tipton County increase sediment and nutrients to Watershed	1	1
Water level	1	1
Silt from construction sites	1	1
Runoff from construction sites	1	1
Leaking of oil and gas while using the reservoir for recreational purposes	0	0
Phosphorus - Internal nutrient loading	0	0
Brown water	0	0
Debris in curbs and grates	0	0
Grass clippings/Litter in water	0	0
Manure Management	0	0
Livestock access to surface water within the Watershed	0	0
Building Zoning Restriction	0	0
Erosion control at construction sites	0	0
Combined sewer overflows - Tipton County	0	0
Residential fertilizer use	0	0
Need for dredging	0	0
Increase in Canada Geese population	0	0
Fish consumption advisories/safety	0	0
Effectiveness of Indianapolis drinking water treatment	0	0
Odor taste of water	0	0
Water treatment plant operation/Lime in water	0	0
How to prioritize numerous watershed concerns for maximum improvement	0	0
Need for water storage reservoir by Anderson	0	0
Changing public perception of stormwater as a bi-product	0	0
Stewardship quality/too few interested parties within the Watershed	0	0
Safety of using water for irrigation due to presence of blue-green algae	0	0
Effectiveness of algae treatments	0	0

Morse Waterways Association
Cicero Creek Watershed
PUBLIC MEETING
7:00 to 9:00 pm Thursday, October 8, 2009
Tipton County 4-H Fairgrounds – Education Center: Prairie Room

AGENDA

1. Welcome and Introductions (7:00-7:05)

2. Morse Reservoir and Cicero Creek Watershed Management Plan, (7:05-7:25)

3. Your Watershed and Agricultural Land – What's the Connection?? (7:25-7:50)

4. Questions and Discussion (7:50-8:00)

5. Break (8:00-8:05)

6. Public Participation – Water Quality Issues and Concerns from Stakeholder's within the Watershed (8:05-8:55)

7. Thank you for your Participation, Closing and Adjournment (8:55-9:00)

UWRWA
Upper White River Watershed Alliance

MWA
Morse Waterways Association

Morse/Cicero Creek Watershed
Public Meeting
October 8, 2009 Sign-In Sheet

Name	Phone	Email or Address
CLAUDE SPURGEON	317-985-1311	27649 GWINN Rd ATLANTA 46031
Jerry L. Brown	317-984-3896	6101 E. 236 ST. Cicero, IN. 46034
Ben Heffelmire	765-675-7996	445 Wilson St. Tipton, IN. 46072
Kerry Smith	765-675-2316 Ex 3	243 Ash St. Suite B, Tipton IN 46072
JOHN SOUTH	317-773-2181	john.south@hamiltoncounty.in.gov
DAVID GLUNT	317-758-5640	7460 S. 1400 E Sheridan IN 46069
Jessica Spurlock	630-729-6310	jspurlock@V3co.com
Carrie Pintar	630-729-6134	cpintar@v3co.com

UWRWA
Upper White River Watershed Alliance

MWA
Morse Waterways Association

Morse/Cicero Creek Watershed
Public Meeting
October 8, 2009 Sign-In Sheet

Name	Phone	Email or Address
Paul Whitmore	317.263.6517	paul.whitmore@veoliawaterna.com
MIKE MURPHY	317 984-4571	MPMURPHY40@GMAIL.COM
Angela Sturdevant	317-234-4906	asturdevant@dnr.in.gov
Jason Henton	765-675-2793	Tipton.Surveyor@TDS.net
Luther Cline	317-776-8495	Luther.cline@hamiltoncounty.in.gov
Gale Sherwood	765-292-2647	gsherwood@mail.hhsc.k12.in.us
Terry Sherwood	"	"
Greg Wolterstorff	630-729-6334	gwolterstorff@v3co.com

Summary of Concerns from Morse Public Meeting, October 8, 2009		
Concern	**Score Ranking**	**Number of Individuals**
Silt inputs from Watershed into Morse Reservoir	24	8
Streambank Erosion	21	9
Nutrient Management	11	4
Habitat Degradation	5	3
Flooding	5	2
Combined sewer overflows - Tipton County	4	2
Subsurface Drainage	3	1
Failing septic systems impact to water quality	2	1
Landfill Leaking	1	1
Ditch Maintenance	1	1
Water quality pre- and post development	1	1
Wastewater Package Plants	1	1
Atrazine	0	0
Buffer Areas	0	0
Construction Clearing	0	0
Livestock Access to Water	0	0

Appendix F – IDEM Data

A summary of the data obtained from IDEM within the Morse Reservoir/Cicero Creek watershed is provided within this Appendix. The summary contains the mean value of the parameters from all available studies. The raw data is provided on CD at the end of this report. The IDEM studies with the number of data points within the watershed are listed below.

- 1991 Fish Tissue - 3
- 1992 Macroinvertebrates - 4
- 1996 Fish Tissue - 2
- 1996 Sediment Bio - 2
- 1996 Synoptic - 4
- 1996 Watershed - 1
- 1999 Fixed Station - 1
- 2000 Fixed Station - 1
- 2001 Cicero Creek Assessment - 10
- 2001 Corvallis - 4
- 2001 Corvallis Biological - 3
- 2001 E. Coli – Upper WFWR - 5
- 2001 Fish Tissue - 3
- 2001 Fixed Station - 1
- 2001 Macroinvertebrate - 1
- 2001 Sediment Bio - 1
- 2001 W Fk White River in Hamilton Co Assessment - 1
- 2002 Fixed Station - 1
- 2003 Fixed Station - 1
- 2004 Fixed Station - 1
- 2005 Fixed Station - 1
- 2006 Corvallis - 2
- 2006 Corvallis E. Coli - 2
- 2006 Fish Tissue - 4
- 2006 TMDL Cicero Creek - 44
- 2007 Fixed Station Monitoring - 1
- 2008 Fixed Station Monitoring - 1
- 2009 Fixed Station Monitoring - 1

Available Data Summary

		Prairie Creek	Cox Ditch	Dixon Creek	Buck Creek	Tobin Ditch	Weasel Creek	Teter Branch	Little Cicero Creek	Hinkle Creek	Morse Reservoir/Cicero Creek	Watershed Total
IDEM Studies	303d Impaired		IBC, Nutrients, Algae		Ecoli	Ecoli			Ecoli		E. Coli, Algae, Taste/Odor, PCBs in Fish Tissue	.
	305b uses	Recreational(2), Fishable(3), Aquatic Life(2)	Recreational(2), Fishable(3), Aquatic Life(5A)	Recreational(2), Fishable(3), Aquatic Life(2)	Recreational(5A/2), Fishable(3), Aquatic Life(2)	Recreational(5A/2), Fishable(3), Aquatic Life(2)	Recreational(5A), Fishable(3), Aquatic Life(2)	Recreational(2/5A), Fishable(3), Aquatic Life(2)	Recreational(5A), Fishable(3), Aquatic Life(2)	Recreational(5A), Fishable(3), Aquatic Life(2)	Recreational(2/5A), Fishable(3/2/5B), Drinking Water(5A), Aquatic Life(3/2)	
	1992 Macros						1		2	1		4
	1996 Fish Tissue										1	1
	1996 Sediment Bio										1	1
	1996 Synoptic				1		1		1		1	4
	1996 Watershed					1						1
	1999-2009 Fixed Station						1					1
	2001 Cicero Creek Assessment										10	10
	2001 Corvallis		1						1	1	1	4
	2001 Corvallis Biological									1	1	2
	2001 Ecoli - Upper WFWR				1	1	1		1	1	1	6
	2001 Fish Tissue										1	1
	2001 Macros									1		1
	2001 WFWR Assessment										1	1
	2006 Corvallis		1			1						2
	2006 Corvallis Ecoli		1			1						2
	2006 Fish Tissue						1				1	2
	2006 TMDL Study	5	5	3	3	6	4	3	3	3	9	44

	IDEM 303d	IDEM Biological/Habitat Data			IDEM Water Quality Data						
		Macros mIBI	Fish IBI	Habitat QHEI	DO	E. Coli	pH	Nitrate+Nitrite	Total P	TSS	Turbidity
Prairie Creek						5 21					
		N/A	N/A	N/A	N/A	822	N/A	N/A	N/A	N/A	N/A
Cox Ditch	IBC, nutr, algae				2 11	5 30	2 11	2 4	2 6	2 6	2 10
		N/A	N/A	N/A	10.1	638	7.8	7.4	0.103	27.7	32.2
Dixon Creek						3 15					
		N/A	N/A	N/A	N/A	329	N/A	N/A	N/A	N/A	N/A
Buck Creek	E. Coli				1 11	4 16	1 11		1 5	1 4	1 10
		N/A	N/A	N/A	10.9	2464	8.1	N/A	0.097	74.8	16.8
Tobin Ditch	E. Coli				2 14	8 36	2 14	1 2	2 4	2 4	2 13
		N/A	N/A	N/A	10.4	1046	8.1	7.1	0.118	13.5	17.2
Weasel Creek		1 1		1 1	2 125	6 26	2 125	1 108	1 101	1 71	2 121
		2.2	N/A	63	9.9	2041	8.1	6.1	0.109	27.9	29.9
Teter Branch						3 12					
		N/A	N/A	N/A	N/A	2585	N/A	N/A	N/A	N/A	N/A
Little Cicero Creek	E. Coli	2 2		2 2	3 14	5 17	3 14	1 2	2 8	2 7	3 14
		3.7	N/A	61	9.3	3934	8	7.9	0.792	46.4	32.4
Hinkle Creek		1 2		1 2	2 8	4 13	2 8	1 2	1 3	1 3	2 8
		4.9	N/A	73.5	8.4	1919	8.1	7.3	0.186	23.7	14.4
Morse Reservoir/ Cicero Creek	E. Coli, algae, Taste/Odor, PCBs in fish				14 61	21 89	14 61	1 2	2 7	2 8	14 61
		N/A	N/A	N/A	8.7	864	8	6.1	0.074	9.6	9.5
Limits					Min 4.0mg/L Max 12.0mg/L	Max 235CFU/100ml	Min 6.0 Max 9.0	Max 1.6mg/L	Max 0.076mg/L	Max 30.0mg/L	Max 10.4 NTU

Prairie Creek

IDEM WQ
2006 TMDL

	Morse Gen Chem.xls			
	Sample Date	Coliforms (Total) (MPN/100 mL)	E_ Coli (MPN/100 mL)	
WWU080-0055	8/28/2006 11:35	> 2420	686.7	686.7
	9/5/2006 12:00	> 2420	325.5	325.5
	9/11/2006 11:50	> 2420	461.1	461.1
	9/18/2006 13:00	> 2420	1203.3	1203.3
	9/25/2006 11:55	> 2420	387.3	387.3
WWU080-0060	8/28/2006 11:55	> 2420	> 2420	2420
	9/5/2006 11:50	> 2420	547.5	547.5
	9/11/2006 11:40	> 2420	166.9	166.9
	9/18/2006 12:50	> 2420	1119.9	1119.9
	9/25/2006 11:40	> 2420	435.2	435.2
WWU080-0061	8/28/2006 12:00	> 2420	344.8	344.8
	9/5/2006 11:45	> 2420	88	88
	9/11/2006 11:35	> 2420	98.8	98.8
	9/18/2006 12:45	> 2420	57.6	57.6
	9/25/2006 11:35	> 2420	115.3	115.3
WWU080-0064	8/28/2006 11:00	> 2420	> 2420	2420
	9/5/2006 11:00	> 2420	49.5	49.5
	9/11/2006 10:50	> 2420	344.8	344.8
	9/18/2006 12:05	> 2420	1986.3	1986.3
	9/25/2006 10:40	> 2420	1732.9	1732.9
WWU080-0065	8/28/2006 10:45	> 2420	> 2420	2420
	9/5/2006 11:15	19863	224.7	224.7
	9/11/2006 11:05	> 2420	40.4	40.4
	9/18/2006 12:20	> 2420	> 2420	2420
	9/25/2006 11:00	> 2420	461.1	461.1
				822.304

Cox Ditch

IDEM WQ

2001 Corvallis

		MorseFieldData.xls						MorseGenChem.xls										
	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	AFDM (g/M2)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	Chlorophyll a - Periphyton (mg/M2)	Chlorophyll a - Phytoplankton (ug/L)	COD (mg/L)	Cyanide (Total) (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	
WWU080-0011	5/21/2001 14:30	9.47	19.2	107.3	7.82	690	96.09		220	40			< 5	< 0.005	342	< 0.1		17
	7/25/2001 9:50	9.55	29.85	134.6	8.15	570	12.6		210	47			27	< 0.005 (Q)	248	< 0.1	0.011 (DJ)	
	9/19/2001 12:05	8.67	19.81	97.3	8.03	562	50.9	209.25	200	48	34.12111	1.857576	11	< 0.005	229	< 0.1		2.4

2006 Corvallis

		MorseFieldData.xls						MorseGenChem.xls									
	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	COD (mg/L)	Cyanide (Total) (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)
WWU080-0043	5/9/2006 12:19	12.7	17.68	137.1	7.95	759	13.5	240	39	17	< 0.02 (QJ)	390	< 0.1	10	0.08	56	470
	7/17/2006 15:20	14.05	32.69		7.6	730	10.53	256	25	< 10	< 0.02	370	0.34	6.7 (B)	0.14	73	470
	9/11/2006 12:30	7.79	20.24	89.5	7.5	685	19	178	39	17 (QJ)	< 0.02 (QJ)	310	0.13	0.39	0.09	96	390

2006 Corvallis E. Coli

		MorseFieldData.xls						MorseGenChem.xls	
	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100 mL)	E_ Coli (MPN/100mL)
WWU080-0043	4/11/2006 9:30	11.04	11.5	93.8	7.72	814	0	1413.6	77.6
	4/18/2006 9:45	9.34	10.41	83.7	7.54	658	50.2	> 24200	5794
	4/25/2006 9:45	9.78	10.58	88	7.67	794	13.7	> 2420	71.7
	5/2/2006 9:50	9.13	12.55	86	7.59	766	35.6	> 24200	408
	5/9/2006 9:45	9.4	13.16	89.8	7.68	813	20.2	> 2420	93.4

2006 TMDL

		Morse Gen Chem.xls	
	Sample Date	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
WWU080-0043	8/28/2006 11:15	> 2420	920.8
	9/5/2006 11:30	> 2420	228.2
	9/11/2006 11:20	> 2420	132
	9/18/2006 12:30	> 2420	1413.6
	9/25/2006 11:20	> 2420	328.2
WWU080-0054	8/28/2006 11:40	> 2420	137.4
	8/28/2006 12:10	> 2420	1203.3
	9/5/2006 12:05	> 2420	81.3
	9/11/2006 11:50	> 2420	51.2
	9/18/2006 13:05	> 2420	159.4
	9/25/2006 12:00	> 2420	115.3
WWU080-0058	9/5/2006 12:30	> 2420	1046.2
	9/11/2006 12:20	> 2420	325.5
	9/18/2006 13:30	> 2420	1553.1
	9/25/2006 12:30	> 2420	307.6
WWU080-0059	8/28/2006 11:20	> 2420	146.7
	9/5/2006 11:35	> 2420	38.6
	9/11/2006 11:25	> 2420	78.9
	9/18/2006 12:40	> 24200	1203.3
	9/25/2006 11:30	> 2420	307.6
WWU080-0063	8/28/2006 11:10	> 2420	2419.2
	9/5/2006 11:20	24192	108.6
	9/11/2006 11:15	> 2420	261.3
	9/18/2006 12:25	> 2420	31.6
	9/25/2006 11:10	> 2420	90.6

DO	110.92	10.08364
Ecoli	19134.2	637.8067
pH	85.25	7.75
N	29.79	7.4475
P	0.62	0.103333
TSS	166	27.66667
Turbidity	322.32	32.232

Cox Ditch 2

xls										MorseMetals.xls										
Phaeophyton - Periphyton (attached) (mg/M2)	Phaeophyton - Phytoplankton (suspended) (ug/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	Total POC (mg/L)	TS (mg/L)	TSS (mg/L)	Arsenic (Total) (ug/L)	Cadmium (Total) (ug/L)	Calcium (ug/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Lead (Total) (ug/L)	Magnesium (ug/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Selenium (Total) (ug/L)	Zinc (Total) (ug/L)
		0.094	< 5 (QJ)	410	< 0.1 (QJ)	1.7		540	54	< 4	< 1	89000	< 2	< 3	< 2	29000	< 0.2	4.3	< 3	24.1
		0.046	31	320	1	5.4		380	26	< 5	< 1	45900	< 2	3.5	< 2	32300	< 0.2	4.4	< 5	11.2
24.91751	2.061242	0.17	31	300 (QDJ)	1.1	6	2.404	440	51	< 5	< 1	51400	< 2	4.2	< 2	24400	< 0.2	4.2	< 10	< 10

				MorseMetals.xls																			
TKN (mg/L)	TOC (mg/L)	TS (mg/L)	TSS (mg/L)	Aluminum (Total) (ug/L)	Antimony (Total) (ug/L)	Arsenic (Total) (ug/L)	Cadmium (Total) (ug/L)	Calcium (mg/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Lead (Total) (ug/L)	Magnesium (mg/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Selenium (Total) (ug/L)	Zinc (Total) (ug/L)	SUBSTRATESCORE	INSTREAMCOVERSCORE	CHANNELSCORE	RIPARIANSCORE	POOLGLIDESCORE	RIFFLERUNSCORE
< 0.5	2.57	490	10			< 2	< 1	100	< 2	< 1	< 1	31	< 0.1	< 1	3.1	< 5						
	2.73	460	11	360	< 1		< 1	97	8.1	2.1	< 1	32		9.7	< 2 (QJ)	15	1	4	6	4	0	0
	3.53	440	14	770 (fDJ)	< 1	< 2	< 1	65	6.8	2.6	1.2	37		10	< 2	11						

Cox Ditch 3

Cicero Cr Macro Sites.xls

GRADIENTSCORE	TOTALSCORE	HBISCORE	EPTTOCHIRONOMIDRATIO	NUMBEROFTAXA	NUMBEROFVIALS	NUMBEROFINDIVIDUALS	EPTCOUNT	CHIRCOUNT	DOMINANTTAXONPCT	EPTINDEX	EPTTOTALRATIO	METRICSCOREHBI	METRICSCORENUMBEROFTAXA	METRICSCORENUMBEROFINDIVIDUALS	METRICSCOREEPTINDEX	METRICSCOREEPTCOUNT	METRICSCOREEPTTOCHIRONOMIDRATI	METRICSCORECHIRCOUNT	METRICSCOREDOMINANTTAXON	METRICSCOREEPTTOTOTALRATIO	METRICSCOREINDIVIDUALSPERSQUAR	MIBIMETRICSCORE
6	21	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36

Cox Ditch 4

WATERTEMP	DISSOLVEDO2	PH	SPECIFIC CONDUCTIVITY
30.28	14.98	7.73	677

Dixon Creek

IDEM WQ
2006 TMDL

	Morse Gen Chem.xls		
	Sample Date	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
WWU080-0053	8/28/2006 12:25	> 2420	166.4
	9/5/2006 12:15	> 2420	133.4
	9/11/2006 12:00	> 2420	74.3
	9/18/2006 13:10	> 24200	1203.3
	9/25/2006 12:10	> 2420	298.7
WWU080-0057	8/28/2006 12:40	> 2420	127.4
	9/5/2006 12:40	> 2420	177.9
	9/11/2006 12:35	> 2420	249.5
	9/18/2006 13:40	> 2420	579.4
	9/25/2006 12:40	2419.2	38.4
WWU080-0090	8/28/2006 12:30	> 2420	307.6
	9/5/2006 12:20	> 2420	231
	9/11/2006 12:10	> 2420	47.4
	9/18/2006 13:15	> 2420	920.8
	9/25/2006 12:15	> 2420	387.3
			329.52

Buck Creek

IDEM WQ

1996 Synoptic

Site	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	E_ Coli (CFU/100mL)	Hardness (as CaCO3) (mg/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)
		MorseFieldData.xls					MorseGenCh					
WWU080-0001	2/20/1996 14:15	12.4	6.4	8	274.5	9.8	220	43	10 (JH)	300	0.084	55
	4/22/1996 14:00	9.4	12.69	7.73	234.199	260	130	46		280	0.28 (B)	45
	5/29/1996 12:57	9.64	14.81	7.73	540.63	67.3	140 (Q)	33		270	0.11	39 (B)
	7/9/1996 12:19	9.55	22.7	8.18	576	16.79	170	42		280	0.11	47
	10/1/1996 11:30	9.26	15.81	7.96	571	9.39	190	45	130	230	0.088	56
	11/12/1996 11:26	12.25	2.38	7.92	669	17.29	220 (Q)	45	500	330	0.091	60

2001 E. coli-Upper WFWR

Site	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
		MorseFieldData.xls					MorseGenChem.xls	
WWU080-0001	6/4/2001 16:20	10.3	13.92	7.86	679	12.5	> 2419.2 (Q)	727 (Q)
	6/11/2001 15:35	11.64	23.82	8.22	701	8	> 2419.2	328.2
	6/18/2001 16:20	11.81	26.27	8.35	694	10	> 2419.2	517.2
	6/25/2001 15:40	10.89	26.88	8.43	717	10	> 2419.2	185
	7/2/2001 14:25	13.03	25.21	8.36	666	7	> 2419.2	108.1

2006 TMDL

Site	Sample Date	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
	MorseGenChem.xls		
WWU080-0050	9/5/2006 13:10	> 2420	119.8
	9/11/2006 13:00	> 2420	12.2
	9/18/2006 14:05	> 2420	> 2420
	9/25/2006 13:05	> 2420	2419.2
WWU080-0051	8/28/2006 13:20	> 2420	> 2420
	9/5/2006 13:15	> 2420	113
	9/11/2006 13:10	686.7	3.1
	9/18/2006 14:10	> 24200	1986.3
	9/25/2006 13:15	> 2420	66.9
WWU080-0052	8/28/2006 13:00	> 2420	> 2420
	9/5/2006 13:00	19863	1732.9
	9/11/2006 12:50	12997	435.2
	9/18/2006 13:55	> 24200	24192
	9/25/2006 12:55	14136	1046.2

DO	120.17	10.92455
Ecoli	41892.3	2464.253
pH	88.74	8.067273
P	0.483	0.0966
TSS	299	74.75
Turbidity	168.07	16.807

hem.xls						MorseMetals.xls				
TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TPH - IR (mg/L)	TS (mg/L)	TSS (mg/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Iron (Total) (ug/L)	Lead (Total) (ug/L)	Zinc (Total) (ug/L)
380	0.13 (BJ)	2.4	< 1 (U)	420	< 4 (U)	< 20 (U)	< 20 (U)	270	< 5 (U)	< 20 (U)
360	2.7 (B)	6	< 1 (U)	630	220	< 20 (U)	20	6400	< 5 (U)	34 (Q)
390	1 (B)	4		480	57	< 20 (U)	< 20 (U)	2200	< 5 (U)	29
330	0.6 (JH)	3.2		440	13	< 20 (U)	< 20 (U)	415	< 5 (U)	20
310	0.59	5.8		360	< 4 (U)	< 20 (U)	< 20 (U)	220	< 5 (U)	< 20 (U)
420	0.66	3.8		440	9	< 20 (U)	< 20 (U)	330	< 5 (U)	< 20 (U)

Tobin Ditch

IDEM WQ

1996 Watershed

Site	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	E_Coli (CFU/100mL)	Hardness (as CaCO3) (mg/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TS (mg/L)	TSS (mg/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Iron (Total) (ug/L)	Lead (Total) (ug/L)
		MorseFieldData.xls					MorseGenChem.xls											MorseMetals.xls			
WWU080-0036	8/6/1996 14:15	6.41	29	7.88	620	52.9	210	49	210	250	0.14	48	380	0.89 (Q)	4.8	410	24	< 20 (U)	< 20 (U)	960	< 5 (U)

2001 E. coli-Upper WFWR

Site	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100mL)	E_Coli (MPN/100 mL)
		MorseFieldData.xls					MorseGenChem.xls	
WWU080-0036	6/4/2001 15:45	9.87	13.77	8.1	678	11.89	> 2419.2 (Q)	1119.85 (Q)
	6/11/2001 15:50	11.43	23.64	8.22	714	6	> 2419.2	238.2
	6/18/2001 16:30	11.42	26.2	8.38	714	8	> 2419.2	178.5
	6/25/2001 15:55	10.98	26.05	8.35	745	9	> 2419.2	344.8
	7/2/2001 14:35	11.49	22.25	8.21	684	11	> 2419.2	218.7

2006 Corvallis

Site	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	COD (mg/L)	Cyanide (Total) (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TS (mg/L)	TSS (mg/L)
		MorseFieldData.xls						MorseGenChem.xls													
WWU080-0042	5/8/2006 17:35	14	18.82	154.9	8.36	644	3.85	210	39	< 5	< 0.02 (QJ)	320	< 0.1	8.8	0.06	33	380	0.8	2.62	400	< 10
	7/17/2006 13:40	8.45	27.59	110	8	708	3.1	252	43	< 10	< 0.02	310	< 0.1	6.5 (B)	0.13	31	430		4.02	410	< 10
	9/11/2006 14:50	13.47	22.31	154.3	8.22	963	1.4	239	110	15 (QJ)	< 0.02 (QJ)	300	< 0.1	5.3	0.14	48	530		4.35	570	< 10

2006 Corvallis E. Coli

Site	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100 mL)	E_Coli (MPN/100mL)
		MorseFieldData.xls						MorseGenChem.xls	
WWU080-0042	4/11/2006 10:20	11.39	11.09	103.7	8.05	739	0	> 2420	248.9
	4/18/2006 10:20	9.1	10.08	80.9	7.61	572	86.7	> 24200	7701
	4/25/2006 10:20	9.54	13.4	91.6	7.97	742	7.2	> 2420	298.7
	5/2/2006 10:25	8.93	13.89	86.6	7.87	734	17.7	> 24200	3255
	5/9/2006 10:25	9.12	15.5	91.6	8	739	5.1	> 2420	214.2

2006 TMDL

Site	Sample Date	Coliforms (Total) (MPN/100mL)	E_Coli (MPN/100 mL)
		MorseGenChem.xls	
WWU080-0046	8/28/2006 14:00	> 2420	7.3
	9/5/2006 13:45	3448	39.9
	9/11/2006 13:35	> 2420	88.4
	9/18/2006 14:35	> 2420	313
	9/25/2006 13:40	> 2420	115.3
WWU080-0047	8/28/2006 13:25	> 2420	> 2420
	9/5/2006 13:25	1553.1	20.1
	9/11/2006 13:15	1203.3	10.9
	9/18/2006 14:20	> 2420	1732.9
	9/25/2006 13:25	> 2420	214.2
WWU080-0048	8/29/2006 9:20	> 2420	2419.2
	9/6/2006 8:50	> 2420	224.7
	9/12/2006 9:10	> 2420	> 2420
	9/19/2006 9:05	> 2420	> 2420
	9/26/2006 9:20	> 2420	261.3
WWU080-0056	8/28/2006 13:35	> 2420	> 2420
	9/5/2006 13:35	960.6	36.9
	9/11/2006 13:30	> 2420	5.2
	9/18/2006 14:30	> 2420	238.2
	9/25/2006 13:35	> 2420	25
WWU080-0062	8/29/2006 10:05	> 2420	42.6
	9/6/2006 9:25	> 2420	920.8
	9/12/2006 9:30	> 2420	2419.2
	9/19/2006 9:35	> 2420	920.8
	9/26/2006 9:55	> 2420	920.8
WWU080-0091	8/29/2006 9:30	> 24200	920.8
	9/6/2006 9:05	> 2420	193.5
	9/12/2006 9:00	> 2420	1413.6
	9/19/2006 9:15	> 2420	547.5
	9/26/2006 9:30	> 2420	88.2

DO	145.6	10.40
Ecoli	37638.15	1045.504
pH	113.22	8.087143
N	14.1	7.05
P	0.47	0.1175
TSS	54	13.5
Turbidity	223.84	17.21846

Tobin Ditch 2

Zinc (Total) (ug/L)
< 20 (U)

MorseMetals.xls																										
Aluminum (Total) (ug/L)	Antimony (Total) (ug/L)	Arsenic (Total) (ug/L)	Cadmium (Total) (ug/L)	Calcium (mg/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Lead (Total) (ug/L)	Magnesium (mg/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Selenium (Total) (ug/L)	Zinc (Total) (ug/L)	SUBSTRATE SCORE	INSTREAMCOVERSCORE	CHANNEL SCORE	RIPARIAN SCORE	POOLGLIDESCORE	RIFFLERUNSCORE	GRADIENTSCORE	TOTALSCORE	HBISCORE	EPTTOCHIRONOMIDRATIO	NUMBER OFTAXA	NUMBER OFVIALS	NUMBER OFINDIVIDUALS	EPTCOUNT
		< 2	< 1	80	< 2	1.4	< 1	30	< 0.1	< 1	< 2	7.1														
88	< 1		< 1	79	7.5	2.6	< 1	27		7.7	< 2 (QJ)	24	15	6	8	5	0	0	4	38	0	0	0	1	0	0
49 (fDJ)	< 1	< 2	< 1	70	6.3	4.3	< 1	31		9.8	< 2	8.9														

Tobin Ditch 3

Cicero Cr Macro Sites.xls

CHIRCOUNT	DOMINANTTAXONPCT	EPTINDEX	EPTTOTOTALRATIO	METRICSCOREHBI	METRICSCORENUMBEROFTAXA	METRICSCORENUMBEROFINDIVIDUALS	METRICSCOREEPTINDEX	METRICSCOREEPTCOUNT	METRICSCOREEPTTOCHIRONOMIDRATI	METRICSCORECHIRCOUNT	METRICSCOREDOMINANTTAXON	METRICSCOREEPTTOTOTALRATIO	METRICSCOREINDIVIDUALSPERSQUAR	MIBIMETRICSCORE	WATERTEMP	DISSOLVEDO2	PH	SPECIFICCONDUCTIVITY
0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	28.73	9.77	7.96	658

Weasel Creek

IDEM WQ
1996 Synoptic

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	E_Coli (CFU/100mL)	Hardness (as CaCO3) (mg/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TPH - IR (mg/L)	TS (mg/L)	TSS (mg/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Iron (Total) (ug/L)	Lead (Total) (ug/L)	Zinc (Total) (ug/L)
		MorseFieldData.xls					MorseGenChem.xls												MorseMetals.xls				
WWU080-0002	2/20/1996 11:57	13.7	3.59	8	313.6	7.8	210	62	70 (JH)	370	0.096	66	430	0.081 (BJ)	3	< 1 (U)	460	< 5 (U)	< 20 (U)	< 20 (U)	180	< 5 (U)	< 20 (U)
	4/22/1996 11:47	9.23	14.5	8	238.699	80.9	150	49		270	0.2 (B)	47	330	2.7 (B)	5.3	< 1 (U)	530	110	< 20 (U)	< 20 (U)	3100	< 5 (U)	< 20 (QU)
	5/29/1996 11:43	9.34	13.9	7.71	573.44	75.4	150 (Q)	35		280	0.1	40 (B)	420	1.5 (B)	3		500	70	< 20 (U)	< 20 (U)	2100	5.4	50
	7/9/1996 10:40	9.22	22.32	8.22	612	12.39	190	54		300	0.094	52	360	0.71 (JH)	3.2		410	6	< 20 (U)	< 20 (U)	273	< 5 (U)	31
	10/1/1996 10:46	9.95	15.94	8.07	657	12	200	63	170	260	0.28	53	390	0.59	5.5		440	< 4 (U)	< 20 (U)	< 20 (U)	210	< 5 (U)	< 20 (U)
	11/12/1996 10:43	12.1	3.35	7.98	346	20.79	210 (Q)	43	200	280	0.098	47	370	0.4	3.3		390	4	< 20 (U)	< 20 (U)	210	< 5 (U)	37

1999-2009 Fixed Station

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	COD (mg/L)	E_Coli (CFU/100 mL)	E_Coli (MPN/100 mL)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	pH (SU)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TS (mg/L)	TSS (mg/L)	Arsenic (Total) (ug/L)	Boron (ug/L)	Cadmium (Total) (ug/L)	Calcium (ug/L)	Chromium (Total) (ug/L)
		MorseFieldData.xls					MorseGenChem.xls																				
WWU080-0002	4/21/1999 10:00	9.8	14.19	6.8	567	68.4	174	30	23.5			272	0.1	8.6	8.2	0.17	34	353	1	3.3	463	102	< 4		< 1		5.1
	5/19/1999 10:40	8.6	17.6	8.3	614	22.79	210	43	< 5			340	0.15	8.5		0.13	200	360	0.67	3.6	420	16	< 4		< 0.2		< 5 (J)
	6/21/1999 14:30	11.55	24.18	8.44	640	26.7	210	43	< 5			390	< 0.1	9.4		0.073	41	390	0.19 (J)	2.6	480	< 4	< 4		< 0.2		< 5
	7/14/1999 13:00	11.21	25.23	8.48	717	23.39	222	66	14.9			284	< 0.1	2.6	8.4	0.2	40	432	0.9	5.8	462	10	2.3		< 1		< 4
	8/9/1999 10:55	7.34	21.19	8.35	798	13.19	208	105	16.4	220		256	0.3	1.6	8.1	0.18	37	477	1	6.3	489	9	3.2		< 1		< 4
	9/14/1999 10:00	7.24	15.77	8.21	1168	6.55	273	185	22			302	< 0.1	1.9	8	0.13	72	696	1	8.2	708	6	< 4		< 1		< 4
	10/6/1999 13:00	10.72	12.97	8.05	1298	23.1	263	210	26			250	0.1	3.7	8	0.1	94	795	1.2	11.5	793	< 4	< 2		< 1		< 4
	11/17/1999 11:45	13.38	5.53	8.32	1145	4.23	282	180	20.8			300	< 0.1	0.2	8.1	0.04	66	678	0.9	8.4	691	< 4	< 4		< 1		< 4
	12/8/1999 13:45	13.5	4.76	8.57	1207	2.11	257	185	26.7			266	< 0.1	5.7	8.1	0.05	56	703	1	7.3	710	< 4	< 2		< 1		< 4
	1/12/2000 14:00	15.29	4.82	9.03	511	6.3	207	125	20.6			274	< 0.1	2.4	8.5	0.07	51	521	0.9	6.2	530	< 4	< 2		< 1		< 4
	3/8/2000 14:10	12.13	16.72	8.39	853	11.5	173	89	27.1			257	< 0.1	6.5 (QJ)	8.4	0.07	82	498	< 0.1	5.4	526	5	< 2		< 1		< 4
	4/13/2000 13:15	15.45	12.97	8.64	847	5.94	207	86	14.3		24	307	< 0.1	4.4	8.3	0.06	78	543	0.9	5.4	531	< 4	< 2		< 1		< 4
	5/11/2000 11:45	7.81	18.25	8.14	712	48.7	160	49	15.2			341	< 0.1	16	7.8	0.11	45	471	1	4.4	513	34	< 2		< 1		< 4
	6/13/2000 14:15	7.51	24.93	7.59	591		157	40	15.9			296	< 0.1	17	8.2	0.13	35	412	1	3.9	449	29	< 2		< 1		< 4
	7/12/2000 10:30	6.86	22.56	8.06	723		219	50	11.4			326	< 0.1	9.4	8	0.11	35	445	0.6 (QJ)	3.7	459	8	< 2		< 1		< 4
	8/2/2000 10:00	7.06	22.56	7.96	564		169	54	15.1			210	< 0.1	1.8	7.7	0.17	36	337	0.5	4.9	362	13	< 2		< 1		< 4
	9/27/2000 15:30	9.27	16.5	8.19	765	13	246	56	12.5			382	< 0.1	9.9	7.7	0.15	38	484	0.5	3.6	528	21	1.1		< 1		< 1.2
	10/12/2000 12:20	10.78	11.53	7.9	827	4.26	289	57	12.7			434	< 0.1	9.7	8.2	0.09	47	549	< 0.1	3.2	558	< 4	< 1		< 1		< 1.2
	11/13/2000 13:25	10.82	8.9	8.15	774	7.92	255	52	11.4			377	< 0.1	10	8	0.04	48	485	0.5	3.5	495	< 4	1.6		< 1		1.9
	12/11/2000 10:40	12.54	1.19	8.06	880	3.28	272	82	9.8			379	< 0.1	7.4	8	< 0.03	62	521	0.4	3.1	543	< 4	< 1		< 1		< 1.2
	2/20/2001 12:50	11.51	5.36	7.88	711	25.5	216	46	9.4			343	< 0.1	12	8	0.06	45	456	0.4	2.4	494	9	< 1 (DJ)		< 0.7		< 1.2
	3/7/2001 12:50	12.18	3.95	8.21	741	7.98	230	49	6			350	< 0.1	11	8	0.04	50	480	0.5	2.3	504	< 4	< 1		< 0.7		< 1.2
	4/4/2001 13:00	13.4	11.69	8.5	762	12.69	226	55	10.3			346	< 0.1	8.2	8.3	< 0.03	62	456	0.4	2.9	490	< 4	< 1		< 0.7		< 1.2
	5/16/2001 13:00	7.5	18.7	8.1	754	13.6	236	55	12.2			343	< 0.1	8.7	7.9	0.07	43	468	0.8	2.8	473	5	1.4		< 1		< 1.2
	6/26/2001 11:30	8.8	22.1	8.19	753	14.1	244	48	8.2			352	< 0.1	8.8	8.3	0.08	40	491	0.6	2.6	480	6	1.6		< 1		< 1.2
	7/31/2001 12:10	8.1	25.6	8.3	827	22.1	275	71	16.2			326	< 0.1	3.4	8.1	0.18	40	513	0.6	4.5	532	11	3.2		< 1		4.8
	8/16/2001 12:10	8.1	21.7	8.19	962	12.3	267	120	21.4		210	300	< 0.1	1.8	8.4	0.2	42	569	1.1	5.9	587	12	4.3		< 1		< 1.2
	10/10/2001 10:30	9.2	13.8	7.9	797	4.5	301	47	10.4			402	< 0.1	7.6	8.1	0.07	35	455	< 0.1	3.9	482	4	1.4		< 1		< 1.2
	11/13/2001 12:05	14.6	7.69	8.39	775	3.4	275	47	12.8			381	< 0.1	6.9	8.4	0.03	44	466	0.5	3.4	498	7	1.4		< 1		< 1.2
	12/5/2001 12:05	10.8	11.89	8.5	779	4.69	273	44	6.1			394	< 0.1	10	8.3	0.04	41	479	0.4	2.3	506	< 4	1.7		< 1		< 1.2
	1/7/2002 11:55	13.1	0.81	8.39	806	2.9	279	48.8162	7.4			388	< 0.1	8.4329	8.4	0.0364	46.8193	483	0.456	2.267	482	< 4	1.27		< 1		< 1.2
	2/11/2002 11:50	12.3	4.9	7.8	777	3.29	241	45.0977	5.8			362	< 0.1	8.7988	8.2	0.0458	47.1837	470	0.3559	2.076	470	4	1.53		< 1		< 1.2
	3/11/2002 11:50	12.7	4.5	7.5	699	12	217	39.4809	9.2			326	< 0.1	11.6979	8.1	0.0556	38.4635	428	0.5539	2.265	477	16	< 1.2		< 1		< 1.2
	4/1/2002 11:50	11	6.8	7.4	579	24.1	177	29.7222	11.8			276	< 0.1	11.7186	8.1	0.1112	30.0719	384	0.7135	3.99	399	27	1.66		< 1		2.67
	5/15/2002 13:05	8.1	14	7.5	405	191	127	17	21.3			197	0.1	7.9	8	0.3	20	287	1.4	6.2	367	50	2.23		< 1		5.93
	6/3/2002 12:00	7.4	20.89	8.19	677	6	228	37	9			331	< 1	9.3	8.4	0.05	36	417	0.4	2.8	426	9	1.55		< 1		< 1.2
	7/1/2002 11:50	4.9	25.5	8	601	12	197	28	14.4			282	< 0.1	8.3	8.4	0.12	28	359	0.6	3.9	410	22	2.1		< 1		1.95
	8/5/2002 10:50	7.1	27	8.3	801	8	234	80	19.4			260	< 0.1	1.4	8.3	0.14	45	456	0.6	5.9	469	6	4.39		< 1		1.32
	9/4/2002 12:30	8	22	8.1	822	9.89	216	98	15.8			262	< 0.1	1.1	8.1	0.09	56	471	0.8		488	6	3.25		< 1		< 1.2
	10/1/2002 11:00	8.4	20.29	7.9	608	11.1	169	66	16			205	< 0.1	1.3	8	0.1	41	346	0.5	4.9	360	7	2.37		< 1		< 1.2
	11/7/2002 11:45	9.6	5.9	8	822	8.39	258 (DJ)	82	16.5			296	< 0.1	1.9	7.8	0.05	49	479	0.5	6.5	499	8	1.93		< 1		< 1.2
	1/8/2003 11:30	12.8	3	8	8.1	5.4	242	72	7.1			369	0.1	8.8	8	0.04	50	480	0.5	2.8	509	< 4	< 1.2		< 1		< 1.2
	2/4/2003 12:30	12.3	0.7	7.5	691	61.7	169	74	20.8			282	0.2	6.8	7.7	0.2	34	403	1.2	3.9	490	66	1.56		< 1		
	3/4/2003 12:00	14.6	1.6	8.2	843	4.2	228	96	10.8		21	371	< 0.1	6.2	8.1	< 0.03	53	506	0.4	3.4	533	< 4	< 1.2		< 1		
	4/2/2003 11:30	7.7	13	8	661	26.5	194	43	11.5			331	< 0.1	10	8.1	0.03	37	404	0.4	2.6	442	9	1.29		< 1		< 1.2
	5/8/2003 11:00	8.5	14.3	7.5	535	171	154	29	23.5			294	< 0.1	12	7.7	0.27	27	367	1.1	4.5	519	122	2.23		< 1		4.72
	6/2/2003 13:00	11.3	16.2	8.3	679	27.8	218	42	10.3			340	< 0.1	9	8.3	0.04	36	409	0.5	3.4	423	11	1.61		< 1		< 1.2
	7/1/2003 10:00	7.5	22.5	8.2	653	9.7	205	51	11.3			297	< 0.1	4.9	7.9	0.05	35	404	0.7	4.1	431	7	2.58		< 1		1.76
	8/4/2003 10:10	8	22.5	8	687	19	247	42	13.2			340	< 0.1	4.2	8.1	0.04	36	419	0.4	3.6	434	6	1.72		< 1		1.22
	9/3/2003 11:25	6.93	19.72	7.39	417	44.6	157	16	19.4			206	< 0.1	4	7.5	0.16	17	258	0.8	5.5	315	41	1.74		< 1		1.95
	10/6/2003 9:40	9.41	13.23	7.93	687	2.74	265	32	6.8			359	< 0.1	5.9	8.1	0.03	34	410	0.4	2.8	436	< 4	< 1.2		< 1		< 1.2
	11/6/2003 11:30	10.14	11.34	8.05	702	2.13	248	39	5.3			367	< 0.1	4.6	8.1	< 0.03	35	403	0.2 (DJ)	3.1	424	< 4 (DJ)	< 1.2		< 1		< 1.2
	12/1/2003 9:25	11.1	6.4	7.78	687	3.33	253	35	5.6			363	< 0.1	6.8	7.9	0.03 (DJ)	33	438	0.1	2.2	442	< 4	1.38		< 1		< 1.2
	1/6/2004 13:00	12.05	1.99	7.2	362	200	116	17	29.8			202	< 0.1	5.5	7.5	0.39	19	238	1.5	5.8	407 (QJ)	62	3.16		< 1		10.8
	2/3/2004 9:45	11.88	0.38	7.47	719	2.25	268	44	6.9			361	< 0.1	5.4	7.8	0.03 (DJ)	46	436	0.4	2.7	448		< 1.2		< 1		< 1.2
	3/2/2004 10:15	10.62	6.96	7.5	564	59.8	181	33	13.9			301	< 0.1	8.2	7.8	0.14	27	335	1	3	426	84	1.82		< 1		2.7
	4/7/2004 10:00	11.13	11.06	7.84	652	9.94	211	36	7.8			345	< 0.1	7.5	8.1	< 0.03 (Q)	37	381	0.2	2.2	396	8	< 1.2		< 1		< 1.2
	5/5/2004 9:45	10.11	14.3	8.33	625	7.88	226	41	11.6			329	< 0.1	5.9	8	0.04	36	414	0.5	2.4	409	9	2.1		< 1		1.36
	6/2/2004 9:35	8.39	18.79	8.23	604	24.6	224	33	9.3			325	< 0.1	8.8	8	0.06	28	404	0.6	2.4	424	18	< 1.2		< 1		< 1.2
	7/8/2004 10:30	8.4	21.95	8.37	689	10.2	236	46	< 5			321	< 0.1	4.1 (DJ)	8.1	0.04	36	406	0.5 (DJ)	3.4	443	9	1.61		< 1		< 1.2
	8/16/2004 9:50	8.93	17.49	8.1	783	7.83	235	84	10.3			300	< 0.1		8.2	0.04 (DJ)	55	456	0.6	4.4	475		1.99		< 1		< 1.2
	9/29/2004 10:20	9.05	14.84	7.97	972		228	122	17.2			306	< 0.1	2.9	7.9	0.04 (DJ)	51	541	0.8	5.3	573	< 4	1.88		< 1		< 1.2
	10/27/2004 10:15	7.05	14.06	7.91	741	2.34	253	60	17.5			346	< 0.1	2.6	7.9	0.06	40	435	0.6	4	461	< 4	1.99		< 1		< 1.2
	11/17/2004 10:00	10.28	9.71	8.03	768	2.68	279	61	9.7			340	< 0.1	4.4	8	< 0.03	42	439	0.5	2.8	472	< 4	< 1.2		< 1		< 1.2
	12/10/2004 9:45	9.83	9.5	7.87	624	77.3	220	35	14			325	< 0.1	9.6	7.7	0.18	29	371	0.8	2.7	434	25	< 1.2		< 1		1.26
	1/12/2005 9:00	11.41	5.69	7.43	166	451	55	8.1	34.1			94	< 0.1	2.2	7.3	0.45	8.9	144	2		374	270	3.57		< 1		12.6
	2/2/2005 10:30	12.65	1.58	7.65	699	4.2	262	45	5.2			352	< 0.1	5.9	7.9	0.04	40	423	0.5	2.6	455	< 4	< 1.2		< 1		< 1.2
	3/10/2005 11:30	13.76	2.81	7.6	619	4	225	41	7.8			309	< 0.1	6	8.2	< 0.03	36	370	0.4	2.3	396	< 4	< 1.2		< 1		< 1.2
	4/20/2005 10:25	9.02	18.77	8.06	628	4.4	227	41	12.6			310	< 0.1	3.8	8	< 0.03	39	369	0.6	3.2	398	8	< 1.2		< 1		< 1.2
	5/17/2005 9:15	9.6	13.25	8.23	648	12.3	234	36	13.1			345	< 0.1	7.5	8	0.04 (fDJ)	33	374	0.5 (fDJ)	2.3 (fDJ)	412	13	< 1.2		< 1		< 1.2
	6/27/2005 9:05	6.78	23.6	8.2	622	15	204	38	17.8			312	< 0.1	4.4	8	0.06	32	361	0.8	3.8	414	10	1.33		< 1		< 1.2

