BIG TURKEY LAKE WATERSHED
FEASIBILITY STUDY

LAGRANGE, STEUBEN, DEKALB,
AND NOBLE COUNTIES, INDIANA

September 5, 2002

Prepared For:
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EXECUTIVE SUMMARY

The objective of this study is to locate, conceptually design, and foster the development of projects that will improve the water quality, habitat, and recreational value of Big Turkey Lake. This study explores the feasibility of the general recommendations made in the 1990 Big Turkey and Little Turkey Lake Enhancement Feasibility Study as well as the feasibility of additional projects not identified in the 1990 study. In general, this study focuses on projects that will reduce stream bank and island erosion, in-lake sediment agitation, and nutrient/sediment loading from Big Turkey Lake's watershed.

To accomplish the study objectives, J.F. New & Associates (JFNew) held three public meetings, conducted lake/watershed tours, reviewed all previous studies, and determined the feasibility of six projects. For each of the six projects, JFNew determined whether the project was physically feasible and whether the landowner would allow construction of the project on his or her property. JFNew documented the permit requirements for those projects that need regulatory approval to proceed. The project evaluation also included an examination of any unusual social concerns and environmental impacts associated with the project. Additionally, JFNew estimated probable cost for each project. Finally, JFNew developed project timelines and identified funding sources for each feasible project.

The six proposed projects identified in this feasibility study include: 1) bank stabilization along Dewitt Weicht Sparks Drain (Mud Creek) between Henry Lake and Big Turkey Lake, 2) wetland restoration at the corner of State Road 4 and State Road 327, 3) wetland restoration near the headwaters of Mud Creek along County Road 700 West, 4) sediment trap installation on Turkey Creek at County Road 475 South, 5) lake depth alterations, and 6) stabilization of island shorelines. After review, projects 1, 4, 5, and 6 were considered feasible.

ACKNOWLEDGEMENTS

The work included in this study was funded by the Indiana Department of Natural Resources (IDNR) - Division of Soil Conservation, Lake and River Enhancement Program with matching funds provided by the Big Turkey Lake Improvement Association. J. F. New & Associates, Inc. would like to thank the following individuals and organizations who helped with the study and production of this document: Jack Hollowell, Garl Miles, Stan Poeppel, and Patty Wittler all provided significant input and time to this study; Mike Massonne of the IDNR – Division of Soil Conservation and Kelly Bushong of the LaGrange-Steuben County SWCD provided valuable advice and support. We would especially like to thank all of the members of the Big Turkey Lake Improvement Association who attended the public meetings and participated in the discussion and selection of the projects.

John Richardson, the Project Manager for this study, authored this report. Contributors included Drew Bender, Marianne Giolitto, Brian Majka, Sara Peel, Cornelia Sawatzky, and Steve Zimmerman.

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1.0 INTRODUCTION

1.1 BACKGROUND

Driven by concerns over the observed increase in aquatic plant growth, the adverse effects of sediment deposition, and the decrease in water clarity observed in the lake, lakeside residents and users of Big and Little Turkey Lakes have supported several studies and projects examining and improving their lakes' water quality. In 1989, the Big Turkey Lake Improvement Association (Lake Association) received a grant from the Indiana Department of Natural Resources (IDNR) "T by 2000" Lake Enhancement Program to conduct a study of Big and Little Turkey Lakes. Harza Engineering Company (Harza) conducted the study, which was published in 1990 as the "Big Turkey and Little Turkey Lake Enhancement Feasibility Study". The study notes that excessive phosphorus from the watershed has resulted in a eutrophic rating for the lake. According to Harza, Smathers Ditch, Mud Creek, and Turkey Creek contribute the greatest amount of phosphorus and sediment to Big Turkey Lake. In their 1990 study, Harza recommended aquatic vegetation control and the installation of eight wetland sediment traps throughout the watershed to reduce phosphorus and sediment loading. In the 10 years following the Harza study, the Lake Association installed a sewer system to serve the lake community and implemented a vegetation control program. The Lake Association also attempted to raise the lake level; however, they failed in this effort. In 2000, the Lake Association received an IDNR Lake and River Enhancement (LARE) grant to assess current conditions and determine specific best management projects feasible for design and construction. J.F. New & Associates (JFNew) produced this document as a result of the 2000 grant award.

1.2 SCOPE OF STUDY

The geographical scope of this study includes Big and Little Turkey Lakes and their watershed. During the course of this study, JFNew participated in three public meetings (Appendix A) and conducted a lake and watershed reconnaissance to identify potential projects that will improve the ecological health and recreational value of the lake and its surrounding watershed. In addition, JFNew attempted to locate and assess projects recommended in Harza's 1990 study. The following are projects (Figure 1) included in this feasibility study based on the findings of surveys conducted by JFNew and Harza (1990):

1. Bank stabilization along Dewitt Weicht Sparks Drain (Mud Creek) between Henry Lake and Big Turkey Lake
2. Wetland restoration at the corner of State Road 4 and State Road 327
3. Wetland restoration near the headwaters of Mud Creek along County Road 700 West
4. Sediment trap installation on Turkey Creek at County Road 475 South
5. Lake depth alterations
6. Stabilization of island shorelines

1.3 STUDY GOALS

The goal of this study is to identify four "feasible projects" that can be designed and implemented in following years. Projects are considered "feasible" if they can physically be implemented, are agreed to by affected landowners, are economically justifiable, and have regulatory approval. This feasibility study examines each of these criteria to ensure project success.

2.0 DESCRIPTION OF STUDY AREA

2.1 LOCATION

The Big and Little Turkey Lakes Watershed (14 Digit-HUCs 04050001110-100, -110, -090) encompasses 56.5 square miles (36,109 acres) and is located in portions of Lagrange, Steuben, Dekalb, and Noble Counties, Indiana (Figure 1). The watershed drains into Big Turkey Lake largely through Mud Creek and Turkey Creek. Mud Creek drains 7.5 square miles (4,814 acres). Turkey Creek is the largest tributary to Big Turkey Lake, draining 23.5 square miles (15,068 acres) or two-thirds (66%) of the watershed. Turkey Creek flows from Big Turkey Lake through Little Turkey Lake and continues to the Pigeon River that eventually reaching the St. Joseph River.

