

WATERSHED MANAGEMENT PLAN

for

TURTLE CREEK and LITTLE TURTLE CREEK

Prepared By

***PARTNERSHIP
FOR TURTLE CREEK***



WATERSHED COMMITTEE

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1.0 INTRODUCTION

This Watershed Management Plan addresses the conditions determined by the preliminary assessment of the Turtle Creek/Little Turtle Creek Watershed carried out by the Partnership for Turtle Creek. In addition, it provides a roadmap for determining additional watershed concerns and educating all stakeholders on the importance of protecting and improving water quality in the watershed. This watershed plan will be updated annually to reflect changes in the watershed and updated status of work completed and action items to be worked on.

1.1 Watershed Overview

The Turtle/Little Turtle Creek watershed consists of 24,540 acres in Sullivan County, Indiana. The watershed is located in the west central portion of the county, in portions of both the Gill and Turman Townships (Figure 1.). Little Turtle Creek empties into Turtle Creek south of the dam for the Turtle Creek Reservoir and the entire watershed empties into the Wabash River near Riverton.

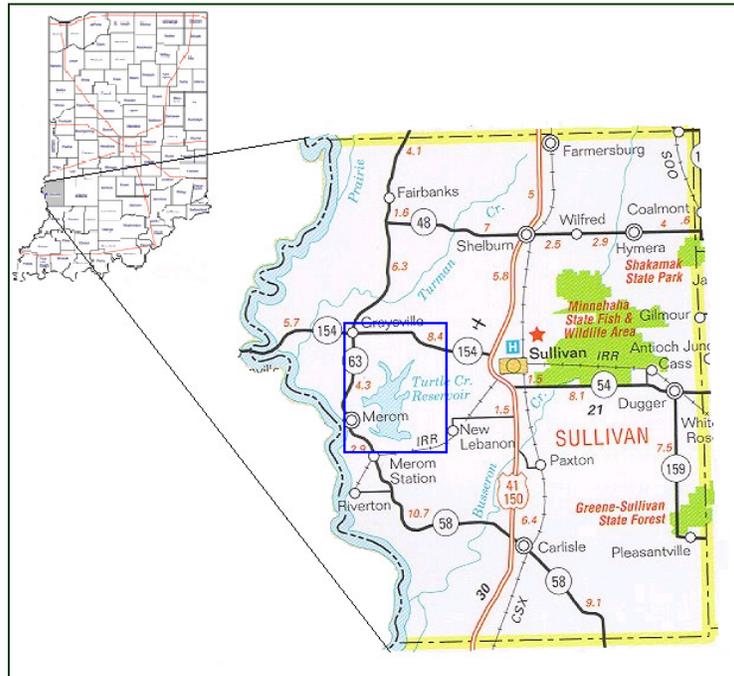


Figure 1. Location of the Turtle Creek Watershed within Sullivan County, Indiana

The boundaries of the Turtle Creek and Little Turtle Creek watersheds were determined with the assistance of the Natural Resources Conservation Services and the Indiana Department of Natural Resources, Division of Soil Conservation. Using standard techniques, watershed boundaries were drawn onto USGS 7.5 Minute Series Topographic maps (portions of the Fairbanks, Shelburn, Merom and Sullivan quadrangles). Visual inspections of the land were made to verify any boundary concern. The resultant watershed boundary map is found in Figure 2.

Turtle Creek, Little Turtle Creek Watersheds

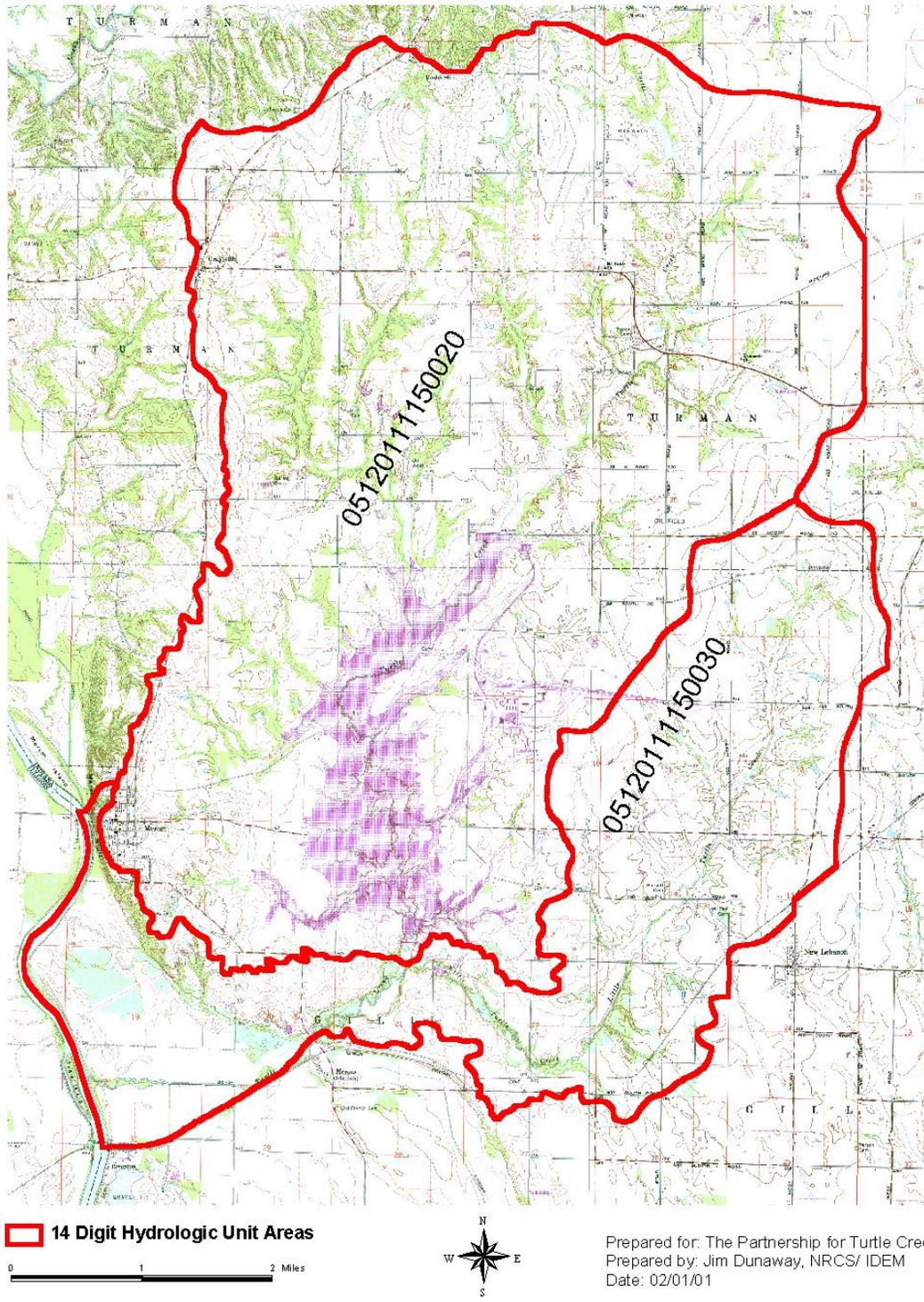


Figure 2. The Turtle Creek and Little Turtle Creek Watersheds boundary map

The Turtle Creek/Little Turtle Creek Watershed falls within the Middle Wabash-Busseron Basin, as shown in Figure 3.

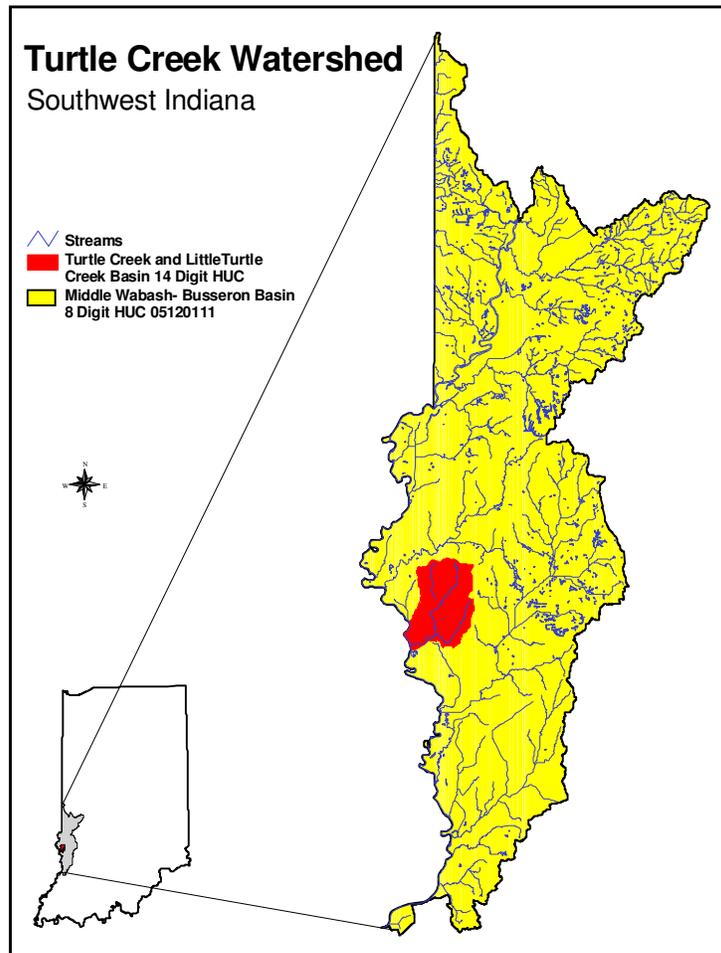


Figure 3. Turtle Creek Watershed’s location within the Middle Wabash-Busseron Basin.

Of the 24,540 acres in the watershed, land practices consist of the following:

| | | |
|--------------------------|--------------|-------|
| Turtle Creek Reservoir | 1,550 Acres | 6.3% |
| Cropland area | 14,730 Acres | 60% |
| Non-cultivated cropland | 215 Acres | 0.9% |
| Forested land | 3,280 Acres | 13.4% |
| Pasture land | 4,380 Acres | 17.8% |
| Urban (residential) land | 385 Acres | 1.6% |

These numbers were determined with the assistance of the Natural Resources Conservation Service and the IDNR Division of Soil Conservation using aerial photographs and standard practices for determining land uses based on the information provided by those maps.

Figure 4 shows the locations of these land uses within the Turtle Creek Watershed as compiled by the USDA's National Agriculture Statistics Service¹ using categorized satellite image data.