Weasel Creek 2	7/14/2005 10:15	7.58	22.93	8.1	753	13	208	84	13.9
	8/26/2005 8:00	6.82	21.23	8.13	857	7.1	247	95	16
	9/27/2005 11:00	7.77	18.63	7.86	582	90	182	41	22
	10/12/2005 11:20	9.52	15.58	8.2	808	7	235	77	14.3
	11/15/2005 10:30	8.57	10.03	7.05	469	188	138	30	39.6
	12/7/2005 11:15	14.42	0.85	7.8	795	4	277	70	10
	1/24/2006 9:30	11.71000004	4.47	7.73	662	14	210	39	6.2
	2/13/2006 9:50	13.56000042	2.09	7.76	680	4	236	40	6.9
	3/15/2006 8:45	10.93000031	6.24	7.56	585	49	183	33	14.3
	4/3/2006 11:25	9.89	9.66	7.65	688	58	203	36	20.2
	5/9/2006 10:50	10.16	16.33	8.3	661	5	210	39	18.8
	6/27/2006 10:50	8.02	20.88	7.98	673	21	232	34	12.8
	7/24/2006 9:00	7.17	21.39	8.17	737	9	263	53	16.5
	8/29/2006 15:05	7.04	22.54	7.97	573	57	174	50	13.6
	9/11/2006 9:55	7.57	19.32	8.22	824	5	247	86	16.8
	10/26/2006 11:55	10.29	9.06	8.21	719	14	274	34	9.2
	11/16/2006 10:55	8.99	8.65	8.43	455	212	162	24	39.2
	12/12/2006 10:20	11.21	6.9	8.01	676	8.64	274	30	7.8
	1/3/2007 8:20	11.24	5.16	7.6	574	45.5	218	22	< 8
	3/6/2007 11:10	13.3	0.89	8.43	414	66.2	158	18	16.5
	4/20/2007 8:45	10.81	9.59	8.48	618	9.6	235	27	7.2
	5/16/2007 10:30	7.27	17.8	8.51	638	14.8	239	34	11.2
	6/6/2007 10:40	8.01	17.1	8.09	635	5.1	227	42	11.4
	7/25/2007 9:50	7.47	20.55	8.05	646	5.21	205	61	16.1
	8/16/2007 11:15	6.86	23.24	7.99	747	6.19	195	90	17.5
	9/6/2007 10:15	5.72	21.87	7.87	863	5.98	209	104	18
	10/5/2007 10:15	5.87	19.69	8.01	1030	4.29	255	135	10.5
	11/9/2007 10:15	8.61	6.44	8.32	939	4.3	240	104	21.2
	11/27/2007 11:50	11.93	5.32	8.16	581	23	178	30	12.1
	1/31/2008 11:05	13.73	0.04	8.35	664	16.5	204	46	12.4
	2/28/2008 10:15	14.2	0.24	8.22	722	5.84		64	9
	3/26/2008 9:35	11.82	5.37	8.25	554	22.4	193	28	11.8
	4/29/2008 10:30	10.86	10.55	8.14	630	10	210	36	19
	5/15/2008 10:50	8.55	11.88	7.37	415	93.7	128	18	21.2
	6/10/2008 12:35	6.54	19.31	7.44	394	202	122	14	29
	7/9/2008 9:10	6.91	23.44	8.25	580	21	220	29	11.3
	8/28/2008 12:10	8.86	21.07	8.37	823	6.76	232	88	15.4
	9/9/2008 8:15	5.11	18.63	8.04	887	9.01	249	108	17.4
	10/7/2008 12:30	9.45	14.36	8.28	993	6.01	254	127	19
	11/17/2008 9:15	11.79	4.45	8.75	794	2.6	218	86	16.7
	12/9/2008 11:10	14.02	1.13	8.8	918	5.1	232	110	13.6
	1/5/2009 9:35	11.47	1.68	8.3	606	9	190	39	11.4
	3/2/2009 10:30	10.26	0.53	8.39	556	10.8	182	31	7

7/14/2005 10:15	297	< 0.1	2.4 (fDJ)	8.1	0.08	41	448	0.8	4.6	482	9	2.05		< 1		< 1.2
8/26/2005 8:00	315	< 0.1	1.6	8	0.1	40	507	0.6	4.4	542	6	2.29		< 1		< 1.2
9/27/2005 11:00	255	< 0.1	5.6	7.8	0.19	29	377	1	6.5	401	22	2.06		< 1		< 1.2
10/12/2005 11:20	350	< 0.1	2.3	8.1	0.06	41	471	0.6	3.8	517	4	1.38		< 1		< 1.2
11/15/2005 10:30	238	< 0.1	8	7.4	0.46	21	331	2.1	7	478	132	2.5		< 1		5.94
12/7/2005 11:15	367	0.1	4.8	8	0.04	41	497	0.7	3.6	528	< 4	< 1.2		< 1		< 1.2
1/24/2006 9:30	335	< 0.1	10	7.9	0.04	34	420	< 0.1 (DJ)	2.1	443	6	< 1.2		< 1		< 1.2
2/13/2006 9:50	348	< 0.1	8.7	8	< 0.03	37	431	0.3	2.2	435	< 4	< 1.2		< 1		< 1.2
3/15/2006 8:45	298	< 0.1	9.6	7.8	0.14	31	371	0.9	3.3	382	25	< 1.2		< 1		1.92
4/3/2006 11:25	323	< 0.1	8.8	7.7	0.12	31	369	0.9	3.1	468	58	1.22		< 1		2.76
5/9/2006 10:50	320	< 0.1	8.3	8.1	0.17	38	392	0.9	6.2	416	5	< 1.2		< 1		< 1.2
6/27/2006 10:50	332	< 0.1	9.4	7.8	0.11	28	466	0.6	3	519	21	1.34		< 1		1.55
7/24/2006 9:00	342	< 0.1	3.5	8	0.09	32	448	0.6	4	494	5	2.45		< 1		< 1.2
8/29/2006 15:05	228	< 0.1	2.1	7.8	0.17	26	338	0.8	5.2	362	9	2.82		< 1		< 1.2
9/11/2006 9:55	321	< 0.1	1	8.1	0.08	39	467	0.6	4.6	502	< 4	1.95		< 1		< 1.2
10/26/2006 11:55	374	< 0.1	6	7.9	0.06	25	428	0.2	3.1	459	< 4	< 1.2		< 1		< 1.2
11/16/2006 10:55	270	< 0.1	4.7	7.5	0.24	18	287	2.2	7.2	467	150	2.41		< 1		8.88
12/12/2006 10:20	366	< 0.1	5.3	7.9	0.05	31	401	0.5	3.2	439	5 (DJ)	< 1.2		< 1		< 1.2
1/3/2007 8:20	289	< 0.1	5.99	7.82	0.086	28.3	304	< 0.5	2.76	366	19	< 1.2		< 1	77000	2.25
3/6/2007 11:10	223	< 0.1	3.28	7.29	0.183	21.3	199	1.46	3.83	257	29	< 1.2		< 1	60300	1.79
4/20/2007 8:45	289	< 0.1	5.3	7.9	< 0.03	29	354	0.2	2.7	390	< 4	< 1.2		< 1		< 1.2
5/16/2007 10:30	318	< 0.1	4.3	8	0.04	30	355	0.5	3.15	397	4	1.21		< 1		< 1.2
6/6/2007 10:40	314	< 0.1	2.4	7.9	0.05	30	371	0.5	4.1	393	< 4	1.8		< 1		< 1.2
7/25/2007 9:50	273	< 0.1	0.6	7.9		35	364	0.6	5.3	396	4	2.94		< 1		< 1.2
8/16/2007 11:15	256	< 0.1	0.2	7.9	0.07	41	421	0.7	7.8	448	4	3.98		< 1		< 1.2
9/6/2007 10:15	296	< 0.1	1.1	7.8	0.08	50	488	0.7	6	514	4	2.71		< 1		< 1.2
10/5/2007 10:15	309	< 0.1	2.5	7.7	0.06	45	576	1.1	7.7	598	< 4	2.51		< 1		< 1.2
11/9/2007 10:15	312	< 0.1	1.8	7.6	0.05	53	522	0.7	7.9	544	< 4	1.74		< 1		< 1.2
11/27/2007 11:50	297	0.3	8.5	7.6	0.1	28	403	0.5	3.1	372	10	< 1.2		< 1		< 1.2
1/31/2008 11:05	306	< 0.1	6.6	7.7	0.1	35	388	0.8	3.3	442	21	1.24		< 1		1.54
2/28/2008 10:15	340	< 0.1	5.9	7.8	0.04			0.5	2.6			< 1.2		< 1		< 1.2
3/26/2008 9:35	287	< 0.1	6.6		0.04	28	316	0.4	2.8	367	11	< 1.2		< 1		< 1.2
4/29/2008 10:30	296	< 0.1	5.4	8	< 0.03	33	361	0.3	4.1	402	< 4	< 1.2	30.7	< 1		< 1.2
5/15/2008 10:50	212	< 0.1	9.5	7.4	0.26	16	273	1.2	5.5	357	58	1.74	29.2	< 1		2.83
6/10/2008 12:35	209	0.2	8.8	7.3	0.28	13	251	1.7	5.6	417	122	2.67	36.7	< 1		5.19
7/9/2008 9:10	314	< 0.1	6	8	0.07	26	349	0.6	3.8	395	13	1.32	44.7	< 1		< 1.2
8/28/2008 12:10	305	< 0.1	1.7	8.2	0.08	41	465	0.6	5.4	491	4	2.41	122	< 1		< 1.2
9/9/2008 8:15	316	< 0.1	2.2	8	0.08	45	520	0.6	5.8	562	7	2.58	153	< 1		< 1.2
10/7/2008 12:30	297	< 0.1	2.5	8.1	0.03	46	560	0.7	6.7	584	< 4	2.03	189	< 1		< 1.2
11/17/2008 9:15	286	< 0.1	2.4	7.8	0.06	39	444	0.6	6.4	466	< 4	1.28	126	< 1		< 1.2
12/9/2008 11:10	325	< 0.1	4.2 (QJ)	8.1	< 0.03	46	517	0.7	5.6	533	< 4	< 1.2	121	< 1		< 1.2
1/5/2009 9:35	297	0.1	6.1 (Q)	8	0.09	38	341	0.7	3	384	6	< 1.2	32.4	< 1		< 1.2
3/2/2009 10:30	271	< 0.1	7	7.8	0.06	29	319	0.4	2.2	344	9	< 1.2	23.3	< 1		< 1.2

2001 E.Coli

		MorseFieldData.xls					MorseGenChem.xls	
	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
WWU080-0031	6/4/2001 15:22	9.38	13.76	8.11	687	17.29	> 2419.2 (Q)	1732.87 (Q)
	6/11/2001 15:15	9.4	22.4	8.13	748	18	> 2419.2	290.9
	6/18/2001 16:00	9.45	24.9	8.25	748	7	> 2419.2	360.9
	6/25/2001 15:20	10.11	23.96	8.39	783	7	> 2419.2	172.3
	7/2/2001 14:05	9.94	22.92	8.27	734	8	> 2419.2	82

2006 TMDL

		MorseGenChem.xls	
	Sample Date	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
WWU080-0081	8/29/2006 10:55	> 2420	1119.9
	9/6/2006 9:45	> 2420	218.7
	9/12/2006 9:45	> 24200	> 24200
	9/19/2006 9:55	> 2420	1413.6
	9/26/2006 10:15	> 2420	344.8
WWU080-0082	8/29/2006 10:50	> 2420	1986.3
	9/6/2006 9:50	> 2420	648.8
	9/12/2006 9:55	> 2420	> 2420
	9/19/2006 10:05	> 2420	488.4
	9/26/2006 10:20	> 2420	285.1
WWU080-0083	8/29/2006 9:50	> 2420	37.9
	9/6/2006 9:25	> 2420	16.1
	9/12/2006 9:40	> 24200	19863
	9/19/2006 9:45	> 2420	1203.3
	9/26/2006 10:05	> 2420	770.1
WWU080-0084	8/29/2006 9:55	> 2420	1732.9
	9/6/2006 9:20	> 2420	648.8
	9/12/2006 9:20	> 2420	> 2420
	9/19/2006 9:30	> 2420	1732.9
	9/26/2006 9:45	> 2420	193.5

DO	9.924560006
Ecoli	2040.564688
pH	8.051440002
N	6.060353704
P	0.10929703
TSS	27.93670886
Turbidity	29.90008264

MorseMetals.xls

Copper (Total) (ug/L)	Iron (Total) (ug/L)	Lead (Total) (ug/L)	Magnesium (ug/L)	Manganese (Total) (ug/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Strontium (ug/L)	Zinc (Total) (ug/L)
4.4	2500	< 7			< 0.1	< 5		14
< 3	650	< 5			0.42	< 6		25
< 3	340	< 5			< 0.2	< 6 (J)		< 10
4.7	220	< 7			< 0.2	< 5		7
< 4	230	< 7		45	< 0.2	7.1		< 6
6.5	200	< 7			< 0.2	13		26
5.5	91	< 7		11	< 0.2	10		26
< 4	75	< 7		9.3	< 0.2	6.9		8.2
4	78	< 7		8	< 0.2	9.9		22
< 4	100	< 7		8.9	< 0.2	< 5		6.7
< 4	110	8.9		23	< 0.2	< 5		< 6
< 4	170	7.1		24	< 0.2	< 5		< 6
< 4	800	< 7		65	< 0.2	< 5		< 6
< 4	900	< 7			< 0.2	< 5		7.5
< 4	220	7.7		13	< 0.2	< 5		< 6
< 4	290	< 7			< 0.2	< 5		< 6
2.5	500	< 1.7			< 0.2	2.3		6.3 (QJ)
2.2 (BJ)	68	< 1.7			< 0.2	5.5 (BJ)		< 6
5.3	56	2.8			< 0.2	4.8		6.7
2.9	81	< 1.7			< 0.2	2.3		7.6
2	300	< 1.7			< 0.2	2.8		40
1.6	140	< 1.7			< 0.2	3		10 (UJ)
	140	< 1.7			< 0.2	3.2		20 (UJ)
< 3	260	< 1			< 0.2	2		< 6
2	250	< 1			< 0.2	2.1		12
3.8 (DJ)	300	< 1			< 0.2	4.5		7 (UJ)
4.2	300	< 1			< 0.2	4		7.4 (UJ)
1.9	85	< 1 (DJ)			< 0.2	2.9		< 6
1.7	120	< 1			< 0.2	2		< 6
1.7	65	< 1			< 0.2	2.3		< 6
1.32	116.7289	< 1			< 0.2	1.87		< 6
1.71	107.3535	< 1			< 0.2	1.9		< 6
2.3	591.2321	< 1			< 0.2	2.36		< 12
3.67	1552.719	1.39			< 0.2	3.3		8.8264 (UJ)
7.41	4570 (QJ)	3.79			< 0.2	6.66		21.1
2.11	283	< 1			< 0.2	2.3		< 6
3.19	747	< 1			< 0.2 (QJ)	3.12		8.24 (UJ)
4	201	< 1			< 0.2	4.47		28.4
3.72	131	< 1			< 0.2	3.96		18.4 (UJ)
2.67	154	< 1			< 0.2	2.21		6.01 (UJ)
2.98	253	< 1			< 0.2	3.06		9.83 (UJ)
1.41	101	< 1			< 0.2	2.16		< 6
4.16	1780	1.94			< 0.2	3.5		15.8
1.68	140	< 1			< 0.2	6.28		18.1
1.69	293	< 1			< 0.2	2.57		86.4
6.38	4420	4.09			< 0.2	5.98		20.3
4.24	272	< 1			< 0.2	3.09		426
2.93	204	< 1			< 0.2	3.68		355
3.03	217	< 1			< 0.2	4.39		145
4.3	1300	1.28			< 0.2	3.54		9.49
1.74	123	< 1			< 0.2	1.77		10.7 (fDJ)
1.62	67.9	< 1			< 0.2	< 1.4		62.6 (fDJ)
1.97	110	< 1			< 0.2	1.68		9.02
10.3	8660	7.23			< 0.2	8.73		47.9
1.42	123	< 1			< 0.2	1.51		6.42
3.76	2220	1.95			< 0.2	3.37		11.6
1.77	241	< 1			< 0.2	1.64		< 6
1.99	246	< 1			< 0.2	2.05		< 6
1.97	538	< 1			< 0.2	2.01		< 6
2.95	179	< 1			< 0.2	1.75		< 6
3.62	130	< 1			< 0.2	2.32		16.1
4.16	141	< 1			< 0.2	3.02		10.2
1.87	69.2	< 1			< 0.2	1.51		< 6
2.32	73	< 1			< 0.2	1.45		< 6
2.65	885	< 1		25.9	< 0.2	1.89		6.58
11.6	11800	8.67			< 0.2	10.1		53.2
1.42	128	< 1			< 0.2	< 1.4		< 6
1.41	139	< 1			< 0.1	< 1.4		7.81
1.83	356	< 1			< 0.1	< 1.4		< 6
1.59	339	< 1			< 0.1	< 1.4		< 6
2.4	367	< 1			< 0.1	1.47		6

2.96	307	< 1		< 0.1	1.98			20.6
3.13	200	< 1		< 0.1	2.24			26.6
2.82	745	< 1		< 0.1	1.95			19.4
2.45	161	< 1		< 0.1	1.53			10.2
8.64	4840	4.85		< 0.1	6.12			44.9
1.82	151	< 1		< 0.1	1.4			18.5
1.81	164 (fBJ)	< 1		< 0.1	< 1.4		< 6	
1.93	129	< 1		< 0.1	< 1.4			21.4
2.83	1250	1.03		< 0.1	1.95			11.1
4.05	1680	1.83		< 0.1	2.79			14.8
2.02	154	< 1		< 0.1	< 1.4			7.39
3.07	603	< 1			1.92			8.82
3.37	178	< 1			1.72			72.4
3.31	351	< 1			1.96			8.58
4.17	126	< 1			2.39			27.7
1.96	95.6	< 1			< 1.4			6.53
9.04	5590	5.07			7.13			42.5
1.98	238	< 1			1.68			24.7
2.79	1030	< 1	23600		2.14			8.68
3.16	1090	< 1	17700		2.19			168
1.81	144	< 1			< 1.4		8.19 (fDJ)	
2.08	159	< 1			1.51			6.72
2.26	148	< 1			1.61			7.25
3.47	153	< 1			2.49			7.07
3.29	128	< 1			3.87		26.9 (fDJ)	
3.12	151	< 1			3.08			65.1
4	92.8	< 1			3.77			64.3
3.4	83.1	< 1			2.59			48.9
2.68	652	< 1			1.71			41.7
2.98 (fDJ)	1060	1.01			2.11			17.6
2.08	197	< 1			< 1.4			23.7
2.45	694	< 1			1.66			37.2
1.97	119	< 1			< 1.4	315	< 6	
5	2400	2			3.64	142		15.6
7.11	4660	3.9			5.42	134		43.3
2.51	415	< 1			1.59	279		23.8
3.85	138	< 1			2.85	532	< 6 (fB)	
4.1	211	< 1			3.07	576		22.5
4.33	97.2	< 1			2.95	618		6.5
3.47	60	< 1			< 1.4	549		8.32
3.48	99.7	< 1			1.47	648		7.96
2	235	< 1			1.43	270	< 6	
2.01	346	< 1			< 1.4	220	< 6	

Teter Branch

IDEM WQ
2006 TMDL

		MorseGenChem.xls	
	Sample Date	Coliforms (Total) (MPN/100 mL)	E_ Coli (MPN/100 mL)
WWU080-0066	8/28/2006 10:30	> 2420	> 2420
	9/5/2006 10:45	> 2420	344.8
	9/11/2006 10:40	> 2420	307.6
	9/18/2006 11:55	> 2420	2419.2
	9/25/2006 10:30	> 2420	686.7
WWU080-0067	8/28/2006 10:25	> 2420	> 2420
	9/5/2006 10:35	> 24200	5794
	9/11/2006 10:30	> 24200	648.8
	9/18/2006 11:50	> 2420	2419.2
	9/25/2006 10:20	> 2420	1553.1
WWU080-0086	8/29/2006 10:20	> 2420	290.9
	9/6/2006 10:20	> 2420	248.1
	9/12/2006 10:15	> 24200	17329
	9/19/2006 10:30	> 2420	1732.9
	9/26/2006 10:45	> 2420	161.6
			2585.06

Little Cicero Creek

IDEM WQ

1996 Synoptic

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	E_ Coli (CFU/100 mL)	Hardness (as CaCO3) (mg/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TPH - IR (mg/L)
		MorseFieldData.xls					MorseGenChem.xls									
WWU080-0003	2/20/1996 12:54	13.7	4.59	8.1	296.899	7.5	210	61	< 10 (JHU)	340	0.059	55	370	0.093 (BJ)	2.6	< 1 (U)
	4/22/1996 13:00	9.2	14	7.9	257.299	113	160	54		300	0.21 (B)	51	360	3 (B)	7.8	< 1 (U)
	5/29/1996 11:07	9.32	14.28	7.36	154.69	94.4	130 (Q)	31		250	0.078	37 (B)	360	5.5 (B)	4	
	7/9/1996 11:05	7.81	21.62	7.98	631	34.9	200	44		300	0.16	49	360	0.85 (JH)	2.9	
	10/1/1996 10:30	8.02	16.07	7.86	551	20.29	170	46	200	220	0.2	42	310	0.74	4.9	
	11/12/1996 10:57	13.35	3.05	7.98	753	20.29	240 (Q)	60	1200	320	0.18	50	440	0.71	4.4	

2001 Corvallis

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	COD (mg/L)	Coliforms (Total) (MPN/100 mL)	Cyanide (Total) (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	Phosphorus, Total (mg/L)
		MorseFieldData.xls						MorseGenChem.xls								
WWU080-0013	5/22/2001 12:15	9.21	15.69	96.59	8.13	683	21.29	190	52	< 5		< 0.005	308	< 0.1	14	0.12
	7/31/2001 10:45	7.22	25.12	90.3	7.88	759	23	230	74	10		< 0.005	292	< 0.1	1.8	0.24
	10/2/2001 8:45	7.24	14.01		7.73	789	17.39	250	69	39		< 0.005	263	5.1	3.1 (fB)	5.3

2001 E. coli-Upper WFWR

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
		MorseFieldData.xls					MorseGenChem.xls	
WWU080-0032	6/4/2001 15:15	9.62	13.68	8.14	654	16.89	> 2419.2 (Q)	1732.87 (Q)
	6/11/2001 14:35	10.32	22.96	8.14	705	16	> 2419.2	488.4
	6/18/2001 15:45	8.83	25.55	8.17	699	28	> 2419.2	461.1
	6/25/2001 15:05	8.6	23.79	8.18	746	21	> 2419.2	579.4
	7/2/2001 13:50	8.15	21.25	7.96	892	20	> 2419.2	410.6

2006 TMDL

	Sample Date	Coliforms (Total) (MPN/100 mL)	E_ Coli (MPN/100 mL)
		MorseGenChem.xls	
WWU080-0016	8/29/2006 10:35	> 2420	1986.3
	9/6/2006 10:30	> 2420	1413.6
	9/12/2006 10:25	> 2420	> 2420
	9/19/2006 10:40	> 2420	488.4
	9/26/2006 10:55	> 2420	866.4
WWU080-0079	8/29/2006 11:05	> 2420	686.7
	9/6/2006 10:40	> 2420	155.3
	9/12/2006 10:35	> 2420	> 2420
	9/19/2006 10:45	> 24200	1779
	9/26/2006 11:05	> 2420	770.1
WWU080-0080	8/29/2006 10:30	> 24200	2419.2
	9/6/2006 10:05	> 24200	> 24200
	9/12/2006 10:05	> 242000	38730
	9/19/2006 10:20	129970	1732.9
	9/26/2006 10:35	19863	1413.6

DO	9.327857
Ecoli	3934.267
pH	7.965
N	7.90
P	0.792125
TSS	46.42857
Turbidity	32.425

Little Cicero 2

		MorseMetals.xls				
TS (mg/L)	TSS (mg/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Iron (Total) (ug/L)	Lead (Total) (ug/L)	Zinc (Total) (ug/L)
460	< 4 (U)	< 20 (U)	< 20 (U)	170	< 5 (U)	< 20 (U)
570	180	< 20 (U)	< 20 (U)	4200	5.2	32 (Q)
480	60	< 20 (U)	< 20 (U)	120	< 5 (U)	26
420	25	< 20 (U)	< 20 (U)	903	6.4	< 20 (U)
360	10	< 20 (U)	< 20 (U)	640	< 5 (U)	< 20 (U)
470	< 4 (U)	< 20 (U)	< 20 (U)	200	< 5 (U)	< 20 (U)

						MorseMetals.xls										
Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TS (mg/L)	TSS (mg/L)	Arsenic (Total) (ug/L)	Cadmium (Total) (ug/L)	Calcium (ug/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Lead (Total) (ug/L)	Magnesium (ug/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Selenium (Total) (ug/L)	Zinc (Total) (ug/L)
14 (QJ)	390	0.24 (QJ)	2.6	420	25	< 4	< 1	82000	< 2	< 3	< 2	25000	< 0.2	3.3	< 3	< 10
44	420	0.92 (B)	4.7	480	13	< 5	< 1	74900	< 2	< 3	< 2	25500	< 0.2	4.1	< 5	< 10
52 (DJ)	420	5.7	8	460	12	6.5	< 1	58100	< 2	5.3	< 2	28700	< 0.2	4.9	< 5	11

Hinkle Creek

IDEM WQ
2001 Corvallis

Site	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	AFDM (g/M2)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	Chlorophyll a - Periphyton (mg/M2)	Chlorophyll a - Phytoplankton (ug/L)
		MorseFieldData.xls										
WWU080-0010	5/22/2001 13:45	10.28	17.29	111.5	8.34	718	11.5		230	50		
	7/25/2001 10:50	3.75	26.27	49.4	7.73	601	18.29	12.55	230	43	16.875	6.396667
	9/19/2001 13:45	7.41	18.6	83	7.88	657	46.5	13.45	240	44	1.257112	2.682775

2001 E. coli-Upper WFWR

Site	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
		MorseFieldData.xls					MorseGenChem.xls	
WWU080-0015	6/4/2001 14:20	9.88	13.84	8.21	728	4.21	> 2419.2 (Q)	686.7 (Q)
	6/11/2001 14:05	9.7	22.87	8.13	729	7	> 2419.2	613.1
	6/18/2001 15:00	8.51	25.4	8.18	729	10	> 2419.2	248.9
	6/25/2001 13:55	8.96	23.15	8.23	770	9	> 2419.2	152.9
	7/2/2001 13:15	9.1	21.07	8.05	673	9	> 2419.2	222.4

2006 TMDL

Site	Sample Date	Coliforms (Total) (MPN/100 mL)	E_ Coli (MPN/100 mL)
		MorseGenChem.xls	
WWU080-0068	8/28/2006 10:05	> 2420	> 2420
	9/5/2006 10:20	> 2420	1553.1
	9/11/2006 10:10	> 2420	325.5
	9/18/2006 11:20	> 2420	> 2420
	9/25/2006 9:35	> 2420	387.3
WWU080-0069	8/28/2006 9:50	> 2420	> 2420
	9/5/2006 10:00	17329	1669
	9/11/2006 10:00	> 2420	770.1
	9/18/2006 11:05	> 24200	17329
	9/25/2006 9:25	> 2420	517.2
WWU080-0070	8/28/2006 10:00	> 2420	> 2420
	9/5/2006 10:10	11199	579.4
	9/11/2006 10:05	> 2420	365.4
	9/18/2006 11:10	> 2420	> 2420
	9/25/2006 9:35	> 2420	866.4

DO	8.44875
Ecoli	1919.32
pH	8.09375
N	7.285
P	0.186333333
TSS	23.66666667
Turbidity	14.4375

Hinkle Creek 2

MorseGenChem.xls															
COD (mg/L)	Cyanide (Total) (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	Phaeophyton - Periphyton (attached) (mg/M2)	Phaeophyton - Phytoplankton (suspended) (ug/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	Total POC (mg/L)	TS (mg/L)	TSS (mg/L)	Arsenic (Total) (ug/L)
< 5	< 0.005	334	< 0.1	14			0.059	16 (QJ)	440	0.7 (QJ)	2.6		440	8	< 4
14	< 0.005 (Q	263	0.2	0.43 (DJ)	16.06	8.596667	0.18	36	380	1.2	5.2	4.965	410	19	< 5
20	< 0.005	307	< 0.1	0.57	0.467028	6.815794	0.32	57	380 (DJ)	0.87	6.1	2.452	450	44	< 5

Hinkle Creek 3

MorseMetals.xls									
Cadmium (Total) (ug/L)	Calcium (ug/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Lead (Total) (ug/L)	Magnesium (ug/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Selenium (Total) (ug/L)	Zinc (Total) (ug/L)
< 1	91000	< 2	< 3	< 2	26000	< 0.2	3.5	< 3	< 10
< 1	70100	< 2	< 3	< 2	21300	< 0.2	3.8	< 5	< 10
< 1	80200	< 2	< 3	< 2	25800	< 0.2	4.4	< 5	< 10

Morse Reservoir

IDEM WQ

1996 Synoptic

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	E_Coli (CFU/100 mL)	Hardness (as CaCO3) (mg/L)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TPH - IR (mg/L)	TS (mg/L)	TSS (mg/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)
		MorseFieldData.xls					MorseGenChem.xls												Mo	
WWU080-0004	2/20/1996 10:45	12.2	6.59	7.9	222.1	7.3	150	50	20 (JH)	230	0.059	29	260	1.6 (B)	4.6	< 1 (U)	330	< 4 (U)	< 20 (U)	< 20 (U)
	4/22/1996 11:15	11	14.1	8.5	234.899	26.7	150	53		240	0.036 (BJ)	51	330	1.6 (B)	3.9	< 1 (U)	370	6	< 20 (U)	< 20 (U)
	5/29/1996 10:10	9.01	17.26	8.14	335.94	29.5	130 (Q)	34		230	0.093	39 (B)	340	1.2 (B)	4		430	4	< 20 (U)	< 20 (U)
	7/9/1996 9:38	5.63	23.21	7.78	500	6.8	130	36		230	0.099	43	310	0.77 (JH)	3.1		390	7	< 20 (U)	< 20 (U)
	10/1/1996 9:45	8.1	17.84	7.94	489	34.59	150	38	380	220	0.12	38	270	1.1	3.6		350	26	< 20 (U)	< 20 (U)
	11/12/1996 11:12	11.22	8.77	7.94	469	19.29	140 (Q)	40	40	190	0.048 (J)	37	260	0.96	3.8		280	6	< 20 (U)	< 20 (U)

2001 Cicero Creek Assessment

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100 mL)	E_Coli (MPN/100 mL)
		MorseFieldData.xls						MorseGenChem.xls	
WWU080-0020	6/4/2001 9:33	8.45	16.5	86.5	7.96	571	0.2	> 2419.2	149.7
	6/11/2001 9:10	8.37	20.87	93.59	8.07	574	5.3	> 2419.2	98.5
	6/18/2001 9:35	6.91	24.09	82.4	7.92	558	4.19	> 2419.2	191.8
	6/25/2001 9:02	7.25	22.32	83.59	7.75	556	1.89	> 2419.2	88
	7/2/2001 9:40	8.87	18.95	97	7.61	688	6.3	> 2419.2	248.1
WWU080-0021	6/4/2001 9:43	8.18	14.39	78.8	7.67	638	3.79	> 2419.2	579.4
	6/11/2001 9:20	8.01	20.87	89.69	7.67	658	26.5	> 2419.2	1299.65
	6/18/2001 9:45	6.67	22.35	77.09	7.71	636	6.69	> 2419.2	1986.4
	6/25/2001 9:15	7.59	21.37	85.9	7.65	636	9.8	> 2419.2	435.2
	7/2/2001 9:30	7.77	19.95	85.69	7.78	547	3.2	> 2419.2	120.1
WWU080-0022	6/4/2001 9:50	9.4	13.39	90	7.92	676	5.59	> 2419.2	260.2
	6/11/2001 9:27	9.22	19.48	100.5	8.05	726	3.5	> 2419.2	488.4
	6/18/2001 9:50	9.16	20.97	103.5	7.92	695	2.7	> 2419.2	206.3
	6/25/2001 9:47	8.82	18.37	94	7.86	705	3.09	> 2419.2	727
	7/2/2001 9:42	9.93	17.22	103.5	7.98	691	4	> 2419.2	686.7
WWU080-0023	6/4/2001 9:01	8.32	16.7	85.8	7.96	574	0.1	> 2419.2	111.2
WWU080-0024	6/4/2001 10:00	9.5	12.6	89.4	7.86	657	29.2	> 2419.2	866.4
	6/11/2001 9:35	9.38	18.43	100.09	7.92	672	11.19	> 2419.2	435.2
	6/18/2001 10:00	8.78	20.04	96.59	7.98	634	7.3	> 2419.2	727
	6/25/2001 9:25	9.01	16.97	93.4	8.03	738	5.69	> 2419.2	920.8
	7/2/2001 9:50	10.64	14.6	104.9	8.01	757	3.2	> 2419.2	1203.31
WWU080-0025	6/4/2001 10:08	9.4	12.77	89	7.84	693	8.5	> 2419.2	1119.85
	6/11/2001 9:50	9.37	18.85	100.8	7.96	703	7.5	> 2419.2	816.4
	6/18/2001 10:10	9.09	20.79	101.59	9.92	658	9.89	> 2419.2	1986.28
	6/25/2001 9:32	8.68	18.59	93.8	7.94	751	10.39	> 2419.2	1413.6
	7/2/2001 10:00	9.58	17.2	99.69	7.98	613	20.7	> 2419.2	> 2419.2
WWU080-0026	6/4/2001 10:20	9.9	12.56	93.3	7.78	687	0.6	> 2419.2	1299.65
	6/11/2001 10:00	10.19	18.1	107.9	7.94	678	5	> 2419.2	770.1
	6/18/2001 10:55	9	20.07	99.4	7.5	681	4.59	> 2419.2	1732.87
	6/25/2001 9:37	8.24	19.06	89.09	7.73	722	7.3	> 2419.2	2419.2
	7/2/2001 10:10	8.83	17.52	92.5	7.76	635	9.89	> 2419.2	> 2419.2
WWU080-0027	6/4/2001 10:30	9.46	12.42	88.69	7.8	701	5.19	> 2419.2	1986.28
	6/11/2001 10:05	9.2	18.2	97.69	7.94	673	4.9	> 2419.2	613.1
	6/18/2001 10:25	8.3	19.96	91.59	7.88	673	7	> 2419.2	> 2419.2
	6/25/2001 9:45	9.38	17.62	98.5	7.96	714	10	> 2419.2	55.6
	7/2/2001 10:20	10.23	16	103.69	7.96	584	12.1	> 2419.2	1986.28
WWU080-0028	6/4/2001 10:40	8.9	16.68	92.3	8	562	0.1	> 2419.2	49.6
	6/11/2001 10:20	8.95	21.53	101.3	8.27	561	5.09	> 2419.2	32.7
	6/18/2001 10:35	7.63	24.7	91.8	8.02	552	2.29	> 2419.2	22.7
	6/25/2001 9:58	5.89	22.62	67.19	7.76	550	3.9	> 2419.2	73.8
	7/2/2001 10:30	7.8	20.34	86.5	7.76	536	2.9	> 2419.2	150
WWU080-0029	6/4/2001 10:52	8.62	16.89	89	8	563	0.5		68.3
	6/11/2001 10:30	9.08	22.23	104.5	8.34	562	6.59	> 2419.2	32.7
	6/18/2001 10:45	7.76	25.77	95.5	8.14	553	4.09	> 2419.2	114.5
	6/25/2001 10:08	6.82	23.92	80.69	7.88	550	6.19	> 2419.2	57.3
	7/2/2001 10:45	7.65	22.11	87.5	7.86	540	3.29	> 2419.2	83

2001 Corvallis

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	AFDM (g/M2)	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	Chlorophyll a - Periphyton (mg/M2)	Chlorophyll a - Phytoplankton (ug/L)	COD (mg/L)	Cyanide (Total) (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	Phaeophyton - Periphyton (attached) (mg/M2)	Phaeophyton - Phytoplankton (suspended) (ug/L)	Phosphorus, Total (mg/L)
		MorseFieldData.xls						MorseGenChem.xls												
WWU080-0012	5/22/2001 15:00	8.39	20.28	96.69	8.31	541	13.69		140	54			19	< 0.005	213	< 0.1	9.7			0.038
	7/25/2001 14:00	7.17	31.55	100	8.36	485	5.3	30.95	120	49	58.75	8.13	21	< 0.005 (Q)	201	0.19	4.7 (DJ)	37.76	1.755	0.037
	9/19/2001 15:25	8.7	21.89	101.5	8.31	481	13.39	20.85	150	48	8.336268	4.053333	8.3	< 0.005	100	< 0.1	2.4	2.62308	0.656648	0.071

2001 E. coli-Upper WFWR

MorseFieldData.xls	MorseGenChem.xls

Morse Reservoir 2

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	Coliforms (Total) (MPN/100mL)	E_ Coli (MPN/100 mL)
WWU080-0006	6/4/2001 14:50	7.26	15.6	8.05	688	39.2	> 2419.2 (Q)	410.6 (Q)
	6/11/2001 15:00	0	27.1	8.64	610	24	> 2419.2	260.2
	6/18/2001 15:20	10.81	28.15	8.35	627	19	> 2419.2	24.3
	6/25/2001 14:40	14.2	26.96	8.63	647	16	> 2419.2	8.4
	7/2/2001 13:30	10.65	26.45	8.28	564	17	> 2419.2	82

2001 W Fk White River in Hamilton Co Assessment

MorseFieldData.xls | MorseGenChem.xls

	Sample Date	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	E_ Coli (MPN/100 mL)
WWU080-0019	6/4/2001 11:14	9.13	16.34	93.69	8.14	572	5	102.2 (J)

2006 TMDL Cicero Creek

MorseGenChem.xls

	Sample Date	Coliforms (Total) (MPN/100 mL)	E_ Coli (MPN/100 mL)
WWU080-0019	8/29/2006 12:35	> 2420	1986.3
	9/6/2006 13:05	> 2420	172.7
	9/12/2006 11:45	> 24200	3255
	9/19/2006 12:05	> 2420	135.4
	9/26/2006 12:25	> 2420	58.1
WWU080-0071	8/29/2006 12:00	> 2420	7.3
	9/6/2006 12:35	3448	12
	9/12/2006 11:20	> 2420	290.9
	9/19/2006 11:40	> 2420	143
	9/26/2006 11:55	1046.2	35
WWU080-0072	8/29/2006 11:50	> 2420	238.2
	9/6/2006 12:30	> 2420	6.2
	9/12/2006 11:15	> 2420	45.7
	9/19/2006 11:30	> 2420	3
	9/26/2006 11:50	> 2420	1
WWU080-0073	8/29/2006 12:15	> 2420	2419.2
	9/6/2006 12:45	> 2420	1732.9
	9/12/2006 11:25	> 24200	9208
	9/19/2006 11:45	> 2420	1119.9
	9/26/2006 12:05	> 2420	727
WWU080-0074	8/29/2006 12:20	> 2420	1203.3
	9/6/2006 12:50	> 2420	387.3
	9/12/2006 11:30	> 2420	> 2420
	9/19/2006 11:55	> 2420	235.9
	9/26/2006 12:10	> 2420	121.1
WWU080-0075	8/29/2006 11:40	> 2420	613.1
	9/6/2006 12:20	> 2420	1046.2
	9/12/2006 11:05	> 2420	> 2420
	9/19/2006 11:25	> 2420	> 2420
	9/26/2006 11:40	> 2420	488.4
WWU080-0076	8/29/2006 11:25	> 2420	10.9
	9/6/2006 10:55	> 2420	7.4
	9/12/2006 10:50	> 2420	66.3
	9/19/2006 11:10	> 2420	1203.3
	9/26/2006 11:20	> 2420	29.8
WWU080-0077	8/29/2006 11:15	> 2420	980.4
	9/6/2006 10:45	> 2420	76.2
	9/12/2006 10:40	> 2420	> 2420
	9/19/2006 11:00	> 2420	> 2420
	9/26/2006 11:10	> 2420	298.7
WWU080-0078	8/29/2006 11:30	> 2420	517.2
	9/6/2006 11:00	> 2420	1553.1
	9/12/2006 10:55	> 24200	4884
	9/19/2006 11:15	> 2420	816.4
	9/26/2006 11:25	> 2420	816.4

DO	8.71557377
Ecoli	863.5307
pH	8.007704918
N	6.05
P	0.073857143
TSS	9.571428571
Turbidity	9.486393443

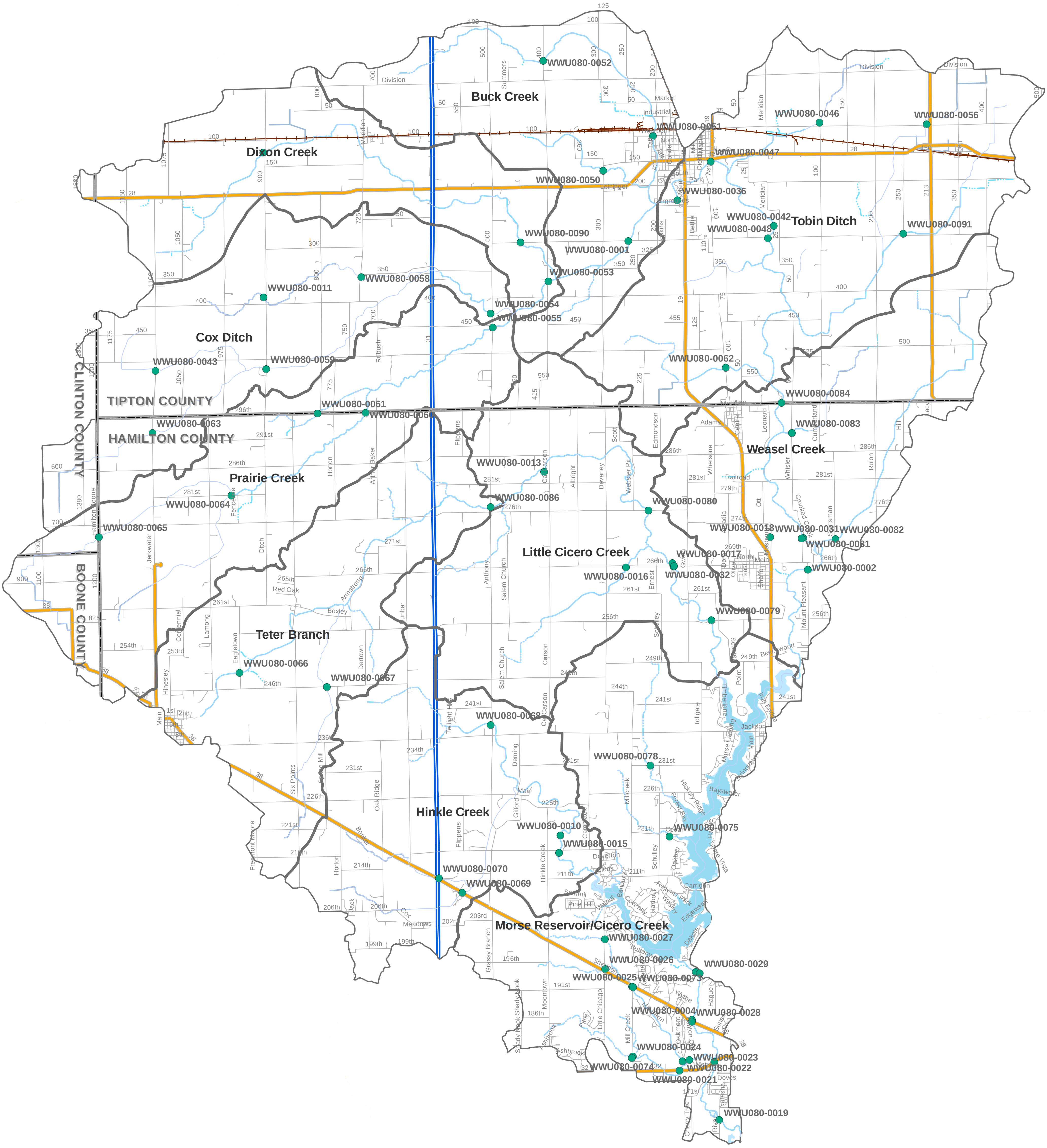
Morse Reservoir 3

orseMetals.xls

Iron (Total) (ug/L)	Lead (Total) (ug/L)	Zinc (Total) (ug/L)
93	< 5 (U)	< 20 (U)
150	< 5 (U)	< 20 (QU)
270	< 5 (U)	< 20 (U)
131	< 5 (U)	< 20 (U)
880	< 5 (U)	< 20 (U)
250	< 5 (U)	< 20 (U)

MorseMetals.xls

Sulfate (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	Total POC (mg/L)	TS (mg/L)	TSS (mg/L)	Arsenic (Total) (ug/L)	Cadmium (Total) (ug/L)	Calcium (ug/L)	Chromium (Total) (ug/L)	Copper (Total) (ug/L)	Lead (Total) (ug/L)	Magnesiu m (ug/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Selenium (Total) (ug/L)	Zinc (Total) (ug/L)
7.5 (QJ)	290	1.1 (QJ)	3.5		320	< 4	< 4	< 1	49000	< 2	< 3	< 2	22000	< 0.2	2.5	< 3	< 10
44	290	1.8	4.8	3.306	320	8	< 5	< 1	38600	< 2	98.2	< 2	25400	< 0.2	2.2	< 5	< 10
39	240 (DJ)	1.3	4.2	2.136	300	10	< 5	< 1	21200	< 2	4.4	< 2	11500	< 0.2	2.2	< 5	< 10



Appendix F: IDEM Sampling Locations

Appendix G – CIWRP Data

A summary of the data obtained from CIWRP within the Morse Reservoir/Cicero Creek watershed is provided within this Appendix. The raw data is provided on CD at the end of this report.