2.2 GEOLOGIC HISTORY

The drainage basin of the Big and Little Turkey Lakes Watershed formed during the most recent glacial retreat of the Pleistocene Era. The glacial advance and retreat of the Huron-Saginaw and Ontario-Erie Lobes of the last Wisconsian glaciation shaped much of the present topography within the watershed and northern two-thirds of Indiana (Wayne, 1966). The broad, flat to rolling glaciated plain left by the retreat of the Huron-Saginaw Lobe includes glacial fill and outwash, sandy gravelly beach ridges, and flat belts of morainal hills and bog kettle depressions (Simon, 1997). Many of these features are visible in the Big Turkey Lake Watershed landscape today. This geologic history defines the watershed's ecoregion and shapes the current land use in the watershed.

2.3 LAND USE

The Big and Little Turkey Lakes Watershed has been impacted by agricultural practices. Prior to settlement, the area was a mix of oak-hickory forest and wetlands. Early settlers cleared forests, drained wetlands, and straightened streams in an attempt to farm the rich soils. Today, row crop agriculture accounts for approximately 66% of the watershed landscape (Table 1, Figure 2). Pasture/hay, deciduous forest, and open water are also important components of the watershed landuse. These land uses cover 16%, 10%, and 5% of the watershed, respectively (Table 1, Figure 2).

TABLE 1. Land use in the Big and Little Turkey Lakes Watershed.

Land Use	Acres	Percentage
Row crops	23,843.7	65
Pasture/hay	5642.5	15
Deciduous forest	3461.9	10
Open water	1618.9	5
Woody wetlands	915.2	2.5
Emergent herbaceous wetlands	356.8	1
Low intensity residential	186.7	0.5
Other	82	1
TOTAL	**36,108**	**100**

Source: USGS/EROS Indiana Land Cover Data Set, Version 98-12 (updated December, 1998)

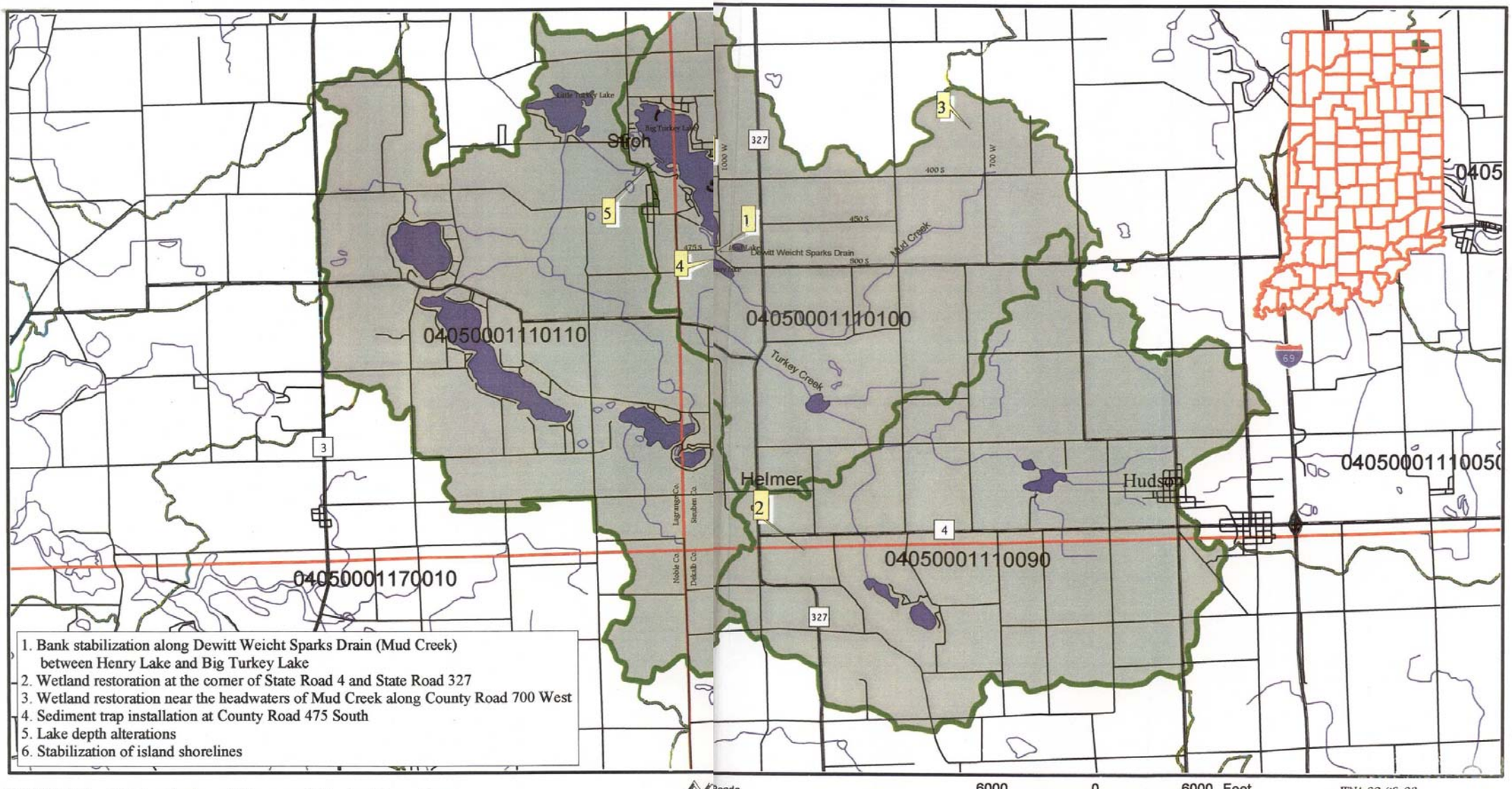


FIGURE 1: Watershed and Proposed Project Locations
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb, and Noble Counties, Indiana