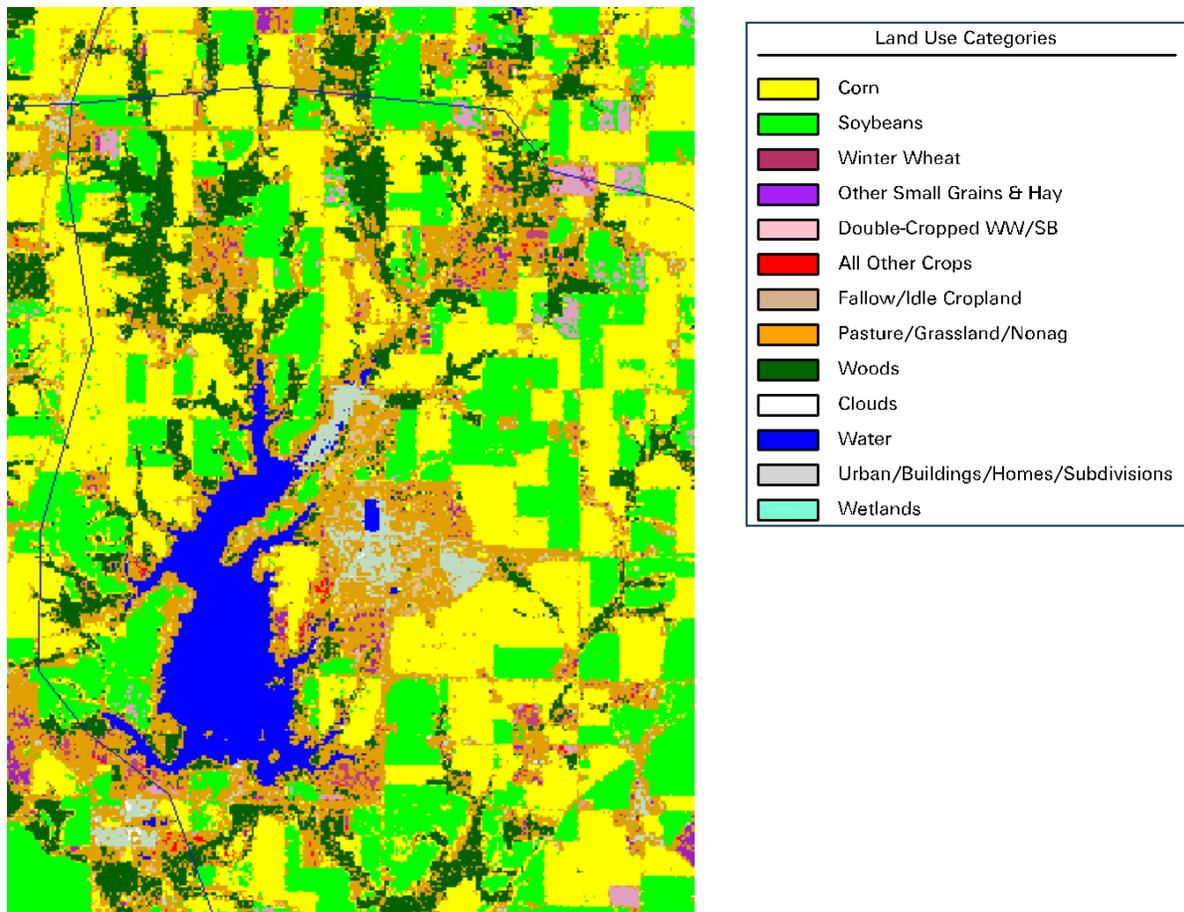


Figure 4. Land uses around the Turtle Creek/Little Turtle Creek Watershed.

1.2 Problems Statement

Beginning in 1994, aquatic vegetation within the Turtle Creek Reservoir (which is the recipient of most of the watershed's drainage area) began to disappear. At the same time, empirical observations showed that the water clarity in the reservoir had also diminished. Since 1995, secchi disk readings have been taken in conjunction with school groups; these show that water clarity depth is continuously between 0.5 and 0.8 meters near the dam where the students have sampled. This is far below the 2-meter goal for water clarity in a lake². Both the loss of vegetation and the decrease in water clarity are the main causes of concern within the watershed

¹ USDA National Agricultural Statistics Service Research and Development Team. *Cropland Data Layer CD-ROM: Indiana*. 2000.

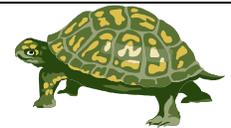
² Bill Jones, Associate Professor, School of Public and Environmental Affairs, Indiana University, Bloomington, Indiana.

that prompted the formation of a partnership to further investigate water quality issues within the watershed. The recent reduction in spawning of largemouth bass in the Turtle Creek Reservoir, as well as the need for erosion control in agricultural, streambed and shoreline areas are currently the Partnership's primary concerns.

1.3 Partnership for Turtle Creek

1.3.1 Formation & Determination of Stakeholders. In 1998, the Partnership for Turtle Creek, an exploratory watershed management group, was organized to identify the source of reported water quality problems within the watershed and to determine the need for development and implementation of a watershed management plan. Michalene Reilly, Environmental Team Leader for Hoosier Energy noticed the clarity, vegetation, and largemouth bass population in the reservoir were all declining. Ms. Reilly contacted Sullivan County NRCS District Conservationist Tammy Swihart to help organize a plan of action. All interested stakeholders (landowners, farm tenants, business and government representatives and other interested parties) were encouraged to become a part of this process. In order to determine the stakeholders involved in the watershed, addresses were compiled based on a property ownership list obtained from the Sullivan County Courthouse. In addition, tenant farmers were also identified from information collected by the Soil and Water Conservation Service and the Natural Resources Conservation Service to complete the list of all agricultural stakeholders. Business stakeholders were determined through less exhaustive measures: both water users and those who depend on the watershed for their livelihood were identified. In addition, businesses dealing with agriculture or other primary interests in the watershed were included as stakeholders. Periodic updates of the stakeholders' list will be completed to insure that all stakeholders receive information. A current list of stakeholders can be found in Appendix A.

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In August of 1999, a public meeting was held by the exploratory watershed management group to determine interest in the formation of watershed management committee. As a result of this meeting, a formal "watershed management steering committee" was formed to assess the issues within the watershed and determine what actions are possible to improve the water quality within the watershed. The steering committee is made up of stakeholders and advisory technical experts. Appendix B lists the current steering committee members and officers, the core group of people who are consistently active in moving the project forward, and subcommittee members. Appendix C is a list of the technical experts/organizations providing support to the steering committee.

Any stakeholders interested in the process are invited to monthly meetings, held on the second Tuesday of each month at 6:30 p.m. at the Hoosier Energy Environmental Education Center. An annual meeting to update the community is held each August. The steering committee elects a chairperson and secretary each January.

1.3.2 Mission and Vision Statements. The Partnership for Turtle Creek has developed vision and mission statements to guide the steering committee in developing ideas and programs to improve the water quality within the Turtle/ Little Turtle Watershed.

The Vision: *The Turtle Creek Watershed: Productive for fish, wildlife, and mankind through Natural Resource Conservation.*

Our Mission: *The Partnership for Turtle Creek shall: Promote, educate, and facilitate sound conservation practices to the watershed community.*

1.3.3. Partnership Objectives. Based on the information and data gathered by the Partnership for Turtle Creek Watershed Committee and open meetings to discuss the issues, four main objectives were determined by the group. The objectives of the Partnership are:

- To identify sources of water quality impairments
- To establish a venue for cooperation and involvement through education, information and communication.
- To implement “Best Management Practices” that minimizes pollutants and enhances natural resources.
- To seek financial resources to facilitate project activities.

In order to fulfill these objectives and prioritize corrective measures for future action, an assessment of the all resources within the watershed was completed.

2.0 WATERSHED RESOURCE ASSESSMENT

2.1 Turtle Creek Reservoir

2.1.1 Description. An important part of the watershed is the Turtle Creek Reservoir, the



cooling pond for the Merom Generating Station, owned and operated by Hoosier Energy REC, Inc. The reservoir has approximately 38 miles of shoreline, makes up 1,550 acres of the watershed, and is the first place where environmental effects were noted within the watershed. As a cooling pond, the reservoir is thermally enriched on a

year-round basis. Cooling water from the power plant discharges on the north end of the reservoir (eastern side). The power plant intake is on the east side of the reservoir, a little more south than the middle of the reservoir itself. The plant withdraws a maximum of 488.5 million gallons of water each day at full load. This equates to the entire volume of the reservoir cycling through the plant approximately every 8 to 9 days.

Certain unique and potentially determining characteristics the reservoir are that:

- Covering 1,550 acres, the reservoir has an average depth of 8.1 feet (down from 8.6 feet at the time of construction). With the depth of the original streambed in the region of 35 feet, this means that much of the reservoir is extremely shallow.
- The reservoir is located less than 2 miles from the town of Merom, Indiana and the Merom Bluffs, which overlook the Wabash River that is the border between Indiana and Illinois. The Bluff formation causes higher than normal low level winds across Sullivan County. As these winds concentrate up the bluffs and move east, white peaks are not uncommon on the Reservoir.
- The elevation drop between Merom and the reservoir is over 100 feet, resulting in very fast moving water across the western portion of the watershed.

While swimming is not allowed on the reservoir, Turtle Creek Reservoir is a very popular spot for boating, fishing and waterfowl hunting recreational activities. The reservoir is stocked with bluegill, redear sunfish, black crappie, largemouth bass and channel catfish and provides in-season hunting for both goose and duck. Many watershed stakeholders are concerned about the affect of poor watershed management on water quality within the Reservoir and its potential impacts on these recreational opportunities. Also, Bald Eagles, Golden Eagles and Great Blue Heron are often seen at the Reservoir.

2.1.2 Water quality problem. Because it is the first recipient of most of the watershed’s drainage area prior to discharge to the Wabash River, as well as the most visible aspect of the watershed, the Reservoir has been the focus of much of the initial assessment of the watershed. As noted earlier, a decrease in vegetation and in water clarity within the reservoir have been highly noticeable. According to monitoring data from EA Engineering, Science and Technology (prepared for Hoosier Energy REC, Inc.), there has been a “gradual and consistent decline in the aerial extent of aquatic macrophytes [vascular plants] in Turtle Creek Reservoir” from 1993 to 1996. Since 1996, the foliage in the reservoir has consisted mainly of near-shore emergent vegetation.³ Their study also monitors fish populations in Turtle Creek Reservoir, and found that the largemouth bass catch during July seining has declined considerably since 1995. In 1999, and again in 2001, no largemouth bass were collected through seining at all – for the first time since monitoring began in 1981. The average catch of young-of-year (YOY) largemouth bass since 1981 has been 247; since 1996 it has dropped to 3 per year. EA’s report lists reduced light penetration and herbicide runoff as “plausible causes” for the decline in macrophytes, and the lack of submerged macrophyte cover as a possible cause for the poor catch of YOY largemouth bass. The lack of macrophytes may be a direct deterrent to spawning, as these bass like to spawn in shallow, sheltered areas associated with aquatic vegetation.⁴



During the summer of 2001, Hoosier Energy REC, Inc. instituted a weekly monitoring program; taking secchi disk readings (among other measurements) at nine transect points throughout the reservoir. The average readings for each point over the 22 summer weeks are reported in the table below. The standard water clarity goal for healthy lakes is two meters (79 inches) in depth; as can be seen in the table, the water clarity throughout the reservoir is well below this goal.