CEES Water Quality Data

	DO				E. Coli				pH				Nitrate+Nitrite			
Prairie Creek	1	7	11.59	NR	1	6	1886.17	5	1	7	7.71	NR	1	7	7.49	1
Cox Ditch	1	7	11.59	NR	1	6	1886.17	5	1	7	7.71	NR	1	7	7.49	1
Dixon Creek	1	7	11.59	NR	1	6	1886.17	5	1	7	7.71	NR	1	7	7.49	1
Buck Creek	1	7	11.2	NR	1	6	2462.17	4	1	7	7.72	NR	1	7	7.13	2
Tobin Ditch	1	7	11.2	NR	1	6	2462.17	4	1	7	7.72	NR	1	7	7.13	2
Weasel Creek	1	9	10.64	NR	1	7	4566.29	2	1	9	7.73	NR	1	9	5.72	4
Teter Branch	1	7	11.79	NR	1	6	1571.83	6	1	7	7.78	NR	1	7	4.4	5
Little Cicero Creek	1	8	11.02	NR	1	6	2770.5	3	1	8	7.76	NR	1	8	6.16	3
Hinkle Creek	1	8	11.49	NR	1	6	4809.67	1	1	8	7.57	NR	1	8	2.71	6
Morse Reservoir/ Cicero Creek			N/A	NR			N/A	NR			N/A	NR			N/A	NR
Limits	Min 4.0mg/L Max 12.0mg/L				Max 235CFU/100mL				Min 6.0 Max 9.0				Max 1.6mg/L			

	Total P				TSS				Turbidity			
Prairie Creek	1	7	0.15	6	1	6	40.07	2	1	6	75.33	2
Cox Ditch	1	7	0.15	6	1	6	40.07	2	1	6	75.33	2
Dixon Creek	1	7	0.15	6	1	6	40.07	2	1	6	75.33	2
Buck Creek	1	7	0.17	5	1	6	60.03	1	1	6	149.02	1
Tobin Ditch	1	7	0.17	5	1	6	60.03	1	1	6	149.02	1
Weasel Creek	1	9	0.18	4	1	8	27.18	4	1	8	70.35	3
Teter Branch	1	7	0.2	2	1	6	26.5	5	1	6	32.37	6
Little Cicero Creek	1	8	0.19	3	1	7	32.89	3	1	7	36.31	4
Hinkle Creek	1	8	0.33	1	1	7	32.89	3	1	7	32.84	5
Morse Reservoir/ Cicero Creek			N/A	NR			N/A	NR			N/A	NR
Limits	Max 0.076mg/L				Max 30.0mg/L				Max 10.4 NTU			

Prairie Creek

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/m	Water Surf	Stream Bot	Water Dept	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (NT	TSSolids (p	Silica (mg/l	Silica (mg/l	Cl- (mg/L)	SO4 (mg/L	NO2 (mg/L	NO3 (mg/L	Ophos (mg	Total P (m	Alkalinity (mg
3/6/2003	2.50	29.0136				0.0500	0.4400	7.6500	0.4260	0.2727	0.2100	13.5200					32.0000	27.0000	<0.04	6.2000	0.2300	0.3300	130.0000
5/12/2003	9.48	199.6262	235			0.0500	13.1200	7.2400	0.3073	0.1968	0.1500	9.1700	380.0000	140.0000	7.7000		13.0000	17.0000	<0.20	7.9000	<0.20	0.3100	110.0000
5/22/2003	1.99	23.1313	500			0.0500	14.6000	7.8800	0.5555	0.3559	0.2800	10.5700	20.0000	25.0000	7.6000	8.1000	25.0000	34.0000	<0.20	10.0000	<0.20	0.0890	190.0000
9/23/2003	2.03	15.0495	375	484	109	0.0500	18.8600	7.6600	0.6052	0.3877	0.3100	12.2200	6.9000	14.0000	9.8000	9.6000	27.0000	32.0000	<0.10	7.3000	<0.10	0.0580	240.0000
10/9/2003	0.87	2.7692	390	484	94	0.0500	16.1800	8.1400	0.5889	0.3766	0.3000	12.1500	2.3000	1.6000	3.7000	3.6000	27.0000	37.0000	<0.10	5.9000	<0.10	0.0270	240.0000
11/24/2003	12.17	59.4924	320	484	164	0.0500	8.0200	7.4300	0.5441	0.3479	0.2800	9.4200	41.0000	59.0000	9.3000	9.3000	30.0000	28.0000	<0.10	7.6000	<0.10	0.2200	210.0000
12/4/2003	1.27	0.2020	380	484	104	0.0500	5.2000	7.9600	0.6451	0.4134	0.3300	14.0900	1.8000	0.8000	8.1000	8.1000	31.0000	39.0000	<0.10	7.5000	<0.10	0.0290	260.0000
	4.33	47.04	366.67	484.00	117.75	0.05	10.92	7.71	0.52	0.34	0.27	11.59	75.33	40.07	7.70	7.74	26.43	30.57	#DIV/0!	7.49	0.23	0.152	197.14

Prairie Creek 2

Total Hardı	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield	DIC (m	d13CDIC	±	d18O	±	TKN (mg/L	Total Colifc	E. Coli (co	HPC (color	Chlo-A (mg	MIB (ppb)	Geosmin (p	Calculated	Location D	Comments
200.0000	0.3100	55.0000	16.0000	4.0000	12.0000	8.7000	9.5000	C	32.1000	1.1000	18.6770	22.4124	-10.1250	0.1040	-13.7010	0.0230	1.0000	>24192	377.00	6200.00	<0.10			2.5001	300W - on	2 pipes (1 g
180.0000	0.1000	50.0000	13.0000	2.7000	4.6000	6.2000	7.3000	C	16.5000	3.6000	7.1473	8.5768	-11.9150	0.0140	-15.0410	0.0060	1.4000				<0.1	BDL	BDL	NA		landmark h
310.0000	0.1200	83.0000	25.0000	1.6000	8.2000	3.8000	3.5000	C	54.3000	10.1000	27.0854	32.5025	-12.1100	0.0150			0.4900	46000.00	980.00		0.30	BDL	BDL	1.9916		Uncertain c
340.0000	<0.02	91.0000	27.0000	1.6000	9.6000	3.3000	3.3000	E	57.5000	-7.6000	41.7038	50.0446	-8.9230	0.0050			1.9000	173290.00	3950.00		0.60	BDL	BDL	2.0285		landmark h
340.0000	<0.02	91.0000	28.0000	1.2000	9.2000	2.7000	2.8000	E	60.7000	-7.0000	43.3626	52.0351	-8.5660	0.0090			0.4300	7850.00	2430.00		0.20	BDL	BDL	0.8674		landmark h
300.0000	0.0800	80.0000	24.0000	2.3000	8.7000	4.1000	4.7000	E	56.9000	-0.7000	36.9188	44.3026	-10.4450	0.0010			1.2000	120330.00	3170.00		0.60	BDL	BDL	NA		landmark h
370.0000	0.0600	99.0000	29.0000	1.0000	9.3000	1.9000	1.9000	E	83.4000	2.1000	52.0394	62.4473	-9.5130	0.0040			0.3100	8780.00	410.00		0.50	BDL	BDL	1.2658		landmark h
291.43	0.13	78.43	23.14	2.06	8.80	4.39	4.71	#DIV/0!	51.63	0.23	32.42	38.90	-10.23	0.02	-14.37	0.01	0.96	71250.00	1886.17	6200.00	0.44			1.73		

Prairie Creek 3

green, 1 brown) flowing into stream.
ieight measured from center of bridge west side. Uncertain of where on road deck measurement was taken. Very windy (~30+ mph). Flow too swift to measure.
of where on road deck landmark height was measured.
ieight measured from bottom of road deck
ieight measured from bottom of road deck
ieight measured from bottom of road deck
ieight measured from bottom of road deck

Cox Ditch

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/m3)	Water Surf	Stream Bot	Water Depth (cm)	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (NT	TSSolids (p	Silica (mg/l	Silica (mg/l	Cl- (mg/L)	SO4 (mg/l	NO2 (mg/l	NO3 (mg/l
3/6/2003	2.50	29.0136				0.0500	0.4400	7.6500	0.4260	0.2727	0.2100	13.5200					32.0000	27.0000	<0.04	6.2000
5/12/2003	9.48	199.6262	235			0.0500	13.1200	7.2400	0.3073	0.1968	0.1500	9.1700	380.0000	140.0000	7.7000		13.0000	17.0000	<0.20	7.9000
5/22/2003	1.99	23.1313	500			0.0500	14.6000	7.8800	0.5555	0.3559	0.2800	10.5700	20.0000	25.0000	7.6000	8.1000	25.0000	34.0000	<0.20	10.0000
9/23/2003	2.03	15.0495	375	484	109	0.0500	18.8600	7.6600	0.6052	0.3877	0.3100	12.2200	6.9000	14.0000	9.8000	9.6000	27.0000	32.0000	<0.10	7.3000
10/9/2003	0.87	2.7692	390	484	94	0.0500	16.1800	8.1400	0.5889	0.3766	0.3000	12.1500	2.3000	1.6000	3.7000	3.6000	27.0000	37.0000	<0.10	5.9000
11/24/2003	12.17	59.4924	320	484	164	0.0500	8.0200	7.4300	0.5441	0.3479	0.2800	9.4200	41.0000	59.0000	9.3000	9.3000	30.0000	28.0000	<0.10	7.6000
12/4/2003	1.27	0.2020	380	484	104	0.0500	5.2000	7.9600	0.6451	0.4134	0.3300	14.0900	1.8000	0.8000	8.1000	8.1000	31.0000	39.0000	<0.10	7.5000
	4.33	47.04	366.67	484.00	117.75	0.05	10.92	7.71	0.52	0.34	0.27	11.59	75.33	40.07	7.70	7.74	26.43	30.57	#DIV/0!	7.49

Cox Ditch 2

Ophos (mg	Total P (m	Alkalinity (r	Total Hardı	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield (1(	DIC (mg C.	d13CDIC	±	d18O	±	TKN (mg/l	Total Colifc	E. Coli (co	HPC (color	Chlo-A (mg	MIB (ppb)
0.2300	0.3300	130.0000	200.0000	0.3100	55.0000	16.0000	4.0000	12.0000	8.7000	9.5000	C	32.1000	1.1000	18.6770	22.4124	-10.1250	0.1040	-13.7010	0.0230	1.0000	>24192	377.00	6200.00	<0.10	
<0.20	0.3100	110.0000	180.0000	0.1000	50.0000	13.0000	2.7000	4.6000	6.2000	7.3000	C	16.5000	3.6000	7.1473	8.5768	-11.9150	0.0140	-15.0410	0.0060	1.4000				<0.1	BDL
<0.20	0.0890	190.0000	310.0000	0.1200	83.0000	25.0000	1.6000	8.2000	3.8000	3.5000	C	54.3000	10.1000	27.0854	32.5025	-12.1100	0.0150			0.4900	46000.00	980.00		0.30	BDL
<0.10	0.0580	240.0000	340.0000	<0.02	91.0000	27.0000	1.6000	9.6000	3.3000	3.3000	E	57.5000	-7.6000	41.7038	50.0446	-8.9230	0.0050			1.9000	173290.00	3950.00		0.60	BDL
<0.10	0.0270	240.0000	340.0000	<0.02	91.0000	28.0000	1.2000	9.2000	2.7000	2.8000	E	60.7000	-7.0000	43.3626	52.0351	-8.5660	0.0090			0.4300	7850.00	2430.00		0.20	BDL
<0.10	0.2200	210.0000	300.0000	0.0800	80.0000	24.0000	2.3000	8.7000	4.1000	4.7000	E	56.9000	-0.7000	36.9188	44.3026	-10.4450	0.0010			1.2000	120330.00	3170.00		0.60	BDL
<0.10	0.0290	260.0000	370.0000	0.0600	99.0000	29.0000	1.0000	9.3000	1.9000	1.9000	E	83.4000	2.1000	52.0394	62.4473	-9.5130	0.0040			0.3100	8780.00	410.00		0.50	BDL
0.23	0.152	197.14	291.43	0.13	78.43	23.14	2.06	8.80	4.39	4.71	#DIV/0!	51.63	0.23	32.42	38.90	-10.23	0.02	-14.37	0.01	0.96	71250.00	1886.17	6200.00	0.44	

Cox Ditch 3

Geosmin (	Calculated	Location D	Comments
	2.5001	300W - on	2 pipes (1 green, 1 brown) flowing into stream.
BDL	NA		landmark height measured from center of bridge west side. Uncertain of where on road deck measurement was taken. Very windy (~30+ mph). Flow too swift to measure.
BDL	1.9916		Uncertain of where on road deck landmark height was measured.
BDL	2.0285		landmark height measured from bottom of road deck
BDL	0.8674		landmark height measured from bottom of road deck
BDL	NA		landmark height measured from bottom of road deck
BDL	1.2658		landmark height measured from bottom of road deck
	1.73		

Dixon Creek

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/m3)	Water Surf	Stream Bot	Water Depth (cm)	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (NT	TSSolids (p	Silica (mg/l	Silica (mg/l	Cl- (mg/L)	SO4 (mg/L	NO2 (mg/L	NO3 (mg/L
3/6/2003	2.50	29.0136				0.0500	0.4400	7.6500	0.4260	0.2727	0.2100	13.5200					32.0000	27.0000	<0.04	6.2000
5/12/2003	9.48	199.6262	235			0.0500	13.1200	7.2400	0.3073	0.1968	0.1500	9.1700	380.0000	140.0000	7.7000		13.0000	17.0000	<0.20	7.9000
5/22/2003	1.99	23.1313	500			0.0500	14.6000	7.8800	0.5555	0.3559	0.2800	10.5700	20.0000	25.0000	7.6000	8.1000	25.0000	34.0000	<0.20	10.0000
9/23/2003	2.03	15.0495	375	484	109	0.0500	18.8600	7.6600	0.6052	0.3877	0.3100	12.2200	6.9000	14.0000	9.8000	9.6000	27.0000	32.0000	<0.10	7.3000
10/9/2003	0.87	2.7692	390	484	94	0.0500	16.1800	8.1400	0.5889	0.3766	0.3000	12.1500	2.3000	1.6000	3.7000	3.6000	27.0000	37.0000	<0.10	5.9000
11/24/2003	12.17	59.4924	320	484	164	0.0500	8.0200	7.4300	0.5441	0.3479	0.2800	9.4200	41.0000	59.0000	9.3000	9.3000	30.0000	28.0000	<0.10	7.6000
12/4/2003	1.27	0.2020	380	484	104	0.0500	5.2000	7.9600	0.6451	0.4134	0.3300	14.0900	1.8000	0.8000	8.1000	8.1000	31.0000	39.0000	<0.10	7.5000
	4.33	47.04	366.67	484.00	117.75	0.05	10.92	7.71	0.52	0.34	0.27	11.59	75.33	40.07	7.70	7.74	26.43	30.57	#DIV/0!	7.49

Dixon Creek 2

Ophos (m	Total P (m	Alkalinity (r	Total Hard	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield (1(	DIC (mg C.	d13CDIC	±	d18O	±	TKN (mg/l	Total Colifo	E. Coli (co	HPC (color	Chlo-A (mg	MIB (ppb)
0.2300	0.3300	130.0000	200.0000	0.3100	55.0000	16.0000	4.0000	12.0000	8.7000	9.5000	C	32.1000	1.1000	18.6770	22.4124	-10.1250	0.1040	-13.7010	0.0230	1.0000	>24192	377.00	6200.00	<0.10	
<0.20	0.3100	110.0000	180.0000	0.1000	50.0000	13.0000	2.7000	4.6000	6.2000	7.3000	C	16.5000	3.6000	7.1473	8.5768	-11.9150	0.0140	-15.0410	0.0060	1.4000				<0.1	BDL
<0.20	0.0890	190.0000	310.0000	0.1200	83.0000	25.0000	1.6000	8.2000	3.8000	3.5000	C	54.3000	10.1000	27.0854	32.5025	-12.1100	0.0150			0.4900	46000.00	980.00		0.30	BDL
<0.10	0.0580	240.0000	340.0000	<0.02	91.0000	27.0000	1.6000	9.6000	3.3000	3.3000	E	57.5000	-7.6000	41.7038	50.0446	-8.9230	0.0050			1.9000	173290.00	3950.00		0.60	BDL
<0.10	0.0270	240.0000	340.0000	<0.02	91.0000	28.0000	1.2000	9.2000	2.7000	2.8000	E	60.7000	-7.0000	43.3626	52.0351	-8.5660	0.0090			0.4300	7850.00	2430.00		0.20	BDL
<0.10	0.2200	210.0000	300.0000	0.0800	80.0000	24.0000	2.3000	8.7000	4.1000	4.7000	E	56.9000	-0.7000	36.9188	44.3026	-10.4450	0.0010			1.2000	120330.00	3170.00		0.60	BDL
<0.10	0.0290	260.0000	370.0000	0.0600	99.0000	29.0000	1.0000	9.3000	1.9000	1.9000	E	83.4000	2.1000	52.0394	62.4473	-9.5130	0.0040			0.3100	8780.00	410.00		0.50	BDL
0.23	0.15	197.14	291.43	0.13	78.43	23.14	2.06	8.80	4.39	4.71	#DIV/0!	51.63	0.23	32.42	38.90	-10.23	0.02	-14.37	0.01	0.96	71250.00	1886.17	6200.00	0.44	

Dixon Creek 3

Geosmin (µ	Calculated	Location D	Comments
	2.5001	300W - on	2 pipes (1 green, 1 brown) flowing into stream.
BDL	NA		landmark height measured from center of bridge west side. Uncertain of where on road deck measurement was taken. Very windy (~30+ mph). Flow too swift to measure.
BDL	1.9916		Uncertain of where on road deck landmark height was measured.
BDL	2.0285		landmark height measured from bottom of road deck
BDL	0.8674		landmark height measured from bottom of road deck
BDL	NA		landmark height measured from bottom of road deck
BDL	1.2658		landmark height measured from bottom of road deck
	1.73		

Buck Creek

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/m3)	Water Surf	Stream Bot	Water Depth (cm)	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (N	TSSolids (pp	Silica (mg/l	Silica (mg/l	Cl- (mg/L)	SO_4 (mg/L	NO_2 (mg/L	NO_3 (mg/L
3/6/2003	4.31	31.1111				0.0500	-0.1000	7.6200	0.4110	0.2630	0.2100	13.7200					37.0000	26.0000	<0.04	5.6000
5/12/2003	14.69	276.2617	270			0.0500	12.1500	7.3800	0.2588	0.1674	0.1200	9.5600	810.0000	260.0000	6.9000		12.0000	14.0000	<0.20	6.4000
5/22/2003	2.56	34.0206	560	601	41	0.0500	13.4300	7.7700	0.5712	0.3656	0.2900	10.6300	29.0000	27.0000	7.6000	7.9000	31.0000	35.0000	<0.20	10.0000
9/23/2003	3.92	9.1000	540	601	61	0.0500	17.4900	7.7400	0.6145	0.3932	0.3100	11.2600	6.6000	13.0000	9.6000	9.8000	33.0000	32.0000	<0.10	7.0000
10/9/2003	1.45	0.8290	565	601	36	0.0500	15.7800	8.0600	0.6168	0.3648	0.3200	10.3500	1.9000	0.8000	4.1000	4.1000	31.0000	39.0000	<0.10	6.2000
11/24/2003	18.35	59.5897	500	601	101	0.0500	8.4300	7.4500	0.5580	0.3571	0.2800	9.0700	45.0000	59.0000	8.5000	9.0000	32.0000	30.0000	<0.10	7.1000
12/4/2003	1.94	0.7143	565	601	36	0.0500	5.0700	8.0100	0.6757	0.4330	0.3500	13.8300	1.6000	0.4000	8.3000	8.5000	36.0000	40.0000	<0.10	7.6000
	6.74	58.80	500.00	601.00	55.00	0.05	10.32	7.72	0.53	0.33	0.27	11.20	149.02	60.03	7.50	7.86	30.29	30.86		7.13

Buck Creek 2

Ophos (m	Total P (m	Alkalinity (r	Total Hard	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield (1(	DIC (mg C	d13CDIC	±	d18O	±	TKN (mg/l	Total Colifo	E. Coli (co	HPC (color	Chlo-A (mg	MIB (ppb)
0.2500	0.3400	120.0000	190.0000	0.2900	52.0000	15.0000	4.4000	17.0000	9.1000	10.0000	E	36.0000	4.6000	20.2032	24.2438	-10.3630	0.0200	-14.4350	0.0260	1.2000	>24192	813.00	10000.00	<0.10	
<0.20	0.4100	92.0000	150.0000	0.1200	42.0000	10.0000	3.6000	4.8000	6.5000	7.3000	E	26.7000	4.2000	14.5250	17.4300	-11.5180	0.0060	-11.4920	0.0050	2.0000				<0.1	BDL
<0.20	0.0730	200.0000	310.0000	0.0730	83.0000	24.0000	1.9000	11.0000	3.7000	3.8000	E	54.9000	8.1000	30.0284	36.0341	-10.8250	0.0030			0.6700	31000.00	850.00		0.30	BDL
<0.10	0.0670	240.0000	330.0000	0.0440	88.0000	26.0000	2.2000	14.0000	3.7000	3.7000	E	56.1000	-7.3000	40.6192	48.7430	-9.8370	0.0020			1.4000	173290.00	630.00		0.60	BDL
<0.10	0.0290	240.0000	350.0000	0.0400	93.0000	28.0000	1.4000	12.0000	2.8000	2.8000	E	62.1000	-6.9000	44.1920	53.0304	-9.6490	0.0080			0.5100	12240.00	310.00		0.20	BDL
<0.10	0.2500	210.0000	300.0000	0.1100	80.0000	24.0000	2.3000	11.0000	3.9000	4.7000	E	61.0000	-0.9000	39.6622	47.5946	-10.5160	0.0060			1.1000	155310.00	11190.00		0.90	BDL
<0.10	0.0360	260.0000	420.0000	0.0300	100.0000	37.0000	1.3000	14.0000	2.0000	2.0000	E	84.1000	2.1000	52.4860	62.9832	-9.7740	0.0040			BDL	10460.00	980.00		0.50	BDL
0.25	0.172	194.57	292.86	0.10	76.86	23.43	2.44	11.97	4.53	4.90		54.41	0.56	34.53	41.44	-10.35	0.01	-12.96	0.02	1.15	76460.00	2462.17	10000.00	0.50	

Buck Creek 3

Geosmin (ı	Calculated	Location D	Comments
	4.3061	CR 600. ea	lots of ice floating. 2 pipes on both sides of bridge
BDL	NA		landmark height measured from center of bridge at drainage on N side at bridge outer ledge. Uncertain of where on road deck measurement was taken. Flow too swift to measure.
BDL	2.5617		landmark height measured from bottom of road deck
BDL	3.9210		landmark height measured from bottom of road deck
BDL	1.4522		landmark height measured from bottom of road deck
BDL	NA		landmark height measured from bottom of road deck
BDL	1.9448		landmark height measured from bottom of road deck
	2.84		

Tobin Ditch

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/m3)	Water Surf	Stream Bot	Water Depth (cm)	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (N	TSSolids (pp	Silica (mg/l	Silica (mg/l	Cl- (mg/L)	SO4 (mg/L	NO2 (mg/l
3/6/2003	4.31	31.1111				0.0500	-0.1000	7.6200	0.4110	0.2630	0.2100	13.7200					37.0000	26.0000	<0.04
5/12/2003	14.69	276.2617	270			0.0500	12.1500	7.3800	0.2588	0.1674	0.1200	9.5600	810.0000	260.0000	6.9000		12.0000	14.0000	<0.20
5/22/2003	2.56	34.0206	560	601	41	0.0500	13.4300	7.7700	0.5712	0.3656	0.2900	10.6300	29.0000	27.0000	7.6000	7.9000	31.0000	35.0000	<0.20
9/23/2003	3.92	9.1000	540	601	61	0.0500	17.4900	7.7400	0.6145	0.3932	0.3100	11.2600	6.6000	13.0000	9.6000	9.8000	33.0000	32.0000	<0.10
10/9/2003	1.45	0.8290	565	601	36	0.0500	15.7800	8.0600	0.6168	0.3648	0.3200	10.3500	1.9000	0.8000	4.1000	4.1000	31.0000	39.0000	<0.10
11/24/2003	18.35	59.5897	500	601	101	0.0500	8.4300	7.4500	0.5580	0.3571	0.2800	9.0700	45.0000	59.0000	8.5000	9.0000	32.0000	30.0000	<0.10
12/4/2003	1.94	0.7143	565	601	36	0.0500	5.0700	8.0100	0.6757	0.4330	0.3500	13.8300	1.6000	0.4000	8.3000	8.5000	36.0000	40.0000	<0.10
	6.74	58.80	500.00	601.00	55.00	0.05	10.32	7.72	0.53	0.33	0.27	11.20	149.02	60.03	7.50	7.86	30.29	30.86	

Tobin Ditch 2

NO3 (mg/l	Ophos (mg	Total P (m	Alkalinity (r	Total Hardı	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield (1(	DIC (mg C.	d13CDIC	±	d18O	±	TKN (mg/l	Total Colifc	E. Coli (co	HPC (color	Chlo-A (mg
5.6000	0.2500	0.3400	120.0000	190.0000	0.2900	52.0000	15.0000	4.4000	17.0000	9.1000	10.0000	E	36.0000	4.6000	20.2032	24.2438	-10.3630	0.0200	-14.4350	0.0260	1.2000	>24192	813.00	10000.00	<0.10
6.4000	<0.20	0.4100	92.0000	150.0000	0.1200	42.0000	10.0000	3.6000	4.8000	6.5000	7.3000	E	26.7000	4.2000	14.5250	17.4300	-11.5180	0.0060	-11.4920	0.0050	2.0000				<0.1
10.0000	<0.20	0.0730	200.0000	310.0000	0.0730	83.0000	24.0000	1.9000	11.0000	3.7000	3.8000	E	54.9000	8.1000	30.0284	36.0341	-10.8250	0.0030			0.6700	31000.00	850.00		0.30
7.0000	<0.10	0.0670	240.0000	330.0000	0.0440	88.0000	26.0000	2.2000	14.0000	3.7000	3.7000	E	56.1000	-7.3000	40.6192	48.7430	-9.8370	0.0020			1.4000	173290.00	630.00		0.60
6.2000	<0.10	0.0290	240.0000	350.0000	0.0400	93.0000	28.0000	1.4000	12.0000	2.8000	2.8000	E	62.1000	-6.9000	44.1920	53.0304	-9.6490	0.0080			0.5100	12240.00	310.00		0.20
7.1000	<0.10	0.2500	210.0000	300.0000	0.1100	80.0000	24.0000	2.3000	11.0000	3.9000	4.7000	E	61.0000	-0.9000	39.6622	47.5946	-10.5160	0.0060			1.1000	155310.00	11190.00		0.90
7.6000	<0.10	0.0360	260.0000	420.0000	0.0300	100.0000	37.0000	1.3000	14.0000	2.0000	2.0000	E	84.1000	2.1000	52.4860	62.9832	-9.7740	0.0040			BDL	10460.00	980.00		0.50
7.13	0.25	0.172	194.57	292.86	0.10	76.86	23.43	2.44	11.97	4.53	4.90		54.41	0.56	34.53	41.44	-10.35	0.01	-12.96	0.02	1.15	76460.00	2462.17	10000.00	0.50

Tobin Ditch 3

MIB (ppb)	Geosmin (p	Calculated	Location D	Comments
		4.3061	CR 600. ea	lots of ice floating. 2 pipes on both sides of bridge
BDL	BDL	NA		landmark height measured from center of bridge at drainage on N side at bridge outer ledge. Uncertain of where on road deck measurement was taken. Flow too swift to measure.
BDL	BDL	2.5617		landmark height measured from bottom of road deck
BDL	BDL	3.9210		landmark height measured from bottom of road deck
BDL	BDL	1.4522		landmark height measured from bottom of road deck
BDL	BDL	NA		landmark height measured from bottom of road deck
BDL	BDL	1.9448		landmark height measured from bottom of road deck
		2.84		

Weasel Creek

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/m3)	Water Surf	Stream Bot	Water Depth (cm)	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (N	TSSolids (|	Silica (mg/l	Silica (mg/l	Cl- (mg/L)	SO4 (mg/L	NO2 (mg/L
3/6/2003	5.02	34.8649				0.0500	0.5200	7.8500	0.4123	0.2639	0.2100	14.2700					37.0000	26.0000	<0.04
5/12/2003	18.06	202.9630	365	641	276	0.0500	13.1400	7.4200	0.2395	0.1527	0.1100	9.0600	450.0000	94.0000	7.4000		10.0000	12.0000	<0.20
5/22/2003	3.19	25.6122	610	641	31	0.0500	15.2300	7.9000	0.5888	0.3767	0.3000	11.2900	21.0000	19.0000	7.8000	7.8000	31.0000	36.0000	<0.20
7/10/2003		23.9604	400	641	241	0.0500	22.4000	7.4500	0.2908	0.1862	0.1400	6.8200	21.0000	24.0000	8.1000	8.5000	11.0000	12.0000	
9/23/2003	5.55	14.5833	585	641	56	0.0500	17.1100	7.7800	0.5957	0.3813	0.3000	9.6800	8.2000	12.0000	9.3000	9.3000	31.0000	30.0000	<0.10
9/23/2003		1.4368					19.2400	7.7500	0.7462	0.4778	0.3900	8.8600	1.7000	2.4000	11.0000	11.0000	61.0000	22.0000	<0.10
10/9/2003	1.86	1.6580	610	641	31	0.0500	15.5900	8.0000	0.6372	0.4077	0.3300	10.4200	2.1000	1.6000	4.9000	4.9000	35.0000	39.0000	<0.10
11/24/2003	25.32	60.5102	540	641	101	0.0500	8.9800	7.4600	0.5400	0.3458	0.2700	9.3300	57.0000	64.0000	7.6000	8.1000	31.0000	28.0000	<0.10
12/4/2003	2.92	0.3077	600	641	41	0.0500	4.8500	7.9800	0.6788	0.4344	0.3500	15.9900	1.8000	0.4000	7.8000	7.8000	38.0000	37.0000	<0.10
	8.85	40.66	530.00	641.00	111.00	0.05	13.01	7.73	0.53	0.34	0.27	10.64	70.35	27.18	7.99	8.20	31.67	26.89	#DIV/0!

Weasel Creek 2

NO3 (mg/l	Ophos (mg	Total P (m	Alkalinity (r	Total Hardı	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield (1(	DIC (mg C.	d13CDIC	±	d18O	±	TKN (mg/l	Total Colifc	E. Coli (co	HPC (color	Chlo-A (mg
5.5000	0.2400	0.3200	120.0000	190.0000	0.2900	53.0000	15.0000	4.3000	18.0000	8.9000	9.7000	C	32.7000	4.6000	16.8297	20.1956	-10.1890	0.0080	-14.8330	0.0100	1.5000	>24192	784.00	5100.00	<0.10
5.9000	<0.20	0.3800	90.0000	150.0000	0.2000	42.0000	11.0000	3.6000	3.9000	7.7000	8.2000	C	14.8000	3.1000	6.3829	7.6595	-12.6220	0.0080	-14.8990	0.0080	1.5000				<0.1
9.7000	<0.20	0.1100	200.0000	320.0000	0.1400	86.0000	26.0000	1.8000	12.0000	3.6000	3.5000	E	63.8000	7.0000	36.4084	43.6901	-9.6940	0.0040			0.5700	100000.00	720.00		0.30
4.6000	BDL	0.2700	100.0000	140.0000	0.0800	41.0000	11.0000	3.5000	4.6000	6.5000	6.3000										0.7200	NS	NS		
6.7000	<0.10	0.0980	230.0000	320.0000	0.0580	86.0000	25.0000	2.0000	12.0000	3.9000	3.8000	E	53.2000	-9.2000	39.9812	47.9774	-10.4640	0.0040			8.6000	241920.00	7270.00		0.60
2.8000	<0.10	0.0780	290.0000	350.0000	<0.02	96.0000	28.0000	1.4000	37.0000	1.9000	1.8000	E	67.1000	-8.3000	48.2752	57.9302	-12.0430	0.0070			1.2000	111990.00	980.00		0.70
5.8000	<0.10	0.0470	260.0000	350.0000	<0.02	93.0000	28.0000	1.7000	15.0000	2.8000	3.0000	E	64.3000	-7.1000	45.7232	54.8678	-9.5030	0.0030			0.7800	9330.00	2010.00		0.20
6.0000	<0.10	0.2800	210.0000	290.0000	0.1000	78.0000	23.0000	2.6000	11.0000	4.1000	4.4000	E	9.2000	-1.4000	6.9328	8.3194	-10.2180	0.0020			1.4000	198630.00	19350.00		0.70
4.5000	<0.10	0.0390	270.0000	370.0000	0.0900	100.0000	29.0000	1.8000	15.0000	2.1000	2.2000	E	86.3000	1.9000	54.0172	64.8206	-10.8470	0.0030			0.3700	8360.00	850.00		0.50
5.72	0.24	0.180	196.67	275.56	0.14	75.00	21.78	2.52	14.28	4.61	4.77	#DIV/0!	48.93	-1.18	31.82	38.18	-10.70	0.00	-14.87	0.01	1.85	111705.00	4566.29	5100.00	0.50

Weasel Creek 3

MIB (ppb)	Geosmin ((	Calculated	Location D	Comments
		5.0154	266th St. - east of HWY19 - north side of bridge	
BDL	BDL	NA		landmark height measured at bottom of row deck from the center of bridge north side. Flow too swift to measure. Road flooded to west of bridge.
BDL	BDL	3.1936		landmark height measured from bottom of road deck
		NA		Only inflow points into reservoir were collected on this sampling day. landmark height measured from bottom of road deck.
BDL	BDL	5.5543		landmark height measured from bottom of road deck
BDL	BDL			
BDL	BDL	1.8632		landmark height measured from bottom of road deck
BDL	BDL	NA		landmark height measured from bottom of road deck
BDL	BDL	2.9208		landmark height measured from bottom of road deck
		3.71		

Teter Branch

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/n	Water Surf	Stream Bot	Water Depth (cm	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (N	TSSolids (r	Silica (mg/l	Silica (mg/l	Cl- (mg/L)	SO4 (mg/L	NO2 (mg/L	NO3 (mg/L	Ophos (mg	Total P (m
3/6/2003	1.27	11.2985				0.0500	0.6400	7.7400	0.4008	0.2566	0.2000	14.2200					36.0000	25.0000	<0.04	3.9000	0.3400	0.3700
5/12/2003	2.57	106.9725	260	345	85	0.0500	13.4300	7.3600	0.3667	0.2348	0.1800	8.4300	110.0000	76.0000	7.9000		20.0000	20.0000	<0.20	6.2000	<0.20	0.2800
5/22/2003	0.46	14.0404	290	315	25	0.0500	14.3400	7.9300	0.6111	0.3910	0.3100	10.4400	11.0000	15.0000	8.5000	8.5000	40.0000	37.0000	<0.20	7.0000	<0.20	0.1100
9/23/2003	0.32	4.5263	280	315	35	0.0500	16.8500	7.8600	0.5511	0.3530	0.2800	11.3800	4.1000	1.6000	9.0000	9.3000	36.0000	29.0000	<0.10	3.7000	<0.10	0.1400
10/9/2003	0.16	1.6327	280	315	35	0.0500	15.0900	8.1700	0.6202	0.3967	0.3200	12.3600	2.4000	6.0000	4.9000	4.9000	42.0000	40.0000	<0.10	3.3000	<0.10	0.0600
11/24/2003	3.38	67.7387	220	315	95	0.0500	7.6100	7.3300	0.4040	0.2585	0.2000	9.2200	65.0000	60.0000	8.5000	9.0000	26.0000	19.0000	<0.10	4.2000	0.1300	0.4200
12/4/2003	0.43	1.5764	275	315	40	0.0500	4.8600	8.0400	0.6391	0.4093	0.3300	16.4600	1.7000	0.4000	8.8000	8.8000	31.0000	39.0000	<0.10	2.5000	<0.10	0.0490
	1.23	29.68	267.50	320.00	52.50	0.05	10.40	7.78	0.51	0.33	0.26	11.79	32.37	26.50	7.93	8.10	33.00	29.86	#DIV/0!	4.40	0.24	0.204

Teter Branch 2

Alkalinity (r	Total Hardı	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield	DIC (m	d13CDIC	±	d18O	±	TKN (mg/l	Total Colifc	E. Coli (co	HPC (color	Chlo-A (mg	MIB (ppb)	Geosmin (p	Calculated	Location D
130.0000	190.0000	0.2900	50.0000	15.0000	5.4000	15.0000	10.0000	11.0000	E	36.2000	4.5000	20.3946	24.4735	-11.2650	0.0280	-14.2730	0.0090	1.0000	>24192	911.00	7200.00	<0.10			1.2658	500W on w
120.0000	190.0000	0.1900	54.0000	15.0000	3.8000	9.0000	6.6000	7.4000	E	39.7000	3.6000	23.2018	27.8422	-12.1990	0.0140	-12.1290	0.0070	1.2000				<0.1	BDL	BDL	NA	
210.0000	320.0000	0.1400	86.0000	26.0000	2.4000	19.0000	3.2000	3.1000	C	52.4000	9.3000	26.3847	31.6616	-12.4030	0.0090			0.4900	58000.00	1600.00		0.30	BDL	BDL	0.4591	
210.0000	280.0000	0.0640	76.0000	21.0000	3.3000	18.0000	4.4000	4.5000	E	48.4000	-7.9000	36.0894	43.3073	-10.1120	0.0030			1.4000	98040.00	2920.00		0.70	BDL	BDL	0.3155	
240.0000	330.0000	<0.02	88.0000	27.0000	2.5000	20.0000	2.9000	3.1000	E	55.6000	-7.1000	40.1726	48.2071	-10.2130	0.0070			0.8100	12110.00	930.00		0.20	BDL	BDL	0.1623	
150.0000	210.0000	0.0500	57.0000	16.0000	4.8000	9.0000	6.6000	7.8000	E	41.7000	-1.4000	27.6678	33.2014	-12.0090	0.0340			1.6000	241920.00	1320.00		0.60	BDL	5.00	NA	
250.0000	340.0000	0.0500	93.0000	27.0000	1.8000	15.0000	2.1000	2.2000	E	80.3000	2.2000	49.9978	59.9974	-12.1010	0.0020			0.3400	11690.00	1750.00		0.50	BDL	BDL	0.4265	
187.14	265.71	0.13	72.00	21.00	3.43	15.00	5.11	5.59	#DIV/0!	50.61	0.46	31.99	38.38	-11.47	0.01	-13.20	0.01	0.98	84352.00	1571.83	7200.00	0.46		5.00	0.53	