Roads
14-Digit Watersheds
Little Turkey Lake Watershed

6000 0 6000 Feet

Scale: 1"=6000'

JFNA 00-08-03

J.F. New & Associates
wetland consultants / environmental engineers

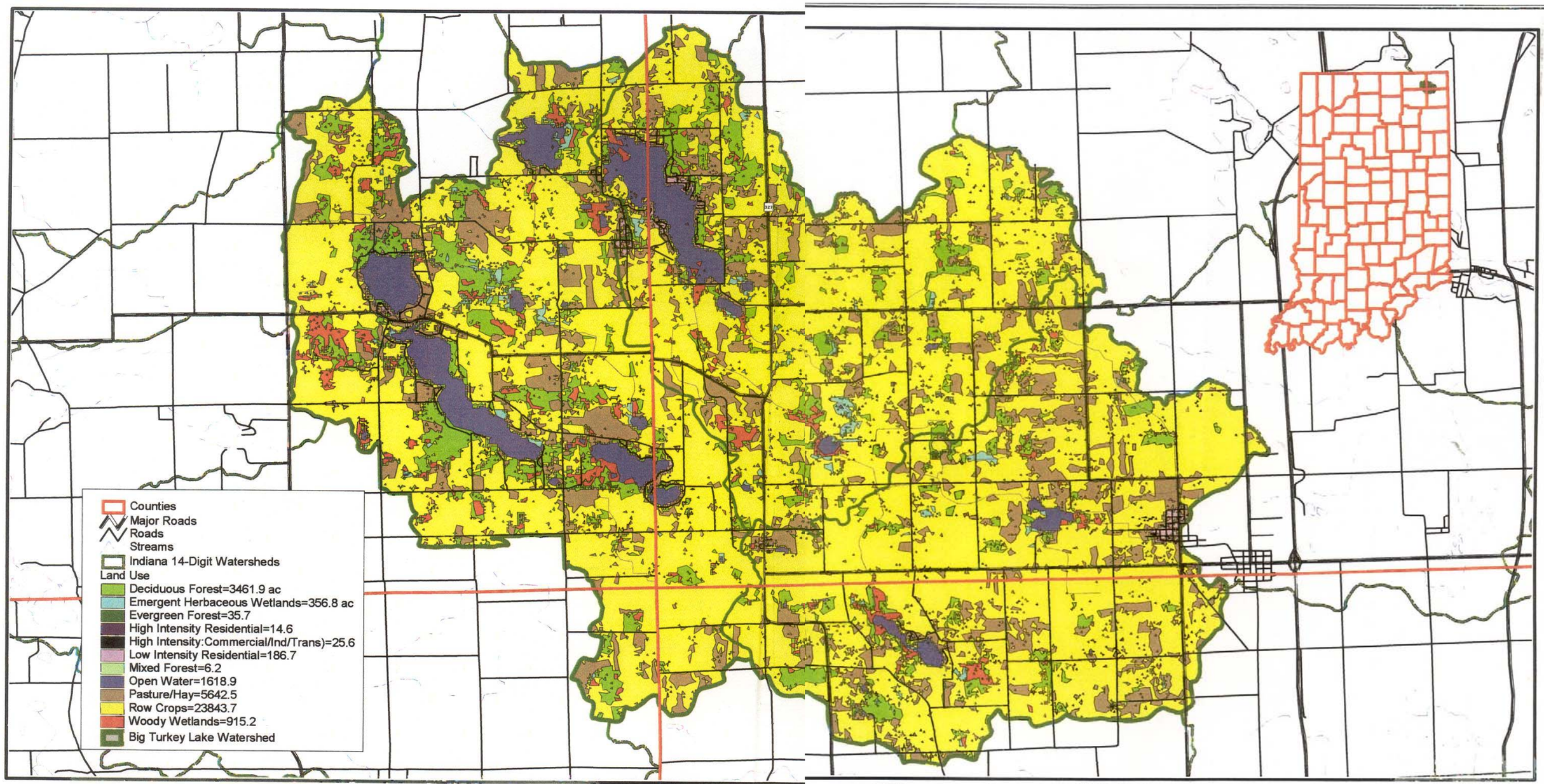


FIGURE 2: Land Use in the Big and Little Turkey Lakes Watershed
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb, and Noble Counties, Indiana

2.4 SOILS

Deciduous forest vegetation primarily influenced soil development in the Big and Little Turkey Lakes Watershed which originated in glacial drift and till. Soils are predominantly loams and sandy loams, which are well-drained and have good productivity. Table 2 lists the soil series found in the Big and Little Turkey Lakes Watershed.

TABLE 2. Soil series in the Big and Little Turkey Lakes Watershed.

Soil Series	Acres	Percentage
Wawasee	13,885	38
Riddles	12,685	35
Spinks	7,426	21
Kalamazoo	766	2
Homer	717	2
Glynwood	630	2
Total	**36,109**	**100**

Source: STATSGO Database

Wawasee

The Wawasee series consists of deep, well-drained, moderately permeable soils formed in glacial till on moraines and till plains. These upland soils have slopes ranging from 0 to 18 percent.

Riddles

The Riddles series consists of very deep, well-drained, soils that formed in loamy and sandy till on moraines. The permeability of Riddles series soil is moderate and their slopes range from 0 to 35 percent.

Spinks

The Spinks series consists of very deep, well-drained soils formed in sandy eolian or outwash material. These soils exist on dunes, foot slopes or moraines, till and outwash plains, beach ridges, and lake plains. They possess moderately rapid permeability and their slopes range from 0 to 60 percent.

Kalamazoo

The Kalamazoo series consists of deep, well-drained soils formed in loamy outwash overlying sand, loamy sand, or sand and gravel on outwash plains, terraces, valley trains, and low lying moraines. These soils exhibit moderate permeability in the upper loamy materials and rapid permeability in the lower sandy materials. Soil slopes range from 0 to 18 percent.

Homer

Soils in this series are nearly level and somewhat poorly drained. Homer soils exist on flats in outwash areas over sand and gravel deposits. These soils are moderately deep. Permeability is moderate.