Table 1. Average depth of Secchi disk reading in inches from May-September

| | Monitoring Point | | | | | | | | |
|-------------|------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2001 | 18.41 | 18.23 | 18.91 | 28.50 | 19.32 | 18.55 | 15.09 | 17.32 | 18.00 |
| 2002 | 19.16 | 19.66 | 19.02 | 20.60 | 20.60 | 19.81 | 18.55 | 19.60 | 20.57 |
| 2003 | 20.92 | 20.05 | 20.66 | 20.16 | 19.61 | 18.70 | 18.08 | 19.92 | 20.05 |
| 2004 | 20.67 | 18.60 | 17.60 | 20.67 | 17.80 | 21.00 | 19.50 | 23.33 | 21.33 |
| 2005 | | | | | | | | | |

2.1.3. Cause for concern. The Partnership’s primary concern regarding the cause of these issues is erosion. (See photographs 1 - 15 in Appendix D for visual evidence of severe erosion on Turtle Creek Reservoir). Erosion can be linked to the water quality issues described above. It is a major factor that can decrease water clarity, which in turn reduces the sunlight penetration, and may be causing the decrease in vegetation and fish spawning.

³ EA Engineering, Science and Technology. Final Report: Biological and Chemical Monitoring in Turtle Creek Reservoir near Merom Generating Station. July 2000.

⁴ Ibid.

The banks of Turtle Creek Reservoir are especially susceptible to erosion for at least two reasons: the strong winds common to the area, and the presence of highly erodible soil types. The Merom Bluffs are located just over 1.5 miles to the west of the reservoir; there is approximately a 100-foot drop in elevation between the Bluffs and the water. This topography causes an unusually high average wind speed blowing across the reservoir. Measurements taken at Merom Generating Plant's Ambient Air Station show that the average monthly maximum wind speed is 20.6 MPH, blowing mainly to the west and south. Calm winds were reported on average only about 5% of the time – indicating that wind blows fairly constantly across the reservoir. This constant wind, over such a large flat area of shallow water, creates powerful wave action on the reservoir that serves to speed up the natural processes of erosion.

According to U.S. Geological Survey soil maps, the dominant soil types found around the edges of Turtle Creek Reservoir are Alford Silt Loams, Iona Silt loams, and Cincinnati Silt Loams. When combined with steep slopes (such as those found at the edge of the reservoir), these soils have very high surface runoff potentials.



Erosion has been a worry for landowners since the reservoir was first put in; the constant wearing away of the land adjacent to the reservoir is now beginning to threaten home structures built on land which is now at the water's edge. One resident estimates that between 6 and 8 feet of land behind his property has eroded away in the past 20 years. Another resident on the west side of the reservoir suffering from extremely rapid

erosion in the past few years placed stakes and fencing at the shoreline in the summer of 2000 to block wave action; within only a year and a half, so much land has been washed away that the stakes are over a foot away from the shore.

In June 2000, watershed committee members toured the reservoir on pontoon boats to visually inspect the levels of bank erosion. Video footage was shot of the reservoir shoreline areas at this time to document erosion issues,⁵ and Appendix D contains pictures from this expedition. Areas that were not inspected in 2000 due to the inability of the pontoon boats to navigate in shallow water were characterized in July 2001 by committee members using a motorboat, which allowed for a closer view. These further observations aided in the completion of the map shown in Figure 5, which summarizes the state of bank erosion known within the reservoir.

Measurements of eroded bank heights and lengths estimated during the 2001 boat trip were used to calculate the level of sediment loading to the reservoir resulting from the severely eroded

⁵ This video footage is available from the Partnership Secretary upon request

areas (locations shown in pink in Figure 5). A total of 18,165 feet of bank were classified as severely eroded, with bank heights ranging from 1 to 12 feet. Using a spreadsheet program from IDEM⁶, it was calculated that 1350 tons/year of sediment are loaded into the reservoir due to these highly eroded areas alone.

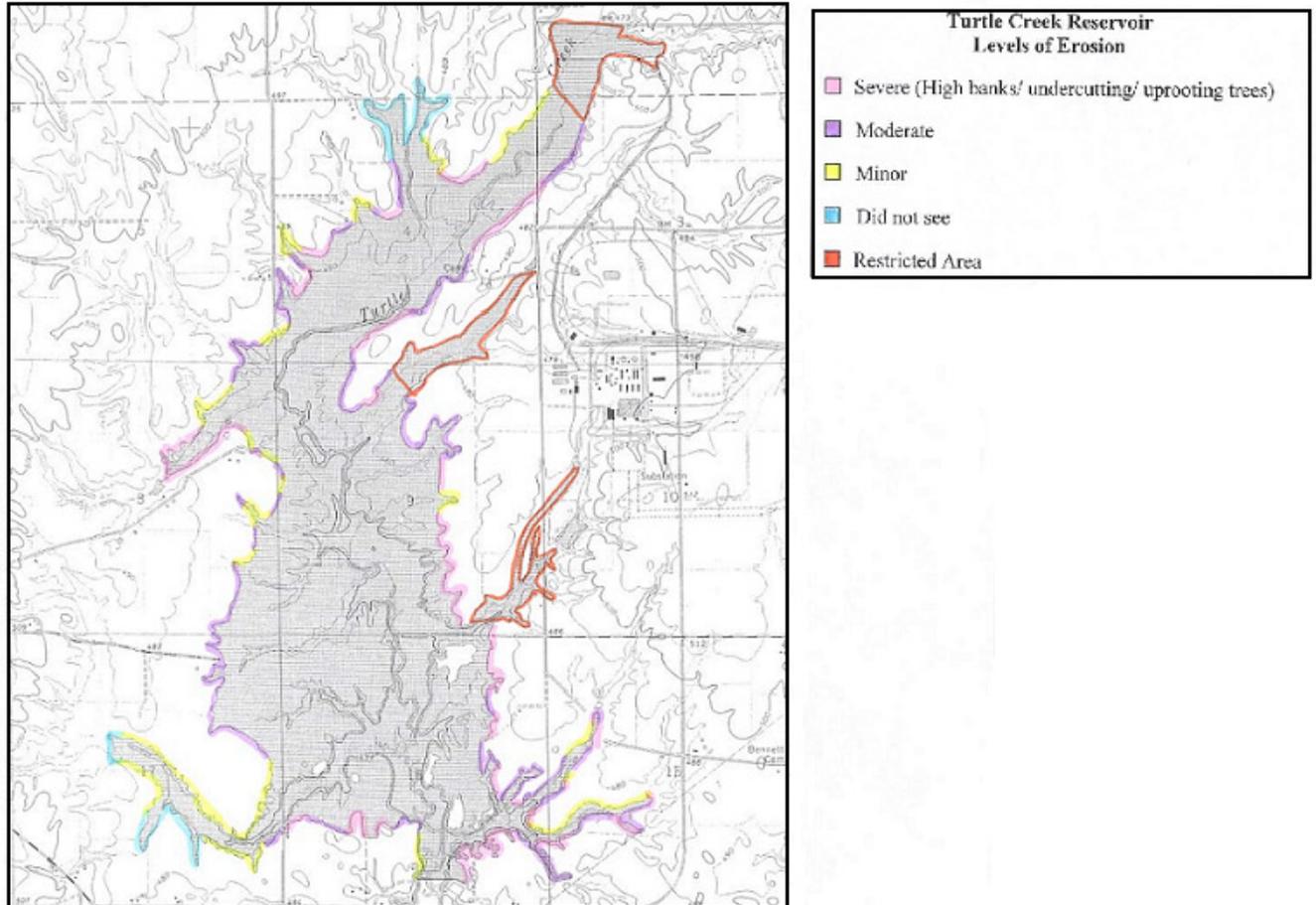


Figure 5. Locations of different levels of erosion along the bank of Turtle Creek Reservoir

In order to assess the amount of sedimentation loading into the reservoir over a 20 year time period (the reservoir began to be filled in January of 1980), a bathymetric survey was completed in 2000 at the behest of Hoosier Energy, REC, Inc. and the results were shared with the Partnership. Results of the survey were as follows:

- Between 1980 and 2000, the amount of sediment within the reservoir has decreased the volumetric capacity of the reservoir by 7%;
- The vast majority of the sediment can be found in two places: within the original streambed of the Turtle Creek and at the dam;
- The average depth of the reservoir was reduced by 0.5 feet from 8.6 feet to 8.1 feet.

⁶ IDEM Load Reduction Calculation Program

Based on the bathymetric survey, the reservoir shows a significant level of sedimentation over a 20-year period. The amount of suspended sediment that is discharged from the dam to the Turtle Creek and ultimately into the Wabash River has not yet been determined. The watershed coordinator will work on this task in 2006.

While there is no way to determine whether the rate of shoreline erosion has remained constant or increased since the noticed reduction in vegetation, the amount of area eroded away from the shoreline since 1997 will be calculated using aerial photographs taken in 1997 and in March, 2002. This information will be included in this Plan when available.

2.2 Agricultural lands

Because the watershed primarily consists of agricultural land (60%), farming practices have a significant affect on the watershed. While agriculture has many benefits for the environment, such as providing habitat for wildlife and lack of impermeable areas, agricultural activities can also have adverse impacts on water quality. Poor management of crops and livestock can cause manure, pesticides, fertilizers and soil to enter streams and the reservoir, potentially causing harm to aquatic and human life. Flyover pictures after a rainfall event in the summer of 2000



show very clearly that sedimentation into the reservoir from cropland runoff is a serious problem. Photographs 4 – 9 in Appendix E provide visual evidence of this runoff sedimentation into the reservoir. Photographs 10 – 14 illustrate typical erosion patterns from agricultural fields within the watershed. Gully erosion is especially evident, in fields very close to streams that discharge into the reservoir.

2.2.1 Tillage practices. Because erosion and sedimentation into Turtle Creek Reservoir and its tributaries from agricultural land is a primary concern, farm fields within the watershed considered to be Highly Erodable Lands (HELs) were identified. HEL fields are defined by the USDA as having at least 1/3 of their field acreage in highly erodable soils. Highly erodable soils have been determined based on slope and erodability factors⁷. The highly erodable soil types found in Sullivan County are listed in Table 2.