Teter Branch 3

Comments

est side of bridge, north of 276th St.

landmark height measured from cetner of bridge on west side at top of road deck. Flow too swift to measure.

landmark height measured from cetner of bridge on west side at bottom of road deck.

landmark height measured from bottom of road deck

landmark height measured from bottom of road deck

landmark height measured from bottom of road deck

landmark height measured from bottom of road deck

Little Cicero Creek

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/m	Water Surf	Stream Bot	Water Depth (cm	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (N	TSSolids (p	Silica (mg/L) (filtere	Silica (mg/L	Cl- (mg/L)	SO4 (mg/L	NO2 (mg/L	NO3 (mg/L
3/6/2003	2.48	25.5556				0.0500	-0.0800	7.9400	0.3504	0.2242	0.1700	14.7100					31.0000	22.0000	<0.04	4.2000
5/12/2003	5.82	152.1495	350	443	93	0.0500	13.6500	7.4400	0.3506	0.2244	0.1700	9.3100	150.0000	100.0000	7.9000		17.0000	18.0000	<0.20	8.4000
5/22/2003	0.90	14.5918	390	443	53	0.0500	14.6500	8.0600	0.5975	0.3824	0.3100	10.0400	12.0000	12.0000	7.9000	8.1000	35.0000	34.0000	<0.20	8.9000
7/10/2003		30.3448	340	443	103	0.0500	21.9400	7.4000	0.2780	0.1779	0.1300	8.0300	30.0000	35.0000	9.0000	8.1000	12.0000	11.0000		4.5000
9/23/2003	0.83	25.8462	385	443	58	0.0500	16.3100	7.8600	0.6182	0.3954	0.3200	10.6900	9.0000	9.2000	6.3000	6.3000	42.0000	37.0000	<0.10	4.9000
10/9/2003	0.44	1.9487	410	459	49	0.0500	15.1100	7.8900	0.6140	0.3929	0.3100	11.1900	2.8000	1.6000	4.8000	4.9000	35.0000	36.0000	<0.10	5.0000
11/24/2003	8.20	72.4378	355	443	88	0.0500	8.4800	7.4900	0.5195	0.3326	0.2600	9.3300	49.0000	72.0000	8.3000	8.5000	30.0000	26.0000	<0.10	7.0000
12/4/2003	0.92	3.0000	390	443	53	0.0500	4.3500	7.9900	0.6311	0.4084	0.3200	14.8300	1.4000	0.4000	7.6000	7.8000	34.0000	34.0000	<0.10	6.4000
	2.80	40.73	374.29	445.29	71.00	0.05	11.80	7.76	0.49	0.32	0.25	11.02	36.31	32.89	7.40	7.28	29.50	27.25	#DIV/0!	6.16

Little Cicero 2

Ophos (mg	Total P (m	Alkalinity (r	Total Hardı	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield	DIC (m	d13CDIC	±	d18O	±	TKN (mg/L	Total Colifc	E. Coli (co	HPC (color	Chlo-A (mg	MIB (ppb)	Geosmin (p
0.2900	0.3200	110.0000	170.0000	0.2300	45.0000	13.0000	4.9000	16.0000	11.0000	12.0000	E	35.8000	1.0000	22.3724	26.8469	-10.3880	0.0120	-11.1580	0.0210	1.2000	>24192	323.00	9200.00	<0.10		
<0.20	0.2600	110.0000	190.0000	0.1700	53.0000	14.0000	3.6000	6.3000	6.6000	7.0000	E	35.1000	3.3000	20.4584	24.5501	-11.2520	0.0100	-11.6210	0.0100	1.3000				<0.1	BDL	BDL
<0.20	0.0380	200.0000	320.0000	0.2000	87.0000	26.0000	1.9000	16.0000	3.2000	2.9000	C	42.9000	8.7000	20.7154	24.8585	-12.4360	0.0060			0.5100	28000.00	850.00		0.30	BDL	BDL
BDL	0.3300	98.0000	140.0000	0.0640	38.0000	10.0000	4.4000	4.7000	7.7000	7.6000										0.7500	NS	NS				
<0.10	0.1100	230.0000	310.0000	<0.02	82.0000	25.0000	3.3000	32.0000	4.1000	4.0000	E	51.0000	-8.7000	38.2586	45.9103	-10.0680	0.0030			2.4000	155310.00	4800.00		0.60	BDL	BDL
<0.10	0.0450	260.0000	340.0000	<0.02	92.0000	27.0000	1.9000	14.0000	2.6000	2.8000	E	63.2000	-7.2000	45.0852	54.1022	-9.9740	0.0030			0.6000	16690.00	2330.00		1.60	BDL	BDL
<0.10	0.3500	200.0000	280.0000	0.0600	75.0000	22.0000	3.1000	10.0000	4.4000	5.0000	E	54.0000	-1.5000	35.5790	42.6948	-10.5200	0.0050			0.9000	198630.00	6570.00			BDL	BDL
<0.10	0.0370	250.0000	350.0000	<0.02	95.0000	27.0000	1.6000	12.0000	2.0000	2.0000	E	86.6000	1.6000	54.4000	65.2800	-9.9080	0.0060			BDL	13740.00	1750.00		0.50	BDL	BDL
0.29	0.186	182.25	262.50	0.14	70.88	20.50	3.09	13.88	5.20	5.41	#DIV/0!	52.66	-0.40	33.84	40.61	-10.65	0.01	-11.39	0.02	1.09	82474.00	2770.50	9200.00	0.75		

Little Cicero 3

Calculated	Location D	Comments
NA	256th St. -	frozen mostly across. Beaver signs of damage. Water frozen at 2 levels so streamflow could not be mesured.
NA		landmark height measured at bottom of road deck on north side of bridge. Flow too swift to measure.
0.8953	*took replic	landmark height measured from bottom of road deck on north side. *took replicate sample
NA		Only inflow points into reservoir were collected on this sampling day. landmark height measured from bottom of road deck.
0.8313		landmark height measured from bottom of road deck
0.4391		landmark height measured from top of road deck
NA		landmark height measured from bottom of road deck
0.9201		landmark height measured from bottom of road deck
0.77		

Hinkle Creek

CEES WQ
2003 Study

Date	Esti-Q	TSSed (g/m	Water Surf	Stream Bot	Water Depth (cm	Sample De	Temp. (°C)	pH	SpC (mS)	TDS (g/L)	Salinity (pp	DO (mg/L)	Turbidity (N	TSSolids (p	Silica (mg/L) (filtere	Silica (mg/L	Cl- (mg/L)	SO4 (mg/L	NO2 (mg/L
3/6/2003	1.00	9.6410				0.0500	2.0400	8.0900	0.4874	0.3117	0.2500	15.2800					50.0000	30.0000	<0.04
5/12/2003	2.65	89.6296	420	468	48	0.0500	13.9400	7.6200	0.3935	0.2603	0.2000	10.2700	86.0000	66.0000	8.3000		21.0000	23.0000	<0.20
5/21/2003	0.34	12.8866	420	433	13	0.0500	15.5400	8.0900	0.5928	0.3795	0.3000	12.1700	8.7000	10.0000	8.1000	8.1000	32.0000	37.0000	<0.20
7/10/2003		28.3673	360	433	73	0.0500	21.8000	7.5700	0.3025	0.1937	0.1500	7.2000	28.0000	47.0000	9.6000	8.7000	13.0000	14.0000	
9/23/2003	0.46	6.9792	500	433		0.0500	15.6800	7.4500	0.5532	0.3544	0.2800	10.4200	8.0000	6.0000	9.6000	9.6000	30.0000	32.0000	<0.10
10/9/2003	0.23	1.9689	450	468	18	0.0500	13.7500	6.5000	0.6288	0.4027	0.3200	11.8900	2.5000	0.4000	7.6000	7.6000	32.0000	39.0000	<0.10
11/24/2003	4.41	103.7624	365	433	68	0.0500	7.3700	7.3000	0.3608	0.2309	0.1800	9.5100	94.0000	100.0000	7.6000	8.5000	25.0000	18.0000	<0.10
12/4/2003	0.55	1.7347	410	433	23	0.0500	4.4000	7.9000	0.6380	0.4082	0.3300	15.2100	2.7000	0.8000	7.8000	7.8000	34.0000	38.0000	<0.10
	1.38	31.87	417.86	443.00	40.50	0.05	11.82	7.57	0.49	0.32	0.25	11.49	32.84	32.89	8.37	8.38	29.63	28.88	#DIV/0!

Hinkle Creek 2

NO3 (mg/l	Ophos (m	Total P (m	Alkalinity (r	Total Hardı	NH4-N (m	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	DOC (mg	TOC (mg	Vac Line	Trans	Zero	CO2 Yield	DIC (m	d13CDIC	±	d18O	±	TKN (mg/l	Total Colif	E. Coli (co	HPC (color	Chlo-A (mg	MIB (ppb)
2.8000	0.1100	0.1600	150.0000	230.0000	0.3000	62.0000	17.0000	3.4000	26.0000	8.1000	8.7000	C	30.2000	1.3000	17.3393	20.8072	-11.7640	0.0080	-14.6930	0.0510	0.9900	>24192	408.00	4600.00	<0.10	
5.1000	<0.20	0.2600	150.0000	220.0000	0.1900	61.0000	16.0000	3.6000	10.0000	6.6000	7.0000	C	22.4000	3.7000	10.8419	13.0103	-12.9120	0.0120	-17.5500	0.0090	1.1000				<0.1	BDL
3.6000	<0.20	0.0890	230.0000	320.0000	0.1500	88.0000	25.0000	1.9000	16.0000	3.3000	3.5000	E	75.5000	7.0000	43.8730	52.6476	-11.5240	0.0060			0.4900	61000.00	980.00		0.30	BDL
1.8000	BDL	0.2700	110.0000	150.0000	0.0480	42.0000	11.0000	4.4000	7.0000	7.7000	7.8000										0.5000	NS	NS			
2.4000	<0.10	0.1200	230.0000	290.0000	<0.02	81.0000	22.0000	3.0000	16.0000	5.3000	5.3000	E	49.7000	-9.4000	37.8758	45.4510	-11.6310	0.0030			5.8000	241920.00	15650.00		0.60	BDL
1.5000	<0.10	0.0370	280.0000	350.0000	<0.02	97.0000	27.0000	1.8000	17.0000	3.2000	3.4000	E	72.1000	-7.1000	50.6996	60.8395	-11.7810	0.0040			0.5100	6950.00	410.00		0.20	BDL
2.1000	0.2900	1.7000	150.0000	180.0000	0.0800	51.0000	14.0000	5.5000	10.0000	7.8000	8.3000	E	34.9000	-2.0000	23.7122	28.4546	-12.6190	0.0100			1.5000	>241920	9540.00		0.70	BDL
2.4000	<0.10	0.0320	270.0000	350.0000	0.0400	98.0000	27.0000	1.4000	16.0000	2.4000	2.4000	E	80.1000	1.5000	50.3168	60.3802	-11.4440	0.0040			0.4000	12360.00	1870.00		0.50	BDL
2.71	0.20	0.334	196.25	261.25	0.13	72.50	19.88	3.13	14.75	5.55	5.80	#DIV/0!	52.13	-0.71	33.52	40.23	-11.95	0.01	-16.12	0.03	1.41	80557.50	4809.67	4600.00	0.46	

Hinkle Creek 3

Geosmin (	Calculated	Location D	Comments
	0.9996	216th St. -	gravely bottom
BDL	NA		landmark height mesaured from top of row deck at center of bridge on north side. Flow too swift to measure.
BDL	0.3411		landmark height measured from bottom of road deck
	NA		Only inflow points into reservoir were collected on this sampling day. landmark height measured from bottom of road deck.
BDL	0.4585		landmark height measured from bottom of road deck
BDL	0.2283		landmark height measured from top of road deck
6.50	4.4140		landmark height measured from bottom of road deck
BDL	0.5543		landmark height measured from bottom of road deck
6.50	1.17		

Morse Reservoir

Center for Earth and Environmental Science

Indiana University ~ Purdue University, Indianapolis

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http://www.cees.iupui.edu/research/water_resources/ciwrp/Algae_Information

CIWRP 2008 Research Project

About CEES

About Veolia Water Indianapolis

Blue-Green Algae Dynamics and Algal Toxicity: A Study of Central Indiana Reservoirs

Following the documentation of toxic blue-green algae and an algal toxin in Geist Reservoir last year, CIWRP research into blue-green algae has been expanded into a comprehensive research program for 2008. Last summer, blue-green algae concentrations in both Eagle Creek and Geist Reservoirs, and the detection of microcystin toxin in Geist Reservoir resulted in recreational usage advisories being posted by the Indiana State Department of Health for both reservoirs. While the 2007 summer drought conditions created unusual conditions very favorable for the proliferation of blue-green algae, potentially toxic blue-green algae blooms have been occurring in central Indiana reservoirs for several years. In fact, there have been documented cases of blooms of potentially toxic blue-green algae in several areas of Indiana since 2001. Further, a review of blue-green algae research throughout the Midwest indicates that blue-green algae blooms and the occurrence of algal toxins, especially microcystin, are becoming increasingly common in midcontinent lakes and reservoirs.

For years, CIWRP research has focused on understanding phytoplankton (typically microscopic floating plants) occurrence and dynamics in area reservoirs because several types cause taste and odor in finished drinking water. These compounds are likely familiar to you as the earthy and/or musty smell and taste sometimes present in drinking water. Nuisance algal blooms of taste and odor producing phytoplankton have been documented in Eagle Creek, Geist and Morse Reservoirs since at least 2000. Resident reservoir phytoplankton from diatoms to blue-green algae and actinomycetes (fungi-like bacteria) are known to produce taste and odor causing compounds - chemically known to be MIB (2-methylisoborneol) and geosmin. Further, certain species of blue-green algae are known to produce specific taste and odor compounds. For example, *Anabaena* has been documented as producing geosmin and potentially MIB; *Pseudanabaena* has been shown to produce MIB; *Aphanizomenon* has been shown to produce geosmin; and *Planktothrix* has been shown to produce both MIB and geosmin. Yet understanding if these same species produce taste and odor compounds locally remains unknown and anecdotal.

In recent years, concern regarding the production and occurrence of blue-green algal toxins has grown in central Indiana and nationally. Evaluation of phytoplankton community structure information from Eagle Creek, Geist and Morse Reservoirs has shown that potentially toxic blue-green algae comprise important parts of the phytoplankton communities in mid-late summer and fall in all three reservoirs. Additional reports of potentiallytoxic blue-green algae in Indiana include Ball Lake in Steuben County, Lake Lemon and Monroe Reservoir in Monroe County, and at least 20 other lakes and reservoirs statewide.

Given the ecological, recreational, and municipal uses of Eagle Creek, Geist and Morse Reservoirs, maintaining and improving their water quality has been a focus of the Central Indiana Water Resource Partnership (CIWRP). A primary focus area has been on Eagle Creek Reservoir (ECR) because of the drinking water intake location within the reservoir. In 2003, CIWRP research focused on obtaining physical, chemical, and phytoplankton data to understand how ECR's physical and chemical environments affect phytoplankton growth (Pascual and Tedesco, 2004a). Algaecide treatment was being used to control algal bloom formation more aggressively in 2003 with three algaecide treatments occurring in ECR in 2003. Thus a secondary focus of the 2003 study included determining algaecide treatment effectiveness (Pascual and Tedesco, 2004b). Subsequent research designed to develop a rapid blue-green algae mapping tool utilizing remote sensing has resulted in monitoring the distribution of blue-green algae in the three reservoirs over the past three years (Li et al., 2006). This work also included Monroe Reservoir in south-central Indiana, a drinking water supply reservoir for Bloomington and surrounding communities and an important recreational use resource. Our work provided snapshots of whole reservoir blue-green algae distributions with some information on the physical and chemical characteristics of the reservoirs and limited information on phytoplankton community structure. However, CIWRP research has not studied the occurrence of blue-green algal toxins in central Indiana reservoirs or elsewhere and information on the occurrence of algal toxins is very limited despite the fact that known toxin-producing algae comprise important components of blue-green algal populations in the three central Indiana reservoirs, as well as elsewhere throughout the state.

Given the importance of the central Indiana reservoirs for the drinking water supply and their recreational use, a comprehensive study of the phytoplankton ecology of the three reservoirs is being undertaken. Additionally, documenting the occurrence of taste and odor compounds (MIB and geosmin) as well as blue-green algae toxin occurrence will be an important part of the study and will be undertaken during the spring, summer, and fall of 2008, and potentially 2009.

The 2008 CIWRP Algal Ecology and Toxicity study has three main purposes:

1) To document algal community composition and abundance;
2) To determine the relationship between physical and chemical reservoir conditions and algal community structure and abundance; and
3) To document the occurrence of blue-green algal toxins (microcystin, anatoxin-a, and cylindrospermopsin) and taste and odor compounds (MIB and geosmin) and their relationship to algal community structure and reservoir conditions.

This study is already underway and will involve a lot of field work. We will sample Eagle Creek, Geist and Morse Reservoirs on every two weeks beginning in mid-May and extending through mid-October. This will result in at least 12 sampling events per reservoir. Additional samples may be taken in response to monitoring specific blooms or during unusual conditions. Researchers will be monitoring physical and chemical reservoir conditions important to understanding the factors that lead to algal blooms and potentially even specific species of algae. This type of monitoring will occur at a series of sites throughout each reservoir. At a few select sites, we will collect water samples throughout the water column (for example at the surface, near the bottom, and at places in the middle of the water column where different important biological conditions occur). These samples will be analyzed for a large number of parameters that can control algae community abundance and composition (eg. levels of the nutrients nitrogen and phosphorus, dissolved oxygen levels, amount of light etc). Additionally, samples will be analyzed for several measures that are created by the algal communities (eg. number and species of phytoplankton present, levels of algal pigments present, amount and type of taste and odor compounds, and amount and type of algal toxins, if any, present).

CEES is partnering with both Veolia Water Indianapolis, LLC. though the CIWRP partnership, and with the State of Indiana (Indiana Department of Natural Resources, Indiana Department of Environmental Management and Indiana State Department of Health) to conduct these studies. CIWRP funding will be the dominant funding source and will document reservoir physical and chemical conditions, algal community dynamics, taste and odor compounds, and some toxin analyses. The State of Indiana will provide limited funding for additional algal toxin analyses predominantly for Geist Reservoir with some additional analyses of Eagle Creek and Morse Reservoirs. Specifically, CEES will collect samples for algal toxin analyses and results will be provided to the State for dissemination to the public via their website at www.algae.in.gov. CEES will not make recommendations to the public regarding health and safety associated with the use of recreational waters. The State will provide additional information to the public on their website. CEES will continue to provide science-based information about blue-green algae and our understanding of the causes and conditions that help promote algal blooms as they become available.

This study is one of the first studies in Indiana that will document the occurrence of algal toxins on a biweekly basis throughout the growing season. While there have been isolated tests for algal toxins on a few select lakes and reservoirs in response to a bloom or as part of a state-wide screening for one specific algal toxin, this study will provide important comprehensive information to help assess blue-green algal occurrence and reservoir conditions that might be responsible for blooms and toxin production.

CIWRP research and the expertise of CEES researchers (especially Tedesco, Clercin, Pascual, and new graduate student Angie Cowan) continues to provide important information and analyses. Our work has been important in that we have been able to provide information to state agencies, the Indiana legislature, Veolia Water, and the general public. We hope to be able to provide solid science data to the public policy arena as Indiana works to set standards, develop policies for advisories and determine if there is a need for statewide monitoring. We have posted some background information about blue-green algae on our website as well as presentations made at a public meeting for Geist residents. We will continue to provide updates and information as we learn more about our water resources and ways to improve, enhance and protect them.

CENTRAL INDIANA
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Blue-Green Algae in Central Indiana: Results from 2008 with a Focus on Morse Reservoir

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Department of Earth Sciences
Center for Earth and Environmental Science

Nicolas Clercin
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Mark Gray
Veolia Water Indianapolis, LLC.

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Blue-Green Algae

- Cyanobacteria
  - Differ from Other Bacteria
    - ➔Can perform photosynthesis
  - Differ from True Eukaryotic Algae
    - ➔Lack a well-defined nucleus
  - More Closely Related to Gram Negative Bacteria than Algae
  - 2.2-3.5 Billion Years Old
  - Naturally Occurring but Antropogenically Amplified

Causes of Algal Blooms

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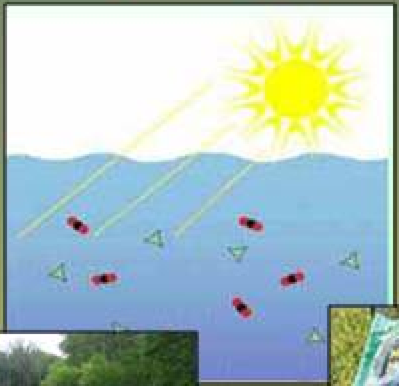
Biomass increases to bloom densities under conditions favorable to growth

- Sunlight (light penetration)
- Temperature – to start growth
- Nutrients – not so simple
- Modified Hydrology
  - Resuspension of Nutrient-rich Bottom Sediment
  - Flushing vs Retention Times



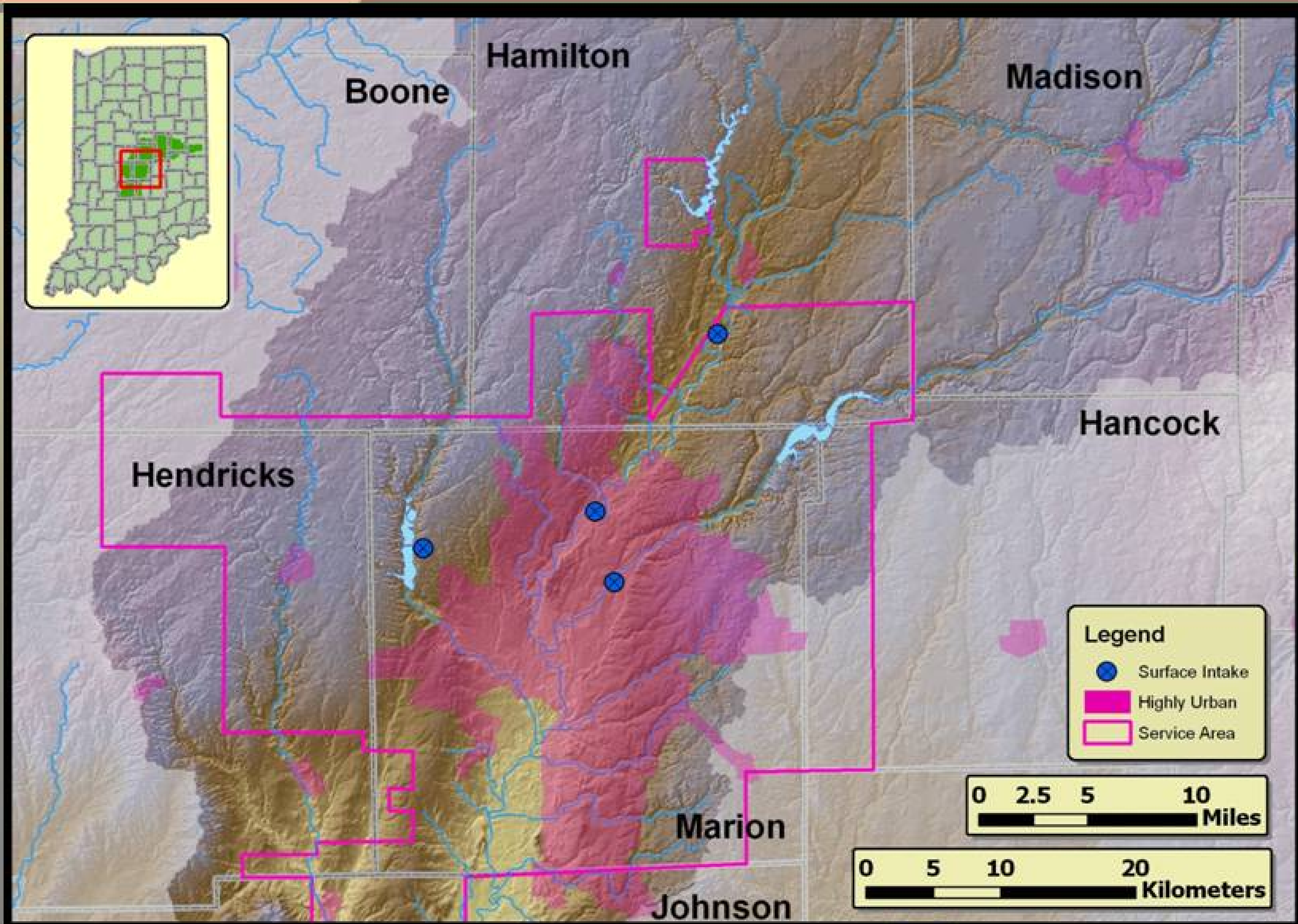
2008 Blue-Green Algae Research: Indianapolis Water Reservoirs

CENTRAL INDIANA WATER RESOURCES PARTNERSHIP

- *Purpose*
  - *Document algae community composition and abundance*
  - *Determine relationship between physical and chemical reservoir conditions and algae, taste and odor and toxin production*
- *Biweekly Mid-May – End-December*
- *Nutrients, Algal Populations, Physical Reservoir Conditions, Taste and Odor Compounds, Algal Toxins*
- *Algal Toxin Analyses by Greenwater Labs, Florida*
- *Funded by Veolia Water Indianapolis through CIWRP with additional funds for toxin analysis from Indiana DNR*

Indianapolis Drinking Water Supply

CENTRAL INDIANA WATER RESOURCES PARTNERSHIP



Reservoir Characteristics: Indianapolis Water Reservoirs

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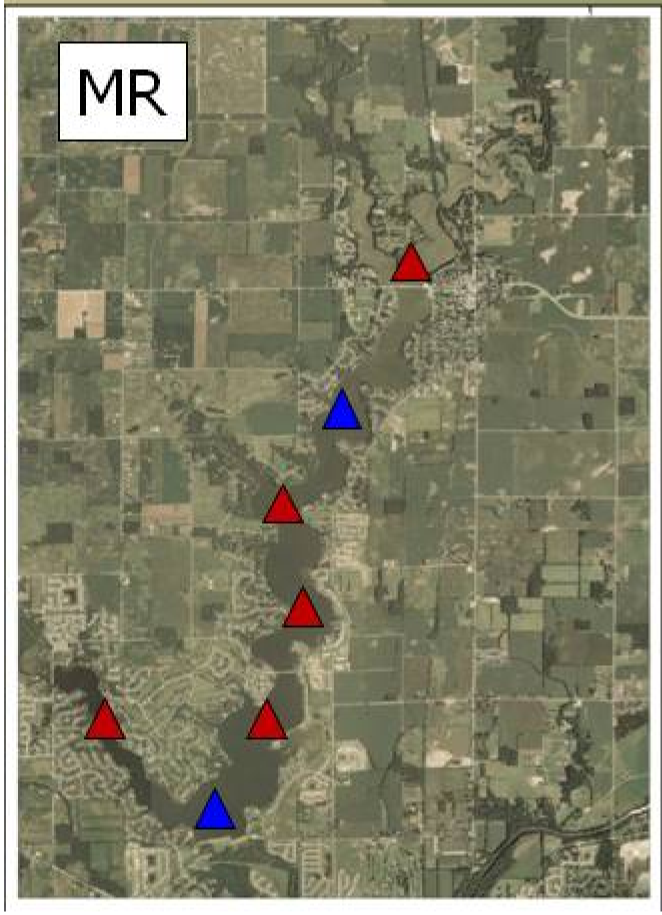
Reservoir	Eagle Creek	Geist	Morse	Units
Surface Area	5	5.9	6	km^2
Reservoir Volume	21	23.8	28	million m^3
Mean Depth	4.2	3.2	4.7	m
Watershed Area above Dam	420	560	590	km^2
% Agriculture in Watershed	52.0%	58.3%	76.9%	%
Median Photic Depth (secchi)	196	167	188	cm
Mean Total P	93	135	112	µg/L
Trophic Status	Eutrophic	Eutrophic	Eutrophic	

2008 Reservoir Study Sites
Eagle Creek, Geist, & Morse Reservoirs

▲ Water Quality Monitoring Station

▲ Water Quality and Algal Toxin



Samples for nutrients and T&O

- Surface, Bottom, Photic Depth

Samples for algae and toxins

- Integrated Photic Depth

Important Cyanobacteria Genera Found in Central Indiana Reservoirs

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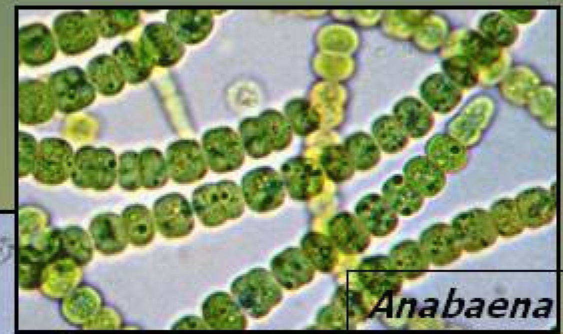
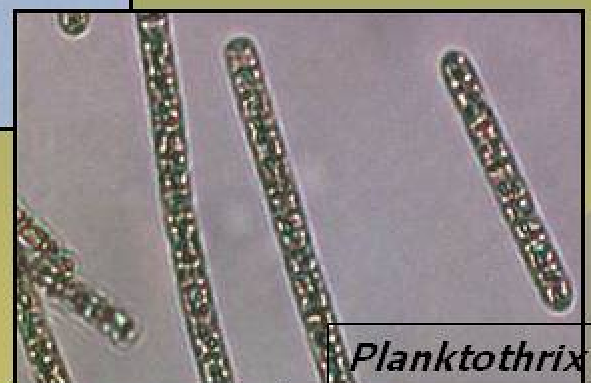
- Unicellular/Colonial – No heterocyst, Non-Nitrogen Fixer (Chroococcales)
  - *Microcystis*
  - *Merismopedia*
  - *Coelosphaerium*
- Filamentous – No heterocyst, Non-N Fixer (Oscillatoriales)
  - *Planktothrix*
  - *Oscillatoria*
  - *Limnothrix*
  - *Pseudanabaena*
- Filamentous – Heterocyst, Nitrogen Fixer (Nostocales)
  - *Cylindrospermopsis*
  - *Aphanizomenon*
  - *Anabaena*
  - *Rhaphidiopsis*





Toxins and Taste and Odor Compounds Produced by Cyanobacteria

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	Dermatotoxin, Irritant Toxin	Hepatotoxin (Liver)	Neurotoxin (Nervous System)	Taste/Odor
Anabaena	LPS	microcystins cylindrospermopsin	anatoxins saxitoxins	geosmin MIB?
Microcystis	LPS	microcystins		
Oscillatoria/ Planktothrix	LPS Lyngbyatoxins	microcystins	anatoxins saxitoxins	geosmin MIB
Cylindrospermopsis	LPS	cylindrospermopsin	saxitoxins	
Aphanizomenon	LPS	cylindrospermopsin microcystins	anatoxins saxitoxins	geosmin
Lyngbya	Lyngbyatoxins		saxitoxins	MIB
Snowella	LPS	microcystins		
Pseudanabaena	LPS	microcystins	anatoxin	geosmin MIB
Aphanacapsa	LPS	microcystins		

LPS = Lipopolysaccharide

Modified from: Graham et al., 2008; Lawton and Edwards, 2008; NOAA, 2007; Graham, 2007; Wiedner et al., 2006

2008 Algal Dynamics
Morse Reservoir @ Dam

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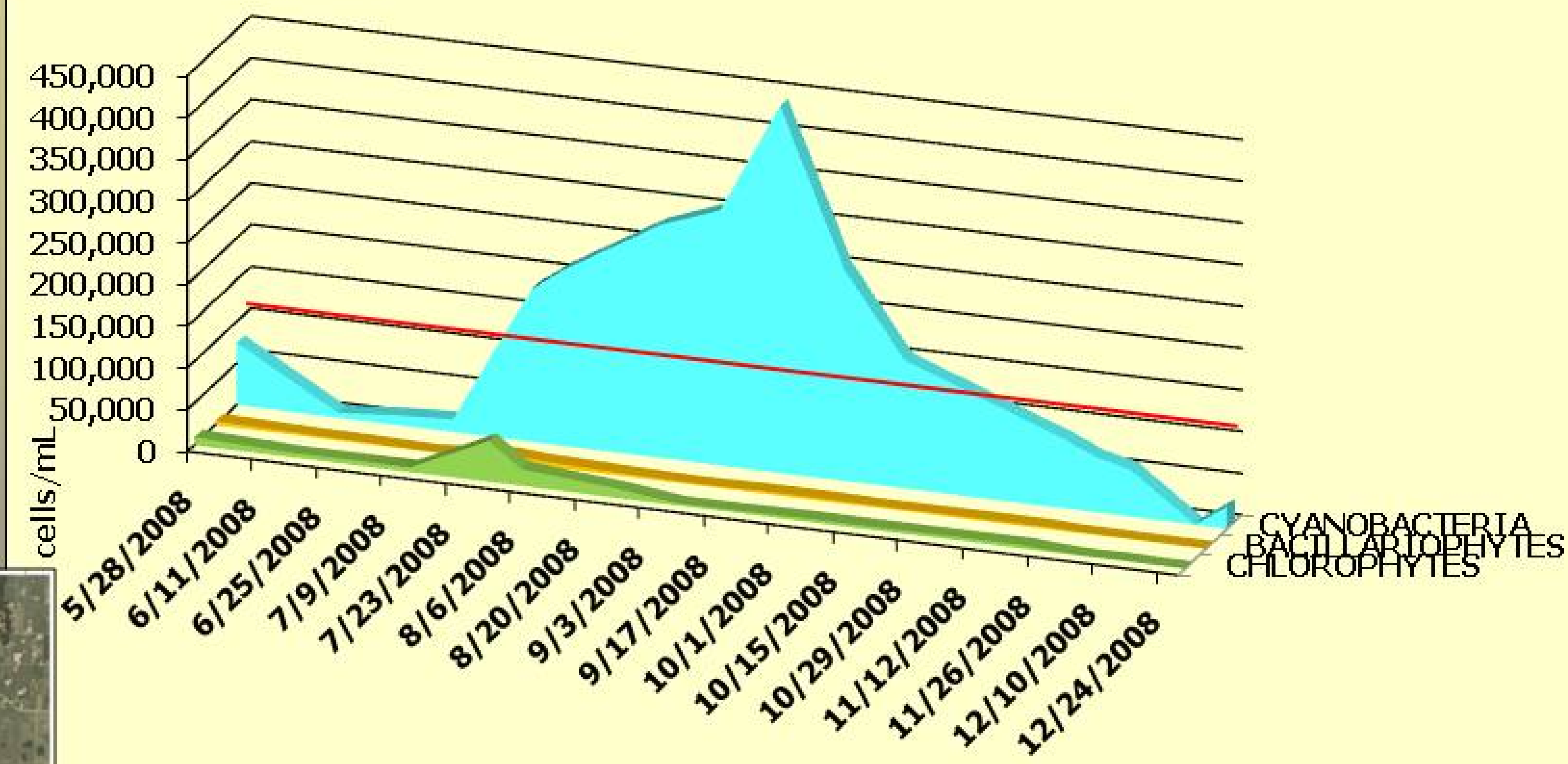
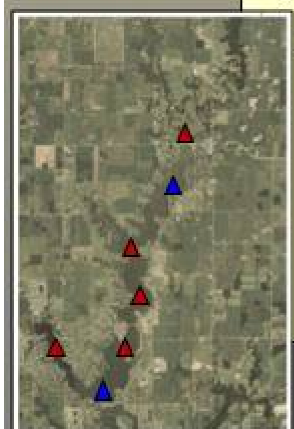
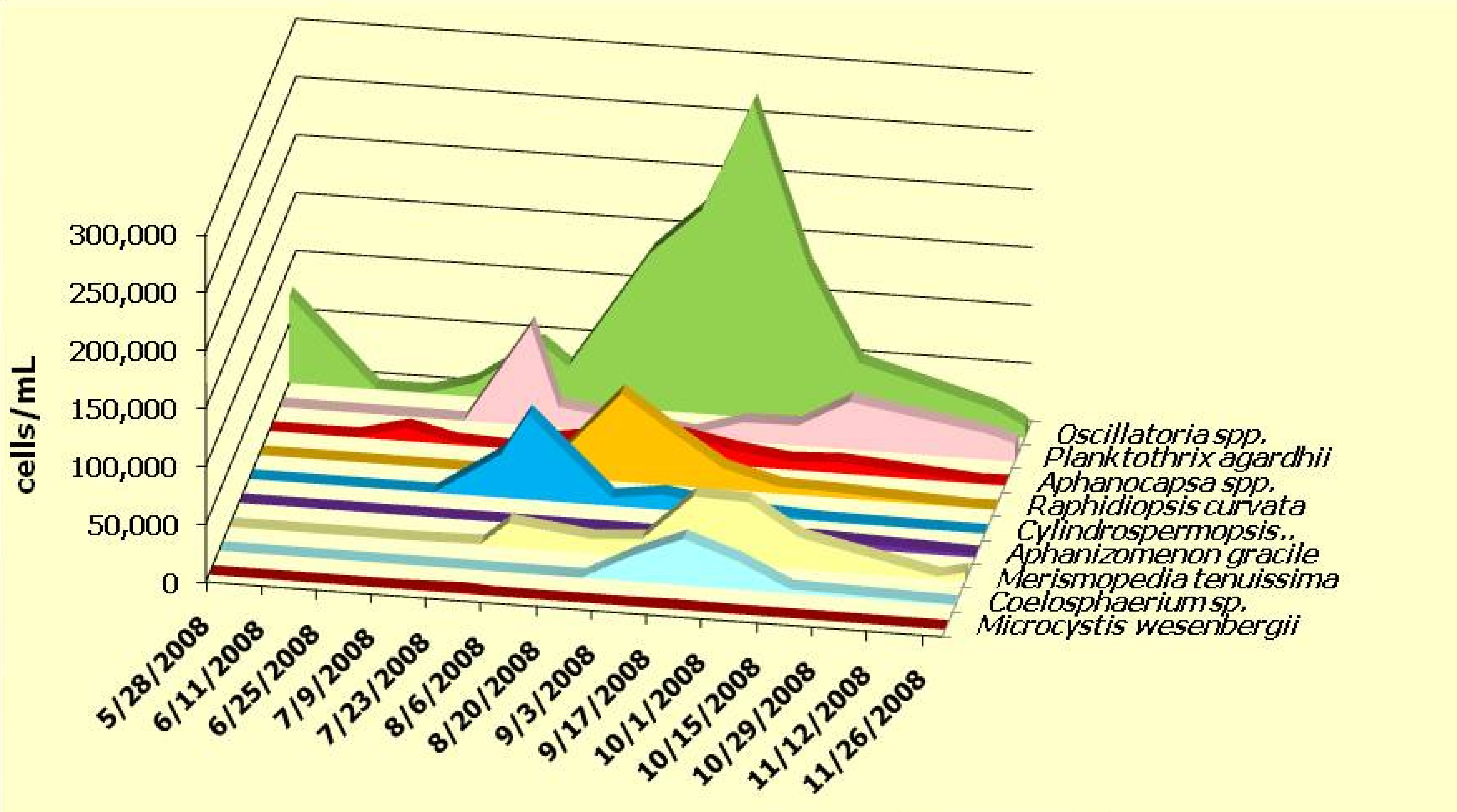


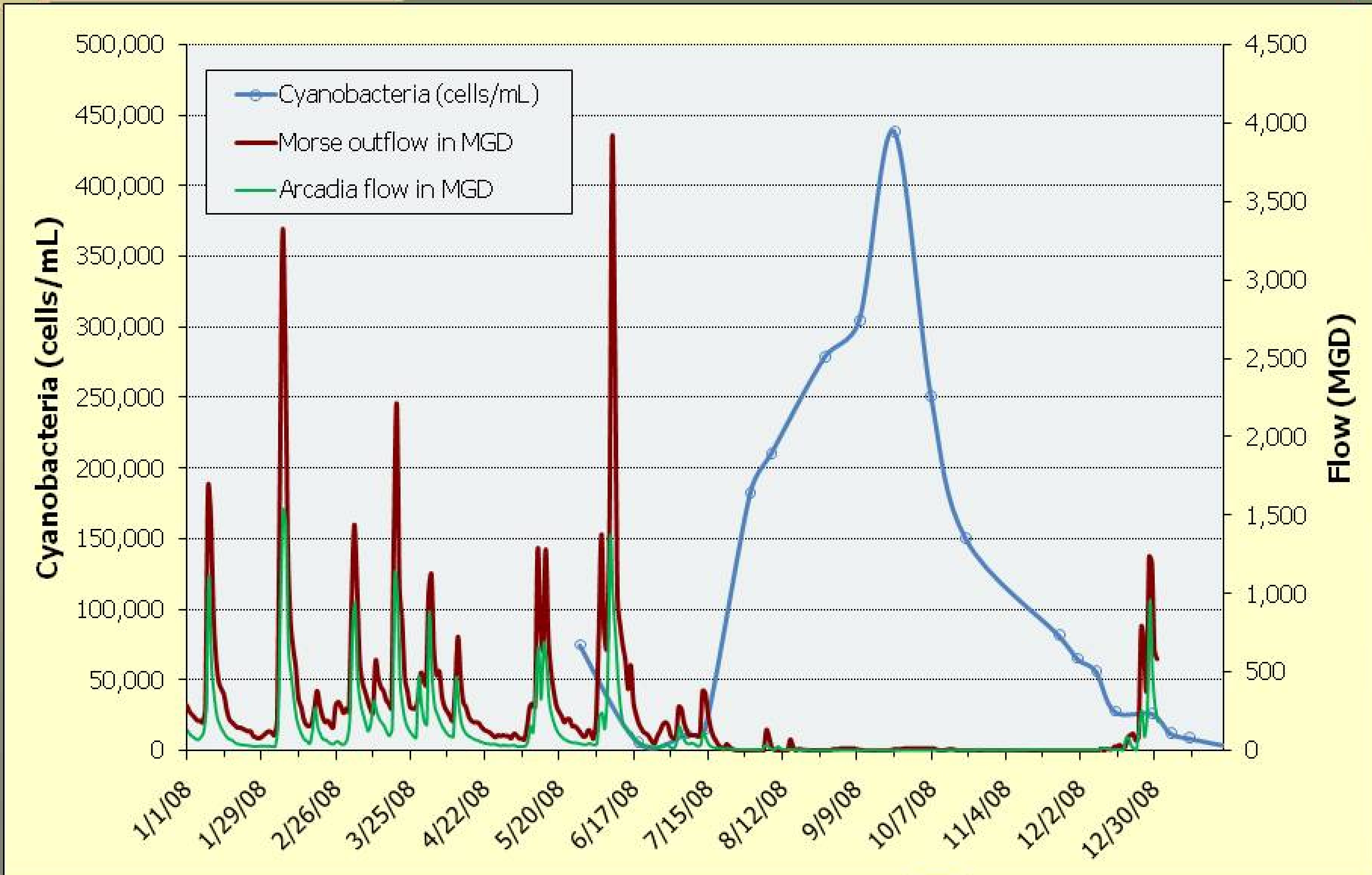


WHO Guideline (Recreation) – Moderate Risk for Adverse Effects = 100,000 cells/mL