Glynwood

The Glynwood series consists of moderately deep, somewhat poorly drained soils that formed in glacial till on till plains and moraines. Soil permeability is moderate in the upper part of the

subsoil, moderately slow in the lower part, and slow in the substratum. Soil slopes range from 0 to 4 percent.

2.5 PRIOR STUDIES IN THE BIG AND LITTLE TURKEY LAKES WATERSHED

Big Turkey and Little Turkey Lake Enhancement Feasibility Study (Harza Engineering Company, 1990)

In 1989, the Department of Natural Resources issued a grant to the Big and Little Turkey Lake Association under the IDNR's "T by 2000" Lake Enhancement Program to perform a lake enhancement feasibility study. Harza Engineering Company conducted the study. During the study Harza: 1) identified areas within the Big Turkey Lake Watershed that contributed to eutrophication and sedimentation, 2) identified technically feasible measures to restore the ecological integrity and recreational value of the two lakes, and 3) recommended measures for lake and watershed restoration, based upon engineering feasibility, cost effectiveness, and environmental compatibility.

Harza (1990) recommended that the Lake Association design and construct six wetlands upstream of Big Turkey Lake and two additional wetlands in Little Turkey Lake's watershed that would function as sediment traps. Harza estimated that implementation of all eight wetlands would reduce sediment loading by 1,400 tons or 33% annually (Harza, 1990). Table 3 and Figure 3 show locations of all eight proposed wetland sites while Appendix B includes aerial photos of each site.

TABLE 3. Proposed wetland locations (Harza, 1990).

	Wetland Number	Subwatershed	Section Number
Big Turkey Lake Watershed			
	1	Mud Creek	Sec. 20, T. 36N., R. 12E.
	2	Turkey Creek	Sec. 19, T. 36N., R. 12E
	3	Turkey Creek	NW ¼ Sec. 4, T. 35N., R 12E.
	4	Turkey Creek	NW ¼ Sec. 35, T. 36N., R. 12E.
	5	Turkey Creek	Sec. 35, T. 35N., R. 12E.
	6	Turkey Creek	NE ¼ Sec. 25, T. 36N., R. 12E.
Little Turkey Lake Watershed			
	7	Cochran Ditch	Sec. 14, T. 36N., R. 11E.
	8	Cochran Ditch	Sec 24, T. 36N., R. 11E.

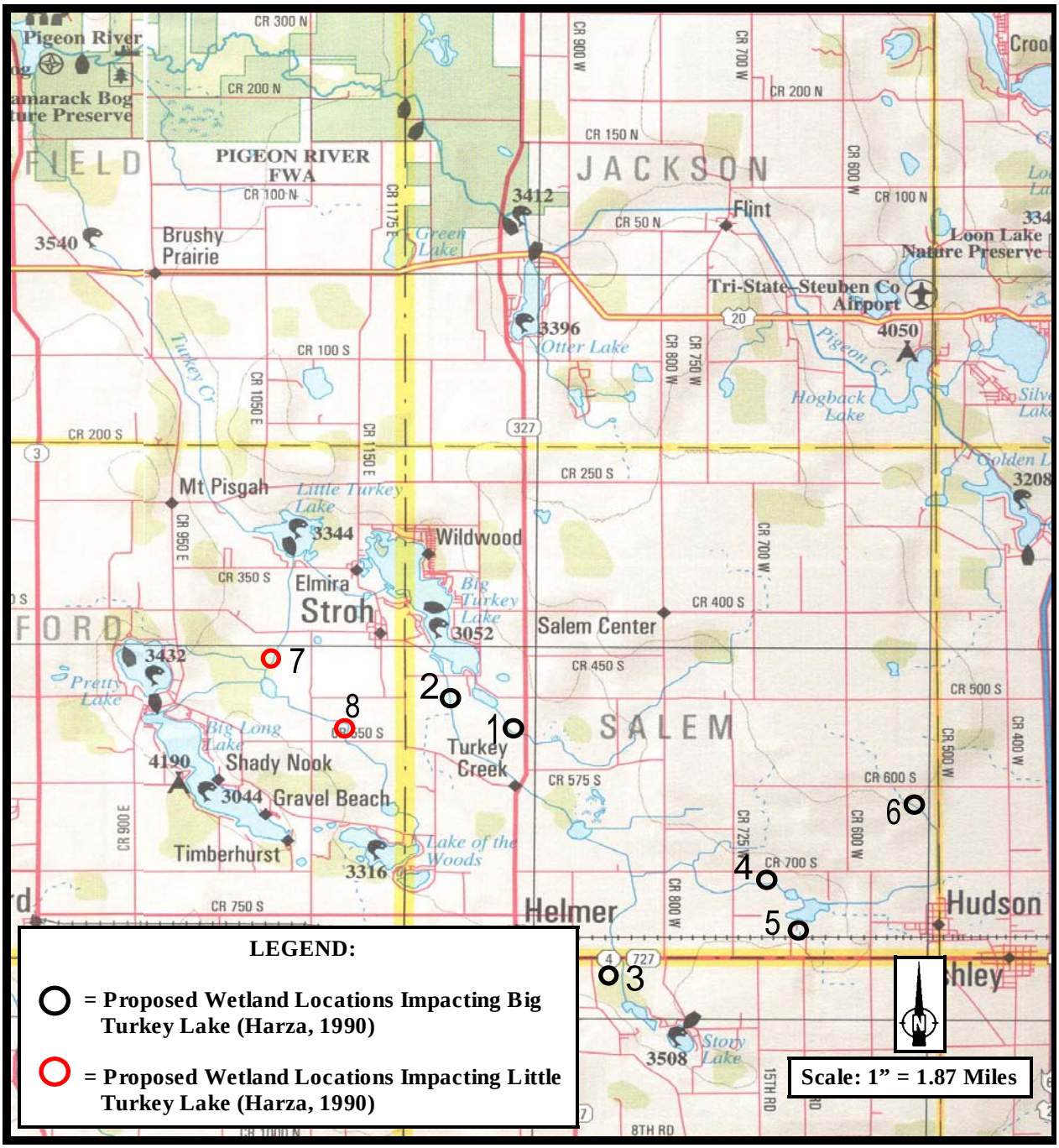


FIGURE 3. Proposed Wetland Locations (Harza, 1990).