Table 2. Sullivan County Highly Erodable Soils List

| Symbol | Name |
|--------|--|
| AfC2 | Alford silt loam, 6 to 12 percent slopes, eroded |
| AfC3 | Alford silt loam, 6 to 12 percent slopes, severely eroded |
| AfD2 | Alford silt loam, 12 to 18 percent slopes, eroded |
| AfD3 | Alford silt loam, 12 to 18 percent slopes, severely eroded |
| AfE | Alford silt loam, 18 to 25 percent slopes |
| AfF | Alford silt loam, 25 to 50 percent slopes |

⁷ Tammy Swihart, NRCS District Conservationist, Sullivan County Soil and Water Conservation District

| | |
|------|--|
| AIB2 | Ava silt loam, 2 to 6 percent slopes, eroded |
| AIB3 | Ava silt loam, 2 to 6 percent slopes, severely eroded |
| BID | Bloomfield loamy fine sand, 12 to 18 percent slopes |
| BIF | Bloomfield loamy fine sand, 18 to 40 percent slopes |
| CnB2 | Cincinnati silt loam, 2 to 6 percent slopes, eroded |
| CnC2 | Cincinnati silt loam, 6 to 12 percent slopes, eroded |
| CnC3 | Cincinnati silt loam, 6 to 12 percent slopes, severely eroded |
| CnD2 | Cincinnati silt loam, 12 to 18 percent slopes, eroded |
| CnD3 | Cincinnati silt loam, 12 to 18 percent slopes, severely eroded |
| FsB | Fox sandy loam, 2 to 6 percent slopes |
| Gu | Gullied land |
| HkE | Hickory silt loam, 18 to 25 percent slopes |
| HkF | Hickory silt loam, 25 to 35 percent slopes |
| HkF3 | Hickory silt loam, 18 to 25 percent slopes, severely eroded |
| HkG | Hickory silt loam, 35 to 50 percent slopes |
| IoB3 | Iona silt loam, 2 to 6 percent slopes, severely eroded |
| MaB2 | Markland silt loam, 2 to 6 percent slopes, eroded |
| MaD2 | Markland silt loam, 12 to 18 percent slopes, eroded |
| MaE2 | Markland silt loam, 18 to 25 percent slopes, eroded |
| Mn | Mine dumps |
| PaC3 | Parke silt loam 6 to 12 percent slopes, severely eroded |
| PaD3 | Parke silt loam 12 to 18 percent slopes, severely eroded |
| PrE2 | Princeton fine sandy loam 18 to 25 percent slopes, eroded |
| PrG | Princeton fine sandy loam, 25 to 50 percent slopes |
| Rs | Rock land |
| St | Strip mines |

Using this list, Soil Maps and aerial photographs provided by the Sullivan County Soil and Water Conservation District, it was determined that there are a total of 972.5 acres of HEL fields within the watershed. While only 7% of watershed cropland is officially considered HEL, other soil types in this area are also considered by the SCSWCD to be frequently problematic and must be considered on a case-by-case basis. These questionable soils are listed in Table 3. It should also be noted that the amount of erosion that occurs on a field is dependent on farming practices and land features in addition to soil type. A great deal of erosion control feature implementation is needed within the watershed to minimize adverse impacts.

Table 3. Potentially Erodable Soils in Sullivan County

| | |
|------|---|
| AdC | Ade loamy fine sand, 6 to 12 percent slopes |
| MuB2 | Muren silt loam, 2 to 6 percent slopes, eroded |
| PrC2 | Princeton fine sandy loam, 6 to 12 percent slopes, eroded |
| VgB2 | Vigo silt loam, 2 to 4 percent slopes, eroded |
| WrC2 | Warsaw sandy loam, 6 to 12 percent slopes, eroded |
| AfB3 | Ava silt loam, 2 to 6 percent slopes, severely eroded |

One important erosion control feature is conservation tillage, any tillage or planting system with 30% or more residue remaining on the soil surface after planting to reduce soil erosion by water and wind. This includes no-till, ridge-till, mulch till, etc. In the fall of 2001, the Partnership (with aid from the Sullivan County Water and Soil Conservation District) conducted a visual investigation of the watershed, sampling approximately half of the crop fields within the watershed and observing amount of residue left on the soil surface. Using this data as well as data from a transect survey conducted by the SCWSCD the previous spring, it was estimated that

only 41.4% of the fields in the watershed currently use conservation tillage. Continuing education and financial support for farmers is needed to encourage more conservation tillage.

2.2.2 Pesticides applied in the watershed. Pesticides are meant to limit insects and weeds from damaging crops. Ideally, they remain in the environment just long enough to control the pests and then break down into harmless compounds. However, in actuality, pesticides are often transported into water supplies before they can be broken down. To get an idea of how much pesticide is being used within the Turtle Creek Watershed, a rough estimation was calculated using the Purdue Extension’s Guide for Watershed Partnerships.⁸ From the map in Figure 4, it was determined that the watershed’s cropland acreage is approximately evenly split between corn and soybean production. Using data given in the guide, the following table was set up to estimate the pesticides applied within the watershed.

Table 4. Estimate of Pesticides Applied in Turtle Creek Watershed

| Crop Type | Crop acres in the watershed | X | Pesticide type | Fraction of acres treated in the state (1998 figures) | X | Average rate of application (lbs/acre) (1998 figures) | = | Estimated amount of pesticide applied (lbs) |
|---------------|-----------------------------|---|------------------|---|---|---|---|---|
| Corn | 7365 | X | Atrazine | 0.89 | X | 1.36 | = | 8915 |
| | | | Metolachlor | 0.42 | | 2.04 | | 6310 |
| | | | Acetochlor | 0.32 | | 1.97 | | 4643 |
| | | | Primisulfuron | 0.14 | | 0.03 | | 30.9 |
| | | | Cyanazine | 0.13 | | 1.43 | | 1369 |
| Soybean | 7365 | | Glyphosate | 0.55 | | 0.85 | | 3443 |
| | | | Chlorimuronethyl | 0.27 | | 0.02 | | 39.8 |
| | | | 2,4-D | 0.26 | | 0.39 | | 747 |
| | | | Imazethapyr | 0.25 | | 0.04 | | 73.7 |
| | | | Paraquat | 0.19 | | 0.89 | | 1245 |
| Total: | | | | | | | | 26,816 |

2.2.3 Fertilizers applied in the watershed. Fertilizers, while providing necessary nutrients for crop growth, can cause water quality problems when in excess in the environment. The two nutrients of most concern in watershed management are nitrogen and phosphorus. Nitrogen degrades into nitrate, which can cause health concerns in ground water. In fields that are drained, nitrate can flow directly into ditches and streams through field tiles. Phosphorus is transported by attaching to soil particles that are eroded away from fields. High levels of these nutrients in waterbodies cause an overgrowth of algae and aquatic plants. While this is not currently a problem in Turtle Creek Reservoir, nutrient levels are an important aspect that must be continually monitored.

⁸ Alyson Faulkenburg and Jane Frankenberger. Watershed Inventory Tool for Indiana: A Guide for Watershed Partnerships. Department of Agricultural and Biological Engineering, Purdue University.

To estimate the amount of fertilizer applied in the Turtle Creek Watershed, fertilizer sales data were obtained from the Office of Indiana State Chemist⁹. Calculations are shown in Table 5. The newest Indiana Fertilizer Tonnage Report has been ordered and this information will be updated when it is received.

Table 5. Estimation of Fertilizer amounts using fertilizer sales

| County | Fraction of the county in the watershed ¹⁰ | X | Total Nutrients (tons) | | X 2,000 lbs/ton | Nutrients in watershed (lbs) | |
|----------|---|---|------------------------|-------------------------------|-----------------|------------------------------|-------------------------------|
| | | | Nitrogen | P ₂ O ₅ | | Nitrogen | P ₂ O ₅ |
| Sullivan | .08573 | X | 5,284 | 2,020 | X 2,000 | 905,995 | 346,349 |

2.2.4. Livestock. Livestock manure is an important source of nitrogen, phosphorus and *E. coli*, a bacterial indicator of the presence of potentially harmful pathogens. To estimate the numbers of animals in the watershed, the numbers of animals in Sullivan county were gathered from the Indiana Agricultural Statistics Service’s webpage¹¹ and multiplied by the fraction of the county that is in the watershed. These calculations are shown in Table 6.

Table 6. Number of animals in the Turtle Creek Watershed based on Indiana agricultural statistics

| Livestock | Number of Animals in the County | X | Fraction of the county in the watershed | = | Number of animals in the watershed |
|--------------|---------------------------------|---|---|---|------------------------------------|
| Beef Cattle | 2,300 | | | | 197 |
| Dairy Cattle | 2,400 | | | | 206 |
| Swine | 11,159 | X | .08573 | = | 957 |
| Chickens | 67 | | | | 20 |
| Turkeys | unknown | | | | - |

The Beef and Dairy Cows number is from January 2004. Partnership members familiar with farming practices in the watershed area indicated that the estimate for dairy cattle is most likely off by a factor of 10; a closer estimate for this part of the county would be 49. Therefore the estimate has been reduced for all future purposes. The number of Hogs is from 2002. According to the Indiana Agricultural Statistics Service there are only 67 Chickens in the county, however, the watershed coordinator knows of at least 20 chickens in the watershed. Also, the number of turkeys in the county is unknown, but there is a CAFO in the watershed that raises tom turkeys and they have approximately 20,000 toms.

In order to determine the amount of manure and nutrients produced within the watershed, Table 7 was set up using data also from Purdue’s Guide.

⁹ Office of Indiana State Chemist. Indiana Fertilizer Tonnage Report. January 1 – December 31, 2000.

¹⁰ The watershed’s 24,540 acres make up 8.57% of Sullivan county’s 286,224 total acres

¹¹ Indiana Agricultural Statistics Service. <<http://www.nass.usda.gov/in/annbul/9900/sullivan.txt>>

Table 7. Manure produced by animals in the Turtle Creek Watershed

| Livestock | Number of animals | X | Avg. amount of manure produced | = | Amount of manure produced (lb/day) | X | Fraction of nutrients in a pound of manure | | = | Pounds of N in the manure | Pounds of P in the manure |
|----------------------------------|-------------------|---|--------------------------------|---|------------------------------------|--|--|------------|---|---------------------------|---------------------------|
| | | | | | | | Nitrogen | Phosphorus | | | |
| Beef Cattle | 197 | | 75 lb/day | | 14,775 | | 0.008 | 0.0065 | | 118.2 | 96.04 |
| Dairy Cattle | 49 | | 115 lb/day | | 5,635 | | 0.0045 | 0.002 | | 25.4 | 11.3 |
| Swine | 957 | X | 11.7 lb/day | = | 11,197 | X | 0.0045 | 0.004 | = | 50.39 | 44.79 |
| Turkeys | 20,000 | | | | | | | | | | |
| Total amount of manure produced: | | | | | | Total amount of nutrients in the manure: | | | | | |

2.3 Streams

The Turtle Creek/Little Turtle Creek Watershed is defined by the streams that flow into the Turtle Creek Reservoir or Little Turtle Creek. There are approximately 70 miles of streams found within the watershed. Streams and ditches are an important part of a watershed because they are the primary transporters of water through the area. In order to maintain water quality, it is necessary to monitor the conditions of the streams.



2.3.1. Impaired Streams. Section 303(d) of the Clean Water Act requires Indiana to identify waters that do not meet water quality standards. The streams that do not meet these standards are found on the 303(d) list maintained by IDEM and found on their website¹². According to this website, no streams within the Turtle Creek Watershed are found on this list.