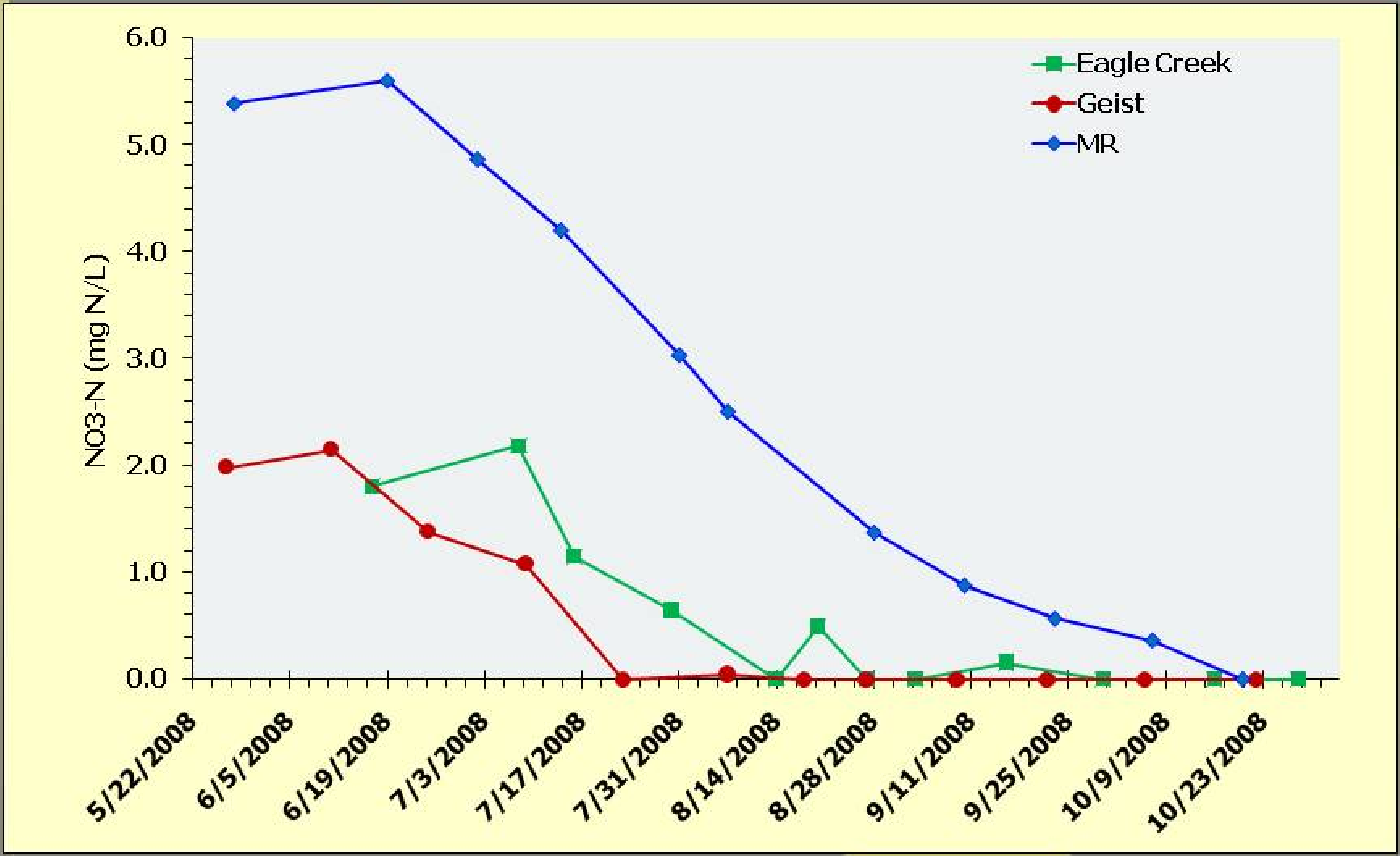
Species Dynamics of Cyanobacteria: Morse Dam



Cyanobacteria Populations vs Reservoir Inflow/Outflow

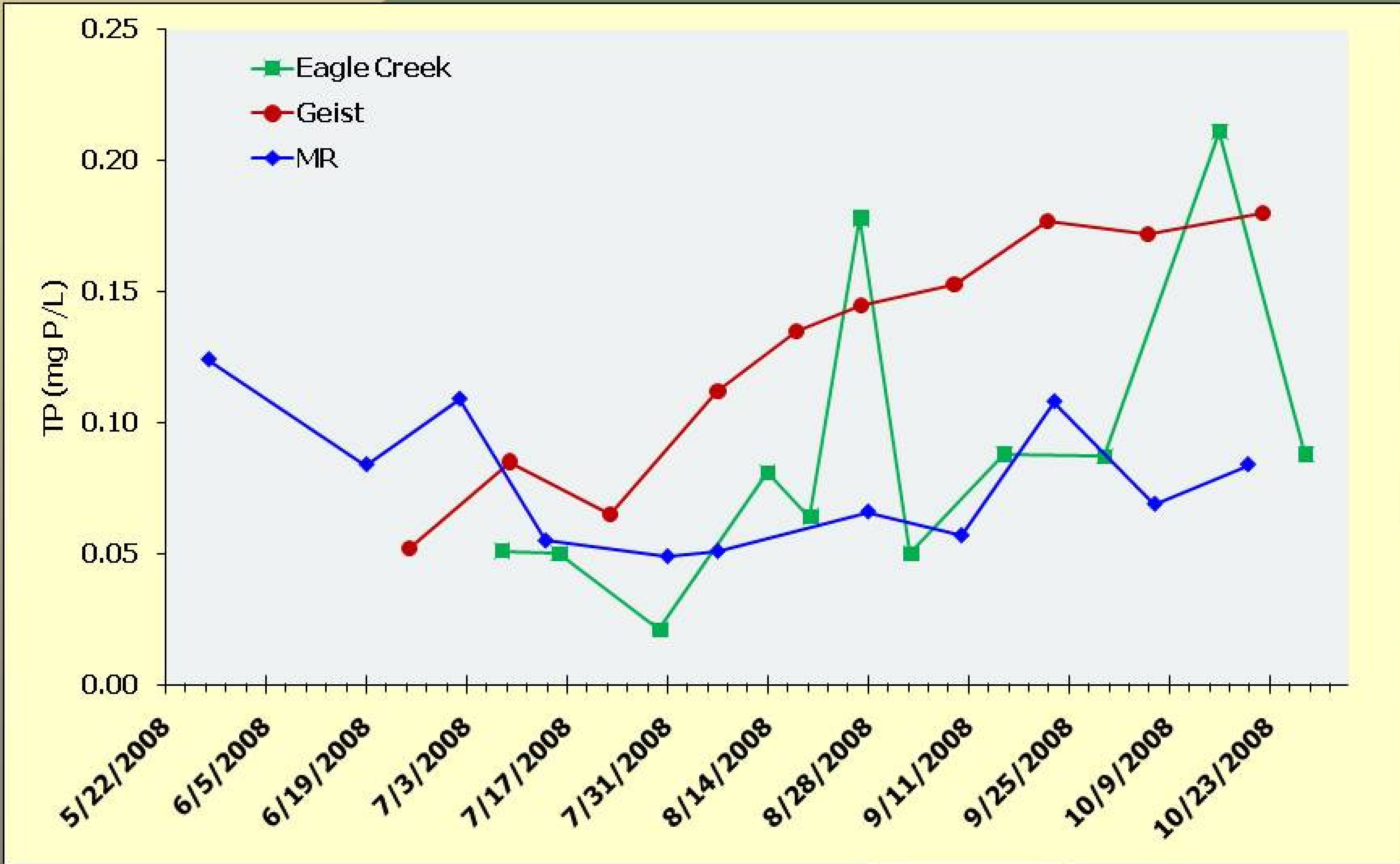


Nutrient Dynamics (Nitrate): Dam Sites



Integrated Photic Depth Samples

Nutrient Dynamics (Total P): Dam Sites



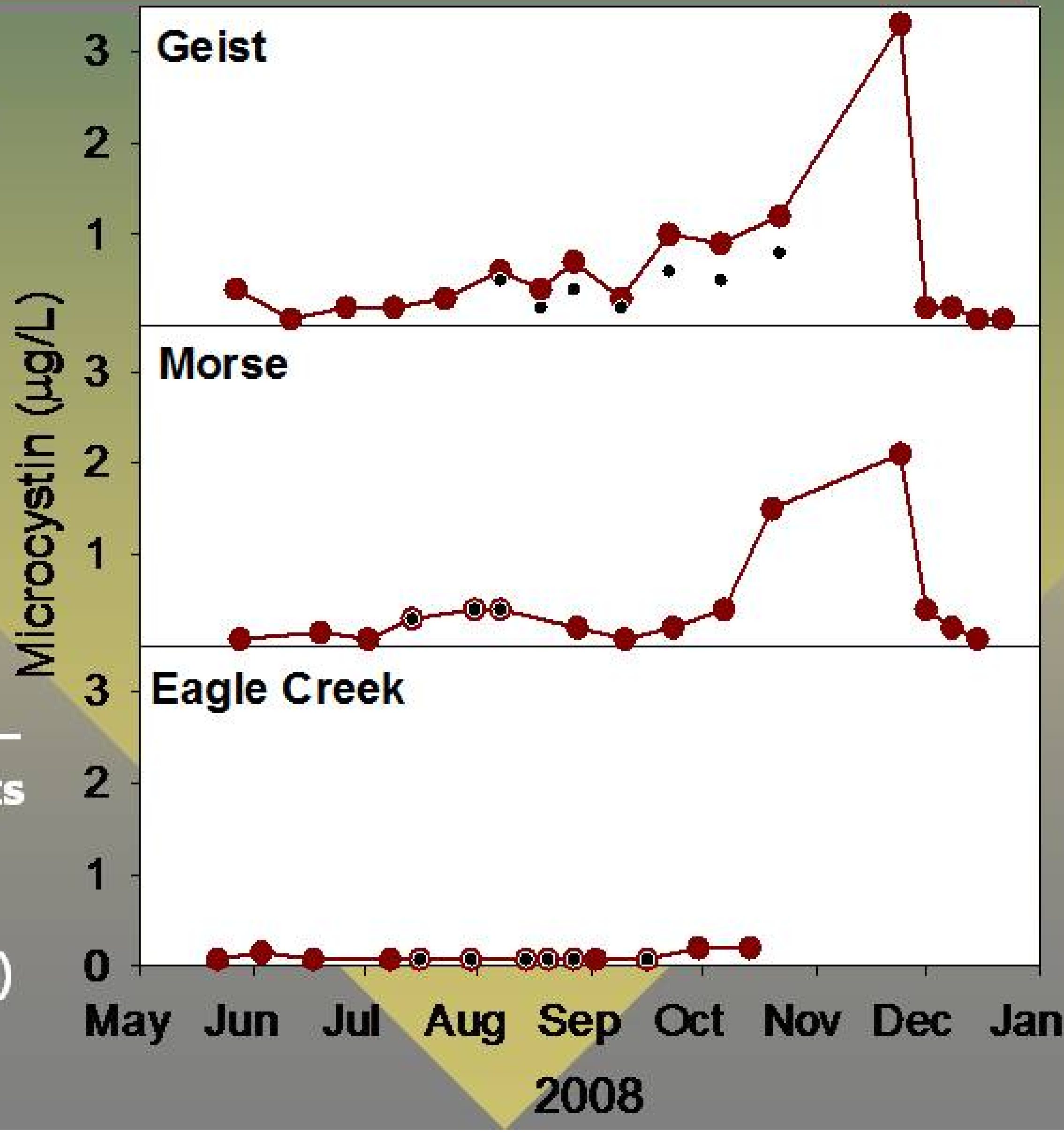
Integrated Photic Depth Samples

Algal Toxin Occurrence in Central Indiana Reservoirs

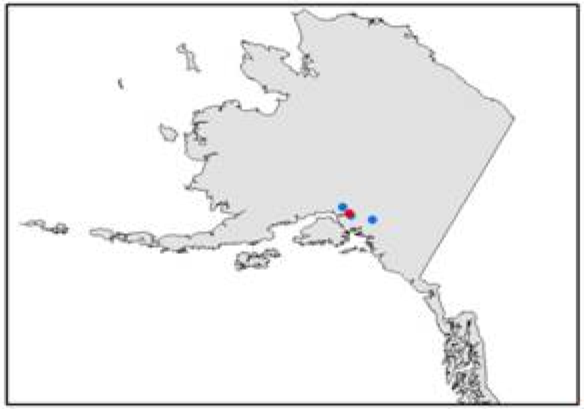
- Microcystin
  - 61% of samples positive for MYC (<0.15 ug/L detection limit)
    - All Reservoirs
      - 40 of 66 samples
      - Avg = 0.56 ug/L
    - Geist
      - 21 of 24 (88%)
      - Avg = 0.62 ug/L
    - Morse
      - 16 of 22 samples (73%)
      - Avg = 0.55 ug/L
    - Eagle Creek
      - 3 of 20 samples (15%)
      - Avg = 0.18 ug/L

WHO Guideline (Recreation) – Low Risk for Adverse Effects = 4 ug/L

- Anatoxin-a and Cylindrospermopsin (n=57)
  - Non-detect (<0.1 ug/L) in all samples



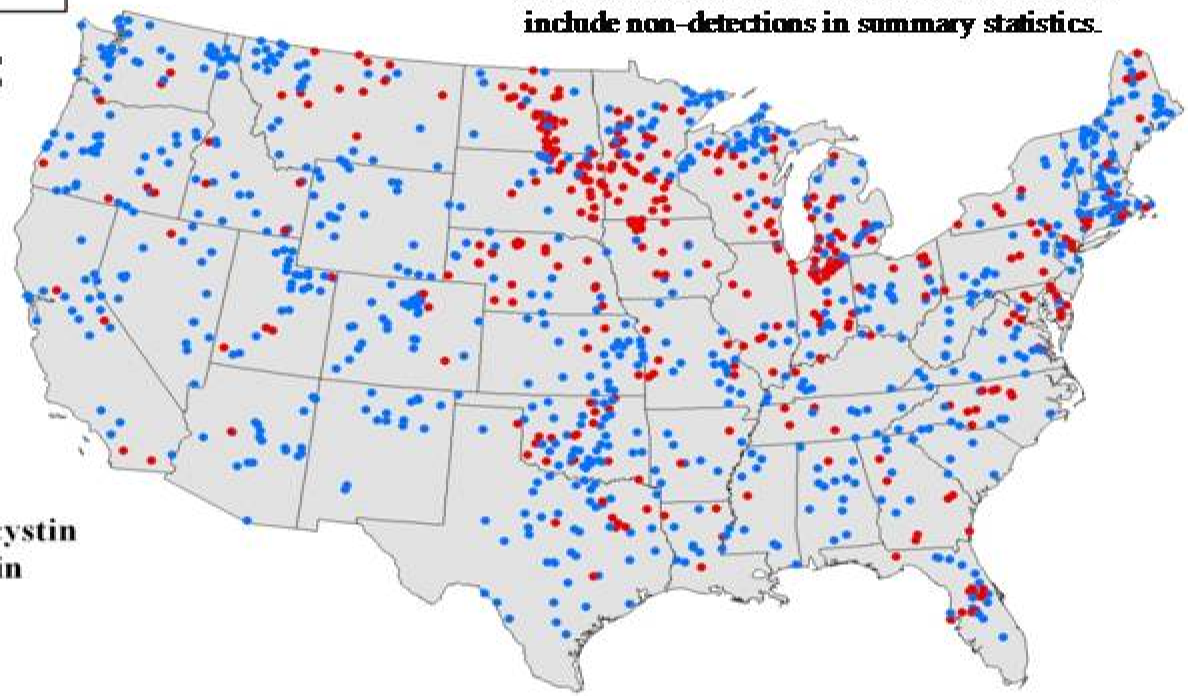
2007 EPA National Lakes Assessment: Microcystin



% Overall Detections:
32 % (401/1238)

Concentration (ppb MCLR equivalents)	Study Lakes
Mean	3.0 (~ 1.0)
Median	0.52 (< 0.10)
Minimum	0.10 (< 0.10)
Maximum	230

1 Values outside parenthesis are summary statistics for detections only. Values inside parenthesis include non-detections in summary statistics.



Algal Species Dynamics in Central Indiana Reservoirs

- Shallow, frequently mixed, nutrient-rich reservoirs in Central Indiana are dominated by *Oscillatoria sp.* and *Planktothrix agardhii* throughout the growing season
- Cyanobacterial cell counts exceed 100,000 cells/mL by mid-July and persist
- Reservoirs are turbid, with shallow light penetration favoring *Oscillatoriales* which are known to be low light specialists



Microcystin Occurrence in Central Indiana Reservoirs

- Microcystin toxin was present at the three reservoirs at low levels
  - Geist Reservoir > Morse > Eagle Creek
- Ongoing data analysis continues to assess nutrient, taste and odor and microcystin relationships and trends.

2009 Cyanobacteria Research

- Biweekly Reservoir Sampling (April-November)
  - → 4-7 Locations/reservoir
  - → Physical and Chemical Conditions
  - → Algal Identification and Enumeration
  - → Microcystin Analysis

- Whole Reservoir Spatial Distribution Sampling
  - → 15-20 sites/reservoir
  - → Two times per reservoir
  - → Same Parameters

Phytoplankton Dynamics: Morse Dam 2009

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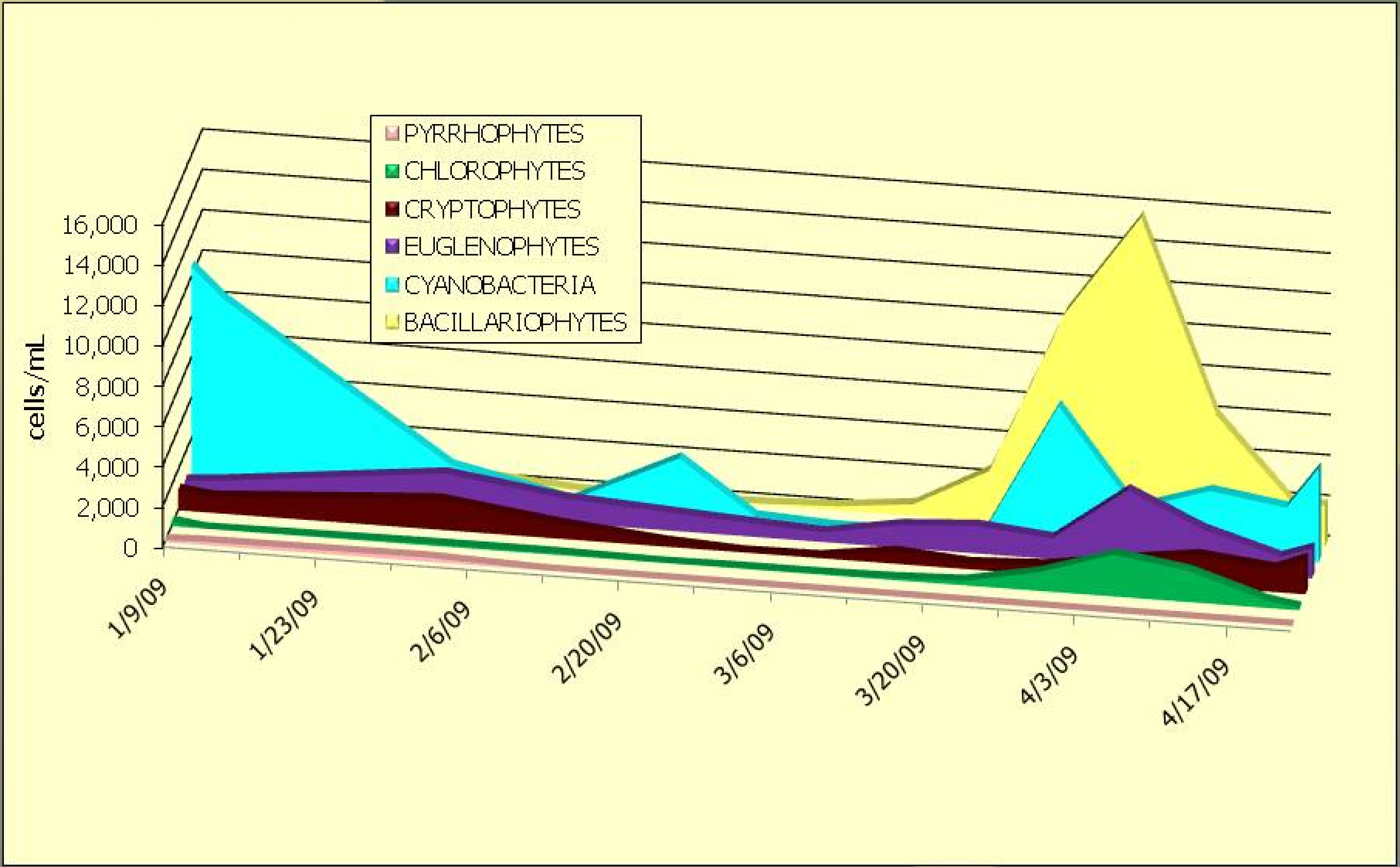

What Can Recreational Users Do

- Wise Users Take Sensible Precautions
- Prepare BEFORE Entering the Water
  - Use Appropriate Gear
  - Check Weather Forecast
- While IN THE WATER
  - Recreate in Groups
  - Always Supervise Children
  - Avoid Consuming Raw (Reservoir or Lake) Water
- When you're FINISHED
  - Make Sure You Shower
  - Clean Your Equipment
- USE COMMON SENSE

What can you do NOW to help?

- Use Phosphorus-free lawn fertilizers and dishwasher detergent
- Fertilize less – first check soils nutrient levels
- Pick up pet wastes regularly
- Keep lawn clippings and leaves out of streets, waterways, and the reservoir!
- Keep household wastes out of storm sewers (including soaps from car washing)
- Collect storm water from gutters to use in gardens, create flower gardens at the base of downspouts
- Cover bare ground with plantings
- Use straw bales or silt fence when doing construction or major landscaping projects
- Plant beds of native flowers or trees with deep roots for infiltration
- Talk to your neighbors about what you are doing
- Think about how water is used around your house and how it moves across your yard!


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Appendix H – Macroinvertebrate Data

Evaluation Methods

Thirteen stations in the Cicero Creek Watershed were evaluated for macroinvertebrate communities. One high quality reference station outside the watershed was taken for comparative analysis. Sampling locations were chosen based on access locations from bridge crossings and spatial locations throughout the watershed. The thirteen sampling locations within the Cicero Creek Watershed were located at the most downstream location within each subwatershed. Station photographs are included. Macroinvertebrates were sampled on October 15 and 16, 2009.

V3 Macroinvertebrate Sampling Stations		
Station #	**Stream Name**	**Location**
1	Cicero Creek	River Avenue and 160th Street
2	East Fork Sly Run	Oakmont and SR 32
3	Hinkle Creek	216th Street and Hinkle Creek Rd
4	Cicero Creek	Royal Pine and Cedar
5	Bear Slide Creek	226th Street and Schulley
6	Little Cicero Creek	266th Street and Gwinn Rd
7	Cicero Creek	Mount Pleasant and 266th Street
8	Little Cicero Creek	276th Street and I-31
9	Cicero Creek	CR 450 S
10	Prairie Creek	CR 500 W
11	Cicero Creek	CR 500 W
12	Dixon Creek	CR 400 W
13	Buck Creek	CR 200 S
14*	Turkey Creek (Tipton County)	SR 213 and CR 650 N

Biological Evaluation Explanation

Macroinvertebrate monitoring followed the US EPA Rapid Bioasssessment Protocol single habitat approach method. The single habitat approach involves sampling riffle/run areas within the sampling reach. A composite sample should be made from two kick samples (2 m^2). The sample is collected by using a one meter wide kick net with 500 µ opening mesh. A kick net is comprised of hemmed sides for poles and a reinforced bottom seam for anchoring while sampling. One person stands downstream holding the kick net in front of them, while another person disturbs a 1 m^2 area upstream of the net by using the heel or toe of the their boot to dislodge the material in the streambed. Larger substrate should be picked up and rubbed by hand to dislodge the organisms that are attached to the rocks. A one-hundred individual sub-sample should be used in order to analyze the data. The collected organisms are sorted at V3 and identified to the family level using appropriate field guides. In addition, macroinvertebrate vouchers are sent to Purdue University to verify that all taxon identifications are correct. Vouchered specimens and correspondence with Purdue is included at the end of this section.

The collection procedure provides representative macroinvertebrate fauna from riffle/run substrate in the sampling reach.

The mIBI uses ten metrics which evaluate a macroinvertebrate community's species richness, evenness, composition, and density within the stream. These metrics include the family-level HBI (Hilsenhoff Biotic Index), number of taxa, number of individuals, Percent Dominant Taxa, EPT index, EPT count, EPT count to total number of individuals, EPT count to Chironomid count, Chironomid count, and number of individuals per number of squares sorted. (EPT stands for the *Ephemeropteran*, *Plecopteran*, and *Trichopteran* orders). These metrics are shown in the table below. Each metric is scored from 0 – 8 where 8 is the highest quality. All metrics are added together and averaged to get a station score. A final score of 0 – 2 is a severely impaired stream, 2 – 4 is moderately impaired, 4 – 6 is slightly impaired and 6 – 8 is not impaired for biological quality.

Scoring Criteria for mIBI

	Scoring				
	0	**2**	**4**	**6**	**8**
	Severely Impaired	**Moderately Impaired**	**Slightly Impaired**	**Not Impaired**	
HBI	≥ 5.63	5.06 - 5.62	4.55 - 5.05	4.09 - 4.54	≤ 4.08
Number of Taxa	≤ 7	8 -10	11 – 14	15 - 17	≥ 18
Number of Individuals	≤ 79	80 - 129	130 – 212	213 - 349	≥ 350
Percent Dominant Taxa	≥ 61.6	43.9 - 61.5	31.2 - 43.8	22.2 - 31.1	≤ 22.1
EPT Index	≤ 2	3	4 – 5	6 - 7	≥ 8
EPT Count	≤ 19	20 - 42	43 – 91	92 - 194	≥ 195
EPT To Total Number	≤ 0.13	0.14 - 0.29	0.30 - 0.46	0.47 - 0.68	≥ 0.69
EPT to Chironomid	≤ 0.88	0.89 - 2.55	2.56 - 5.70	5.71 - 11.65	≥ 11.66
Chironomid Count	≥ 147	55 - 146	20 – 54	7 - 19	≤ 6
Total Number To Number of Squares Sorted	≤ 29	30 - 71	72 – 171	172 - 409	≥ 410

Biological Evaluation Methodologies

An explanation of key benthic macroinvertebrate evaluations is summarized as follows:

Richness Measures

Total number of distinct taxa is a measure of the diversity within the sample. This value generally increases with increasing water quality, habitat diversity, and habitat suitability.

Total number of EPT taxa summarizes the richness of the benthic macroinvertebrate community within the taxa groups that are generally considered pollution sensitive and will generally increase with increasing water quality. EPT index is an index of water quality based on the abundance of three pollution-sensitive orders of macroinvertebrates relative to the abundance of a hardy species of macroinvertebrate. This metric is the total number of distinct taxa within the groups Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly).

Composition Measures

Percent Contribution of Dominant Taxa uses the abundance of the numerically dominant taxa relative to the total number of organisms as an indication of community balance. This value will decrease as water quality, habitat diversity and habitat suitability improve.

The ratio of EPT (mayflies, stoneflies and caddisflies) and Chironomidae (midges) reflects good biotic condition if the sensitive groups (EPT's) demonstrate a substantial representation. If the Chironomidae have a disproportionately large number of individuals in comparison to the sensitive groups then this situation is indicative of environmental stress.

Tolerance/Intolerance Measures

Tolerance/intolerance measures are intended to be representative of relative sensitivity to perturbation. Tolerance is generally non-specific to the type of stressor. However, metrics such as the Hilsenhoff Biotic Index are oriented toward the detection of organic pollution.

The Hilsenhoff Biotic Index (HBI) was developed to detect organic pollution and is based on the family level index developed by William Hilsenhoff in 1988. Pollution tolerance values range from 0 to 10 and increase as water quality decreases. The lower the HBI, the greater the number of pollution intolerant species. A population of benthic macroinvertebrates that poses a lower HBI value is indicative of higher water quality.

V3 Biological Evaluation 2009 Results

V3 identified all macroinvertebrate specimens to family level after collecting all the field data. V3 sent 32 voucher specimens of macroinvertebrates to Purdue University, Department of Entomology to be verified by Arwin Provonsha. V3 used the mIBI to analyze macroinvertebrates. The tables below show the ten metrics and scoring ranges for each station. The raw macroinvertebrate data and the mIBI scoring are also included.

Results from Macroinvertebrate Sampling October 15 and 16, 2009														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
HBI	4.20	4.13	4.01	4.36	4.01	4.58	3.67	4.29	3.81	4.54	4.07	4.58	3.39	3.45
Number of Taxa	16	16	14	8	14	12	20	13	17	15	11	14	18	15
Number of Individuals	168	121	96	92	170	97	283	122	187	99	96	94	189	143
Percent Dominant Taxa	63.1	27.3	30.2	25.0	31.8	26.8	28.6	50.0	43.3	29.3	25.0	39.4	33.9	28.7
EPT Index	7	5	5	2	6	2	7	4	8	4	3	3	7	7
EPT Count	132	52	38	30	69	28	218	77	147	37	24	50	154	106
EPT to Total Number	0.78	0.43	0.39	0.33	0.41	0.29	0.77	0.63	0.79	0.37	0.25	0.53	0.81	0.74
EPT to Chironomid	33.0	8.67	5.43	1.30	9.86	2.55	14.53	4.05	13.36	3.08	2.0	2.5	22.0	13.25
Chironomid Count	4	6	7	23	7	11	15	19	11	12	12	20	7	8
Total Number of Individuals/Number of Squares Sorted	56	60.5	96	46	85	48.5	141.5	61	93.5	49.5	96	47	189	143

mIBI Scoring for Macroinvertebrate Sampling October 15 and 16, 2009.														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
HBI	6	6	6	6	8	4	8	6	8	6	8	4	8	8
Number of Taxa	6	6	4	2	4	4	8	4	6	6	4	4	8	6
Number of Individuals	4	2	2	2	4	2	6	2	4	2	2	2	4	4
Percent Dominant Taxa	0	6	8	6	4	6	6	2	4	6	6	4	4	6
EPT Index	6	4	4	0	6	0	6	4	8	4	2	2	6	6
EPT Count	6	4	2	2	4	2	8	4	6	2	2	4	6	6
EPT to Total Number	8	4	4	4	4	2	8	6	8	4	2	6	8	8
EPT to Chironomid	8	6	4	2	6	2	8	4	8	4	2	2	8	8
Chironomid Count	8	6	6	4	6	6	6	6	6	6	6	4	6	6
Total Number of Individuals/Number of Squares Sorted	2	2	4	2	4	2	4	2	4	2	4	2	6	4
Station mIBI Score	5.40	4.60	4	3.00	5.00	3.00	6.80	4.00	6.2	4.2	3.8	3.4	6.4	6.2

V3 Biological Evaluation 2009 Results Discussion

Station 1 was slightly impaired (5.40) for the average station score. The main reason for the impairment is due to the Percent Dominant Taxa metric score of 0. 63 percent of the fall sampling consisted of net spinning caddisflies, which are desirable to have in the stream however it reduced the Percent Dominant Taxa Score significantly. Four chironmids were collected at Station 1 which represented the lowest chironomid count of all stations. The Number of Individuals metric was slightly impaired and the Total Number of Individuals to Number of Squares Sorted was Moderately Impaired. All other metrics were not impaired for Station 1.

Station 2 was slightly impaired (4.60) for the average station score. The EPT Index, EPT Count, and EPT to Total Number were slightly impaired. The EPT count for Station 2 was 52, which reduced the scores for these metrics. The Number of Individuals for Station 2 was 121 which resulted in a Moderate Impairment for this metric.

Station 3 was slightly impaired (4.0) for the average station score. Station 3 follows the trend of having impairments due to decreased number of EPTs. All stations followed this trend. Station 3 was moderately impaired for Number of Individuals and EPT count.

Station 4 had the lowest average score (3.0) and the lowest Number of Taxa (8). It was severely impaired for EPT Index which scored a 2. Moderate impairment was seen for Number of Individuals, Number of Taxa, EPT Count and EPT to Chironomid metrics. Station 4 had the greatest number of Chironomids which negatively impacted the mIBI scoring. Station 4 is surrounded by residential area and may be negatively impacted by leaf litter that was found deposited along the stream and under the bridge.

Station 5 was slightly impaired (5.0). Number of Taxa, Number of Individuals, Percent Dominant Taxa, EPT Count, EPT to Total Number, and Total Number of Individuals to Number of Squares Sorted were all slightly impaired. The Dominant Taxa was the riffle beetle which was 31% of the organisms collected. The dominant species within Ephemeroptera (mayflies) was the scraping mayfly which represented 28% of total number of individuals collected.

Along with Station 4, Station 6 had the lowest average score (3.0) and was severely impaired for EPT Index (mIBI score of 0). Number of individuals was moderately impaired as well as EPT Count, EPT to Total Number, and EPT to Chironomid. Chironomids accounted for 11% of the sample which negatively impacted the overall mIBI score. Station 6 had the highest HBI value of 4.58 which demonstrates the greatest amount of pollution tolerant species were found at this station. Station 6 had eroded banks and the stream substrate was very silty which negatively impacts macroinvertebrate habitat.

Station 7 had the highest mIBI score (6.8) compared to all stations and was not impaired. This station had the highest Number of Individuals and Number of Taxa. 218 EPT’s were collected representing 77% of organisms collected. Station 7 had significant instream habitat when compared to other stations. The dominant species was the net spinning caddisfly which are in the Trichoptera order. This station was moderately impaired for Total Number of Individuals to Number of Squares Sorted. All other metrics were not impaired.

Station 8 was slightly impaired (4.0). Number of Individuals, Percent Dominant Taxa, and Total Number of Individuals to Number of Squares Sorted were moderately impaired. There were 19 chironomids collected and 77 EPTs collected which caused many of the metrics to have a lower score. Overall, the habitat at this station was more silty and conducive to macroinvertebrates with high tolerance values.

Station 9 had an overall mIBI score of 6.2 and was not impaired. This station had the highest EPT Index (8) of all stations. 147 EPTs were collected at this station and positively impacted the EPT Count, EPT to Total Number and EPT to Chironomid metrics. Total Number of Individuals to Number of Squares Sorted, Number of Individuals and Percent Dominant Taxa were slightly impaired. 43 percent of the sample consisted of net spinning caddisflies, which are desirable to have in the stream.

Station 10 was slightly impaired (4.2). The Number of Individuals, EPT Count and Total Number of Individuals to Number of Squares Sorted were moderately impaired. EPT Index, EPT to Total Number and EPT to Chironomid were slightly impaired. The main reason for this is that during sampling 12 chironomids were collected and only 37 EPTs were collected. Station 10 had significant filamentous algae growth that was covering rock substrate that could provide habitat for macroinvertebrate species. Dominant species included the net spinning caddisflies and water scavenger beetles.

Station 11 was moderately impaired (3.8). Number of Individuals and all EPT metrics were moderately impaired. 24 EPTs were collected and represented 25% of organisms collected. The dominant taxa within EPTs was the finger-net caddisfly which has a tolerance value of 3. The dominant taxa at Station 11 were planeria, riffle beetles and chironomids.

Station 12 had the second lowest average score (3.4). Along with Station 6, Station 12 had the highest HBI value of 4.58 which demonstrates the greatest number of pollution tolerant species were present at this station. EPT to Total Number was the only metric that was not impaired. Trichoptera was the only order present within the EPT group. The dominant taxa within Trichoptera was net spinning caddisflies which accounted for 39% of all species collected. 20 Chironomids were collected and accounted for 21% of the sample. Station 12 had very silty substrate which is attributed to the significant streambank erosion. Livestock have direct access to the stream at this station which is also degrading the streambank.

Station 13 was not impaired and had an overall station score of 6.4. This station had the lowest HBI score (3.39) which demonstrates the greatest amount of pollution intolerant species were found at this station. Station 13 had the second highest Number of Taxa (18) which represents a diverse macroinvertebrate community. The only metrics that were slightly impaired were

Percent Dominant Taxa and Number of Individuals. The dominant species were the little stout crawling mayfly and the net spinning caddisfly. These species are part of the EPT group and represent the gathering and filtering functional feeding group.

Station 14 was a high quality reference station and was not impaired as its overall score was 6.2. Total Number of Individuals to Number of Squares Sorted and Number of Individuals were the only metrics that were slightly impaired. 106 EPTs were collected from this station which positively impacted the EPT metrics. The habitat at this station was conducive to a diverse macroinvertebrate community. Stable vegetated banks, instream cover, and available substrate were all factors that positively impacted the macroinvertebrate scores. Habitat directly affects the species of macroinvertebrates that will be found in a stream.

November 17, 2009

Mr. Arwin Provonsha
Department of Entomology
901 W. State Street
West Lafayette, IN 47907-2089

Re: Invertebrate Voucher Specimens
Morse Reservoir/ Cicero Creek Watershed Management Plan
Boone, Clinton, Hamilton, and Tipton Counties, Indiana

Dear Mr. Provonsha:

Enclosed you will find thirty-two (32) representative macroinvertebrate specimens in individually labeled vials. The accompanying photo-documentation of each provides location and taxonomic identification. This voucher collection is being submitted to Purdue University Department of Entomology as part of the Morse Reservoir/Cicero Creek Watershed Study. It would be greatly appreciated if our identification of these specimens could be verified.

Please contact me at 630-729-6168 if you have any questions or concerns. Thank you very much.