Monitoring Study for the Turkey Creek Watershed Land Treatment Project Area (J.F. New & Associates, Inc., 2001)

In 2001, JFNew conducted a LARE funded study for the Steuben County Soil and Water Conservation District (SWCD) to collect baseline chemical, biological, and habitat data in the Turkey Creek Watershed land treatment project area. Results from the monitoring study will b discussed in the Environmental Assessment sections.

3.0 PROJECTS REVIEWED

3.1 BANK STABILIZATION ALONG DEWITT WEICHT SPARKS DRAIN (MUD CREEK) BETWEEN HENRY LAKE AND BIG TURKEY LAKE

3.1.1 Site Description and Alternatives

The project area encompasses 800 linear feet of Dewitt Weicht Sparks Drain (Mud Creek) between Henry Lake and Big Turkey Lake at the intersection of County Road 475 South and County Road 1000 West in Steuben County, Indiana (Figure 1). Dewitt Weicht Sparks Drain has been straightened and dredged in the past. The channel banks are steep (1:1 or steeper) and lack vegetation on 50% or more of their surface area. The 10-foot high, loamy sand banks are eroding and depositing sediment in the channel due to frequent and severe fluctuations in the water level and boat traffic between the two lakes. The east top of bank is 5 to 10 feet from the edge of County Road 500 South along most of its length. Forested land lies adjacent to the west bank. Mud Creek flows under County Road 475 South through a culvert. The culvert is 22 feet wide at the base and 10 feet high. The average channel width between Henry and Big Turkey Lakes is 35 feet.

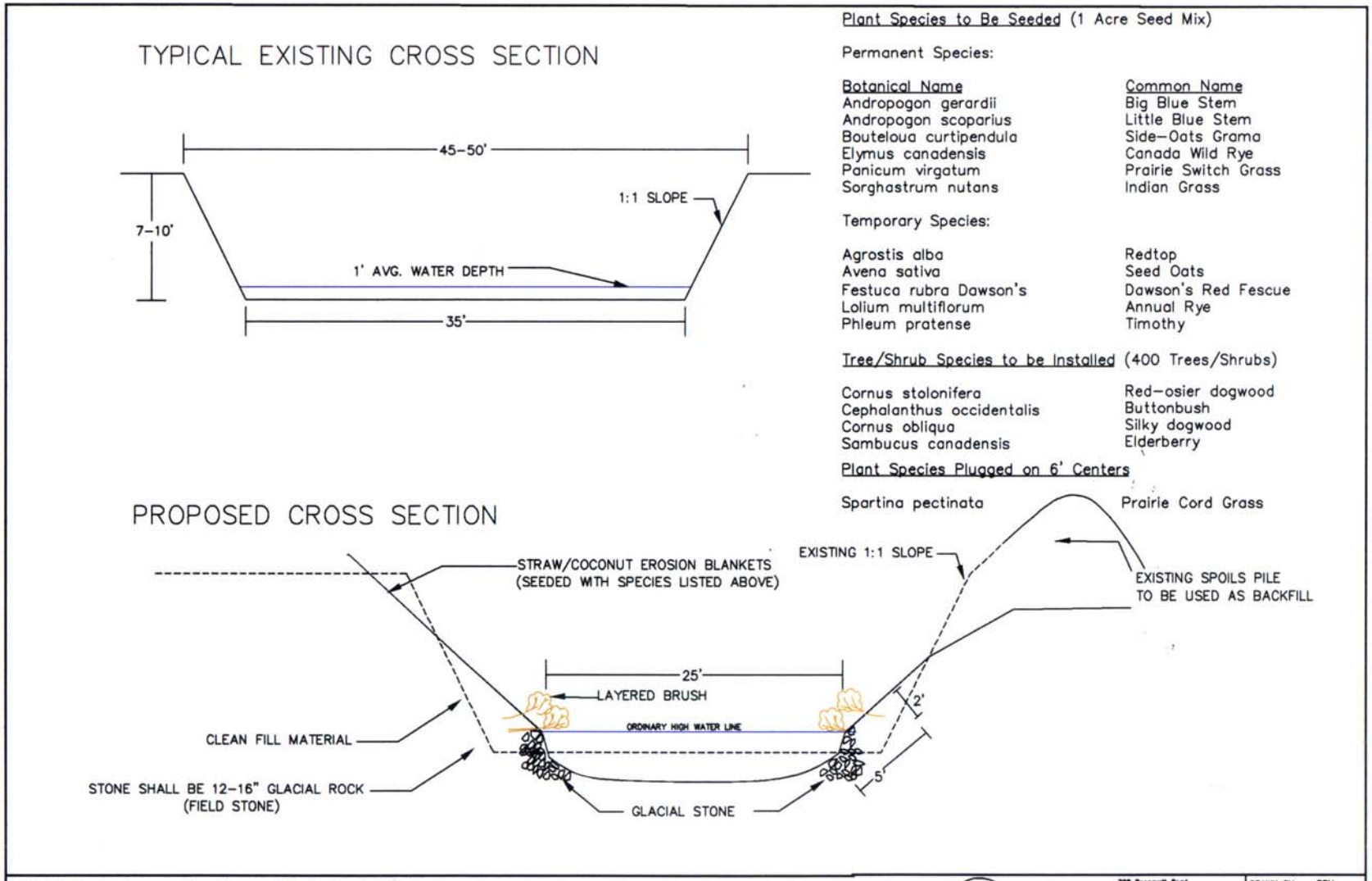
Alternatives considered for restoration of the banks in this reach include:

1) Riprap
2) Glacial stone combined with bioengineered banks (vegetated soil-encapsulated lifts)
3) Sheetpile
4) No action

Boat traffic, steep slopes, variable water levels, and sandy soils necessitate the use of hard armor at the water line. Alternative 1 is physically feasible although riprap does not meet the aesthetic requirements of the residents. Alternative 2 will provide a stable slope toe, easier channel navigation, fish and wildlife habitat, and a stream bank more natural in appearance. Sheetpile (Alternative 3) is also feasible but prohibitively expensive. If no action is taken bank erosion will continue to occur and may eventually reach the foundation of County Road 500 South. Based on the need for a stable slope toe, safe channel navigation, fish and wildlife habitat, and an aesthetically pleasing solution, Alternative 2 was pursued.