¹² Indiana Department of Environmental Management. “1998 303(d) List of Impaired Waterbodies” <<http://www.ai.org/idem/owm/planbr/wqs/303dlst.htm>>

2.3.2. Riparian Buffers. Riparian buffers are strips of vegetation, such as trees, next to a stream that filter polluted runoff and provide a transition zone between water and human use. The larger this area of vegetation, the better for the stream habitat. The recommended width of these buffer areas varies depending on specific site characteristics, but is typically at least two active channel widths on each side¹³. Using aerial photographs taken in 1997, Partnership members assessed the amount of streams in the watershed with sufficient buffer and identified the areas where no buffer exists. (A map describing these locations is found in Appendix F.) It was determined that of the 70 miles of streams:

- 19 miles (27%) are sufficiently buffered
- 13 miles (19%) are lacking a buffer
- 38 miles (54%) are undeterminable using the maps

A visual assessment of the streams within the watershed was performed by a Partnership member and technical advisor in August, 2001. Based on an assessment protocol from the USDA¹⁴ concerning characteristics such as channel condition, hydrologic alteration, riparian zone, bank stability, water appearance, nutrient enrichment, instream fish cover, pools, invertebrate habitat, canopy cover, riffle embeddedness, most of the streams viewed were judged to be in good condition. It must be noted that due to the time of year, the water level in many of the streams was severely low (some completely dry.) This allowed for the observation of a great deal of silt build-up in many streambeds, presumably a product of runoff from nearby crop fields. Cases of bank and gully erosion as well as high levels of nutrient enrichment were noted at several spots. It was concluded that improvements are needed to increase the amount of vegetative buffer around these areas to decrease the amount of runoff and further stabilize banks from erosion.

In the next two years, the watershed coordinator will work towards completing a biological assessment of the streams in the watershed. The committee will choose the locations to monitor. This will require contacting landowners for permission to access the streams from their land. The Hoosier Riverwatch suggested methods will be used and the data will be entered into their database along with the Watershed Management Plan.

2.3.3 Trash and Litter. A great deal of trash was seen in many of the streams, including items from large kitchen appliances to fast food containers. This garbage impairs the natural beauty of the surroundings and can be a nuisance to wildlife. Clean-up activities and litter-prevention education would help to reduce this problem.

¹³ United States Department of Agriculture. *Stream Visual Assessment Protocol*. National Water and Climate Center Technical Note 99-1. December, 1998.

¹⁴ United States Department of Agriculture. *Stream Visual Assessment Protocol*. National Water and Climate Center Technical Note 99-1. December, 1998.

2.4 Forestland

Forestlands are a significant natural resource within the Turtle Creek Watershed. Forests play a



role in everyone's lives and are important to the functioning of the environment as a whole. Forests provide wildlife habitat, wood products, firewood, mushrooms, and places to hunt,

hike and camp. They reduce noise, clean the air, produce oxygen, and protect and improve water quality. Woodlands occupy approximately 3,280 acres in the Turtle Creek Watershed, or 13% of the total area. For the most part, wooded areas are scattered throughout the watershed and located along the numerous streams that drain into Turtle Creek Reservoir.

2.4.1 Timber Harvesting. The majority of woodlands are owned privately. Woodlands are a renewable resource; proper management provides the landowner an excellent economic return while keeping all the benefits listed earlier. One well managed hardwood forest study showed a yield increase of \$184/acre/year in the timber value, with the timber volume nearly doubling in twelve years.¹⁵ Another study showed \$183/acre/year through fourteen growing seasons. The harvested tops brought in an additional \$16,000 in firewood sales.¹⁶ Over a period of fifteen years, a southeast farm in Indiana had an annual compound rate of return of 13.7%.¹⁷ Because logging can be a fairly lucrative activity, it is important for landowners to be aware of the best management practices (BMPs) when involved in timber harvesting. The use of BMPs by loggers, landowners and land managers offers the greatest potential to reduce nonpoint source pollution and improve the quality of our watershed.

2.4.2. Classified Forests. The Indiana Department of Natural Resources' Classified Forest Program is specifically designed to help keep Indiana's private forests intact. It allows landowners with at least 10 acres of forest to set it aside and to remain as forest. In return for meeting program guidelines, landowners receive property tax breaks, forestry literature and periodic free inspections by a professional forester while the forest is enrolled in the program.¹⁸ As of the year 2000, there are roughly 300 acres of classified forest located within the watershed¹⁹. Increasing the amount of classified forest land within the watershed can be one way the Partnership helps to promote retention and stewardship of private forest land. The watershed

¹⁵ Marshal County Mill Pond Demonstration Woodland 1999 Report

¹⁶ Wakeland Forestry Consultants; The Luke Woods, 1996

¹⁷ Southfork Tree Farms, 1997

¹⁸ Indiana Department of Natural Resources Division of Forestry. "Classified Forest Program." <<http://www.state.in.us/dnr/forestry/landassist/clasfor.htm>> Last updated April 17, 2000.

¹⁹ Estimated from a map of classified forest locations supplied by Rex Gambill, District Forester, DNR

coordinator is currently working with District Forester Jeremiah Lemmons to find the number of acres enrolled in the Classified Forest Program. Their goal is to determine the number of acres still eligible for the program, but not enrolled. The plan will be updated as that information is determined.

2.4.3. Riparian Buffers. Forests are the best protectors of watershed, so as mentioned in the previous section, it is important to increase the forested buffer areas around streams so as to filter polluted runoff and reduce nonpoint source pollution entering the area's waterways. Information regarding the importance of riparian buffers will be included in the biannual newsletter to landowners in the watershed.

2.5 Developed/Residential Areas

Approximately 385 acres of the watershed are taken up by urban areas. Development is mainly concentrated in the towns of Merom and Graysville as well as at the Merom Generating Station. Other structures include farmhouses and buildings scattered throughout the watershed. The population of Sullivan County increased by 14.5% between 1990 and 2000²⁰. Similar trends are expected within the watershed in the near future.



2.5.1. Bacterial contamination. An issue of concern to Partnership members is that none of the residencies within the watershed is connected to a sanitary sewer system, and several lack septic tanks. The vast majority of these homes are greater than 20 years in age. Bacterial and pathogenic contamination originating from fecal matter from these residences can be transported by streams into the reservoir; septage has been visually identified in storm drains that empty into the reservoir. To investigate this issue, Partnership members took water samples at stream outlets from within the reservoir and tested the samples for the presence of coliform bacteria, an indicator of the presence of disease causing organisms (test procedures and sampling locations can be found in Appendix G). Out of the twelve samples taken, five showed no evidence of coliform bacteria, while results for samples 1, 2, 3, 4, 5, 6, 7 were inconclusive (growth on agar dishes was noted, but colonies did not resemble typical coliform growth). It must also be noted that samples were taken during August, when streams are fairly dry; further sampling and testing at other times of the year is recommended.

2.5.2. Oil and Gas Well Contamination. Based on map data from the Indiana Department of Conservation Geological Survey (1998), there are approximately: 12 active oil wells, 157 abandoned oil wells, and 6 active gas wells, 27 abandoned gas wells and 7 abandoned water repressuring or brine disposal wells located within the Turtle Creek Watershed. The locations of

²⁰ U.S. Census Bureau. *Sullivan County, Indiana*. <<http://quickfacts.census.gov/qfd/states/18/18153.html>>

these can be seen in the map in Appendix H. A potential but yet uninvestigated concern is that leakage from these sites, especially if the abandoned wells were not closed correctly, may be contaminating water within the watershed. Future evaluation of these potential pollutant sources is necessary to determine whether any remediation work needs to be done. How this will be accomplished will be added to the Watershed Management Plan in the future.

3.0 GOALS AND OBJECTIVES

Based on the information gathered in the above assessment, the following water quality improvement and protection goals were determined. They have been listed *in order of priority*.

3.1 Goal #1: Increase the water clarity at Turtle Creek Reservoir from 0.5 meters to reach a 1.0-meter depth by 2006 by reducing the overall sediment load into the streams and reservoir and implementing conservation practices.



3.1.1 Objective: Install four different types of stream bank stabilization practices for a demonstration area by July 2002.

Target Area: The geographic area to be stabilized is the shoreline next to the Gettinger property on the west side of the reservoir. This area was chosen as a priority because of the severity of the erosion problem there.



The purpose of this privately funded demonstration is to analyze the effectiveness of several kinds of stabilization techniques in order to determine the best methods to use on other areas in the reservoir. We are looking for methods that are the most cost effective, require the least maintenance, are environmentally friendly, provide habitat for wildlife, and are aesthetically pleasing so that landowners will be in favor of installation. Plans are currently underway to install at least four different bio-engineered bank stabilization methods (coconut fiber logs, soil encapsulated lifts, cribwalls and bank resloping) on a 750-foot strip of severely eroding bank on the western side of the reservoir. Each method will be installed in two separate locations to assess how well each stands up to different types of wave action.

Action Items (completed):

- **Receive DNR's Flood Control Permit.** An application has been submitted to the DNR's Division of Water for permission to construct in a floodway.
- **Section 404 Permit.** An application has been submitted to the Army Corps of Engineers.
- **IDEM Permit.** IDEM has been contacted about requirements for necessary permits.
- **Hire Contractor for construction work and purchase materials.** Expected cost of construction is \$50,000.
- **The project was completed in fall of 2002 and adjusted in the summer of 2003.** The four shoreline stabilization practices were installed in the fall of 2002, with varying success. Based on the outcome of these practices, some of the areas (willow plantings, biologs and crib walls) had to be replaced with more productive measures. In the case of the willow wattles, they could not withstand

the wave action. In regards to the biologs and crib walls, the elevation of the lake was not taken into account, so those areas were replaced with the same practices, just at a higher elevation. Areas with the soil lifts and biologs also received a riprap toe.

3.1.2. Objective: Continue installation of bank stabilization measures throughout the next five years at the rate of 1 mile of shore stabilized per year.

Target Area: The geographic areas of priority are those banks with the most severe erosion problems (see map in Figure 5) and those threatening residential areas.

Approximately 1 mile per year of bank will be stabilized using bio-engineered techniques chosen from the Demonstration Project. The most severely eroded areas will be stabilized first. The permits obtained for the Demonstration Project also cover this work; all permits will be renewed as necessary. Community volunteer groups will be recruited to help in the construction process to reduce labor costs.

Action Items (completed): The Partnership Coordinator carried out these action items.

- **Notification and permission from landowners.** After determining proposed project sites, landowners were contacted and permission requested for shoreline construction.
- **Site Designs.** Working with the contractor, consultant and supplier, site designs were established for each of the shoreline sites.
- **Construction.** Contractors were hired and supplies purchased. By the fall of 2005, 6,051 lineal feet of shoreline on 8 different properties have been stabilized using biologs, crib walls, soil lifts and gabion baskets.

Action Items (ongoing):

- **Continue shoreline stabilization projects.** The Partnership will continue to work with landowners of highly eroded shoreline to install stabilization practices on the shoreline of the reservoir.

3.1.3. Objective: Increase best management practices on cropland and conservation tillage from 41.4% (6098 acres) to 60% (8838 acres) by 2005

Target Area: We will prioritize HEL farmland for implementation of BMPs and conservation tillage.