Sincerely,

Jessica L. Dunn

Jessica Dunn
Ecologist

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Cicero Creek	LOCATION
STATION # 1 RIVERMILE ________	STREAM CLASS
LAT ________ LONG ________	RIVER BASIN
STORET #	AGENCY
COLLECTED BY JLD, NAL DATE 10-15-09	LOT #
TAXONOMIST JLD DATE 11-3-09	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR	Organisms		No.	LS	TI	TCR
Oligochaeta						Megaloptera					
						(1) Corydalidae	11	2			
Hirudinea						Coleoptera Psephenidae	1	1			
Isopoda											
						Elmidae (adult)	1	1			
Amphipoda						Elmidae (larvae)	11	2			
						Diptera (3) Simulidae	~~||||~~ ~~||||~~ ~~||||~~ 111	18			
Decapoda						Tipulidae	111	3			
Ephemeroptera Heptageniidae	~~||||~~	5				Chironomidae	1111	4			
						Simulidae (pupae)	111	3			
						Gastropoda (2H) Physidae	11	2			
Caenidae	1111	4									
Baetidae	~~||||~~ 111	8									
(4) Tricorythidae	111	3				Pelecypoda					
Plecoptera											
						Other Oligochaeta	11	2			
Trichoptera Hydropsychidae	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ 111 +25+3	106									
Helicopsychidae	111	3									
Philopotamidae	111	3									
Hemiptera (2) Belostomatidae	1	1									

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 168 **Total No. Taxa** ________

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME East Fork Sly Run	LOCATION
STATION # 2 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
COLLECTED BY JLD NAL DATE 10-15-09	LOT #
TAXONOMIST JLD DATE 11-3-09	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	||	2			
Hirudinea	|	1			
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera					
Caenidae	||||| |	6			
Baetidae	|||	3			
Heptagenidae	||||	4			
Plecoptera					
Trichoptera					
Philopotamidae	||||| ||||| ||||| ||||| |||	23			
(7) Hydropsychidae	||||| ||||| ||||| |	16			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera (6) Psephenidae	||||| ||||	9			
(10) Elmidae (adult)	|||||	5			
(8) Elmidae (larvae)	||||| ||||| ||||| ||||| ||||| |||	28			
Diptera					
Chironomidae	||||| |	6			
Simulidae	||||	4			
Tipulidae (5)	||||| |	6			
Gastropoda					
Physidae	||	2			
Ancylidae (9)	||||	4			
Pelecypoda					
Other					
Tubellaria (planeria)	|	1			
Pleuroceridae	|	1			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 121 **Total No. Taxa** ______

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ___ of ___

STREAM NAME Hinkle Creek			LOCATION
STATION # 3	RIVERMILE ___		STREAM CLASS
LAT ___	LONG ___		RIVER BASIN
STORET #			AGENCY
COLLECTED BY JLD NAL	DATE 10-15-09		LOT #
TAXONOMIST JLD	DATE ___		SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ___

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta					
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera Heptageniidae	II	2			
Caenidae	IIII	4			
Plecoptera					
Trichoptera Hydropsychidae	I	1			
(12) Philopotamidae	~~IIII~~ IIII ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~	29			
Helicopsychidae	II	2			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Elmidae (adult)	III	3			
Elmidae (larvae)	~~IIII~~ ~~IIII~~ ~~IIII~~ IIII	19			
Psephenidae	~~IIII~~ ~~IIII~~ I	11			
Diptera					
Simulidae	II	2			
Chironomidae	~~IIII~~ II	7			
Tabanidae	II	2			
Tipulidae	~~IIII~~ II	7			
Gastropoda					
Physidae (RH)	I	1			
Pelecypoda					
Other Tubellaria (Planaria) #11	~~IIII~~	5			
Coenagrionidae	I	1			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 96 **Total No. Taxa** ___

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Cicero Creek	LOCATION
STATION # 4 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
COLLECTED BY JLD, NAL DATE 10-15-09	LOT #
TAXONOMIST JLD DATE 11-3-09	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	卌 卌 卌 IIII	19			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera					
Plecoptera					
Trichoptera					
(13) Heliocopsychidae	卌 卌 卌 II	17			
Hydropsychidae	卌 卌 III	13			
Hemiptera					
Corixidae	I	1			

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Diptera					
Tipulidae	卌 II	7			
Chironomidae	卌 卌 卌 卌 III	23			
Gastropoda					
Left handed	IIII	4			
Ancylidae	卌 III	8			
Pelecypoda					
Other					

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 92 **Total No. Taxa** 8

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Bear Slide Creek		LOCATION	
STATION # 5	RIVERMILE ____	STREAM CLASS	
LAT ____	LONG ____	RIVER BASIN	
STORET #		AGENCY	
COLLECTED BY JLD, NAL	DATE 10-15-09	LOT #	
TAXONOMIST JLD	DATE 11-5-09	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____	

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR	Organisms		No.	LS	TI	TCR
Oligochaeta #15	|	1				Megaloptera					
Hirudinea						Coleoptera					
						Elmidae (adult)	|||	3			
Isopoda						Elmidae (larvae)	𝍸 𝍸 𝍸 𝍸 𝍸 | 𝍸 𝍸 𝍸 𝍸 𝍸	51			
						Psephenidae	𝍸 𝍸 𝍸 𝍸 ||||	24			
Amphipoda						Diptera					
Decapoda						Simulidae	|	1			
						Tipulidae	𝍸 |||	8			
Ephemeroptera						Chironomidae	𝍸 ||	7			
						Gastropoda					
#16 Caenidae	|||	3									
Baetidae	|	1				Ancylidae	||	2			
Heptageniidae	𝍸+36+2+6	47				Pelecypoda					
Plecoptera											
						Other Planeria	||||	4			
Trichoptera											
Philopotamidae	𝍸 𝍸 |	11									
Heliocopsychidae	||||	4									
Hydropsychidae	|||	3									
Hemiptera											

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 170 **Total No. Taxa** ____

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Little Cicero Creek		LOCATION	
STATION # 6	RIVERMILE ____	STREAM CLASS	
LAT ____	LONG ____	RIVER BASIN	
STORET #		AGENCY	
COLLECTED BY JLD, NAL	DATE 10-15-09	LOT #	
TAXONOMIST JLD	DATE 11-5-09	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____	

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	|||||	5			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera					
Plecoptera					
Trichoptera					
Helicopsychidae	||	2			
Hydropsychidae	||||| ||||| ||||| ||||| |||||		26			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Elmidae (adult)	|||||		6			
Elmidae (larvae)	||||| ||||| ||	12			
Psephenidae	|||||		6			
Diptera					
Chironomidae	||||| |||||		11			
Simulidae	||||| ||||| |||	13			
Tipulidae	||||	4			
Gastropoda					
Sphaeriidae		↓	1			
Corbiculidae	||||	4			
Pelecypoda					
Other Planaria	|||||	5			
Coenagrionidae		(#?)	1			
Hydracarina		(#18)	1			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 97 **Total No. Taxa** ____

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Cicero Creek		LOCATION	
STATION # 7	RIVERMILE ________	STREAM CLASS	
LAT ________	LONG ________	RIVER BASIN	
STORET #		AGENCY	
COLLECTED BY JLD, NAL	DATE 10-6-09	LOT #	
TAXONOMIST JLD	DATE 11-5-09	SUBSAMPLE TARGET ❑ 100 ❑ 200 ❑ 300 ❑ Other ____	

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	|	1			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera					
Caenidae	卌 ||||	9			
(20) Baetidae	卌 |||	8			
Tricorythidae	卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 |||	63			
Heptagenidae	卌 卌 卌 卌 卌 |||	28			
Plecoptera					
Trichoptera					
Philopotamidae	卌 卌 卌 卌 |||	23			
Heliocopsychidae	卌 |	6			
~~[illegible]~~	~~[illegible]~~				
Hydropsychidae	56 + 卌 卌 卌 卌 卌	81			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Elmidae (larvae)	卌 ||||	9			
Psephenidae	卌 卌 |	11			
Diptera					
Chironomidae	卌 卌 卌	15			
Simulidae	||||	4			
Tipulidae	卌 |	6			
Gastropoda RH	||	2			
Corbiculidae	|	1			
Ancylidae	|	1			
Pelecypoda					
LH Pleuroceridae	|	1			
Other (19) Asellidae	|	1			
Tubellaria	卌 卌 |	11			
Coenagrionidae	||	2			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 283 **Total No. Taxa** ________

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Little Cicero Creek	LOCATION
STATION # 8 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
COLLECTED BY JD, NAL DATE 10-16-09	LOT #
TAXONOMIST JD DATE 11-5-09	SUBSAMPLE TARGET ❑ 100 ❑ 200 ❑ 300 ❑ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	ll	2			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera Baetidae	~~HH~~ ~~HH~~ ll	12			
Tricorythidae	ll	2			
Plecoptera					
Trichoptera					
Philopotamidae	ll	2			
Hydropsychidae	44+17	61			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Elmidae (adult)	l	1			
Elmidae (larvae)	~~HH~~ ~~HH~~ ll	12			
Diptera					
Chironomid (Red) (23)	l	1			
Tabanidae (#21)	ll	2			
Tipulidae	llll	4			
Chironomidae (#22)	~~HH~~ ~~HH~~ ~~HH~~ lll	18			
Gastropoda					
(Left hand) Pleuroceridae	l	1			
Pelecypoda					
Other Planaria	lll	3			
Hydracarina	l	1			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 122 **Total No. Taxa** ____

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Cicero Creek	LOCATION
STATION # 9 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
COLLECTED BY JLD, NAL DATE 10-16-09	LOT #
TAXONOMIST JLD DATE 11-6-09	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	|	1			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera					
Tricorythidae	卌 ||| 卌 卌 卌 卌 卌 卌	34			
Heptageniidae	||	2			
Caenidae	卌 ||	7			
Baetidae	卌 卌 ||	12			
Plecoptera					
Trichoptera					
Leptoceridae	|	1			
Philopotamidae	卌 |	6			
Heliocopsychidae	||||	4			
Hydropsychidae	卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌	81			
Hemiptera	卌 卌 卌 |				

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Elmidae (adult)	|||	3			
Elmidae (larvae)	卌 |||	14			
Diptera					
Chironomidae	卌 卌 |	11			
Tabanidae	|	1			
Tipulidae	||	2			
Gastropoda					
Pelecypoda					
Ancylidae	|	1			
Other Tubellaria	||||	4			
Hydracarina	|	1			
Calopterygidae	||	2			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 187 **Total No. Taxa** ____

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

STREAM NAME Prairie Creek	LOCATION
STATION # 10 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
COLLECTED BY JLD, NAL DATE 10-16-09	LOT #
TAXONOMIST JLD DATE 11-6-09	SUBSAMPLE TARGET ❑ 100 ❑ 200 ❑ 300 ❑ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	𝍸 IIII	9			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera					
Caenidae	II	2			
Plecoptera					
Trichoptera					
Leptoceridae	II	2			
Heliocopsychidae	IIII	4			
Hydropsychidae	𝍸 𝍸 𝍸 𝍸 𝍸 IIII	29			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
(#25)					
Hydrophilidae (larvae)	𝍸 𝍸 IIII	14			
Elmidae (larvae)	𝍸 II	7			
Diptera					
Simulidae	III	3			
Chironomidae	𝍸 𝍸 II	12			
Tipulidae	𝍸 I	6			
Gastropoda					
Corbiculidae	I	1			
R-Handed	II	2			
Pelecypoda					
Other planaria	IIII	4			
Hydracarina	II	2			
Coenagrionidae	II	2			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 99 **Total No. Taxa** ____

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Cicero Creek	LOCATION
STATION # 11 RIVERMILE ____	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
COLLECTED BY ____ DATE ____	LOT #
TAXONOMIST ____ DATE ____	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	|||	3			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera					
Baetidae	||||	4			
Plecoptera					
Trichoptera					
Philopotamidae	~~||||~~ ~~||||~~ |||	13			
Heliocopsychidae	~~||||~~ ||	7			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Psephenidae	|||	3			
Hydrophilidae	||	2			
Elmidae (larvae)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |||	23			
Diptera					
Chironomidae	~~||||~~	~~||||~~ ||	12			
Gastropoda					
L Handed			1			
Limpet	||||	4			
Pelecypoda					
Other					
Planaria	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||||	24			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 96 **Total No. Taxa** ____

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Dixon Creek	LOCATION
STATION # 12 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
COLLECTED BY JLD, NAL DATE 10-16-09	LOT #
TAXONOMIST JLD DATE 11-8-09	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR	Organisms		No.	LS	TI	TCR
Oligochaeta	I	1				Megaloptera					
Hirudinea	II	2				Coleoptera					
Isopoda											
						Elmidae (ad)	I	1			
Amphipoda						Hydrophilidae	I	1			
						Diptera					
Decapoda						*Ephydridae	I	1			
						Tipulidae	III	3			
Ephemeroptera						Chironomidae	𝍸 𝍸 𝍸 𝍸	20			
						Simulidae	𝍸 I	6			
						Gastropoda Ram Horn	II	2			
						LHanded	III	3			
						Asian clam	I	1			
						Pelecypoda					
Plecoptera											
						Other Planaria	III	3			
Trichoptera											
Heliocopsychidae	𝍸 IIII	9									
Hydropsychidae	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 II	37									
Philopotamidae	IIII	4									
Hemiptera											

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 94 **Total No. Taxa** ______

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Buck Creek	LOCATION
STATION # 13 RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
COLLECTED BY DATE ______	LOT #
TAXONOMIST DATE ______	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	|	1			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera Heptageniidae	||||	4			
Tricorythidae	(64)	64			
Caenidae	卌 ||	8			
Baetidae	||||	4			
Plecoptera					
Trichoptera					
Philopotamidae	||||	4			
Helicopsychidae	卌 卌 |||	13			
Hydropsychidae	43 + 卌 卌 ||||	57			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Haliplidae	|				
Hydrophilidae	|	1			
Elmidae (larvae)	卌 |	6			
Diptera					
Simulidae	|	1			
Tipulidae	|||	3			
Chironomidae	卌 ||	7			
Gastropoda					
Limpet	|	1			
Lttorded	||||	4			
Pelecypoda					
Other Planeria	卌 ||	7			
Calopterygidae	|||	3			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 188 **Total No. Taxa** ______

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page ____ of ____

STREAM NAME Turkey Creek		LOCATION	
STATION # 14	RIVERMILE ____	STREAM CLASS	
LAT ____	LONG ____	RIVER BASIN	
STORET #		AGENCY	
COLLECTED BY JLD, NAL	DATE 10-16-09	LOT #	
TAXONOMIST JLD	DATE 11-8-09	SUBSAMPLE TARGET ☐ 100 ☐ 200 ☐ 300 ☐ Other ____	

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR
Oligochaeta	III	3			
Hirudinea					
Isopoda					
Amphipoda					
Decapoda					
Ephemeroptera					
Caenidae	III	3			
*Tricorythidae	~~IIII~~ ~~IIII~~ ~~IIII~~ I + 26	41			
Heptagenidae	~~IIII~~ ~~IIII~~ ~~IIII~~ IIII	19			
Plecoptera					
Trichoptera					
Philopotamidae	IIII	4			
Helicopsychidae	II	2			
Hydropsychidae	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ I	36			
Hemiptera					

Organisms		No.	LS	TI	TCR
Megaloptera					
Coleoptera					
Elmidae (adult)	I	1			
Elmidae (larvae)	III	3			
Hydrophilidae	III	3			
Diptera					
Chironomidae	~~IIII~~ III	8			
Tipulidae	III	3			
Gastropoda					
LH	~~IIII~~ I	6			
RH	I	1			
Pelecypoda					
Other: Planaria	~~IIII~~ IIII	9			

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms 143 **Total No. Taxa** ____

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 1

Family: *Corydalidae*
Common Name:
Dobsonflies, Hellgrammites

<u>Station:</u>
Fall '09: 1

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 2

Family: *Belostomatidae*
Common Name:
Giant Water Bug

<u>Station:</u>
Fall '09: 1

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 3

Family: *Simulidae*
Common Name:
Black Fly

<u>Stations:</u>
Fall '09: 1, 2, 3, 5, 6, 7, 10, 12, 13

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 4

Family: *Tricorythidae*
Common Name:
Little Stout Crawler Mayflies

Stations:
Fall '09: 1, 7, 8, 9, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 5

Family: *Tipulidae*
Common Name:
Crane Flies

Stations:
Fall '09: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 6

Family: *Psephenidae*
Common Name:
Water Pennies

Stations:
Fall '09: 1, 2, 3, 5, 6, 7, 11

Morse Reservoir/Cicero Creek
Macroinvertebrates
Vial 7

Family: *Hydropsychidae*
Common Name:
Net-Spinner Caddisflies

<u>Stations:</u>
Fall '09: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 8

Family: *Elmidae*
Common Name:
Riffle Beetle

<u>Stations:</u>
Fall '09: 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 13, 14

Morse Reservoir/Cicero Creek
Macroinvertebrates
Vial 9

Family: *Ancylidae*
Common Name:
Limpets

<u>Stations:</u>
Fall '09: 2, 4, 5, 7, 9, 11, 13

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 10

Family: *Elmidae*
Common Name:
Riffle Beetle

<u>Stations:</u>
Fall '09: 1, 2, 3, 5, 6, 7, 8, 9, 12, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 11

Class: *Turbellaria*
Common Name:
Planerians, Flatworms

<u>Stations:</u>
Fall '09: 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 12

Family: *Philopotamidae*
Common Name:
Finger-Net Caddisflies

<u>Stations:</u>
Fall '09: 1, 2, 3, 5, 7, 8, 9, 11, 12, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 13

Family: *Helicopsychidae*
Common Name:
Snail Case-Maker Caddisflies

Stations:
Fall '09: 1, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 14

Family: *Heptageniidae*
Common Name:
Flathead Mayflies

Stations:
Fall '09: 1, 2, 3, 5, 7, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 15

Class: *Oligochaeta*
Common Name:
Aquatic Earthworms

Stations:
Fall '09: 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 16

Family: *Caenidae*
Common Name:
Square-Gill Mayflies

<u>Stations:</u>
Fall '09: 1, 2, 3, 5, 7, 9, 10, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 17

Family: *Coenagrionidae*
Common Name:
Narrow-winged Damselflies

<u>Stations:</u>
Fall '09: 3, 6, 7, 10

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 18

Order: *Hydracarina*
Common Name:
Water Mite

<u>Stations:</u>
Fall '09: 6, 8, 9, 10

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 19

Family: *Lampyridae*
Common Name:
Lightning Bug

Station:
Fall '09: 7

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 20

Family: *Baetidae*
Common Name:
Small Minnow Mayflies

Stations:
Fall '09: 1, 2, 5, 7, 8, 9, 11, 13

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 21

Family: *Tabanidae*
Common Name:
Horse Flies, Deer Flies

Stations:
Fall '09: 3, 8, 9

Morse Reservoir/Cicero
Creek Macroinvertebrates
Vial 22

Family: *Chironomidae*
Common Name:
Non-biting Midges

<u>Stations:</u>
Fall '09: 1, 2, 3, 4, 5, 6, 7,
8, 9, 10, 11, 12, 13, 14

Morse Reservoir/Cicero
Creek Macroinvertebrates
Vial 23

Family: "Red" *Chironomidae*
Common Name:
Non-biting Midges

<u>Station:</u>
Fall '09: 8

Morse Reservoir/Cicero
Creek Macroinvertebrates
Vial 24

Family: *Calopterygidae*
Common Name:
Broad-winged Damselflies

<u>Stations:</u>
Fall '09: 9, 13

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 25

Family: *Hydrophilidae*
Common Name:
Water Scavenger Beetles

Stations:
Fall '09: 10, 11, 12, 13, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 26

Class: *Hirudinea*
Common Name:
Leech

Stations:
Fall '09: 2, 12

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 27

Family: *Leptoceridae*
Common Name:
Long-horned Case-make Caddisflies

Stations:
Fall '09: 9, 10, 14

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 28

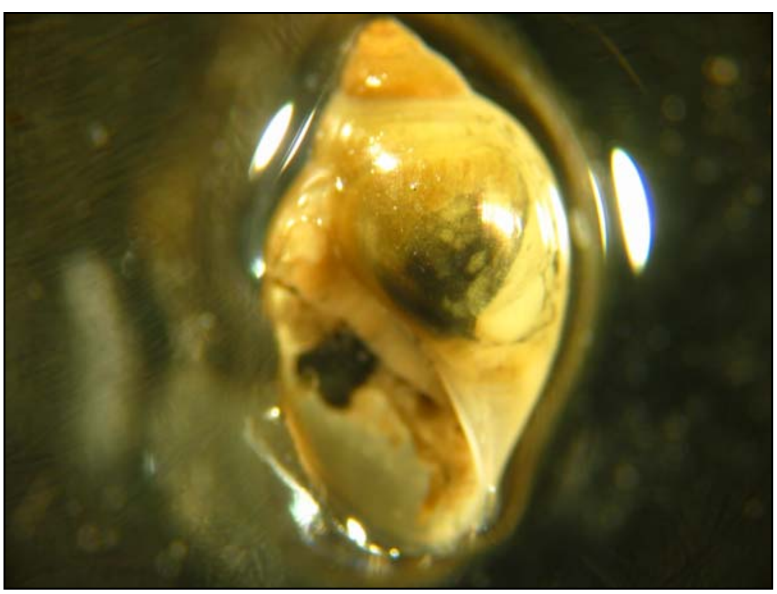
Family: *Ephydridae*
Common Name:
Shore Flies, Brine Flies

<u>Station:</u>
Fall '09: 12

Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 29

Family: *Haliplidae*
Common Name:
Crawling Water Beetles

<u>Station:</u>
Fall ’09: 13



Morse Reservoir/Cicero Creek Macroinvertebrates
Vial 30

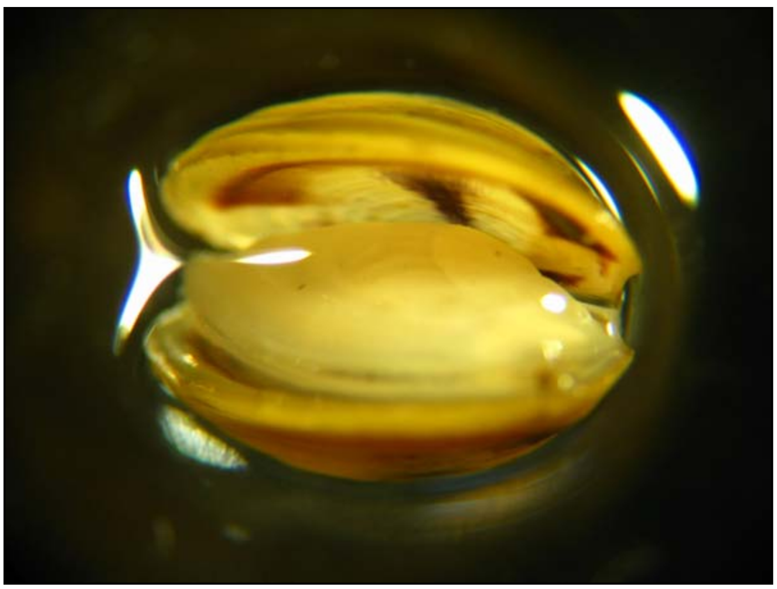
Family: *Pleuroceridae*
Common Name:
Freshwater Snails

<u>Stations:</u>
Fall ’09: 2, 4, 7, 8, 11, 12, 13, 14

Morse Reservoir/Cicero
Creek Macroinvertebrates
Vial 31

Family: *Physidae*
Common Name:
Tadpole Snails

<u>Stations:</u>
Fall '09: 1, 2, 3, 7, 10, 14



Morse Reservoir/Cicero
Creek Macroinvertebrates
Vial 32

Family: *Corbiculidae*
Common Name:
Asian Clam

<u>Stations:</u>
Fall '09: 6, 7, 10

Appendix I – Windshield Survey Data

A summary of the data obtained during the Windshield Survey is included in this Appendix. Survey locations were split up per subwatershed based on the size of the subwatershed with a total of 100 waterway crossing and 50 land points. Observations were made upstream and downstream at each point during October/November 2009 by Steering Committee volunteers. Copies of the original data sheets are provided on CD at the end of this report.

Windshield Survey Field Sheet

Watershed ______________________	Site ID ___________________________
Date ___________________________	Location __________________________
Time ___________________________	Field Investigator(s) ________________

Weather (past 24 hours)	Weather (now)	Wildlife Noted
☐ Rain ☐ Heavy ☐ Steady ☐ Intermittent ☐ Snow ☐ Overcast ☐ Partly cloudy ☐ Clear sky	☐ Rain ☐ Heavy ☐ Steady ☐ Intermittent ☐ Snow ☐ Overcast ☐ Partly cloudy ☐ Clear sky	

Land Use *check more than one if necessary*

- ⊕ **Residential**
  - ⊕ Single-Family
  - ⊕ Multi-Family
  - ⊕ Stormwater management practice
    - ⊕ curb and gutter
    - ⊕ retention basins
- ⊕ **Industrial**
- ⊕ **Commercial** (strip malls, restaurants, etc.)
- ⊕ **Forested**
- ⊕ **Mining/quarry**
- ⊕ **Wetland** (standing water or wetland vegetation)

- ⊕ **Agricultural**
  - ⊕ Field erosion/ gullies present
  - ⊕ Land is absent of vegetation
  - ⊕ Row Crop (corn, soybean, etc)
  - ⊕ Pasture without animals (fallow)
  - ⊕ Pasture with animals
    - ⊕ Cattle
    - ⊕ Hogs
    - ⊕ Other _______________
    - ⊕ Animals have stream access
    - ⊕ Estimated size of operation (number of head) _________
  - ⊕ Tillage type
    - ⊕ No-till
    - ⊕ Reduced till (50% residue)
    - ⊕ Conventional (black dirt)

Land Odor	Please note if Best Management Practice implemented at location:
☐ Sewage ☐ Chemical ☐ Hydrocarbon (gas) ☐ Soaps ☐ Dead Animal ☐ Other ___________	**Please note if Best Management Practice implemented at location:** ____________________ ____ ____ ____

At Stream Location Only

Water Color/Appearance *check all that apply*	**Water Odor**
☐ Clear ☐ Murky ☐ Green ☐ Oily Sheen ☐ Brown ☐ Other ____________	☐ Sewage ☐ Soaps ☐ Chemical ☐ Dead Animal ☐ Hydrocarbons (gas) ☐ Other ____________

Algae *check all that apply*

☐ Floating ☐ Limited growth
☐ Thick mats ☐ Moderate growth
☐ Attached to substrate ☐ Excessive growth

Stream Erosion	**Stream Buffer**
☐ Absent ☐ Stabilized (rip-rap, coir log, etc.) ☐ Present ☐ > 3' tall eroded ☐ < 3' tall eroded *(Please indicate in box above the location of erosion if present.)*	☐ Absent ☐ Present (minimum 10') ☐ > 50 feet ☐ < 50 feet *(Please indicate in the box above the location of buffer if present.)*

Buffer Type: (*circle all that apply)*

Trees Shrubs Grasses Other _______________

In Stream Debris *(circle all that apply)*

Trash Deposits Log Jam Beaver Dam Other_______________

Available Shade/ Stream Cover*	**In-stream Habitat** *check all that apply*
☐ 0% Cover ☐ 1- 25% Cover ☐ 25 - 75% Cover ☐ 75 – 100 % Cover *How much of the stream is shaded	☐ Underwater tree roots ☐ Deep Areas ☐ Boulders ☐ Shallow Areas ☐ Downed trees ☐ Undercut Banks ☐ Other _______________

Additional Notes:

Animal Access		
Watershed	Site ID	Animals with stream access
Prairie Creek	PC-W2	Yes
Cox Ditch	CD-W5	Yes
Teter Branch	TB-W6	Yes
Teter Branch	TB W8A	Yes
Teter Branch	TB-W9A	Yes
Little Cicero	LC-W3	Yes
Little Cicero	LC-W4	Yes
Little Cicero	LC-W8	Yes
Hinkle Creek	HC-W3	Yes
Hinkle Creek	HC-W4	Yes
Hinkle Creek	HC-W8	Yes
Weasel Creek	WC-W8	Yes

Erosion >3'					
Watershed	Site ID	Stream Erosion Quad 1	Stream Erosion Quad 2	Stream Erosion Quad 3	Stream Erosion Quad 4
Cox Ditch	CD-W5	Absent	Absent	Present >3'	Present >3'
Dixon Creek	DC-L4	Absent	Absent	Present >3'	Present >3'
Dixon Creek	DC-W1	Stabilized	Present >3'	Present >3'	
Dixon Creek	DC-W7	Present >3'			
Hinkle Creek	HC-W2	Present >3'			
Hinkle Creek	HC-W3	Present >3'			
Hinkle Creek	HC-W4	Present >3'			
Little Cicero	LC-W3	Absent	Present >3'		
Little Cicero	LC-W4	Absent	Present >3'		
Little Cicero	LC-W6	Present >3'			
Morse/Cicero	MR-W1	Present >3'			
Morse/Cicero	MR-W3	Present >3'			
Morse/Cicero	MR-W4	Stabilized	Present >3'		
Morse/Cicero	MR-W5	Present >3'			
Morse/Cicero	MR-W7	Present >3'	Present <3'		
Morse/Cicero	MR-W8	Stabilized	Present >3'		
Morse/Cicero	MR-W9	Present >3'			
Prairie Creek	PC-W2	Absent	Present >3'		
Teter Branch	TB W8A	Present >3'			
Teter Branch	TB-W1	Present >3'			
Teter Branch	TB-W3	Present >3'			
Teter Branch	TB-W7	Present >3'			
Teter Branch	TB-W8	Stabilized	Present >3'		
Tobin Ditch	TD-W10	Stabilized	Present >3'	Present >3'	Present >3'
Tobin Ditch	TD-W13	Stabilized	Present >3'	Present >3'	
Tobin Ditch	TD-W3	Stabilized	Present >3'	Present >3'	
Weasel Creek	WC-W1	Absent	Absent	Absent	Present >3'
Weasel Creek	WC-W10	Present >3'	Present >3'		

Erosion <3'					
Watershed	Site ID	Stream Erosion Quad 1	Stream Erosion Quad 2	Stream Erosion Quad 3	Stream Erosion Quad 4
Teter Branch	TB-W6	Present <3'			
Little Cicero	LC-W2	Present <3'			
Little Cicero	LC-W8	Present <3'			
Little Cicero	LC-W9	Present <3'			
Morse/Cicero	MR-W2	Present <3'			
Morse/Cicero	MR-W6	Present <3'			
Hinkle Creek	HC-W1	Present <3'			
Morse/Cicero	MR-W7	Present >3'	Present <3'		

No Buffers					
Watershed	Site ID	Stream Buffer Quad 1	Stream Buffer Quad 2	Stream Buffer Quad 3	Stream Buffer Quad 4
Cox Ditch	CD-W7	Absent			
Cox Ditch	CD-W9	Absent	Absent	Present <50	Present <50
Dixon Creek	DC-L3	Absent	Absent	Absent	Absent
Hinkle Creek	HC-W9	Absent			
Little Cicero	LC-W3	Absent			
Little Cicero	LC-W5	Absent			
Little Cicero	LC-W8	Absent			
Morse/Cicero	MR-W5	Absent			
Prairie Creek	PC-w4	Absent			
Prairie Creek	PC-W7	Absent			
Teter Branch	TB-W2	Absent	Present >50		
Tobin Ditch	TD-W11	Absent			
Tobin Ditch	TD-W2	Absent			
Tobin Ditch	TD-W5	Absent			
Weasel Creek	WC-W8	Absent			
Weasel Creek	WC-W9	Absent			

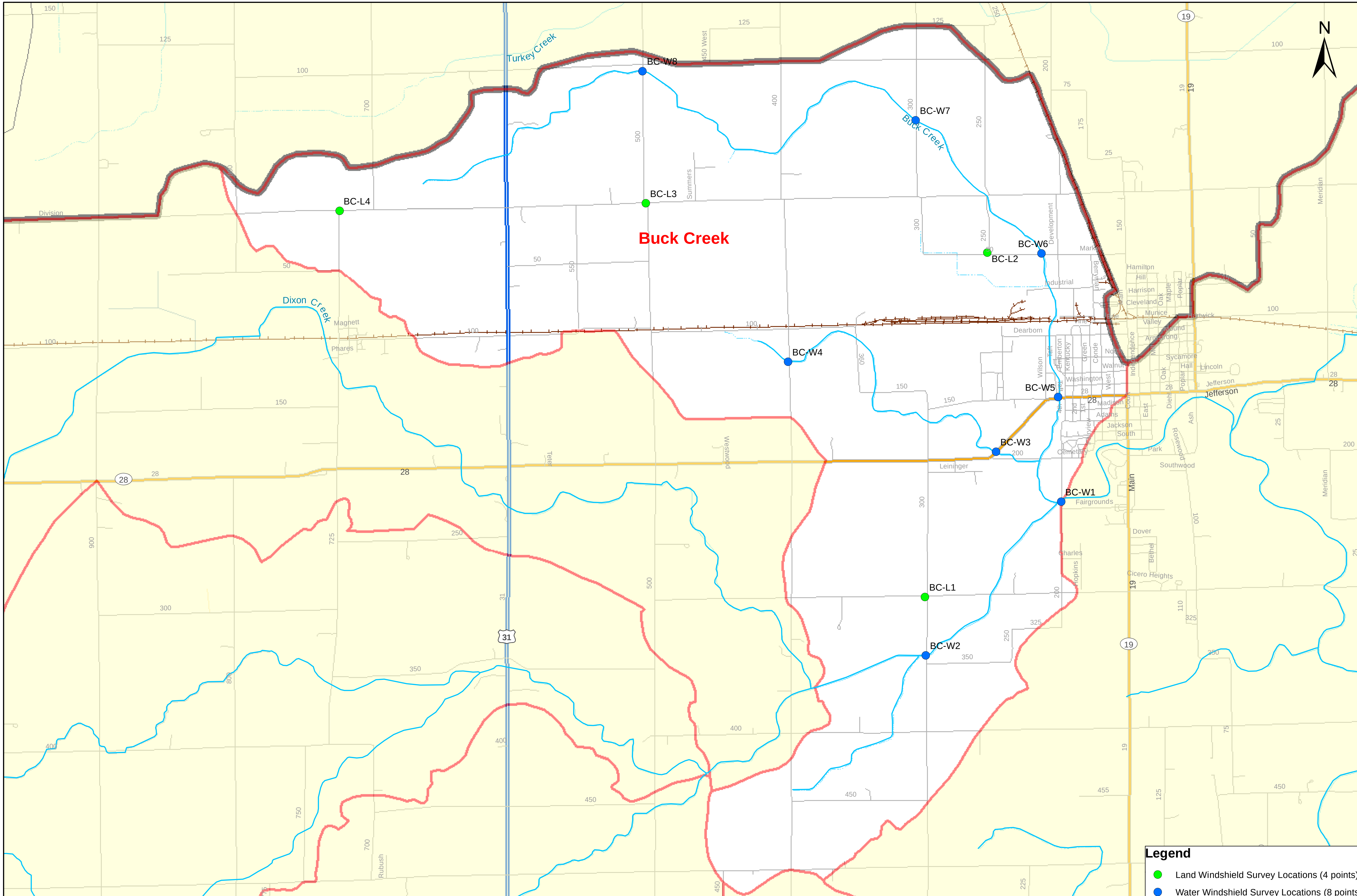
Buffers <50'					
Watershed	Site ID	Stream Buffer Quad 1	Stream Buffer Quad 2	Stream Buffer Quad 3	Stream Buffer Quad 4
Cox Ditch	CD-W1	Absent	Present <50	Present <50	Present <50
Cox Ditch	CD-W2	Present <50	Present <50	Present <50	Absent
Cox Ditch	CD-W8	Absent	Present >50	Present <50	Present <50
Dixon Creek	DC-W3	Present <50			
Hinkle Creek	HC-W1	Present <50			
Hinkle Creek	HC-W2	Present <50			
Hinkle Creek	HC-W3	Present <50			
Hinkle Creek	HC-W4	Present <50			
Hinkle Creek	HC-W5	Present <50			
Hinkle Creek	HC-W6	Present <50			
Hinkle Creek	HC-W7	Present <50			
Hinkle Creek	HC-W8	Present <50			
Little Cicero	LC-W6	Present <50			
Little Cicero	LC-W9	Present <50			
Morse/Cicero	MR-W1	Present <50			
Morse/Cicero	MR-W10	Present <50			
Morse/Cicero	MR-W11	Present <50			
Morse/Cicero	MR-W12	Present <50			
Morse/Cicero	MR-W2	Present <50			
Morse/Cicero	MR-W3	Present <50			
Morse/Cicero	MR-W4	Present <50			
Morse/Cicero	MR-W6	Present <50	Present >50		
Morse/Cicero	MR-W8	Present <50			
Prairie Creek	PC-W10	Present <50			
Prairie Creek	PC-W2	Present <50			
Prairie Creek	PC-W8	Present <50			
Prairie Creek	PC-W9	Present <50			
Teter Branch	TB-W5	Present <50			
Teter Branch	TB-W7	Present <50			
Teter Branch	TB-W8	Present <50			
Teter Branch	TB-W9	Present <50			
Tobin Ditch	TD-W14	Present <50			
Tobin Ditch	TD-W6	Present <50			
Tobin Ditch	TD-W8	Present <50			
Weasel Creek	WC-W5	Present <50			

In Stream Debris				
Watershed	Site ID	In Stream Debris	In Stream Debris 2	In Stream Debris Notes
Cox Ditch	CD-W7	Trash		
Dixon Creek	DC-W5	Other		tire
Hinkle Creek	HC-W1	Other		fallen trees
Hinkle Creek	HC-W2	Deposits	Log Jam	
Hinkle Creek	HC-W4	Other		fencing
Hinkle Creek	HC-W7	Log Jam		
Hinkle Creek	HC-W8	Other		metal stakes/pipes
Hinkle Creek	HC-W9	Trash		limited
Little Cicero	LC-W1	Other		logs
Little Cicero	LC-W2	Deposits		sandbar
Little Cicero	LC-W4	Other		live grass in stream
Little Cicero	LC-W7	Other		large amount of leaves
Little Cicero	LC-W8	Deposits	Other	caught on wire square fence
Little Cicero	LC-W9	Trash	Deposits	plastic bucket; siltbar
Morse/Cicero	MR-W1	Log Jam		
Morse/Cicero	MR-W10	Other		leaves
Morse/Cicero	MR-W11	Other		limbs, riprap across north didn't stop flow
Morse/Cicero	MR-W12	Other		grass
Morse/Cicero	MR-W2	Deposits		
Morse/Cicero	MR-W3	Trash		
Morse/Cicero	MR-W4	Trash		
Morse/Cicero	MR-W7	Trash	Deposits	
Morse/Cicero	MR-W8	Trash		
Morse/Cicero	MR-W9	Log Jam		
Teter Branch	TB-W3	Log Jam		
Teter Branch	TB-W6	Trash	Log Jam	fence under bridge to keep cattle in
Teter Branch	TB-W7	Deposits		
Tobin Ditch	TD-W3	Trash	Other	island
Tobin Ditch	TD-W5	Deposits		
Weasel Creek	WC-W1	Deposits	Log Jam	tires
Weasel Creek	WC-W5	Other		heavy grass

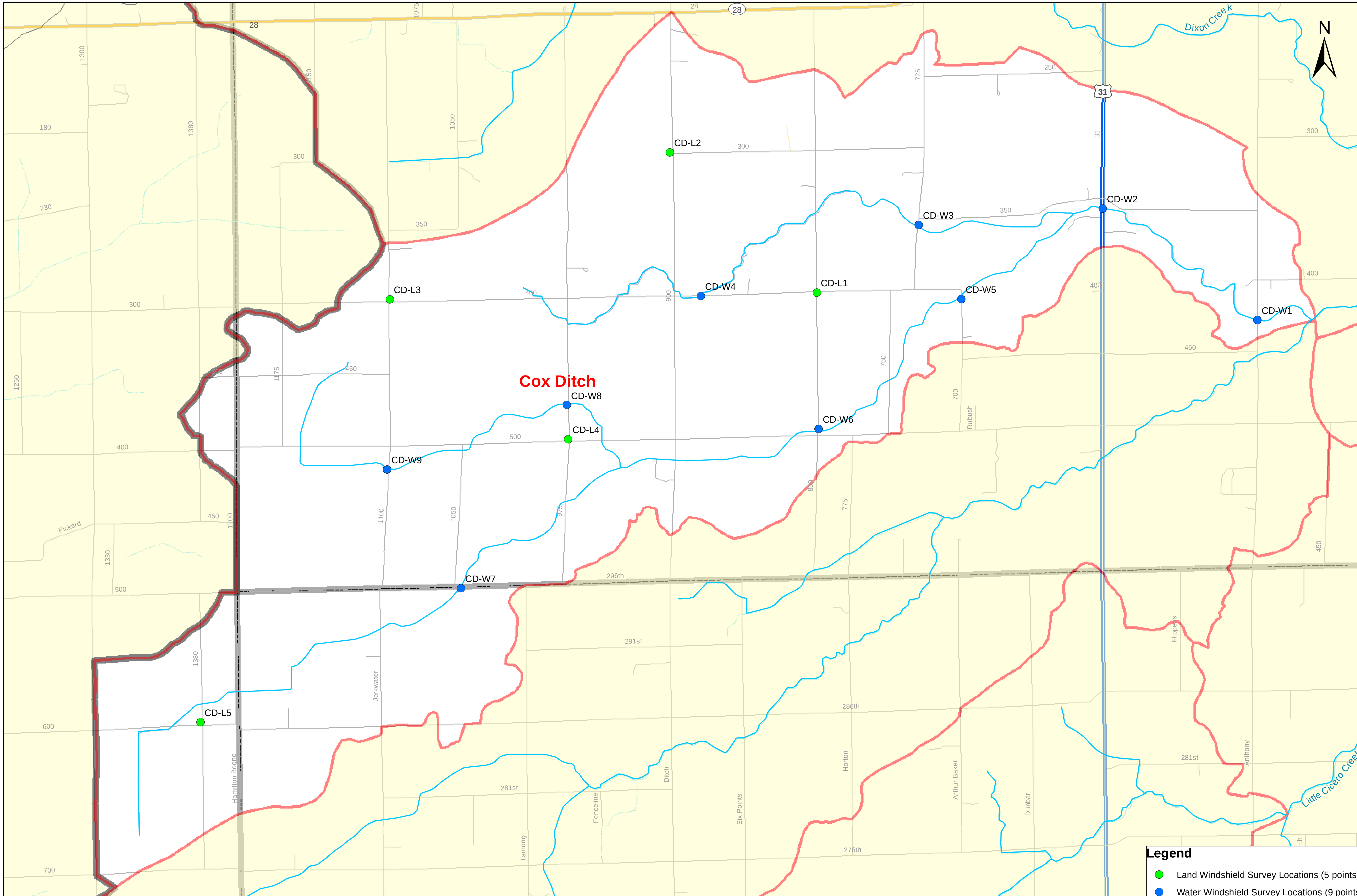
No Stream Cover		
Watershed	Site ID	Shade/Stream Cover
Buck Creek	BC-W1	0% Cover
Buck Creek	BC-W2	0% Cover
Buck Creek	BC-W3	0% Cover
Buck Creek	BC-W4	0% Cover
Buck Creek	BC-W5	0% Cover
Buck Creek	BC-W6	0% Cover
Buck Creek	BC-W7	0% Cover
Buck Creek	BC-W8	0% Cover
Dixon Creek	DC-L3	0% Cover
Dixon Creek	DC-L4	0% Cover
Dixon Creek	DC-W1	0% Cover
Dixon Creek	DC-W6	0% Cover
Dixon Creek	DC-W7	0% Cover
Hinkle Creek	HC-W6	0% Cover
Little Cicero	LC-W3	0% Cover
Little Cicero	LC-W6	0% Cover
Morse/Cicero	MR-W12	0% Cover
Teter Branch	TB-W5	0% Cover
Tobin Ditch	TD-W11	0% Cover
Tobin Ditch	TD-W13	0% Cover
Tobin Ditch	TD-W14	0% Cover
Tobin Ditch	TD-W2	0% Cover
Tobin Ditch	TD-W5	0% Cover
Tobin Ditch	TD-W6	0% Cover
Tobin Ditch	TD-W7	0% Cover
Tobin Ditch	TD-W8	0% Cover
Tobin Ditch	TD-W9	0% Cover
Weasel Creek	WC-W3	0% Cover
Weasel Creek	WC-W5	0% Cover
Weasel Creek	WC-W8	0% Cover
Weasel Creek	WC-W9	0% Cover

Stream Cover <25%		
Watershed	Site ID	Shade/Stream Cover
Cox Ditch	CD-W4	1-25% Cover
Cox Ditch	CD-W5	1-25% Cover
Cox Ditch	CD-W6	1-25% Cover
Cox Ditch	CD-W9	1-25% Cover
Dixon Creek	DC-W2	1-25% Cover
Dixon Creek	DC-W3	1-25% Cover
Dixon Creek	DC-W4	1-25% Cover
Dixon Creek	DC-W5	1-25% Cover
Hinkle Creek	HC-W9	1-25% Cover
Little Cicero	LC-W1	1-25% Cover
Little Cicero	LC-W8	1-25% Cover
Morse/Cicero	MR-W1	1-25% Cover
Morse/Cicero	MR-W11	1-25% Cover
Morse/Cicero	MR-W2	1-25% Cover
Morse/Cicero	MR-W3	1-25% Cover
Morse/Cicero	MR-W5	1-25% Cover
Morse/Cicero	MR-W6	1-25% Cover
Prairie Creek	PC-W10	1-25% Cover
Prairie Creek	PC-w4	1-25% Cover
Prairie Creek	PC-W7	1-25% Cover
Prairie Creek	PC-W8	1-25% Cover
Teter Branch	TB-W2	1-25% Cover
Tobin Ditch	TD-W1	1-25% Cover
Tobin Ditch	TD-W15	1-25% Cover
Tobin Ditch	TD-W4	1-25% Cover
Weasel Creek	WC-W4	1-25% Cover

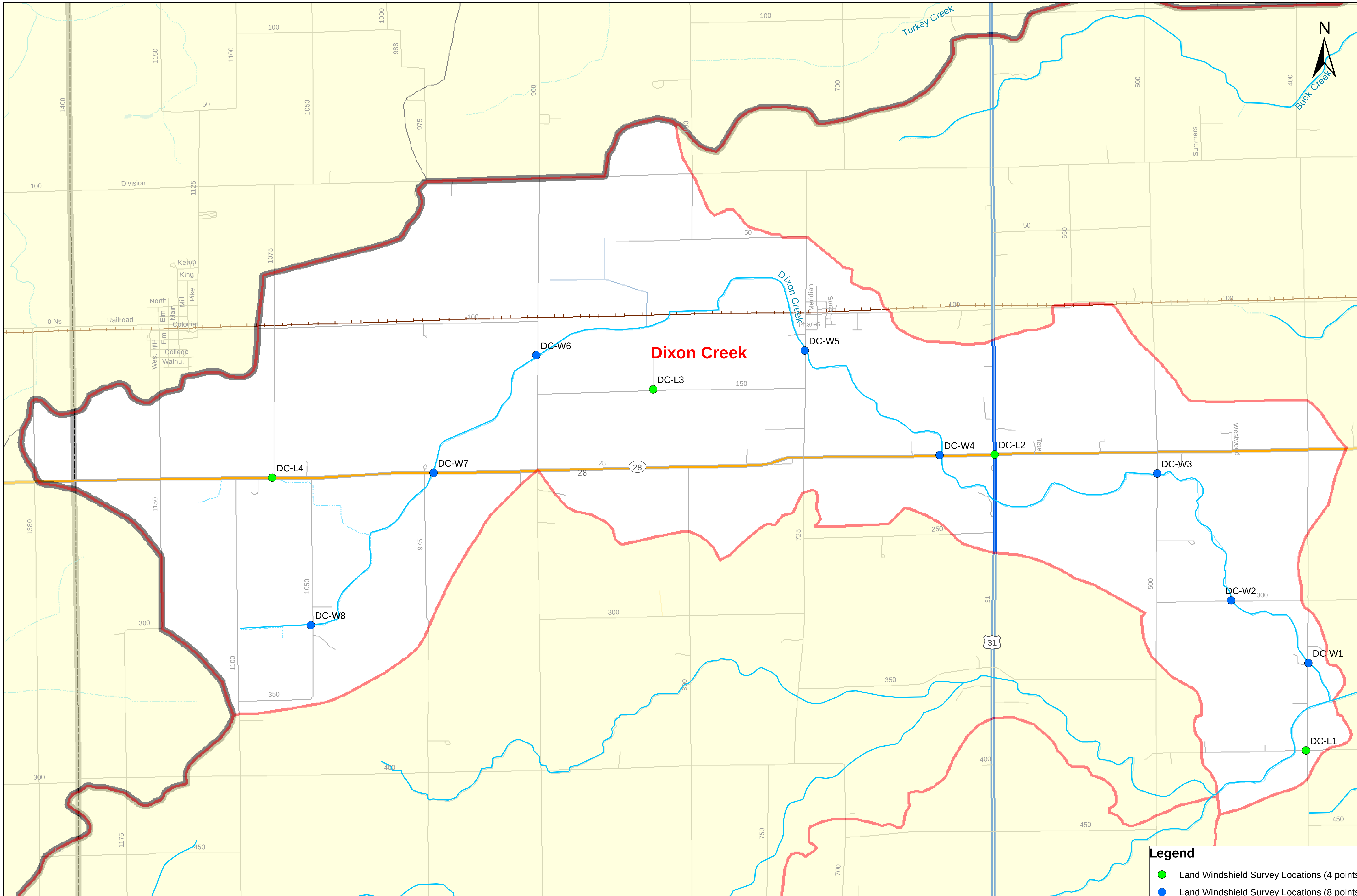
Conventional Till					
Watershed	Site ID	Quad 1 Ag Tillage	Quad 2 Ag Tillage	Quad 3 Ag Tillage	Quad 4 Ag Tillage
Buck Creek	BC-W2	Conventional			
Buck Creek	BC-W4		Conventional		
Dixon Creek	DC-W7		Conventional		
Little Cicero	LC-L1		Conventional	Conventional	Conventional
Little Cicero	LC-L2	Conventional			
Little Cicero	LC-L3	Conventional	Conventional	Conventional	
Little Cicero	LC-L4		Conventional	Conventional	Conventional
Little Cicero	LC-L5	Conventional			
Little Cicero	LC-W4		Conventional	Conventional	
Little Cicero	LC-W7			Conventional	Conventional
Little Cicero	LC-W8			Conventional	
Little Cicero	LC-W9	Conventional			
Morse/Cicero	MR-L2		Conventional	Conventional	
Morse/Cicero	MR-L4	Conventional			
Morse/Cicero	MR-L6		Conventional		
Morse/Cicero	MR-W12	Conventional			
Morse/Cicero	MR-W5				Conventional
Prairie Creek	PC-L1	No-till	Conventional		
Prairie Creek	PC-W10	No-till	No-till	No-till	Conventional
Prairie Creek	PC-W8	No-till	Conventional		
Teter Branch	TB-L1			Conventional	No-till
Teter Branch	TB-L2	Conventional			
Teter Branch	TB-L3	Conventional			
Tobin Ditch	TD-L1	Conventional			
Tobin Ditch	TD-L2	Conventional			
Weasel Creek	WC-L2	Conventional			
Weasel Creek	WC-L5	Conventional			
Weasel Creek	WC-W9	Conventional			