3.1.2 Preliminary Design

The proposed project design includes narrowing of the 35-foot average width of the existing channel along County Road 500 South in order to flatten the existing vertical ditch banks (Figure 4). The extra 13 feet of channel width upstream from the culvert will be used to decrease the slope angle to a 2:1 slope without interfering with top of bank structure. Glacial stone will be placed along the entire channel length of both banks and backfilled with clean fill material. A series of soil-encapsulated lifts of coir fabric will be constructed on top of the glacial stone and planted with deep-rooted prairie grasses and shrubs. Bare root shrubs will be incorporated into at least the first layer of the lift to establish long-term surface scour protection, hide the glacial stone, and provide lateral stability with their deep root mass. The coir fabric will last up to 10 years allowing the plants to fully establish and stabilize the stream bank.



Plant Species to Be Seeded (1 Acre Seed Mix)

Permanent Species:

Botanical Name	Common Name
Andropogon gerardii	Big Blue Stem
Andropogon scoparius	Little Blue Stem
Bouteloua curtipendula	Side-Oats Grama
Elymus canadensis	Canada Wild Rye
Panicum virgatum	Prairie Switch Grass
Sorghastrum nutans	Indian Grass

Temporary Species:

Agrostis alba	Redtop
Avena sativa	Seed Oats
Festuca rubra Dawson's	Dawson's Red Fescue
Lolium multiflorum	Annual Rye
Phleum pratense	Timothy

Tree/Shrub Species to be Installed (400 Trees/Shrubs)

Cornus stolonifera	Red-osier dogwood
Cephalanthus occidentalis	Buttonbush
Cornus obliqua	Silky dogwood
Sambucus canadensis	Elderberry

Plant Species Plugged on 6' Centers

Spartina pectinata	Prairie Cord Grass

FIGURE 4. Cross Section--Bank Stabilization
Big Turkey Lake Watershed Feasibility Study
PROJECT: Bank Stabilization Along Dewitt Weicht Sparks Drain between Henry Lake and Big Turkey Lake
Lagrange, Steuben, Dekalb, and Noble Counties, Indiana

J. F. New & Associates, Inc.
Permitting · Delineations · Mitigation Design · Wetland Nursery · Natural Systems for Wastewater Treatment Engineering

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3855 Eagle Creek Parkway
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317-388-1882 fax 317-388-1886

DRAWN BY:	BRM
DESIGNED BY:	JR
CHECKED BY:	
DATE:	February 27, 2002
JOB NO:	00-08-03
SCALE:	NONE

3.1.3 Permit Requirements

Several permits are required for work within the channel. Required permits must be obtained from the Steuben County Drainage Board as Dewitt Weicht Sparks Drain (Mud Creek) is a legal drain, the IDNR for work within a floodway and within ½ mile of the Big Turkey Lake, the Indiana Department of Environmental Management (IDEM) for Clean Water Act (CWA) Section 401 Water Quality Certification, and the U.S. Army Corps of Engineers (Corps) for a CWA Section 404 permit. The Steuben County Drainage Board has approved the project. (Appendix D contains a copy of county, state, and federal comments regarding this project.) Permits will likely take six months to obtain. Appendix C contains copies of permit applications.

3.1.4 Landowner Agreements

Four properties lie adjacent to the proposed project area. Two individuals own land on the east side of the channel where construction is proposed. Two other individuals own land on the west side of the channel where bank stabilization work may or may not occur depending upon the project's final design. The work will take place entirely within the 75-foot drainage easement of Dewitt Weicht Sparks Drain (Mud Creek); therefore, permission from the four property owners is not required for the work. Despite this, each of the four landowners was contacted to provide them with details of the project. Appendix D contains correspondence with the landowners regarding this project. None of the landowners voiced opposition to the project in the public meetings, phone conversations, or written correspondence. All of the landowners have voiced their support for the project and will be contacted prior to project construction for final approval. The Steuben County Drainage Board has voted to support and provide financial backing for the project.

3.1.5 Unusual Physical and Social Costs

Several unusual physical and social costs must be considered before implementing this project. The work will require the use of construction equipment within the stream channel. This work will be difficult due to the 10-foot high banks and the potential high flows associated with spring storm events. Therefore, the recommended construction period is from July through November. During the one to two weeks of construction, boat traffic in the channel and vehicle traffic on County Roads 1000 East, 500 South, and 475 South will be restricted. Traffic control and removal and replacement of existing guardrails on the east bank along County Road 500 South should be included on the bid list (Table 4). Residents may experience excessive noise during construction and temporary loss of land within the 75-foot drainage right-of-way. Additionally, it may be necessary to remove trees along the west side of the channel to allow for access and regrading of the banks.

3.1.6 Environmental Assessment

IDEM Biological Studies Section and JFNew have conducted biological surveys upstream of the proposed project site where State Road 327 crosses Mud Creek. Appendix E contains JFNew's study which summarizes IDEM's and other organizations studies of the area. The surveys did not find any endangered, threatened, or rare (ETR) macroinvertebrate or fish species. Both IDEM and JFNew utilized the macroinvertebrate data collected at the site to calculate a macroinvertebrate Index of Biotic Integrity (mIBI). IDEM developed the mIBI to assess water quality within a stream reach. IDEM's 1991 mIBI score reflects moderately impaired water quality. JFNew's 2001 (spring and fall) mIBI scores indicate that water quality is severely

impaired for aquatic life use support. IDEM Biological Studies Section also conducted a fish community survey in 1991. IDEM used their fish survey results to calculate an Index of Biotic Integrity (IBI). The IBI assesses ecological health and biological integrity of the fish community as they relate to human impacts. The 1991 IBI score indicates that the site possesses a poor quality fish community.