Because so much of the cropland in the reservoir is made up of highly erodable soils (as described in section 2.2), to reach these objectives the Partnership will work with farmers and landowners to:

- Determine which individual landowners have conservation plans, and determine stage of implementation with the plans. This will assist in the implementation and management of practices already in place as well as to determine sources of effective controls that can be brought to the attention of other stakeholders.
- Have soil conservation assessments conducted on individual properties to determine the types of erosion control practices that would be most effective. The focus will be on long-term strategies: methods that remain in place from year to year.

- Determine areas where erosion control measures would reduce soil loss to the T level²¹.
- Identify land where BMP's have been implemented and determine status of controls. Perform annual visits to these properties to assess the success of the method and its continued practice. This will insure that erosion control features remain intact and continue to be effective
- Assist NRCS in applying for annual EQIP funding. This will assist farmers within the watershed who wish to install conservation tillage and best management practices on their cropland

Action Items (completed):

- By the spring of 2005, the Partnership worked with 9 different landowners to install Best Management Practices on fields (totaling approximately 526.2 acres) containing highly erodible soils. The implementation of these practices prevents 2545.5 tons/year of sediment (based on IDEM's load reduction estimates) from entering the waterways.
- Worked with the Sullivan County Commissioners to cost share 2 streambank projects. These two projects prevent 50.7 tons/year of sediment (based on IDEM's load reduction estimates) from entering the waterways.

Action Items (to be completed):

- The Partnership will look at the watershed after harvest in 2005 and determine what percentage was conservation tillage the past 2 years. We will work with the NRCS District Conservationist to determine how many acres were put into conservation plans for cost-share since the watershed plan was written, especially counting the nutrient and pest management acreage.

3.1.4 Objective: Increase vegetative buffers along the streams from 27% to 46% by 2007 by providing educational materials to landowners along with working with the NRCS to promote cost share funding available for buffers.

Target Area: The streams shown in the map Appendix F to be insufficiently buffered will be our priority target areas to implement vegetative buffers.



It is important for the Partnership to ensure that all streams within the watershed have a riparian buffer zone of at least twice the width of the active channel on each side of the stream.

Action Items (ongoing):

- Discuss need for riparian buffers with affected landowners. Provide educational materials. The Coordinator will be responsible for completing this task.

²¹ The T by 2000 program is designed to address effects of erosion in watersheds. The program is carried out locally through Soil and Water Conservation Districts which work with the Indiana Department of Natural Resources Division of Soil Conservation, the Natural Resources Conservation Service, and the Purdue University Cooperative Extension Service to resolve sedimentation problems through volunteer monitoring efforts and public information and education activities

- Apply for grants to aid in cost of implementing buffers. We hope to offer 50 – 75% cost share to landowners, as funding allows.
- Work with the District Conservationist to determine how many buffers were and will be added in our watershed due to the Conservation Security Program, which awards landowners for buffers.

3.1.5 Objective: Determine the status (sufficient or needing buffering) of the remaining 54% of the streams throughout the watershed by 2006.

Target Area: The streams shown in the map in Appendix F to be undetermined will be priority targeted for inspection.

Action Items (to be completed):

- Obtain up-to-date, high-quality aerial photographs of the watershed to identify presence of vegetated areas around streams. These can be from another flyover or through satellite imagery. Estimated cost: \$1500. We anticipate private funding for this activity. The Partnership Secretary is currently working on this task to be completed by the end of 2005.
- Perform stream walks to verify findings with actual field data.

3.2 Goal #2: Educate the watershed community about natural resource conservation through involvement, information and communication



Because water quality issues are so broad and involve a wide variety of stakeholders, improvements within the watershed as a whole require the participation of the entire community. Our goal is to establish a venue of cooperation and involvement through education, information and communication.

3.2.1 Objective: Provide a public field day to showcase the different conservation practices available throughout the watershed by August 2002.

Target Area: The field day will be held at the Demonstration area described above.

Action Items (completed):

- **Field Days:** The field day took place in August of 2002 to highlight the stabilization practices of the demonstration area. Additionally, another field day took place in August of 2003 to highlight the adjustments made to the initial demonstration site and evaluate and discuss the success of those corrections. Contractors and other technical advisors were on hand to discuss advantages and disadvantages of erosion control and answer any questions. This event stimulated additional interest in the Partnership and kicked off the beginning of our efforts to stabilize all of the other severely eroded areas around the reservoir. Based on the results of this demonstration site, the Partnership was able to determine practices to be used on shoreline sites throughout the reservoir.

3.2.2 Objective: Inform the watershed community of cost-share projects and successes of the Partnership.

Action Items (ongoing):

- The secretary for the Partnership for Turtle Creek will administer mailing of notices and newspaper announcements.
- The Annual Meeting in August, which summarizes all the accomplishments of the watershed group throughout the past year, has brought persons that do not wish to come to monthly meetings; therefore this meeting will be highlighted by sending invitation letters to all stakeholders. Tours of agriculture cost-share and shoreline stabilization projects are given.
- Develop a newsletter by October 2005 that will be mailed to all stakeholders biannually. The newsletter will contain information on the status of implementing the watershed plan, along with other fun and pertinent news within the watershed. The newsletter will focus on two best management practices; riparian buffers and bacterial contamination. The newsletter will include a survey that will help measure the success of the Partnership. It will have questions regarding installation of BMP's and changes in attitude/habits.

3.2.3 Objective: Involve the local news media to help inform the watershed community about project progress and upcoming activities.

Action Items (ongoing):

- Notification of meeting date, time and location will be placed in the Sullivan Times each month – targeting the Friday edition before the Tuesday meeting (the Friday edition of the Sullivan Times has a section on what is up-coming for the next week).
- Invite media to the Annual Meeting
- Ensure that the media is informed about the watershed and assist in distributing information to the public. This will ensure that the Partnership receives the input of all interested parties who could contribute to the process.

3.2.4 Objective: Provide Sullivan County educators with tools for watershed education.



It is important to educate the entire community on the importance of watershed management, not only as a tool to improve water quality, but also as a method of stabilizing soils, chemicals and nutrients to improve the quality of personal property.

Action Items (ongoing):

- Work with the Sullivan County schools to inform science teachers about the importance of discussing watershed management within any water or erosion curriculum. The Partnership will pursue funding to provide written information such as curriculum tools, videos and other education materials to each science

teacher in Sullivan County. A Partnership copy of these materials will be made available for loan until this is accomplished.

- Work with the Sullivan County Soil and Water Conservation District to implement watershed management materials in their education projects. The Partnership will participate in the annual rafting trip by all Sullivan County 8th grade students. As part of the program, watershed information (identifying what a watershed is, looking at sources of erosion, etc) has been incorporated into the activities for the raft trip. The Partnership will participate in annual “field days” conducted by the Service. This will include a watershed demonstration for students attending the field day.
- Work with the DNR, Division of Reclamation’s annual Earth Day celebration by helping with activities, including a watershed demonstration by the watershed coordinator.

3.2.5 Objective: Participate in community activities to bring watershed planning to the general public.

Action Items (ongoing):

- Participation in the annual Sullivan County Ag Day, Earth Day with the DNR Division of Reclamation, Sullivan 4-H Fair, the Merom Chautauqua and other local events. The Partnership will pursue funding to rent booths at appropriate activities to display and distribute watershed specific materials to the public.
- Meeting with local elected officials at the events
- Success is measured by the amount of people who visit the display, the number of children who recognize who the watershed coordinator is, what he/she does, and the importance of the watershed model. Many children in the community have seen the watershed model (either 3-D or the tarp demonstration) and can explain to their younger sibling what it represents.
- Co-sponsorship of Drainage and No-Till Workshops
- Hosting Hoosier Riverwatch Training Workshops

3.2.6 Objective: Organize events like roadside/streambank trash pickups and community tree-plantings to promote community involvement and environmental stewardship.

Action Items (ongoing):

- Identify highly problematic areas for trash pick-up and where trees would be helpful for erosion control. All Partnership members can help in this.
- Contact community groups and arrange periodic events. Possible participating organizations include scout troops, 4-H clubs and the Wabash Valley Correctional Facility. Various Partnership members who are associated with these organizations will aid in the scheduling of these events.

3.2.7. Objective: Hold an Annual Meeting in August every year for the life of the Partnership

Action Items (ongoing)

- Partnership officers will develop an annual presentation of the year's accomplishments and plans for the upcoming year
- Secretary will send out invitations to all landowners in the watershed, government officials and other stakeholders
- Tours of agriculture cost-share and shoreline stabilization projects are given.

3.3 Goal #3: Provide continuous focus and effort towards the activities of the Partnership, so that the goals are accomplished in an efficient and organized manner.

3.3.1 Objective: Hire a watershed coordinator through the 319 Non-Point Source grant program by 2003.

The person filling this position will be responsible for:

- Taking the lead in evaluation and implementation of all Partnership projects
- Investigation of all further water quality concerns within the watershed and implementation of proper remediation methods
- Communicating with landowners and other stakeholders to notify them of the importance of and opportunities for erosion control and other BMPs
- Ensuring organization and coordination among Partnership subcommittees
- Ongoing monitoring of project accomplishments and water quality indicators
- Serving as contact person and providing information to all interested parties

Action Items (completed):

- A watershed coordinator was hired and began in February of 2003. She will maintain her position throughout the duration of the grant.

Action Items (ongoing):

- Secure funding to provide salary for this position (presently: 319 Grant). However, future funding resources will also need to be pursued to continue this position.

3.3.2 Objective: Apply for conservation funding through state, federal, and private sources

To be able to fund all activities carried out by the Partnership in order to complete the above listed objectives, the Partnership will investigate various funding sources. Funding will be critical to ensure that the goals of the Partnership for Turtle Creek are achieved. This includes funding for the Partnership itself for educational materials and operating expenses, funding for any specific control projects the Partnership seeks to have implemented, as well as providing information to interested stakeholders on obtaining funding for their control projects.

Action items (completed):

- The Grant Writing Subcommittee developed applications and submitted them to the appropriate agencies. The Partnership for Turtle Creek applied for the following grants in 2002:
 - A 319 grant for educational materials, water quality demonstrations, and watershed coordinator.
 - The Lake and River Enhancement (LARE) Program to assist in shoreline stabilization and other issues of concern and cost share incentives for implementing conservation practices on private lands.
 - The Natural Resources Conservation Service for continued EQIP funding (which was obtained for the watershed in 2000 and 2001).
 - Other programs as deemed appropriate

The Sullivan County Soil and Water Conservation District designation was used to apply for EQIP, 319, and LARE grants because the Partnership for Turtle Creek is not designated as a corporation or other entity.
- In addition, the Grant Writing Subcommittee will gather information on various grants available to individual stakeholders within the watershed. This will include copies of applications and any pertinent information gathered by the Partnership.
- In order to provide cost-share funds from grant money received by the Partnership to landowners implementing erosion control measures and BMPs, a list of criteria has been drafted that landowners must meet. This information required in their application for cost-share assistance is found in Appendix I.