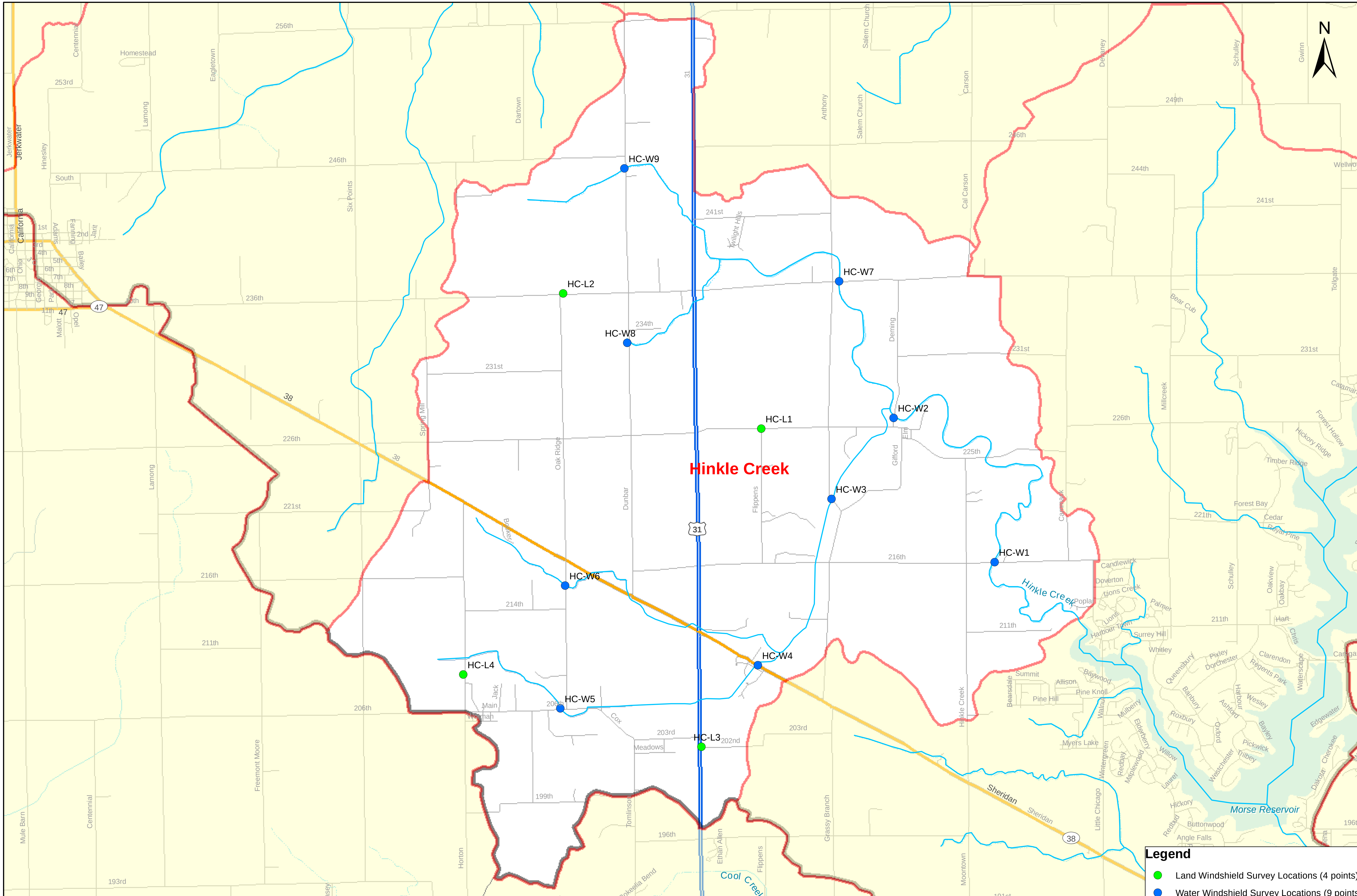


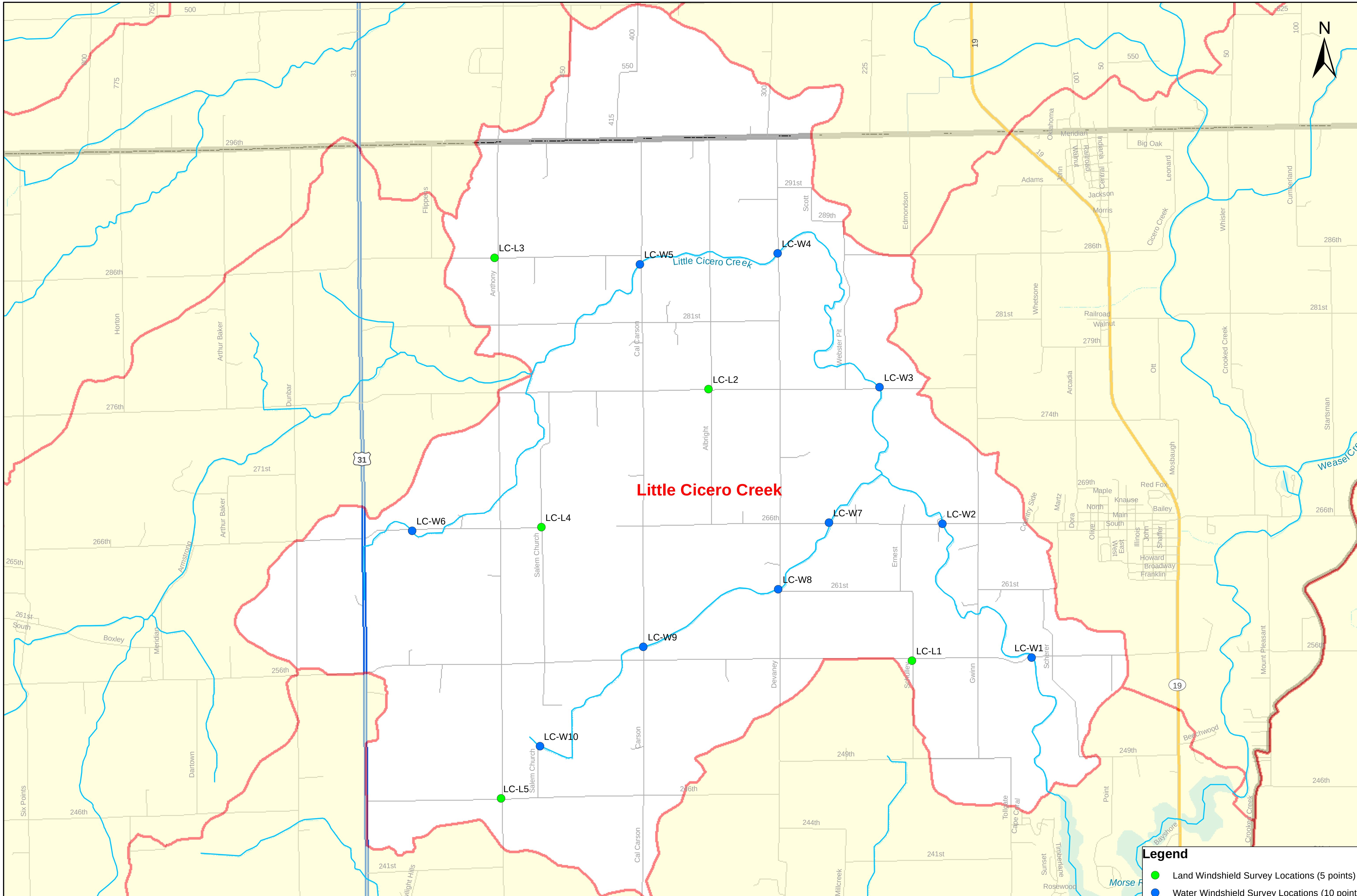
N
Buck Creek
BC-W1
BC-W2
BC-W3
BC-W4
BC-W5
BC-W6
BC-W7
BC-W8
BC-L1
BC-L2
BC-L3
BC-L4
Turkey Creek
Dixon Creek
Buck Creek
Legend
Land Windshield Survey Locations (4 points)
Water Windshield Survey Locations (8 points)



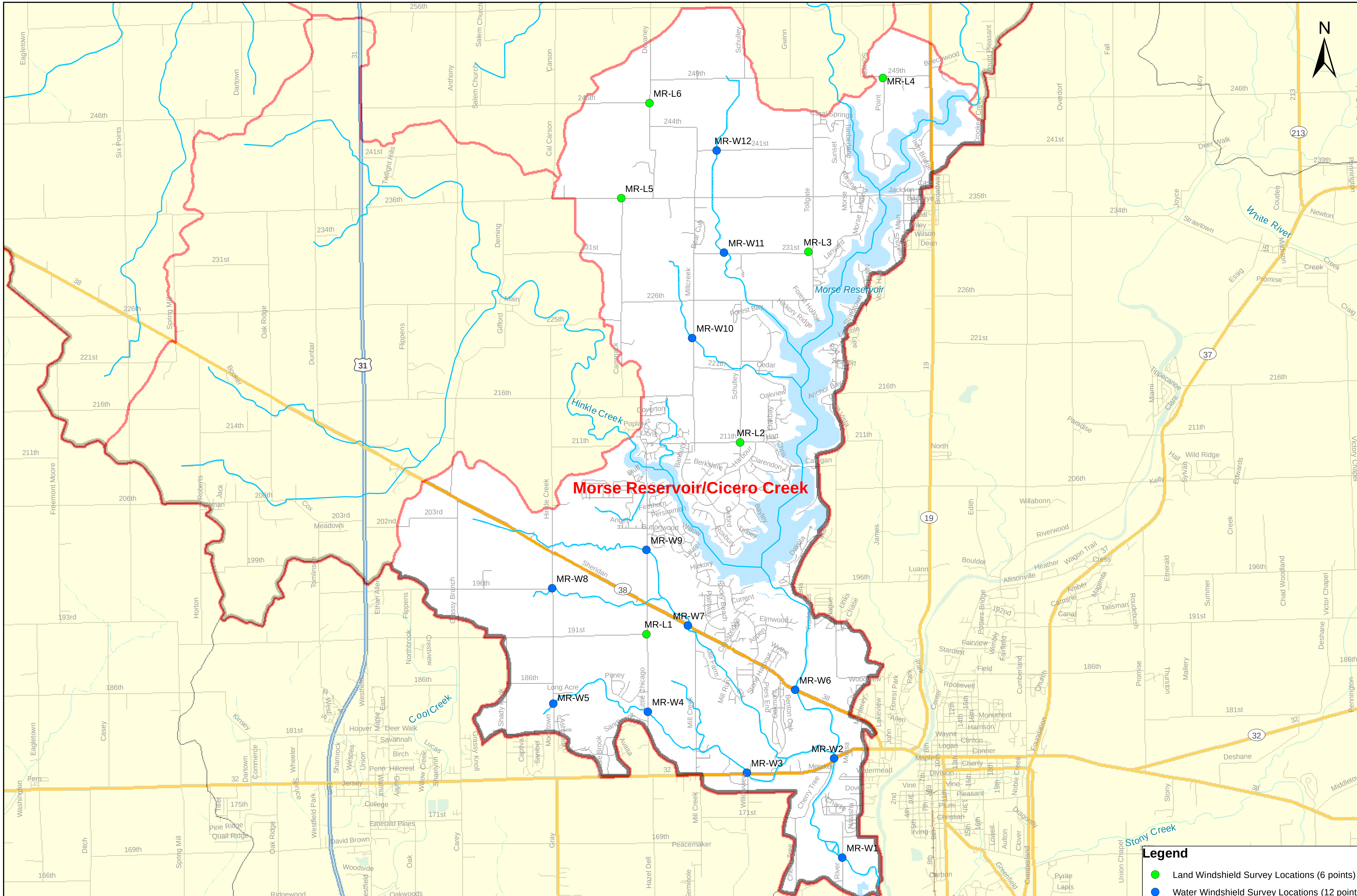
Cox Ditch
CD-L1
CD-L2
CD-L3
CD-L4
CD-L5
CD-W1
CD-W2
CD-W3
CD-W4
CD-W5
CD-W6
CD-W7
CD-W8
CD-W9
N
Dixon Creek
Little Cicero Creek
Legend
Land Windshield Survey Locations (5 points)
Water Windshield Survey Locations (9 points)

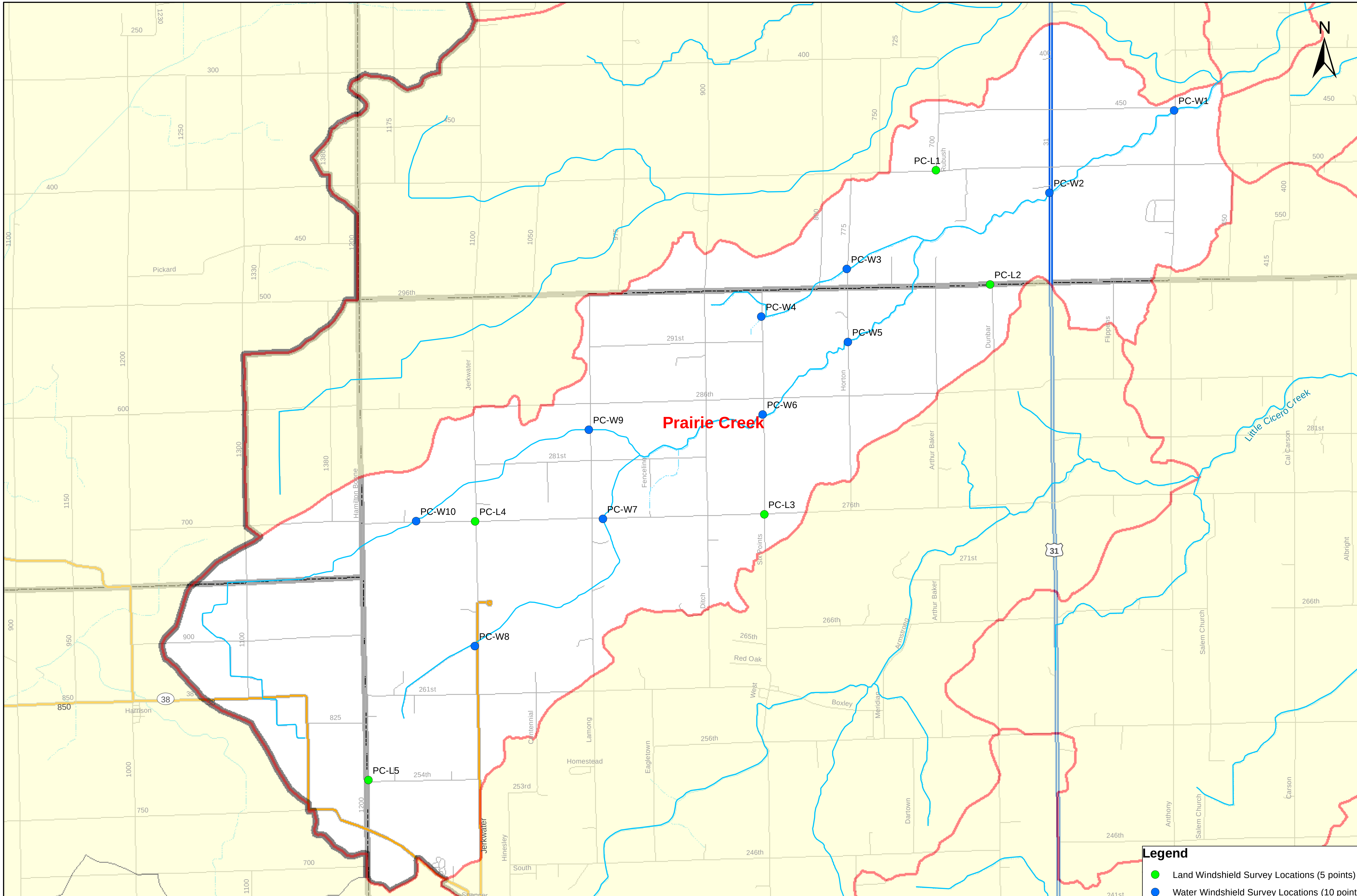

N
Turkey Creek
Buck Creek
Dixon Creek
Dixon Creek
DC-W1
DC-W2
DC-W3
DC-W4
DC-W5
DC-W6
DC-W7
DC-W8
DC-L1
DC-L2
DC-L3
DC-L4
Division
Railroad
Kemp
King
North
Colonial
College
Walnut
Summers
Westwood
Meridian
Phares
28
31
Legend
Land Windshield Survey Locations (4 points)
Land Windshield Survey Locations (8 points)

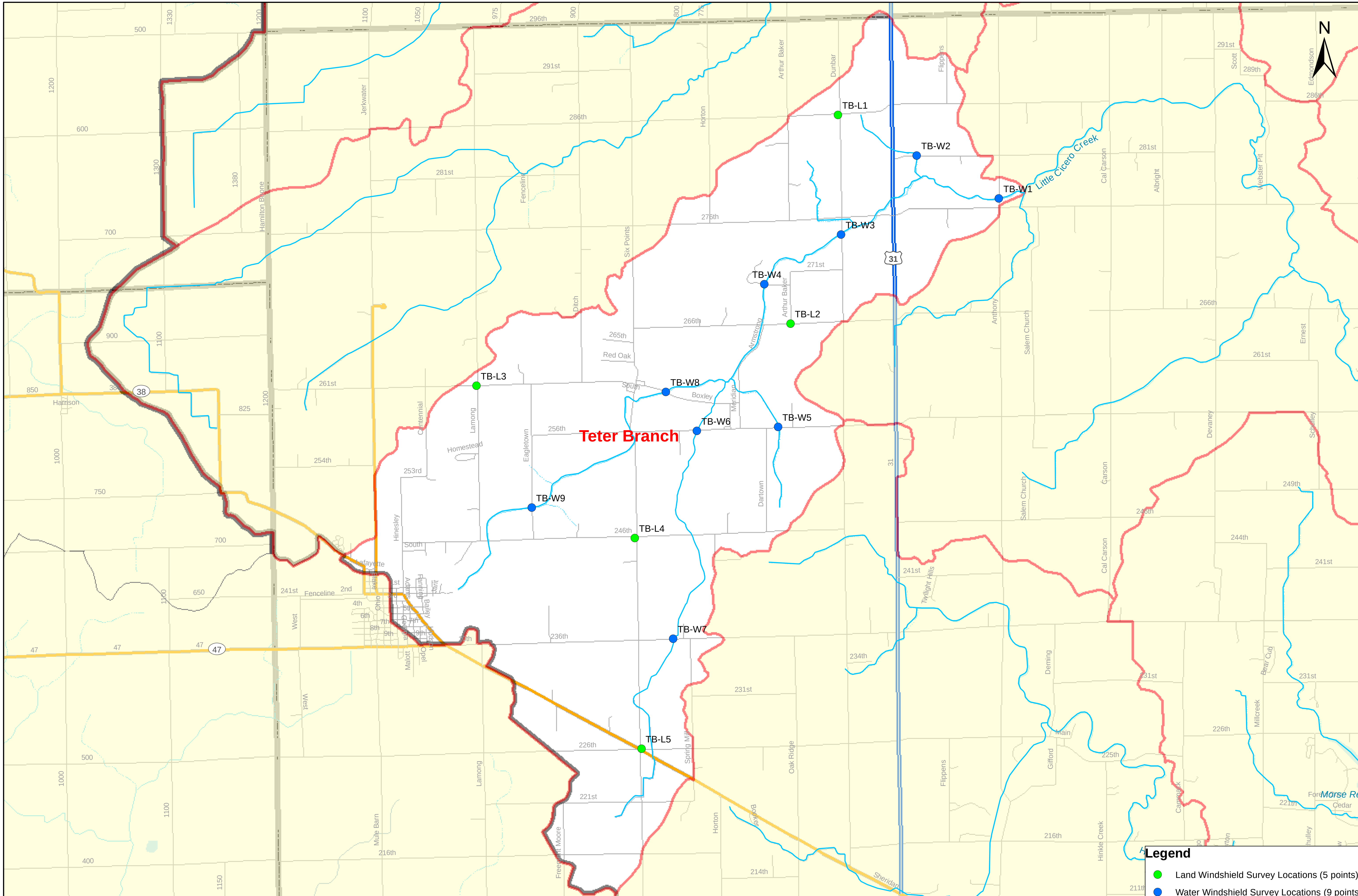

N
Hinkle Creek
HC-W9
HC-L2
HC-W8
HC-W7
HC-L1
HC-W2
HC-W3
HC-W1
HC-W6
HC-W4
HC-L4
HC-W5
HC-L3
Hinkle Creek
Cool Creek
Morse Reservoir
Sheridan
38
31
47
Legend
Land Windshield Survey Locations (4 points)
Water Windshield Survey Locations (9 points)



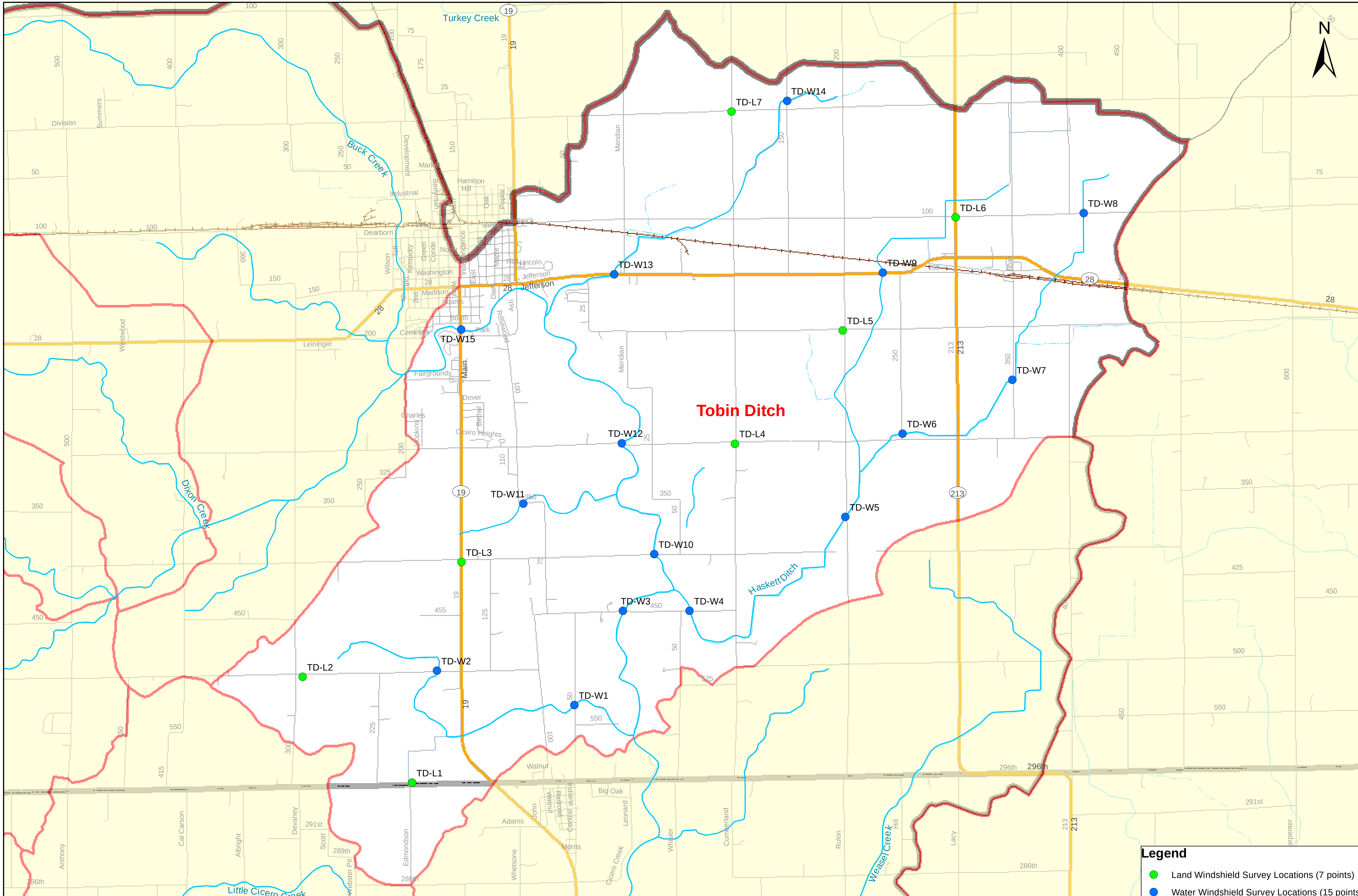
Little Cicero Creek
N
LC-L1
LC-L2
LC-L3
LC-L4
LC-L5
LC-W1
LC-W2
LC-W3
LC-W4
LC-W5
LC-W6
LC-W7
LC-W8
LC-W9
LC-W10
Little Cicero Creek
Weasel Creek
Cicero Creek
Crooked Creek
31
19
Legend
Land Windshield Survey Locations (5 points)
Water Windshield Survey Locations (10 points)

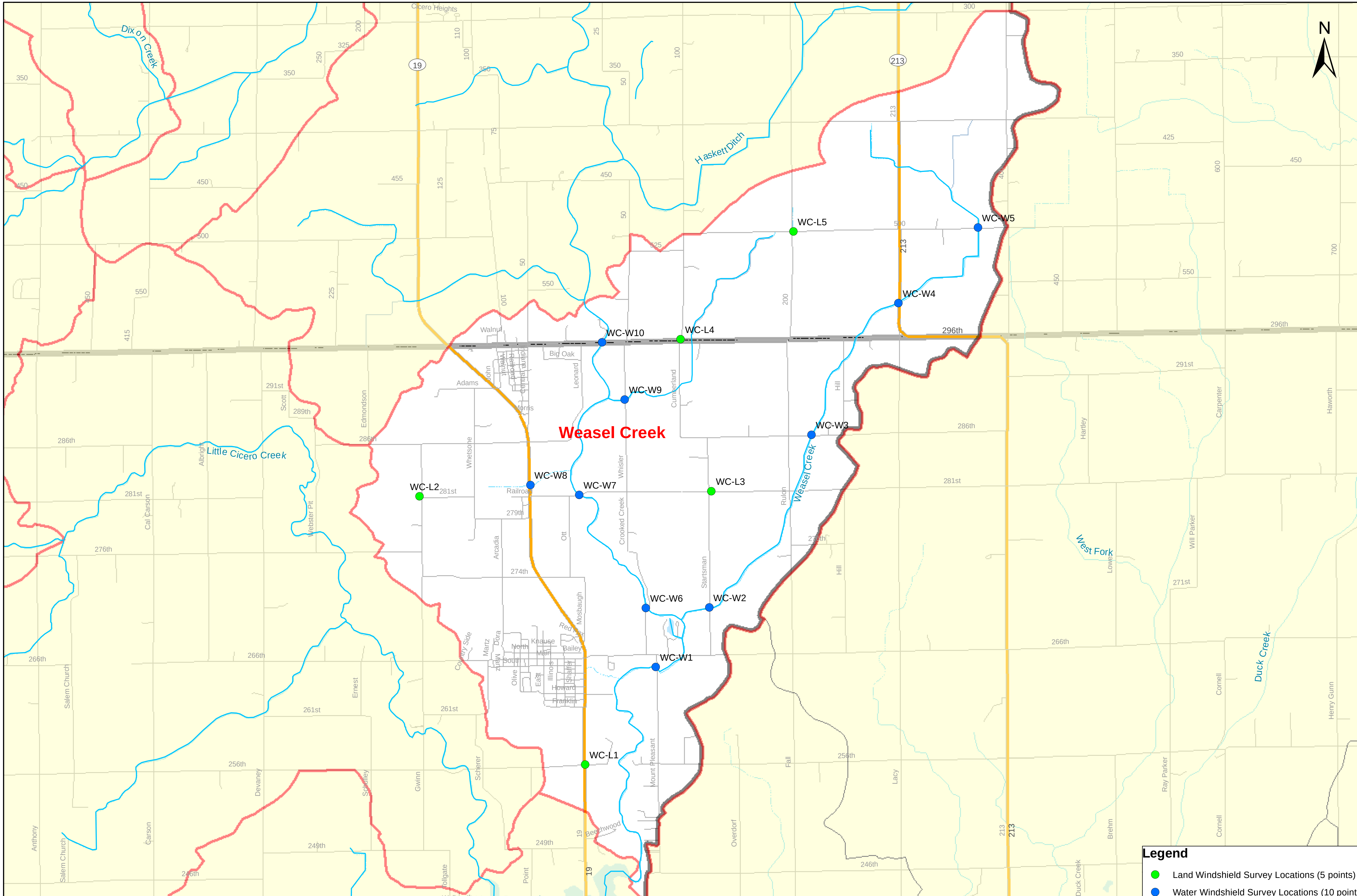

Morse Reservoir/Cicero Creek
N
Legend
Land Windshield Survey Locations (6 points)
Water Windshield Survey Locations (12 points)
MR-L1
MR-L2
MR-L3
MR-L4
MR-L5
MR-L6
MR-W1
MR-W2
MR-W3
MR-W4
MR-W5
MR-W6
MR-W7
MR-W8
MR-W9
MR-W10
MR-W11
MR-W12
Morse Reservoir
Hinkle Creek
Cool Creek
White River
Stony Creek
31
38
19
32
37
213


Prairie Creek
PC-W1
PC-W2
PC-W3
PC-W4
PC-W5
PC-W6
PC-W7
PC-W8
PC-W9
PC-W10
PC-L1
PC-L2
PC-L3
PC-L4
PC-L5
Little Cicero Creek
N
Legend
Land Windshield Survey Locations (5 points)
Water Windshield Survey Locations (10 points)



N
Teter Branch
TB-L1
TB-L2
TB-L3
TB-L4
TB-L5
TB-W1
TB-W2
TB-W3
TB-W4
TB-W5
TB-W6
TB-W7
TB-W8
TB-W9
Little Cicero Creek
Legend
Land Windshield Survey Locations (5 points)
Water Windshield Survey Locations (9 points)


Tobin Ditch
N
TD-L1
TD-L2
TD-L3
TD-L4
TD-L5
TD-L6
TD-L7
TD-W1
TD-W2
TD-W3
TD-W4
TD-W5
TD-W6
TD-W7
TD-W8
TD-W9
TD-W10
TD-W11
TD-W12
TD-W13
TD-W14
TD-W15
Turkey Creek
Buck Creek
Dixon Creek
Haskett Ditch
Little Cicero Creek
Weasel Creek
Cicero Creek
Legend
Land Windshield Survey Locations (7 points)
Water Windshield Survey Locations (15 points)



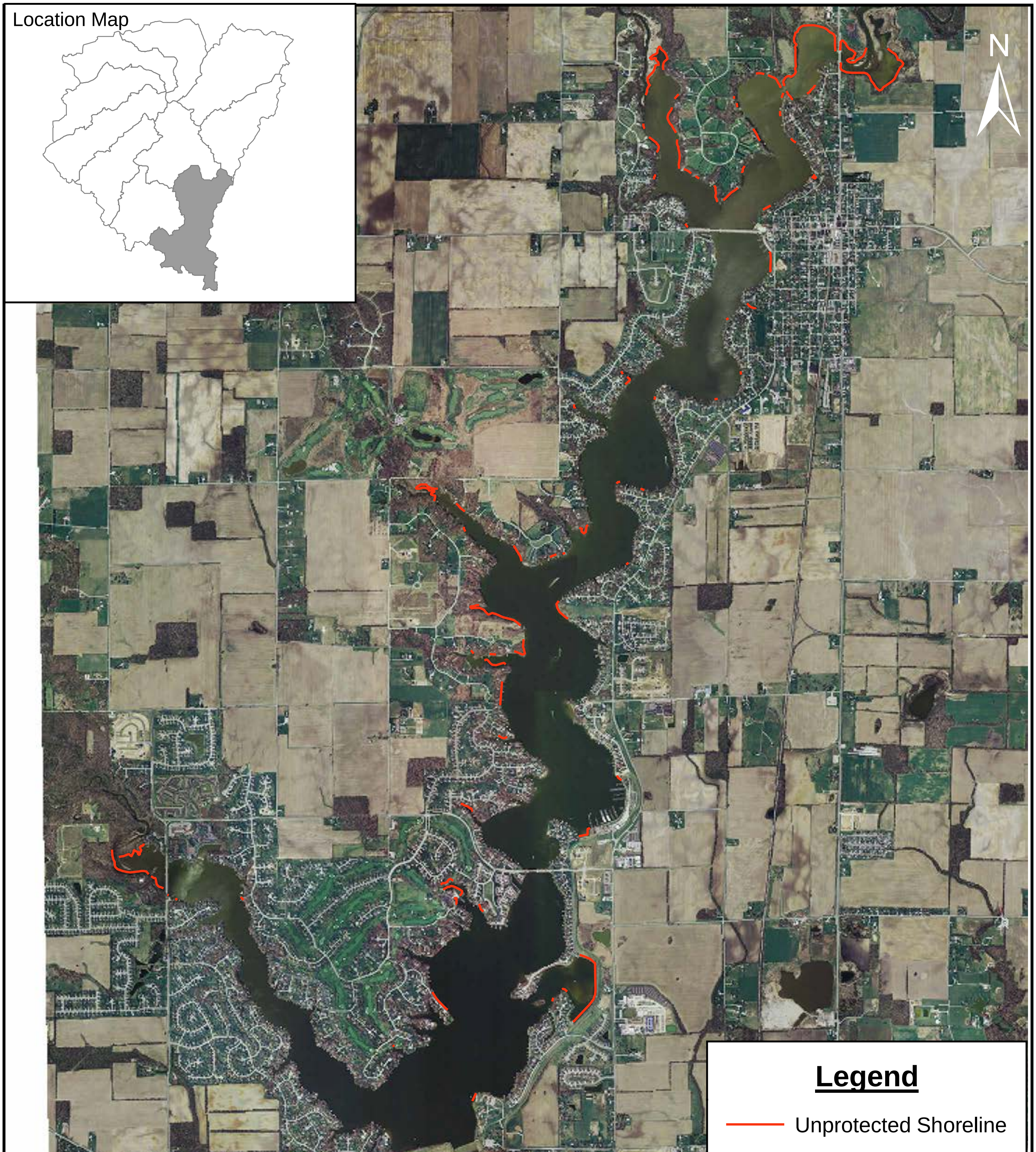
N
Weasel Creek
WC-L1
WC-L2
WC-L3
WC-L4
WC-L5
WC-W1
WC-W2
WC-W3
WC-W4
WC-W5
WC-W6
WC-W7
WC-W8
WC-W9
WC-W10
Dixon Creek
Haskett Ditch
Little Cicero Creek
West Fork
Duck Creek
Morse Reservoir
Cicero Heights
Legend
Land Windshield Survey Locations (5 points)
Water Windshield Survey Locations (10 points)

Appendix J – NPDES & CFO Compliance Data

Compliance information for National Pollutant Discharge Elimination System (NPDES) permits and Confined Feeding Operations (CFO) was obtained from EPA's Enforcement and Compliance History Database and IDEM, respectively. Available information for each permit is provided on CD at the end of this report.

Appendix K – Reservoir Shoreline Investigation

V3 completed at Reservoir Shoreline Investigation of Morse Reservoir In June 2009, using both field observations and aerial photography. During the survey, areas of unprotected shoreline were identified in order to gain an understanding of where erosion may be a concern. An exhibit showing the areas of unprotected shoreline is included in this Appendix along with a copy of the field notes. Photographs taken during the field observations are provided on CD at the end of this report.

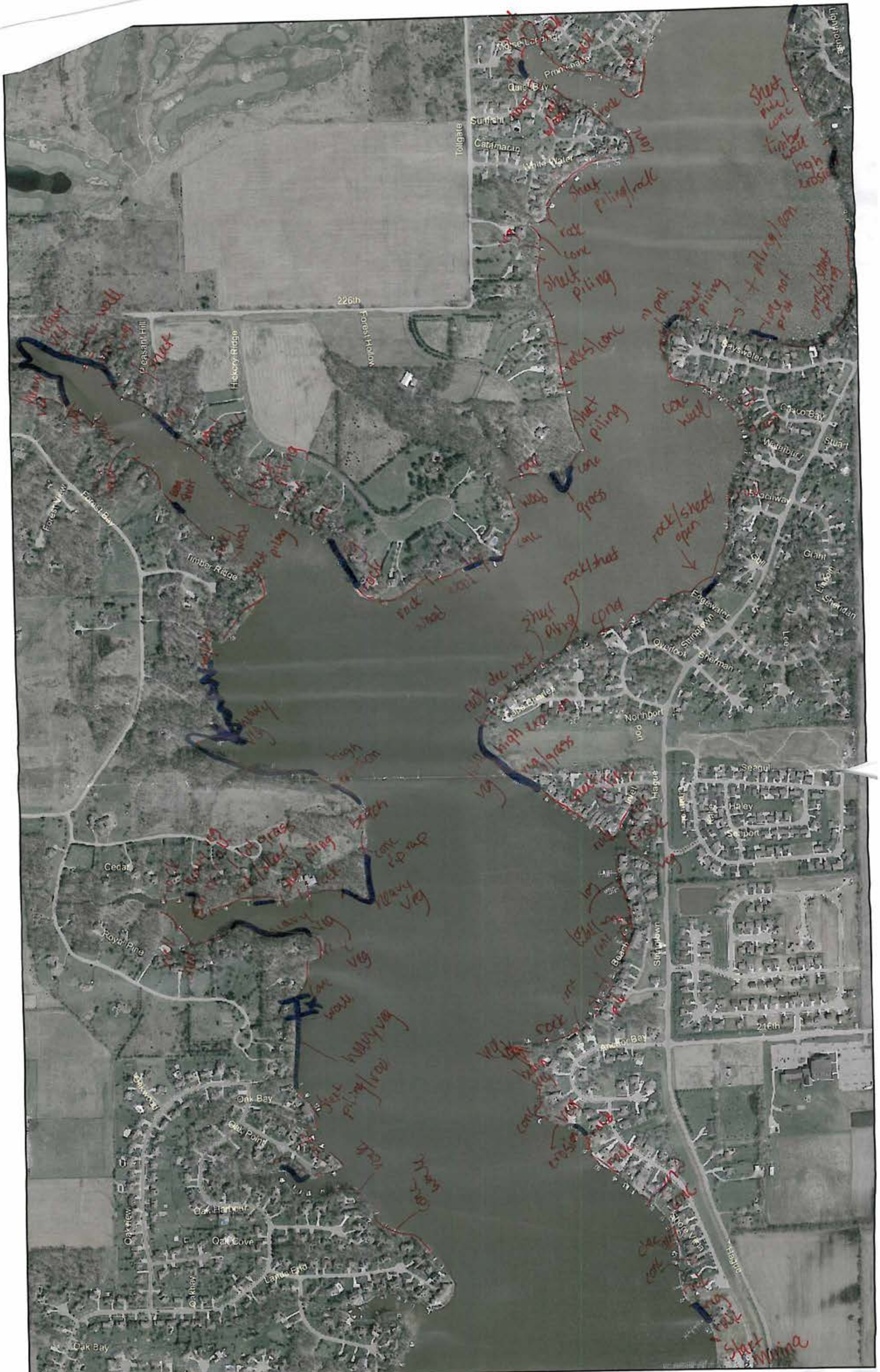


V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

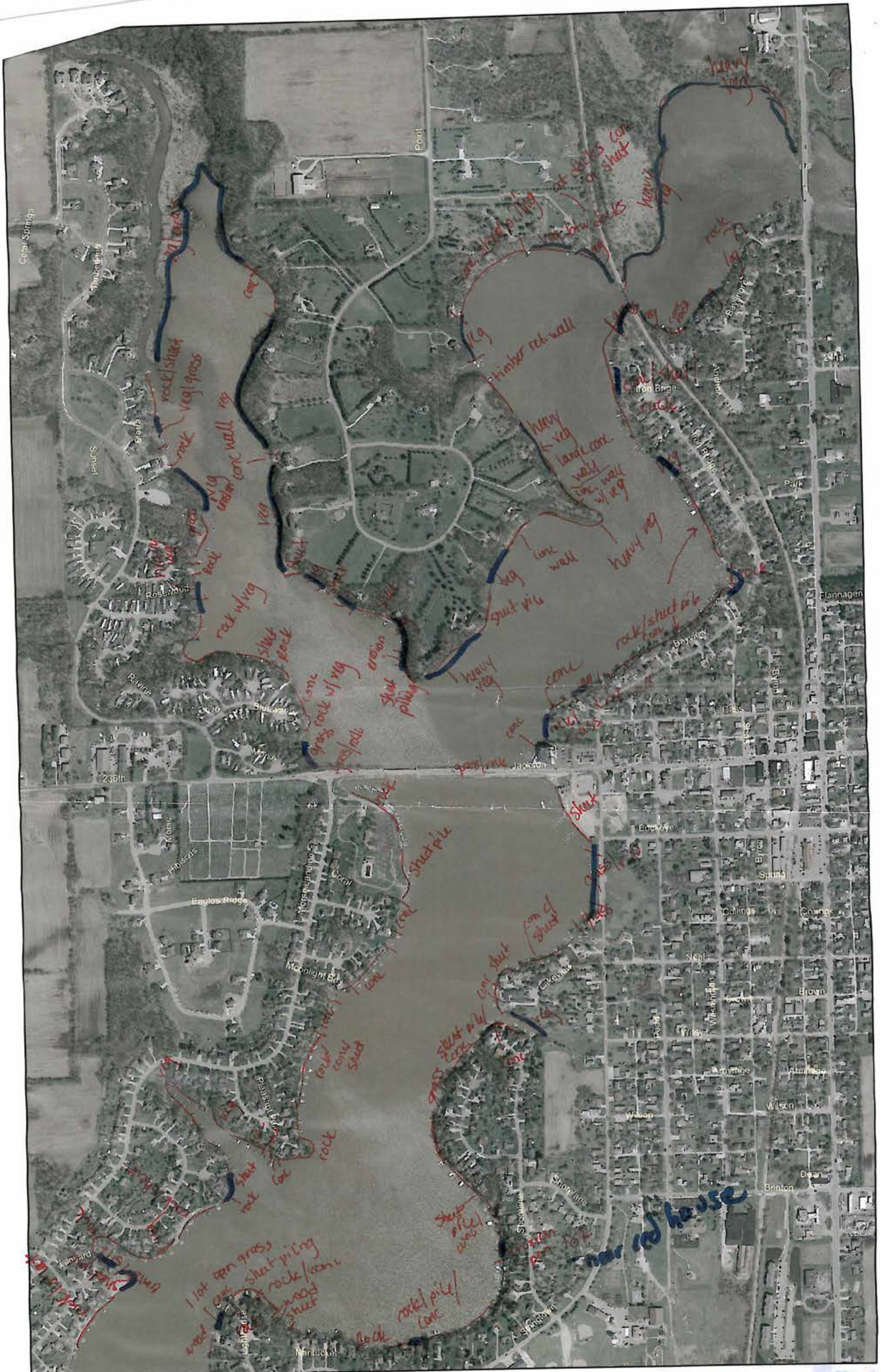
TITLE: Morse Reservoir Unprotected Shoreline	PROJECT: Morse Reservoir/Cicero Creek Watershed Management Plan		
BASE LAYER: N/A	PROJECT NO. 09005	EXHIBIT: L	SHEET: 1 OF: 1
CLIENT: Upper White River Watershed Alliance P.O. Box 2065 Indianapolis, Indiana 46206	QUADRANGLE: N/A	DATE: 11/21/09	SCALE: NTS

Morse Res.