As part of the feasibility study, JFNew conducted a vegetative survey at the project site. The survey results indicate that goldenrod (*Solidago sp.*), common dandelion (*Taraxacum officinale*), common pokeweed (*Phytolacca americana*), Canada thistle (*Cirsium arvense*), nightshade (*Solanum sp.*), prairie cordgrass (*Spartina pectinata*), blue-joint grass (*Calamagrostis canadensis*), poison ivy (*Toxicodendron radicans*), river-bank grape (*Vitis riparia*), and dogwood (*Cornus sp.*) vegetate the channel banks. No ETR plant species were observed during the survey.

The proposed project's goal is to stabilize the severely eroding slopes, thereby increasing habitat on the side slopes and within the channel. Establishing a mix of native plants on the side slopes will add diversity and permanent cover for animal species that utilize the riparian area. Glacial stone will create permanent substrate and interstitial spaces within the channel that are valuable to aquatic macroinvertebrates and fish. When mature, shrubs planted above the glacial stone will shade the channel, creating habitat that does not presently exist.

3.1.7 Probable Cost Estimate

The cost estimate of bank stabilization along Dewitt Weicht Sparks Drain (Mud Creek) between Henry Lake and Big Turkey Lake is approximately $112,000 (Table 4).

TABLE 4. Probable Cost Estimate for Dewitt Weicht Sparks Drain (Mud Creek) bank stabilization.

Item	Cost	Unit	Quantity	Total
Glacial stone	$25	Ton	800	$20,000
Fabric lifts	$15	Linear foot	1,400	$21,000
Seed and trees	$1.50	Linear foot	1,400	$2,100
Clearing and grubbing	$4,000	Per acre	0.75	$3,000
Excavation & backfill	$25	Linear foot	1,400	$35,000
Guardrail work*	$3,000	Lump sum	1	$3,000
Mobilization/demobilization	$2,500	Lump sum	1	$2,500
Clean up	$3,000	Lump sum	1	$3,000
Construction sub-total				**$89,600**
Engineering and permitting	15%	Construction costs	$89,600	$13,440
Construction services	10%	Construction costs	$89,600	$8,960
Sub-total				**$22,400**
Total				**$112,000**

*Type of contractor equipment used will determine whether guardrail removal is necessary.

3.1.8 Project Justification

Stabilization of the channel banks along Dewitt Weicht Sparks Drain (Mud Creek) between Henry Lake and Big Turkey Lake will reduce sediment loads. The banks have been eroding and contributing sediment to Big Turkey Lake for many years (Estil Gayheart, personal observation). The project will eliminate this sediment source with no additional maintenance costs. The project will add habitat diversity and stability to the stream reach, and create a safer boating path between Henry Lake and Big Turkey Lake.

3.2 WETLAND RESTORATION AT THE CORNER OF STATE ROAD 4 AND STATE ROAD 327

3.2.1 Site Description and Alternatives

The project site includes two historical wetland areas adjacent to the south side of State Road 4 approximately ¼ mile east of State Road 327, southeast of Helmer, Indiana (Figure 1). Currently, the site is used for agricultural production. The proposed project involves the restoration of the two former wetland areas (approximately 23 acres) for stormwater retention and sediment/nutrient reduction. JFNew did not consider any other alternatives for this parcel. The landowner was not interested in pursing the project due to his desire to keep the land in row crop production.

3.2.2 Preliminary Design

The proposed design involves restoring the wetlands drained for farming. Breaking the existing drainage tile system in the two low areas will restore a majority of wetland functionality. A riser could be used to control overflow from the restored wetlands to Turkey Creek. The wetlands would be seeded with a diverse mix of native vegetation to provide good wildlife habitat and to enhance the wetland's pollutant trapping capacity. There are no design or engineering fees proposed as part of this project. The Natural Resource Conservation Service (NRCS) could likely design and oversee the construction of the project. The entire cost of restoration could be reimbursed if the landowner were to complete the project under the existing Wetland Reserve Program (WRP). Furthermore, the WRP would make a lump sum or annual payment to the owner for easement.

3.2.3 Permit Requirements

No permits would be required to complete the project.

3.2.4 Landowner Agreements

One family owns and farms the project site. JFNew sent a written request to the owner and called to discuss the proposed project. The owner was not interested in pursuing the project due to his desire to keep the land in row crop production.

3.2.5 Unusual Physical and Social Costs

The loss of productive farmland is the only unusual social cost associated with this project. Furthermore, the project construction site would be relatively simple to access from adjacent state highways or county roads.

3.2.6 Environmental Assessment

The land is currently in agricultural production with minimal wildlife habitat value. A tile drains the former wetlands to Turkey Creek. Removing the tile would decrease water flow to the stream during storm events and likely increase base groundwater flow to the stream. Decreased flow during storm events could allow riparian plant species to become permanently established, thereby stabilizing the banks and minimizing sediment loading. Furthermore, available literature reveals that properly designed wetland restorations remove the majority of solids and 45% to 75% of the nutrient loads in runoff reaching the wetland (Cooke et. al 1993).

3.2.7 Probable Cost Estimate

The cost estimate for wetland restoration at the corner of State Road 4 and State Road 327 is approximately $116,900 (Table 5). It is important to note that land acquisition costs account for approximately 75% of the construction cost and nearly 50% of the total project cost. Under some circumstances, land can be acquired for substantially less than the current real estate cost or may even be donated. This could significantly reduce the overall project cost.

TABLE 5. Probable Cost Estimate for wetland restoration at State Road 4 and State Road 327.