3.4 Implementation Schedule for Partnership Goals

The Partnership for Turtle Creek Watershed Committee has adopted the following implementation schedule (Table 8) through 2006 as a goal for improving water quality and educating the community on watersheds within the Turtle and Little Turtle Creek Watershed. Planned completion dates are listed with room for actual implementation dates to be added. Additional targets will be incorporated as the Watershed Management Plan is annually updated.

Table 8. Implementation Schedule

| Target Completion Date | Activity | Completion Date |
|-------------------------------|--|------------------------|
| Spring, 2001 | Ensure local farmers are aware of EQIP funding in watershed for 2001 | 5-01 |
| Spring, 2001 | Choose Demonstration Area Location | 5-01 |
| 10-1-01 | Design plans created for demonstration area | 11-15-01 |
| 7-01-01 | Apply for applicable permits | Approved, 10-15-01 |
| 9-15-01 | - DNR | Approved, 12-10-01 |
| 10-15-01 | - Corp of Engineers | Approved, 11-26-01 |
| | - IDEM | |
| Winter, 2001-2002 | Prioritize other shoreline areas for stabilization | 1-02 |
| Fall, 2001 | Assist with application for 2002 EQIP funding | 9-7-01 |
| 3-16-2002 | Watershed display at Ag Day breakfast | 3-16-2002 |
| Spring, 2002 | Implement Demonstration Area (Private funding) | Summer 2003 |
| 6-1-2002 | Advertise for Watershed Coordinator (dependent on | Winter 2003 |

| | | |
|------------------|---|--------------|
| | grant funding) | |
| 6-7,8,9-2002 | Watershed display at Merom Chautauqua | 6/9/02 |
| Summer, 2002 | Second demonstration project construction (Private funding) | Fall 2003 |
| 7-20 to 26, 2002 | Watershed display at Sullivan 4-H Fair | 6/26/02 |
| 8-13-2002 | Annual Watershed Meeting and Field Day at demonstration area(s) | 8/13/03 |
| 8-15-2002 | Begin formal application procedure for matching funds for erosion control measures | August 2002 |
| 9-1-2002 | Hire Watershed Coordinator | 1/03 |
| 9-1-2002 | Award grants to 1 st round participants | 1/04 |
| 9-1-2002 | Begin formal educational efforts in Sullivan Schools | Spring/03 |
| Fall, 2002 | Continue evaluation of watershed for additional opportunities; streamwalks. | Summer 2003 |
| October, 2002 | Meet with Merom Town Board | October 2002 |
| October, 2002 | Meet with Graysville residents at public meeting | October 2002 |
| October, 2002 | Continue evaluation of education materials already available and begin development of Turtle Creek specific materials | Spring 2003 |
| December, 2002 | Begin formal application procedure for matching funds for 2 nd round of erosion control measures | Spring 2003 |
| February 3, 2003 | First day of Watershed Coordinator | 2/3/03 |
| March 8, 2003 | Ag Day Breakfast: display and watershed presentation | 3/08/03 |
| April 19, 2003 | Participation in Sullivan Earth Day | 4/19/03 |
| April 2003 | Speak at Kiwanas about Watersheds | April 2003 |
| April 2003 | All month, display at main Sullivan library for Earth Day month. Presentation | April 2003 |
| June 2003 | Merom Chautauqua | 6/8/03 |
| July 2003 | Sullivan 4-H Fair display | 7/04 |
| August 12, 2003 | Annual Meeting for Watershed Committee | 8/12/03 |
| August 2003 | Submit permit application for second demonstration project | 9/8/03 |
| September 2003 | Begin 2 nd shoreline stabilization | 8/9/03 |
| September 6 2003 | Kiwanas Pancake breakfast | 9/6/03 |
| March 2004 | 3 rd grade Ag Day watershed presentation for approx. 300 3 rd grade students | 3/04 |
| April 2004 | Participation in Sullivan Earth Day | 4/04 |
| June 2004 | Merom Chautauqua | 6/04 |
| July 2004 | Sullivan 4-H Fair display | 7/04 |
| August 2004 | Annual Meeting for Watershed Committee | 8/04 |
| December 2004 | 3-D Watershed Model Demo at Aurora High | 12/15/04 |
| February 2005 | Drainage and Nitrate Leaching Workshop | 2/1/05 |
| February 2005 | Conservation Security Program Meeting | 2/9/05 |
| March 2005 | 3rd grade Ag Day watershed presentation for | 3/11/05 |

| | | |
|----------------|---|---------------------|
| | approx. 300 3rd grade students | |
| March 2005 | Ag Day display at Sullivan Fairgrounds -over 1000 people attended and walked by the display | 3/12/05 |
| March 2005 | Grant Writing Workshop | 3/2/05 |
| April 2005 | Participation in Division of Reclamation Earth Day | 4/22/05 |
| April 2005 | Trash pick up in watershed | 4/5, 4/6/05 |
| April 2005 | USDA Media Crew at Watershed | 4/25/05 |
| April 2005 | Excellence in Conservation Award Presentation | 4/26/05 |
| May 2005 | Dugger Kindergarten Watershed Demonstration | 5/5/05 |
| May 2005 | Sullivan 6 th graders -watershed demonstration | 5/12, 5/13/05 |
| June 2005 | New watershed coordinator, Riverwatch Training | 6/2/05 |
| June 2005 | Streambank Stabilization Workshop | 6/15, 6/16/05 |
| June 2005 | Merom Chautauqua | 6/3, 6/4, 6/5/05 |
| June 2005 | Host Hoosier Riverwatch Training Workshop | 6/24/05 |
| June 2005 | Catfish Rodeo | 6/25/05 |
| July 2005 | Sullivan 4-H Fair display | 7/15-7/24/05 |
| August 2005 | Annual Meeting for Watershed Committee | 8/9/05 |
| September 2005 | Trash pick up in watershed | 9/12 & 9/14/05 |
| October 2005 | 8 th grade Wabash River Raft Trip -watershed demo | 10/4, 10/5, 10/6/05 |
| November 2005 | Development of newsletter | |
| December 2005 | New webpage designed | |
| February 2005 | No-till/conservation/bmp workshop | |
| March 2006 | 3rd grade Ag Day watershed presentation for approx. 300 3rd grade students | |
| March 2006 | Ag Day breakfast display | |
| April 2006 | Participation in Division of Reclamation Earth Day | |
| May 2006 | Watershed demonstrations in schools | |
| June 2006 | Merom Chautauqua Display | |
| July 2006 | Sullivan 4-H Fair display | |
| August 2006 | Annual Meeting for Watershed Committee | |
| August 2006 | Host Hoosier Riverwatch Workshop | |
| September 2006 | Corn Festival Display | |
| October 2006 | 8 th grade Wabash River Raft Trip -watershed demo | |
| | | |

Monthly steering committee meetings will discuss and review any recent progress toward meeting goals. These accomplishments are recorded in the meeting minutes, which are kept by the Partnership secretary and distributed at the following meeting.

3.5 Action Register

In order to track actions and achievements of the Partnership's goals, an Action Register has been included in Appendix J. When an event or action is suggested that furthers the

accomplishment of one of the above-listed goals and/or objectives, an Action Register form will be filled out by the Partnership member responsible for the action. Actions will be reviewed at the following steering committee meeting to evaluate success and schedule any necessary follow-up action. The completed forms will be added to the Management Plan once they are reviewed. This register, as well as meeting minutes, will be used in the annual update of goals, objectives and accomplishments as listed in the Management Plan.

4.0 MONITORING AND EVALUATION

4.1. Shoreline Stabilization. Monitoring the effectiveness of the shoreline stabilization methods involves walking the restored areas of the reservoir in the spring and fall for the first two years after construction. The Partnership Steering Committee will carry out semi-annual inspections. Also, the construction areas are located in areas directly visible from the landowners' residence, so any problems will be immediately reported. Periodic inspections will ensure that:

- The native vegetation planted is continuously growing more dense
- Any fabrics should maintain their integrity for their predicted lifespan until the ground surface is completely covered. Ripped fabric sections, or places where the fabric has been undermined by erosion will be repaired immediately and re-seeded.
- Logs, wattles, and other structures should still be in the same location as originally placed, and not undermined or eroded.
- Cuttings should be sprouting after the first growing season. Repairs might include live staking in locations where cuttings have failed or maintenance of any rill and gully erosion using seed and erosion control blankets.

Achieving our objective will be measured by the number of feet of shoreline stabilized each year. (We aim to complete 1 mile of shoreline stabilization per year.) Bank stabilization methods will be judged successful based on construction standards provided by consultant, as well as by a noticeable decrease in shoreline loss over time. Tons of sediment saved from erosion will be calculated using IDEM's Load Reduction Calculation Program. Using this program, it was estimated that 47 tons/year of sediment loading will be prevented by completing the Demonstration Project.

Success will also be measured by taking monthly secchi disk readings at the reservoir. The monitoring will take place at locations where stabilization has been completed and areas that are still eroding. Data will be submitted along with the quarterly reports. See Appendix M for data from 2000.

4.2. Agricultural Land. BMP's will be monitored using the standards and guidelines provided by the NRCS for each particular type of practice. The Coordinator will be responsible for ensuring that each area is inspected at least once annually. Landowners must agree to maintain all conservation features for a minimum of ten years.

Success at achieving our goal will be measured by the percentage of watershed cropland farmed using conservation tillage or best management practices installed. Records will be kept yearly and this number should continue to increase through Partnership efforts. Our aim is to reach a 20% increase within five years in the amount of farmland maintaining BMPs. The amount of sediment and nutrient load reduction as a result of the implementation of BMPs will be calculated using the IDEM Load Reduction Estimate. These results are located in Appendix L.

4.3 Biological & Chemical Monitoring. Using a synoptic approach, streams in the watershed will be monitored using Hoosier Riverwatch Biological & Chemical Monitoring Methods

and Standards. See Appendix N for a map of the sampling locations. Each point will be monitored monthly.

Also, a few sites will be targeted in the areas where we hope to install BMP's, so we will have both upstream and downstream data to compare to after the BMP is installed. See Appendix N for map of monitoring sites, quality control plan and Hoosier Riverwatch method of biological and chemical monitoring.

4.4 Riparian Buffer Zones. Monitoring and maintenance of riparian buffer areas involves an inspection of the plantings after rainstorms and regularly every two weeks for the first two months, then once a month for the first 6 months, then every six months for 2 years. Frequent inspection will be the responsibility of the landowner; semi-annual inspections will be made by the Partnership Steering Committee. Stressed or failed plants must be replaced, invasive species and weeds must be removed, and wildlife browsing must be prevented. Replanting will be necessary if the buffer is subjected to prolonged high water, drought, or ice damage before the plants are fully established. The landowner will be required by contract to leave the riparian zone undisturbed and to avoid using fertilizers or pesticides near the stream for a period of at least 10 years. Success at reaching our objective will be measured by the number of miles of streambeds improved with riparian buffers each year. We expect to increase buffered areas from 27% (current) to 46% by 2006.