N↑ 1"=600'


Moose Landing
Promenade
Quail Bay
Surfside
Catamaran
White Water
Tollgate
Lighthouse
226th
Forest Hollow
Hickory Ridge
Pleasant Hill
Bayswater
Casco Bay
Stuart
Waterbury
Gull
Grant
Sheridan
Edgewater
Stringtown
Overlook
Sherman
Northport
Seagull
Hague
Haley
Seaport
Forest Bay
Timber Ridge
Cedar
Royal Pine
Beach
Anchor Bay
216th
Oak Bay
Oak Point
Oak Harbor
Oak Cove
Oakview
Oakway

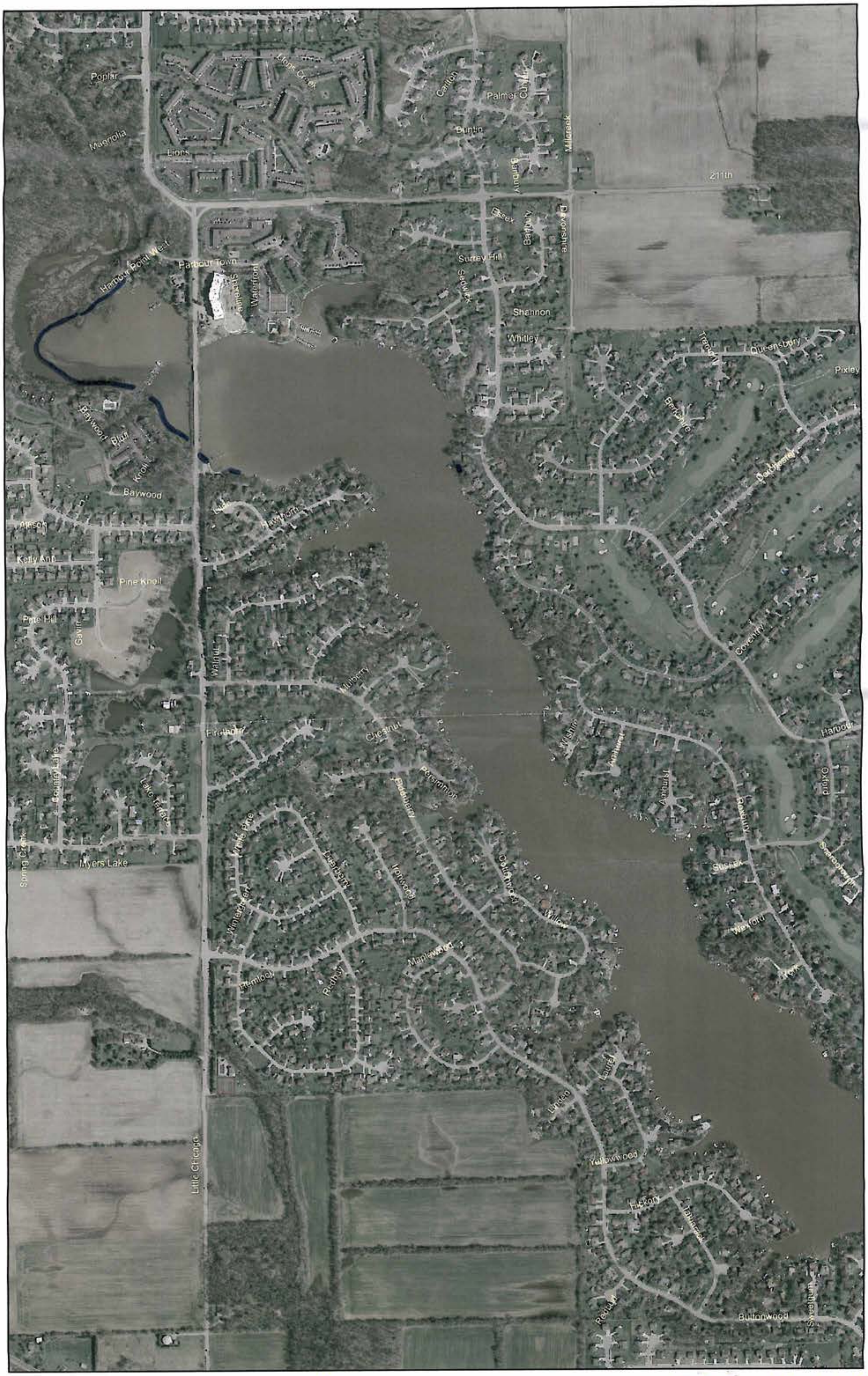
N ↑


Coral Springs
Point
Sunset
Rosewood
Ravine
Cove
Bluewater
Morse
236th
Jackson
Hibiscus
Eagles Ridge
Morse Landing
Coral
Moonlight Bay
Buckeye
Spring
Collings
Neal
Brown
Armitage
Wilson
Brinton
Dean
Shorelane
Springtown
Nantucket
Lakeview
Bayview
Flannagen
Park
Iron Bridge
Anchor
Cass
Byron
heavy veg
timber ret. wall
heavy veg
conc wall
rock/sheet pile
rock
near red house
1 lot open grass
rock/pile/conc

Morse Res.

N

Morse Res. N↑ 1" = 600'



Morse Res. N↑ 1"=600'

Appendix L – Nonpoint Source Pollution Modeling

The Spreadsheet Tool for Estimating Pollutant Load (STEPL) model was used to assess the nonpoint source pollution of three main pollutant parameters (Total Nitrogen, Total Phosphorus and Total Sediment) within the Morse Reservoir/Cicero Creek watershed. The model was executed for each HUC 12 subwatershed and a summary of the results is provided in this Appendix. The complete model and input information is provided on CD at the end of this report.

Input Data Collection and Assumptions
STEPL allows detailed input for land use, hydrologic soil groups, agricultural animals, septic systems and agricultural irrigation. Available data and the assumptions made for each input category are described below.

Subwatersheds
The subwatersheds were defined using the HUC 12 (hydrologic unit code) watershed boundaries within the Cicero Creek Watershed. There are twelve subwatersheds in the study area.

Land Use
The National Land Cover Database (NLCD 2001) and 2008 aerial photography were used for land use information.

The NLCD 2001 for Indiana was obtained from the Indiana Geological Survey as raster data and converted into a shapefile for subwatershed analysis. The NLCD 2001 includes nineteen land classifications ranging from cultivated crops to high intensity developed land and forests to open water. Thirteen of the land classifications were found in the subwatersheds. STEPL allows input for six categories including one user defined option. Listed below are the available STEPL categories with the land classification distribution that was used for the preliminary modeling.

Urban: Developed, Open Space; Developed, Low Intensity; Developed, Medium Intensity; Developed, High Intensity
Cropland: Cultivated Crops
Pastureland: Grassland/Herbaceous; Pasture Hay
Forest: Deciduous Forest; Evergreen Forest; Shrub/Scrub
User Defined: Open Water; Woody Wetlands; Emergent Herbaceous Wetlands
Feedlots: N/A

In order to utilize the most current available data, the 2008 National Agricultural Imagery Program orthophotography was obtained for Tipton, Clinton and Boone Counties and the 2008 Hamilton County Orthophotography (www.co.hamilton.in.us) was obtained for Hamilton County. These aerial images were compared to the NLCD 2001 in order to determine where changes in land use had occurred. Any changes were then incorporated into the STEPL model.

Hydrologic Soil Groups

The U.S. Department of Agriculture, Natural Resources Conservation Service Soil Survey database for Hamilton, Tipton, Boone, and Clinton Counties were utilized to obtain for hydrologic soil group information.

The hydrologic soil group for each soil classification within each subwatershed was determined. A value of one to four was assigned to each hydrologic group classification and a weighted average for the subwatershed was calculated. A value of one represents a soil group that is pervious and a value of four represents a soil group that is impervious.

Septic Systems

No information on the number of septic systems in the watershed was readily available. In order to include an estimate of the impact of failing septic systems on the nonpoint source pollution, population density information was obtained.

The U.S. Department of Commerce, U.S. Census Bureau Population Density 2000 database (as a shapefile) was obtained. The population density for each subwatershed was then used to obtain an estimate of the population within the subwatershed. STEPL assumes 2.43 people per septic system, using this assumption an estimate of the number of septic systems can be obtained. It was assumed that in the highest population density areas (greater than 500 persons per square kilometer), a sanitary sewer system was in place and no septic systems were included. A septic failure rate of 2% was assumed.

Agricultural Irrigation

No information for agricultural irrigation was readily available, so for the purposes of preliminary modeling, this optional STEPL input was not utilized.

Appendix M – Education and Outreach Menu

Electronic Communication & Technology

- Watershed Project Website
- Web-based Resources Center (target audience focus)
- Email distribution lists
- Facebook, Twitter & blogs
- Interactive "Ask the Expert" Q&A web-posts

Mass Media

- Media advertisements (TV and radio spots)
- Newspaper releases
- Public service announcements (PSAs)

Events

- Local festival participation (fall festivals, parades, run/walks, etc.)
- Rotational speaking engagements (Rotary, Chamber, etc.)
- Host Water Quality Awareness Days/Make a Splash (school or community oriented)
- Host workshops for citizens, other target audiences
    - Partner with other organizations (i.e. UWRWA, Green Indy, Indiana Living Green, Indiana Lakes Management Society, Hoosier Riverwatch, etc.)
    - Partner with Project WET, Project WILD, Go Fishin, and Project Learning Tree to reach teachers
- Host field days
    - Agricultural
    - Stormwater
    - Residential ('Extreme Home Makeovers')
    - Septic maintenance
- Storm Drain Stenciling
    - Partner with MS4, schools, Boy Scouts, Girl Scouts…etc.
    - Create/distribute door hanger for houses in area of stenciling
- Reservoir/creek side clean-up days
- Educational float trips
- Promote Waste Collection Day
    - Partner with Solid Waste Mgmt Districts (SWMD) for Household Hazardous Waste Days
- Partner with Health Department or SWMD to conduct prescription drug drop offs
- Public Meeting (topical guest speakers)
- Engage active Riverwatch and Clean Lakes Program volunteers in regular monitoring

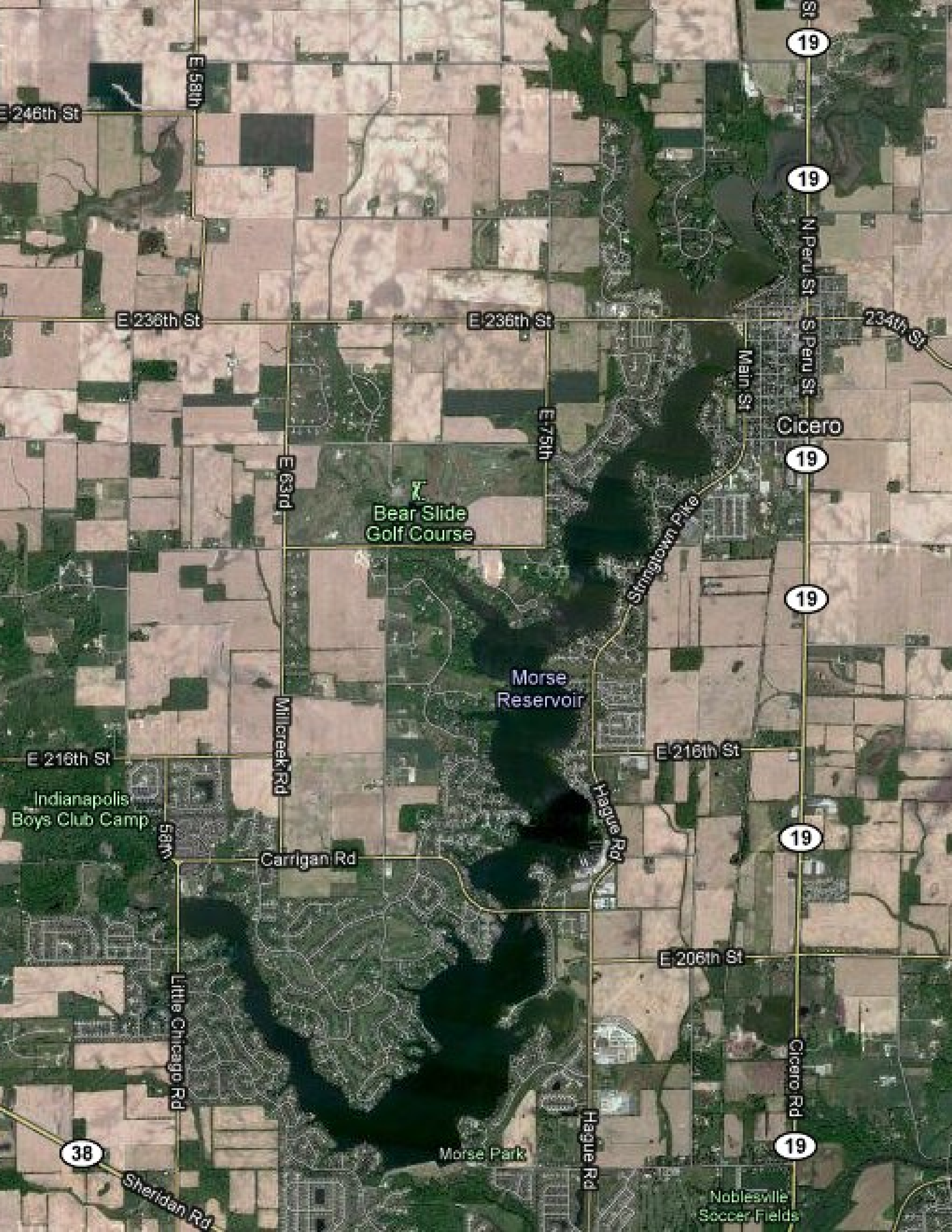
Material Development/Distribution

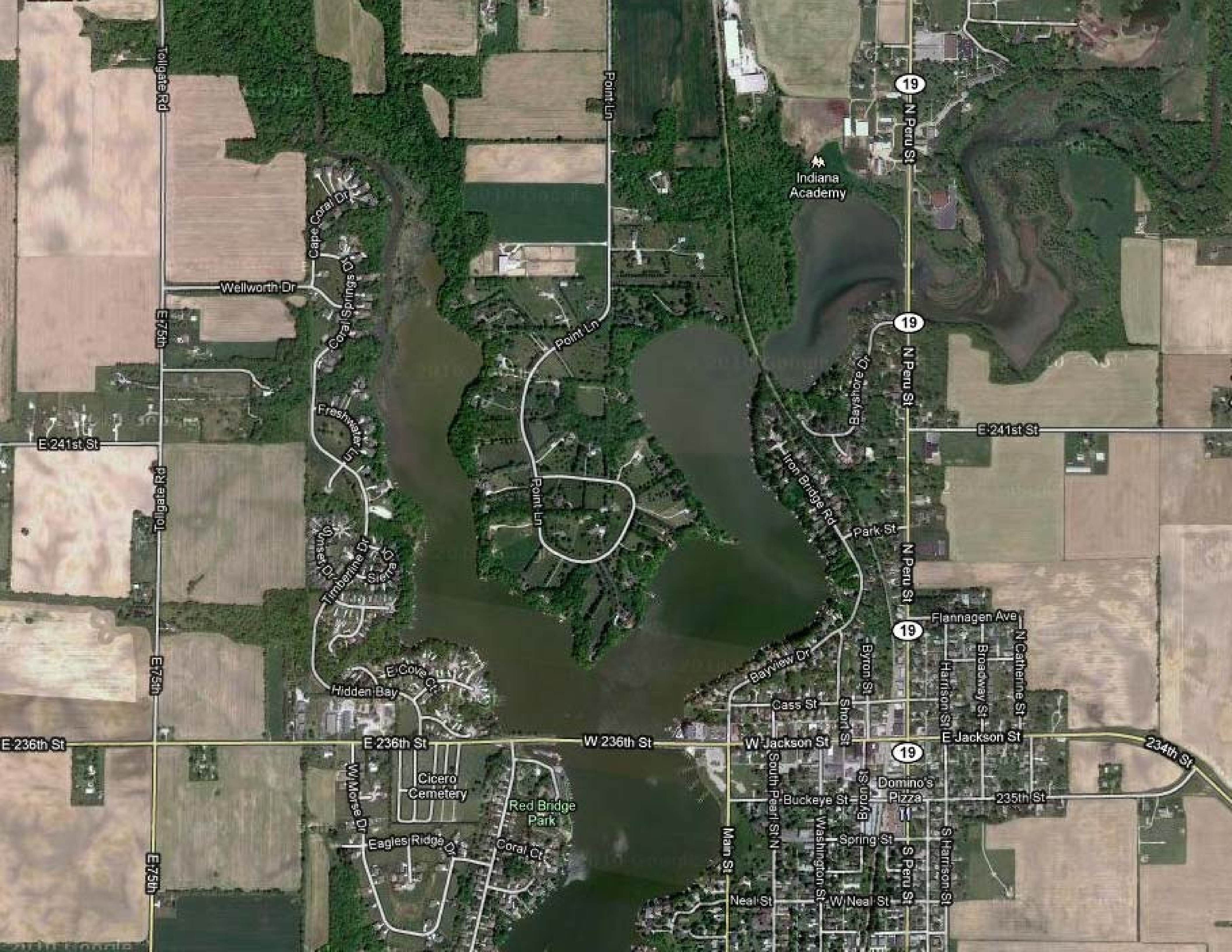
- Brochures and fact sheets (make available to Steering Committee and partners)
    - Watershed specific stats/info

  - Septic Care and Maintenance
- Interpretive signs at BMP sites
- Utility bill inserts (coordinate with MS4)
- Educational Displays (use at festivals, fairs, empty store fronts, libraries, municipalities, etc.)
- Newsletter articles (submit to SWCD's, Business, HOAs, At Geist, etc.)
- Watershed project specific newsletter
- Technical graphics for lay public for use in presentation, newsletter, etc.
- Standardized presentation for anyone to deliver
- Residential "How To" manuals for BMPs (filter strips, rain gardens, etc.)
- Press kits (including background info, digital pictures, contact info, additional resource references, etc.)
- Kids Activity Books (Project Wet or similar programs)

Outreach Staff/Technical Resources

- Use of local agricultural liaison, one on one with farmers selling practices
- Full-time watershed coordinator speaking to community and media
- Engaging Veolia media resources (or others such as IUPUI, local canoe liveries, Kroger, etc.)
- Utilize Mayor's Neighborhood Liaisons
- Utilizing SWCD staff and their events


E 246th St
E 58th
19
19
N Peru St
E 236th St
E 236th St
234th St
S Peru St
Main St
Cicero
19
E 75th
E 63rd
Bear Slide
Golf Course
Stringtown Pike
19
Morse
Reservoir
Millcreek Rd
E 216th St
E 216th St
Indianapolis
Boys Club Camp
58th
Hague Rd
19
Carrigan Rd
E 206th St
Little Chicago Rd
Cicero Rd
Hague Rd
38
19
Morse Park
Sheridan Rd
Noblesville
Soccer Fields


Tollgate Rd
Point Ln
19
N Peru St
Indiana Academy
Cape Coral Dr
Wellworth Dr
Coral Springs Ct
E 75th
Point Ln
19
Bayshore Dr
N Peru St
Freshwater Ln
E 241st St
E 241st St
Iron Bridge Rd
Point Ln
Park St
Tollgate Rd
Sunset Dr
Timberline Dr
Sierra Ct
N Peru St
Flannagen Ave
19
N Catherine St
Broadway St
Harrison St
Byron St
Bayview Dr
E Cove Ct
Hidden Bay
E 75th
Cass St
Short St
E 236th St
E 236th St
W 236th St
W Jackson St
E Jackson St
234th St
19
South Pearl St N
Cicero Cemetery
W Morse Dr
Red Bridge Park
Domino's Pizza
Byron St
Buckeye St
235th St
Washington St
Main St
Eagles Ridge Dr
Coral Ct
Spring St
S Peru St
S Harrison St
E 75th
Neal St
W Neal St


Cicero Ave
Cicero Ave
19
N Peru St

Harbour Pointe Dr
328
318
300
Harbour Pointe E Dr
58th
58th
Little Chicago Rd
Little Chicago Rd
Bluff Rd
300
Baywood Ct
Bluffs Cir
203
Bluff Cir


Harbour Point Dr E
Little Chicago Rd

5-22-89

HIGHLY ERODIBLE LAND of Boone COUNTY, INDIANA

Technical Guide
Section ~~II-C~~ II-iii-5

- HIGHLY ERODIBLE LAND CLASSES -
1 = HIGHLY ERODIBLE LAND
2 = POTENTIALLY HIGHLY ERODIBLE
3 = NOT HIGHLY ERODIBLE

HIGHLY ERODIBLE AND POTENTIALLY HIGHLY ERODIBLE LAND CACULATOR VER 1.1

MUID	MAP SYMBOL	SOIL NAME	#	%	C VALUE	I VALUE	HEL CLASS (WIND EROSION)	R VALUE	K VALUE	T VALUE	SLOPE-PERCEN MIN.		MAX.	SLOPE--LENGTH MIN.		MAX.	LS-VALUE MIN.	LS-VALUE MAX.	8T/RK	HEL CLASS (WATER EROSION)
11BR	BR	BROOKSTON	1	100		48	ERROR	180	0.28	5	0	.5	1	0	150	400	0.000	0.195	0.794	3
11BS	BS	BROOKSTON	1	100		38	ERROR	180	0.28	5	0	.5	1	0	200	400	0.000	0.195	0.794	3
11CRA	CRA	CROSBY	1	100		56	ERROR	180	0.43	3	0	2	3	0	150	300	0.000	0.399	0.310	3
11CSB2	CSB2	CROSBY	1	50		56	ERROR	180	0.43	3	2	2	6	50	130	250	0.163	1.063	0.310	2
11CSB2	CSB2	MIAMI	2	30		56	ERROR	180	0.37	4	2	4	6	50	100	250	0.163	1.063	0.480	2
11FCA	FCA	FINCASTLE	1	100		56	ERROR	180	0.37	5	0	1	3	0	175	300	0.000	0.399	0.601	3
11FSA	FSA	FOX	1	100		56	ERROR	180	0.37	4	0	1	2	0	175	200	0.000	0.247	0.480	3
11FSB2	FSB2	FOX	1	100		56	ERROR	180	0.37	4	2	4	6	50	100	150	0.163	0.823	0.480	2
11FSC2	FSC2	FOX	1	100		56	ERROR	180	0.37	4	6	8	12	50	80	150	0.475	2.209	0.480	1
11GN	GN	GENESEE	1	100		56	ERROR	180	0.37	5	0	.5	2	0	250	400	0.000	0.304	0.601	3
11HEF	HEF	HENNEPIN	1	100		56	ERROR	180	0.32	3	25	30	50	0	50	125	0.000	19.927	0.417	1
11MA	MA	MAHALASVILLE	1	100		38	ERROR	180	0.28	5	0	.5	1	0	250	400	0.000	0.195	0.794	3
	MMA	MIAMI	1	100		56	ERROR	180	0.37	4	0	1	2	0	150	300	0.000	0.279	0.480	3
	MMB2	MIAMI	1	100		56	ERROR	180	0.37	4	2	5	6	50	100	250	0.163	1.063	0.480	1
11MMC2	MMC2	MIAMI	1	100		56	ERROR	180	0.37	4	6	8	12	50	100	225	0.475	2.706	0.480	1
11MMD2	MMD2	MIAMI	1	100		56	ERROR	180	0.37	4	12	14	18	50	75	200	1.275	4.856	0.480	1
11MME2	MME2	MIAMI	1	100		56	ERROR	180	0.37	4	18	20	25	50	75	150	2.428	7.214	0.480	1
11MSB3	MSB3	MIAMI	1	100		48	ERROR	180	0.37	3	2	5	6	50	100	225	0.163	1.008	0.360	1
11MSC3	MSC3	MIAMI	1	100		48	ERROR	180	0.37	3	6	8	12	50	80	125	0.475	2.017	0.360	1
11MSD3	MSD3	MIAMI	1	100		48	ERROR	180	0.37	3	12	14	18	50	75	125	1.275	3.839	0.360	1
11OCA	OCA	OCKLEY	1	100		56	ERROR	180	0.37	5	0	[illegible]	2 .5	0	250	250	0.000	0.264	0.601	3
11OCB2	OCB2	OCKLEY	1	100		56	ERROR	180	0.37	5	2	4	6	50	130	175	0.163	0.889	0.601	2
1RA	RA	RAGSDALE	1	100		38	ERROR	180	0.28	5	0	.5	1	0	250	400	0.000	0.195	0.794	3
1RE	RE	REESVILLE	1	100		56	ERROR	180	0.37	5	0	1	3	0	175	300	0.000	0.399	0.601	3
1SH	SH	SHOALS	1	100		56	ERROR	180	0.37	5	0	.5	3	0	150	300	0.000	0.399	0.601	3
1ST	ST	SLEETH	1	100		56	ERROR	180	0.32	5	0	1	3	0	150	300	0.000	0.399	0.694	3
1SX	SX	SLOAN	1	100		48	ERROR	180	0.28	5	0	.5	1	0	150	400	0.000	0.195	0.794	3
1WE	WE	WESTLAND	1	100		38	ERROR	180	0.28	5	0	.5	1	0	200	400	0.000	0.195	0.794	3
1WH	WH	WHITAKER	1	100		56	ERROR	180	0.37	5	0	1	3	0	200	300	0.000	0.399	0.601	3

New List 10-14-88

HIGHLY ERODIBLE LAND of Clinton COUNTY, INDIANA

Nov 12 13:38 1987 Page 1

- HIGHLY ERODIBLE LAND CLASSES -
1 = HIGHLY ERODIBLE LAND
2 = POTENTIALLY HIGHLY ERODIBLE
3 = NOT HIGHLY ERODIBLE

HIGHLY ERODIBLE AND POTENTIALLY HIGHLY ERODIBLE LAND CACULATOR VER 1.1

MUID	MAP SYMBOL	SOIL NAME	A	%	C VALUE	I VALUE	HEL CLASS	R VALUE	K VALUE	T VALUE	SLOPE-PERCEN MIN.		SLOPE-PERCEN MAX.	SLOPE-LENGTH MIN.		SLOPE-LENGTH MAX.	LS-VALUE MIN.	LS-VALUE MAX.	BT/RK	HEL CLASS
023BE	BE	BRENTON	1	100		48	ERROR	180	0.28	5	0	1	2	0	75	150	0.000	0.227	0.794	3
023CEA	CEA	CAMDEN VARIANT	1	100		48	ERROR	180	0.37	5	0	1	2	0	100	200	0.000	0.247	0.601	3
023CE	CE	CERESCO	1	100		86	ERROR	180	0.24	5	0	1	2	0	100	200	0.000	0.247	0.926	3
023CY	CY	CYCLONE	1	100		48	ERROR	180	0.28	5	0	1	2	0	100	200	0.000	0.247	0.794	3
023DAA	DAA	DANA	1	100		56	ERROR	180	0.32	5	0	1	2	0	90	175	0.000	0.237	0.694	3
– 023DAB	DAB	DANA	1	100		56	ERROR	180	0.32	5	2	3	6	25	100	150	0.132	0.823	0.694	2
023DR	DR	DRUMMER	1	100		38	ERROR	180	0.28	5	0	1	2	0	150	300	0.000	0.279	0.794	3
023FCA	FCA	FINCASTLE	1	100		56	ERROR	180	0.37	5	0	1	2	0	100	200	0.000	0.247	0.601	3
- 023FDA	FDA	FINCASTLE	1	55		56	ERROR	180	0.37	5	0	2	3	0	100	200	0.000	0.353	0.601	3
023FDA	FDA	CROSBY	2	30		56	ERROR	180	0.43	3	0	2	3	0	100	200	0.000	0.353	0.310	2
– 023FSB	FSB	FOX	1	100		56	ERROR	180	0.37	4	2	3	6	25	100	150	0.132	0.823	0.480	2
– 023FSC	FSC	FOX	1	100		56	ERROR	180	0.37	4	6	13	15	25	75	100	0.336	2.559	0.480	2
023GM	GM	GENESEE	1	100		56	ERROR	180	0.37	5	0	1	2	0	100	200	0.000	0.247	0.601	3
- 023HEF	HEF	HENNEPIN	1	100		56	ERROR	180	0.32	3	18	20	50	25	50	75	1.717	15.435	0.417	1
023HO	HO	HOUGHTON	1	100		134	ERROR	180	0.01	5	0	1	2	0	50	100	0.000	0.201	22.222	3
023LA	LA	LANDES	1	100		86	ERROR	180	0.20	4	0	1	2	0	100	200	0.000	0.247	0.889	3
023MA	MA	MAHALASVILLE	1	100		38	ERROR	180	0.28	5	0	1	2	0	90	175	0.000	0.237	0.794	3
023MCA	MCA	MARTINSVILLE	1	100		56	ERROR	180	0.37	5	0	1	2	0	90	175	0.000	0.237	0.601	3
– 023MCB2	MCB2	MARTINSVILLE	1	100		56	ERROR	180	0.37	5	2	~~8~~ 4	6	25	100	150	0.132	0.823	0.601	2
- 023MMC	MMC	MIAMI	1	100		56	ERROR	180	0.37	4	6	10	12	25	100	150	0.336	2.209	0.480	2
– 023MMD	MMD	MIAMI	1	100		56	ERROR	180	0.37	4	12	16	18	25	50	75	0.902	2.974	0.480	1
- 023MSC3	MSC3	MIAMI	1	100		48	ERROR	180	0.37	3	6	10	12	25	100	150	0.336	2.209	0.360	2
- 023MSD3	MSD3	MIAMI	1	100		48	ERROR	180	0.37	3	12	16	18	25	50	75	0.902	2.974	0.360	1
- 023MTB	MTB	MIAMI	1	55		56	ERROR	180	0.37	4	2	~~3~~ 4	6	25	100	175	0.132	0.889	0.480	2
- 023MTB	MTB	CROSBY	2	25		56	ERROR	180	0.43	3	2	4	6	25	100	175	0.132	0.889	0.310	2
023MWA	MWA	MIAMI	1	55		56	ERROR	180	0.37	4	0	1	2	0	90	175	0.000	0.237	0.480	3
023MWA	MWA	MARTINSVILLE	2	30		56	ERROR	180	0.37	5	0	1	2	0	90	175	0.000	0.237	0.601	3
023MX	MX	MILFORD	1	100		86	ERROR	180	0.28	5	0	1	2	0	75	150	0.000	0.227	0.794	3
023OCA	OCA	OCKLEY	1	100		56	ERROR	180	0.37	5	0	1	2	0	100	200	0.000	0.247	0.601	3
- 023OCB	OCB	OCKLEY	1	100		56	ERROR	180	0.37	5	2	3	6	25	90	150	0.132	0.823	0.601	2
023PC	PC	PALMS	1	100		134	ERROR	180	0.01	5	0	1	2	0	50	100	0.000	0.201	22.222	3
023PGB	PGB	PARR	1	100		56	ERROR	180	0.32	4	1	3	5	0	75	150	0.000	0.655	0.556	2
023PM	PM	PATTON	1	100		38	ERROR	180	0.28	5	0	1	2	0	75	150	0.000	0.227	0.794	3
– 023PR	PR	PITS	1	100		38	ERROR	180	0.24	2	12	14	35	25	90	150	0.902	12.519	0.370	1
023PTA	PTA	PROCTOR	1	100		48	ERROR	180	0.32	5	0	2	3	0	75	150	0.000	0.324	0.694	3
023RA	RA	RAGSDALE	1	100		56	ERROR	180	0.28	5	0	1	1	0	100	200	0.000	0.159	0.794	3
023RDA	RDA	RAUB	1	100		56	ERROR	180	0.26	5	0	1	2	0	100	200	0.000	0.247	0.794	3
023RE	RE	REESVILLE	1	100		56	ERROR	180	0.37	5	0	1	2	0	75	150	0.000	0.227	0.601	3
– 023RUB	RUB	RUSSELL	1	100		56	ERROR	180	0.37	5	2	3	6	25	90	150	0.132	0.823	0.601	2
023SA	SA	SABLE	1	100		48	ERROR	180	0.28	5	0	1	2	0	150	300	0.000	0.279	0.794	3
023SC	SC	SABLE	1	40		86	ERROR	180	0.28	5	0	1	2	0	125	250	0.000	0.264	0.794	3
023SC	SC	DRUMMER	2	40		38	ERROR	180	0.28	5	0	1	2	0	125	250	0.000	0.264	0.794	3
023SD	SD	SARANAC	1	100		48	ERROR	180	0.28	5	0	1	2	0	75	150	0.000	0.227	0.794	3

Clinton

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023ST	ST	SLEETH	1	100	56ERROR	150	0.32	5	0	1	2	0	75	150	0.000	0.227 0.694	3
023SU	SU	SLOAN	1	100	43ERROR	130	0.29	5	0	1	2	0	90	175	0.000	0.237 0.794	3
023SX	SX	STARKS	1	100	48ERROR	120	0.37	5	0	1	2	0	75	150	0.000	0.227 0.601	3
023TY	TY	TREATY	1	100	43ERROR	130	0.32	5	0	1	2	0	100	200	0.000	0.247 0.694	3
023WA	WA	HALLVILL	1	100	56ERROR	100	0.37	5	0	1	2	0	90	175	0.000	0.237 0.601	3
023WE	WE	WESTLAND	1	100	38ERROR	100	0.28	5	0	1	2	0	75	150	0.000	0.227 0.794	3
023WH	WH	WHITAKER	1	100	56ERROR	100	0.37	5	0	1	2	0	100	200	0.000	0.247 0.601	3
023XEA	XEA	XENIA	1	100	56ERROR	130	0.37	5	0	1	2	0	90	175	0.000	0.237 0.601	3
~023XEB	XEB	XENIA	1	100	56ERROR	100	0.37	5	2	3	6	25	90	150	0.132	0.823 0.601	2

HIGHLY ERODIBLE LAND of Hamilton COUNTY, INDIANA

- HIGHLY ERODIBLE LAND CLASSES -
1 = HIGHLY ERODIBLE LAND
2 = POTENTIALLY HIGHLY ERODIBLE
3 = NOT HIGHLY ERODIBLE

HIGHLY ERODIBLE AND
POTENTIALLY HIGHLY ERODIBLE
LAND CACULATOR VER 1.1

MUID	MAP SYMBOL	SOIL NAME	*	%	WIND EROSIION C VALUE	I VALUE	HEL CLASS	WATER EROSION R VALUE	K VALUE	T VALUE	SLOPE-PERCEN MIN.	SLOPE-PERCEN MAX.	SLOPE--LENGTH MIN.	SLOPE--LENGTH MAX.	LS-VALUE MIN.	LS-VALUE MAX.	8T/RK	HEL CLASS
********	******	*****************	*	***	*****	******	*****	******	******	*****	******	*****	******	******	*****	*****	*****	****
057BR	BR	BROOKSTON	1	100		38	ERROR	180	0.28	5	0	2	0	400	0.000	0.304	0.794	3
057CRA	CRA	CROSBY	1	100		56	ERROR	180	0.43	3	0	3	0	375	0.000	0.426	0.310	2
057FNA	FNA	FOX	1	100		56	ERROR	180	0.37	4	0	2	0	300	0.000	0.279	0.480	3
057FNB2	FNB2	FOX	1	100		56	ERROR	180	0.37	4	2	6	60	250	0.172	1.063	0.480	2
057FXC3	FXC3	FOX	1	100		48	ERROR	180	0.32	3	8	18	30	100	0.543	3.434	0.417	1
057GE	GE	GENESEE	1	100		56	ERROR	180	0.37	5	0	2	0	400	0.000	0.304	0.601	3
057HEF	HEF	HENNEPIN	1	100		56	ERROR	180	0.32	3	18	50	50	150	2.428	21.829	0.417	1
057HO	HO	HOUGHTON	1	100		134	ERROR	180	0.10	5	0	2	50	150	0.060	0.227	2.222	3
057MMA	MMA	MIAMI	1	100		56	ERROR	180	0.37	4	0	2	0	300	0.000	0.279	0.480	3
057MMB2	MMB2	MIAMI	1	100		56	ERROR	180	0.37	4	2	6	40	275	0.152	1.115	0.480	2
057MMC2	MMC2	MIAMI	1	100		56	ERROR	180	0.37	4	6	12	30	150	0.368	2.209	0.480	2
0'	MMD2	MIAMI	1	100		56	ERROR	180	0.37	4	12	18	30	150	0.988	4.205	0.480	1
0.	MOC3	MIAMI	1	100		48	ERROR	180	0.37	3	6	12	40	200	0.425	2.551	0.360	1
057MOD3	MOD3	MIAMI	1	100		48	ERROR	180	0.37	3	12	18	30	150	0.988	4.205	0.360	1
057MXA	MXA	MILTON VARIANT	1	100		48	ERROR	180	0.37	5	0	2	0	250	0.000	0.264	0.601	3
057NNA	NNA	NINEVEH	1	100		56	ERROR	180	0.28	4	0	2	0	250	0.000	0.264	0.635	3
057OCA	OCA	OCKLEY	1	100		56	ERROR	180	0.37	5	0	2	0	300	0.000	0.279	0.601	3
057OCB2	OCB2	OCKLEY	1	100		56	ERROR	180	0.37	5	2	6	30	250	0.140	1.063	0.601	2
057PA	PA	PALMS	1	100		86	ERROR	180	0.10	5	0	2	50	150	0.060	0.227	2.222	3
057PN	PN	PATTON	1	100		38	ERROR	180	0.28	5	0	2	0	400	0.000	0.304	0.794	3
057PS	PS	PATTON	1	100		38	ERROR	180	0.28	5	0	2	0	400	0.000	0.304	0.794	3
057PT	PT	PITS	1	100			ERROR	180	0.17	5	0	45	50	150	0.060	18.616	1.307	2
057RA	RA	RANDOLPH VARIANT	1	100		56	ERROR	180	0.43	5	0	3	0	375	0.000	0.426	0.517	3
057RO	RO	ROSS	1	100		56	ERROR	180	0.32	5	0	2	0	300	0.000	0.279	0.694	3
057SH	SH	SHOALS	1	100		56	ERROR	180	0.37	5	0	2	0	275	0.000	0.272	0.601	3
057ST	ST	SLEETH	1	100		56	ERROR	180	0.32	5	0	2	0	250	0.000	0.264	0.694	3
057SX	SX	SLOAN	1	100			ERROR	180	0.28	5	0	2	0	200	0.000	0.247	0.794	3
057WE	WE	WESTLAND	1	100			ERROR	180	0.28	5	0	2	0	275	0.000	0.272	0.794	3
057WH	WH	WHITAKER	1	100			ERROR	180	0.37	5	0	2	0	200	0.000	0.247	0.601	3

HIGHLY ERODIBLE LAND of
Tipton COUNTY, INDIANA

- HIGHLY ERODIBLE LAND CLASSES -
1 = HIGHLY ERODIBLE LAND
2 = POTENTIALLY HIGHLY ERODIBLE
3 = NOT HIGHLY ERODIBLE

HIGHLY ERODIBLE AND
POTENTIALLY HIGHLY ERODIBLE
LAND CACULATOR VER 1.1

					WIND EROSION			WATER EROSION										
MUID	MAP SYMBOL	SOIL NAME		%	C VALUE	I VALUE	HEL CLASS	R VALUE	K VALUE	T VALUE	SLOPE- PERCEN MIN.	MAX.	SLOPE--LENGTH MIN.	MAX.	LS- VALUE MIN.	MAX.	8T/RK	HEL CLASS
*******	******	****************	*	***	*****	******	*****	******	******	*****	******	*****	******	******	*****	*****	*****	****
159DEA	DEA	DEL REY	1	65		56	ERROR	180	0.43	3	0	2	100	400	0.069	0.304	0.310	3
159DEA	DEA	CROSBY	2	35		56	ERROR	180	0.43	3	0	2	100	400	0.069	0.304	0.310	3
159PA	PA	PALMS	1	100		86	ERROR	180	0.01	5	0	2	100	350	0.069	0.292	22.222	3
159PC	PC	PALMS	1	100		86	ERROR	180	0.01	5	0	2	100	350	0.069	0.292	22.222	3
159PN	PN	PATTON	1	100		38	ERROR	180	0.28	5	0	2	100	400	0.069	0.304	0.794	3
159PS	PS	PELLA	1	60		38	ERROR	180	0.28	5	0	2	100	350	0.069	0.292	0.794	3
159PS	PS	DRUMMER	2	40			ERROR	180	0.28	5	0	2	100	350	0.069	0.292	0.794	3
159SAC2	SAC2	SISSON	1	60			ERROR	180	0.32	5	~~2~~ 6	~~6~~ 12	50	300	0.163	1.164	0.694	2
159SAC2	SAC2	STRAWN	2	40			ERROR	180	0.37	4	~~2~~ 6	~~6~~ 12	50	300	0.163	1.164	0.480	2
159SH	SH	SLOAN	1	100			ERROR	180	0.28	5	0	2	50	300	0.060	0.279	0.794	3
159TUB2	TUB2	TUSCOLA	1	60			ERROR	180	0.37	5	~~6~~ 1	~~12~~ 6	50	250	0.475	2.852	0.601	~~2~~ 3
159TUB2	TUB2	STRAWN	2	40			ERROR	180	0.37	5	~~6~~ 1	~~12~~ 6	50	250	0.475	2.852	0.601	~~2~~ 3
159UD	UD	UDORTHENTS	1	100			ERROR	180	0.37	3	0	50	50	250	0.060	28.181	0.360	2
159WKB	WKB	WILLIAMSTOWN	1	100			ERROR	180	0.37	4	1	4	100	300	0.129	0.620	0.480	~~2~~ 3