4.5 Forestland Conservation. Success will be measured by the increase in forested acres within the watershed entered into conservation programs and/or using BMPs. The successful implementation of BMPs will be judged based on standards used by the Indiana Department of Natural Resources, as described in their Forestry BMP's webpage (<http://www.state.in.us/dnr/forestry/bmp/logindex.htm>). Our aim is to reach a 10% increase in forested land within five years. The Partnership Coordinator will be responsible for all inspection and record keeping. The Watershed Coordinator is currently working with the District Forester to obtain GIS data layers from Purdue University to determine the exact location and acres of Classified Forest Land in the watershed.

4.6 Community Involvement, Education and Communication. Success will be realized by increasing Partnership membership and support, community-wide interest, knowledge and concern for watershed issues. Success will be measured by the number of educational opportunities where the Partnership participated, the volume of educational materials supplied to local schools, and the number of teachers participating. The Coordinator will keep records of the topics covered for each type of audience, the number of people served, etc. Surveys will be developed in late 2005 and mailed out in late 2005 with the Partnership's newsletter to measure knowledge and behavior change over time.

5.0 FUNDING

5.1 Estimated Costs. In order to implement this Watershed Management Plan, the following annual costs have been determined:

Table 9. Estimated Annual Costs of Implementing Watershed Management Plan

| Goal | Item | Description | Cost per year | Funding Source |
|--|---|--|----------------------|---|
| Partnership Coordination/ Meeting Organization/ Information Tracking | Watershed Coordinator Salary | Full time position | \$30,000 | Grant |
| | Equipment* | Digital camera, laptop computer, printer, projector, cellular phone, etc. (and required accessories) | \$4000 | Grant |
| | Supplies | desk supplies, paper, envelopes, postcards, postage, photocopying | \$2500 | Grant & in-kind (Hoosier Energy) |
| | Office Space | Chair, desk, bookshelves, file cabinet, other overhead | \$1500 | In-kind (Hoosier Energy) |
| | Meeting Facility | Use of Turtle Creek Education Center | \$135 | In-kind (Hoosier Energy) |
| | Travel | Gas mileage for Coordinator's travel within and outside of watershed, conference attendance | \$1000 | Grant & in-kind |
| Turtle Creek Bank Stabilization | Permit Fees* | Construction in a Floodway Army Corps of Engineers | \$75 \$10 | In-kind (Hoosier Energy) |
| | Design Plans (Demonstration Area)* | Prepared by JF New & Associates | \$10,000 | In-kind (Hoosier Energy) |
| | Materials (Demonstration Area)* | Fabric mats, coconut fiber logs, fiber mesh, web grids, biologs, wooden stakes, goose netting, prairie grass mix, plugs, rebar, riprap stone, gravel, etc. | \$20,000 | In-kind (Hoosier Energy) |
| | Labor (Demonstration Area)* | Installation work to be performed by Frey Company | \$35,000 | In-kind (Hoosier Energy) |
| | Materials (Remaining Bank) | Same types as for demonstration area, pending success of each stabilization method | \$132,000 | Grant |
| | Labor (Remaining Bank) | Installation work | Volunteer | Partnership, Stakeholders, Local community groups |
| Implementation of Agricultural and Forestland BMPs | Cost-share grants issued to land-owners | Implementation of conservation tillage practices, other erosion control features | \$250,000 | Grant & in-kind (cost-share with landowners) |

| | | | | |
|-------------------------|--|---|------------------|---|
| Increase Riparian Zones | Supplies | Purchase trees and other native plants, etc. | \$100,000 | Grant & in-kind (cost share with landowners) |
| | Labor | Planting | Volunteer | Partnership, stakeholders, local community groups |
| Bacterial Testing | Kits for Coordinator to test samples | Two kits (20 samples) | \$110 | Grant |
| | Laboratory testing | Professional analysis of samples if necessary | \$1000 | Grant |
| Community Education | Display for fairs and community events | Presentation board, signs, posters, printed brochures, etc. | \$300 | Grant |
| | Curriculum purchases | Videos, software, and other classroom materials dealing with watersheds and water quality issues. | \$1200 | Grant |
| | Watershed Model Purchases* | 1 each of: Nonpoint Source Unit, Hazardous Materials Unit, Wetlands Unit, Set-up video, Carrying case | \$2370 | Grant |
| | Annual Field Day | Advertisement (posters, signs, newspaper ad, flyers) | \$150 | Grant |
| | | Materials/Supplies | \$300 | Grant |
| | | Refreshments | \$200 | In-Kind |
| | | Postage to invite stakeholders | \$165 | Grant |
| | | | | |
| | | | | |
| | | | | |
| TOTAL: | | | \$615,725 | |

* 1-time cost only (not annual)

5.2 Grant Sources. Potential sources of grant money include:

Table 10. Grants Available for Watershed Funding

| Grant | Purpose | Application Date (submitted or upcoming deadline) |
|---|--|---|
| Environmental Quality Incentives Program (USDA) | Implementation of agricultural conservation programs | September 7, 2001 |
| Section 319 (IDEM) | Implementation of management plan | March 31, 2002 |
| Lake and Watershed Enhancement (DNR) | Improvement of watershed | January 31, 2002 |
| <i>Other grants as determined by Coordinator and funding subcommittee</i> | | TBA |

5.3 Funding Accomplishments. The Environmental Quality Incentives Program (EQIP) provides financial assistance to farmers and ranchers who face serious threats to soil, water and other natural resources. Since 1998, farmers within the Turtle Creek Watershed have been receiving funding through this program through grants obtained by the Sullivan County Soil and Water Conservation District (SCSWCD) for all of Sullivan County. In 2000, through a joint effort between the Partnership for Turtle Creek and the SCSWCD, Turtle Creek Watershed was declared a “priority area” by the National Resources Conservation Service (NRCS) and EQIP funding was secured for 2-3 more years specifically for farmland within the Watershed. Farmers in the watershed are eligible for funding support to install erosion control measures or implement best management practices. Funds are awarded to applicants based on the severity of need and cost-effectiveness of the proposed remedy. Table 11 describes how this funding was put to use to address the natural resource concerns within the Turtle Creek Watershed.

Table 11. Summary of EQIP Funding

| Year | Total \$ | Acres | Landowner | Conservation Practice |
|------|----------|-------------|-----------|---|
| 1998 | | 78.4 | Boston | <ul style="list-style-type: none"> • 4 Water & Sediment Control Basins (WASCOBs) • 4.3 acres of filter strips • 7 WASCOBs • 4.8 acres of filter strips • 8 WASCOBs • rock shoot in waterway |
| | | 128.2 | Boston | |
| | | 157.2 | Coulson | |
| | \$20,350 | 363.8 total | | |
| 1999 | | 27.1 | Badger | <ul style="list-style-type: none"> • 1 WASCOB • 2 rock shoots • reduced tillage • 6 WASCOBs • no till • 20 WASCOBs • 1 rock shoot • grass waterway • no till • 2 WASCOBs • no till • 2 WASCOBs • no till |
| | | 42.6 | Burton | |
| | | 283.3 | Chowning | |
| | | 16.5 | Monroe | |
| | | 57.7 | Wible | |
| | \$23,670 | 427.2 total | | |
| 2000 | | 11.4 | Bell | <ul style="list-style-type: none"> • 2 WASCOBs • reduced tillage • 6 WASCOBs • no till • 5 WASCOBs • 1 rock shoot • no till • 10 WASCOBs • 1 rock shoot • 150 ft diversion • mulch till • 5 WASCOBs • 1800 ft field border • no till • 2 WASCOBs • reduced till |
| | | 30.3 | Burton | |
| | | 96.7 | Coulson | |
| | | 73.4 | Huff | |
| | | 33.7 | Wampler | |
| | | 18.5 | Wilson | |
| | \$26,100 | 264 total | | |

| | | | | |
|------|----------|-------------|---------|--|
| 2001 | | 22.3 | Burton | <ul style="list-style-type: none"> • 7 WASCOBs • 8 WASCOBs • 1600 ft field border • 2000 ft diversion • no till • 1 rock shoot • reduced till |
| | | 90.2 | Coulson | |
| | 62.3 | Gettinger | | |
| | 50.7 | Phegley | | |
| | \$29,946 | 225.5 total | | |

6.0 SYSTEMATIC APPROACH

In January of 2001, the Steering Committee approved the development of a plan to accomplish a systematic approach to watershed problem determination, recommendation and implementation of improvements.

6.1 Determination of Sections. A map of the watershed was divided into 5 sections (See Appendix K) based on sub-watershed areas by major tributaries. Although the goal is to prioritize major issues throughout the watershed and work at alleviating those problems first, the sections represent “manageable” amounts of area to focus on during 2-year periods for evaluation, and beyond for assessment and monitoring after completion.

Section 1, located in the southwest corner of the reservoir and characterized by several small tributaries, was chosen by the Partnership to use as a demonstration area. This section was chosen because:

- It contains a large number of the various types of land uses within the watershed including cropland, pasture, woodlands, reservoir shoreline and urban area; therefore, all types of watershed users will be educated and provided with the opportunity to become involved in this community project.
- The vast majority of the stakeholders within the demonstration area have been active in the Partnership for Turtle Creek and the cooperation level is expected to be outstanding. This should greatly assist in involving others in the following targeted sections.
- The zone is not expected to have major problems implementing the recommended strategies as these landowners are in the forefront of the conservation movement in Sullivan County.
- This section represents one of the major challenges as far as topography as the fall between the Merom bluffs and the reservoir is the most significant drop within the watershed and creates higher erosion potential than is found elsewhere.

The idea of the demonstration area is to characterize a small portion of the watershed, assist landowners in identifying the best erosion control practices and facilitate implementation where possible. This will include stabilization of shoreline, creation of buffer zones along waterways, and other erosion control practices as needed. Following implementation and verification of the success of erosion control practices, the demonstration zone will be used as a model and educational tool to bring other stakeholders into the watershed process and to spread the practices used throughout the watershed.

Stakeholders requesting aid for erosion control or other water quality-improving measures will not be denied based on location within the watershed; however, the focus of Partnership efforts are planned to proceed based on Section. After completion of the demonstration area, the four other zones will be focused on in a clockwise rotation and that implementation will proceed accordingly. Each of these zones is expected to take 18 months to 2 years to complete. Upon completion of all zones (a ten year time period) the rotation will begin again.

7.0 ANNUAL REVIEW & DISTRIBUTION

Each year in anticipation of the August annual meeting, the steering committee will review and approve of any changes or updates to the Watershed Management Plan as needed. Meant to be a living document, the plan will be updated at least annually to reflect accomplishments of the goal and objectives. Each update will be distributed to all members of the Partnership Steering Committee and Technical Advisors (as listed in Appendices B and C) as well as any other interested party, as requested. The Coordinator will investigate the possibility of making a current copy of the Management Plan available to the public at the Sullivan County Library. A copy will also be available for viewing at the Turtle Creek Education Center, at the Reservoir.

8.0 CONTACT INFORMATION

All records and documents concerning this plan will be kept by the Partnership Watershed Coordinator. All requests for further information should also be referred to the Coordinator. The current Partnership Watershed Coordinator is:

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