Item	Cost	Unit	Quantity	Total
Tile removal	$275	Per acre*	23	$6,325
Outlet riser	$50	Lump sum	2	$100
Seeding	$500	Per acre	23	$11,500
Mobilization/demobilization	$1,500	Lump sum	1	$1,500
Purchase	$2,500	Per acre	23	$57,500
Construction sub-total				**$76,925**
Construction services	10%	Construction costs	$76,925	$8,000
Contingency	25%	Construction costs	$76,925	$20,000
Design/engineering	15%	Construction costs	$76,925	$12,000
Sub-total				**$40,000**
Total				**$116,925**

*Cost of tile removal is given on a per acre basis rather than per foot basis because the exact number and length of tiles in the field is not known at this time.

3.2.8 Project Justification

Wetland restoration at the site will increase water storage capacity and decrease sediment loading to Turkey Creek. Restoring the approximately 23 acres of former wetlands will add about 50 acre-feet of water storage within the Turkey Creek drainage system. However, due to the landowner's desire to continue farming the parcel, JFNew has determined the project infeasible.

3.3 WETLAND RESTORATION NEAR THE HEADWATERS OF MUD CREEK ALONG COUNTY ROAD 700 WEST

3.3.1 Site Description and Alternatives

The project site includes a low-lying area adjacent to the west side of County Road 700 West, two miles north of County Road 400 South (Figure 1). The site is currently an active agricultural

field. The proposed project involves the restoration of approximately 66 acres of former wetland for stormwater retention and sediment/nutrient reduction. No other alternatives are recommend at this time for this parcel. Since the landowners are interested in maintaining this land in agricultural production the project was not pursued any further.

3.3.2 Preliminary Design

The wetland restoration would involve a reversal of the drainage system previously constructed by landowners. Breaking the existing drainage tile system and filling 3,600 feet of existing drainage ditch through the center of the low area would restore wetland hydrology to approximately 66 acres of agricultural ground. The wetland could be seeded with a diverse mix of native vegetation to provide wildlife habitat and to enhance the wetland's pollutant trapping capacity. The NRCS could design and oversee the construction of the project. If the landowner were to complete the project under the existing WRP, the entire cost of restoration could be reimbursed. Furthermore, lump sum or annual payments would be available for easement conservation.

3.3.3 Permit Requirements

Three permits are required before the wetland can be restored. Required permits include a permit from the Steuben County Drainage Board to abandon a section of legal drain and CWA Section 401 and 404 permits from IDEM and the Corps, respectively, to backfill the existing ditch. Appendix C contains a copy of the permit application forms.

3.3.4 Landowner Agreements

This project would affect four landowners. JFNew sent each of the landowners an introductory letter discussing the proposed project. All landowners have stated that they are interested in maintaining the land in agricultural production; therefore, the project is not feasible at this time.

3.3.5 Unusual Physical and Social Costs

The loss of productive farmland is the only unusual social cost associated with this project. Physical costs are apparent as the land would be easily accessible from county roads.

3.3.6 Environmental Assessment

The site is currently used for agricultural production and provides little in the way of wildlife habitat; a tile drains the area to Mud Creek. JFNew conducted a biological survey on Mud Creek just downstream from the proposed project site. No ETR species were documented during the survey (Appendix E). mIBI scores at the sample site suggest that water quality is severely to moderately impaired.

Removing the tiles and filling the ditch on the property would decrease water flow to Mud Creek's headwater stream during storm events and would increase base flow in Mud Creek. This decrease in discharge during storm events would aid in stabilizing stream banks and decrease the amount of sediment moving downstream. Decreased flow during storm events could allow riparian plant species to become permanently established, thereby stabilizing the banks and minimizing sediment loading.

3.3.7 Probable Cost Estimate

Wetland restoration near the headwaters of Mud Creek along County Road 700 West would cost approximately $369,150 (Table 6). It is important to note that land acquisition costs account for approximately 75% of the construction cost and nearly 50% of the total project cost.

TABLE 6. Probable Cost Estimate for wetland restoration near Mud Creek along County Road 700 West.

Item	Cost	Unit	Quantity	Total
Ditch filling	$4	Cubic yard	6,000	$24,000
Tile removal	$275	Per acre	66	$18,150
Outlet structure	$1,500	Lump sum	1	$1,500
Seeding	$500	Per acre	66	$33,000
Mobilization/demobilization	$1,500	Lump sum	1	$1,500
Land purchase	$2,500	Per acre	66	$165,000
Construction sub-total				**$246,150**
Engineering	15%	Construction cost	$246,150	$36,900
Construction services	10%	Construction cost	$246,150	$24,600
Contingency	25%	Construction cost	$246,150	$61,500
Sub-total				**$123,000**
Total				**$369,150**

3.3.8 Project Justification

Restoring the approximately 66 acres of former wetlands would increase water storage capacity in the watershed and decrease sediment/nutrient loading to Mud Creek. Restoring the wetland could add approximately 132 acre-feet of water storage within the Mud Creek drainage system. Due to landowners' desires, the project cannot be given further consideration at this time.

3.4 SEDIMENT TRAP INSTALLATION ON TURKEY CREEK AT COUNTY ROAD 475 SOUTH

3.4.1 Site Description and Alternatives

The project site includes the existing Turkey Creek stream channel and a fallow agricultural field bordering the western edge of the channel (Figure 1). The fallow agricultural field was historically a wetland that has been tile-drained for agricultural production.

The alternative actions considered for this site include:

1. Meandering the existing channel through the fallow agricultural field
2. On-line sediment trap
3. Restored wetland
4. No action

Due to the muck soils on the Turkey Creek banks and in fallow farm fields, Alternative 1 is not feasible. High flows associated with storm events will likely erode the banks of a meandering wetland filter. Furthermore, the landowner was not interested in this option. Alternative 2 is feasible and would all for sediment and sediment-attached nutrient settling from the water column before entering Big Turkey Lake. Alternative 3 is not feasible because it was not an

attractive option for the landowner. Alternative 4 will not address sediment and nutrient load s that continue to enter Big Turkey Lake. Following review, Alternative 2 was pursued.

3.4.2 Preliminary Design

In order to remove sediment and nutrients from Turkey Creek, flow must be slowed. To achieve this, the existing stream channel must be widened. Approximately 1,200 feet of Turkey Creek will be widened from an existing width of 30 feet to a proposed width of 90 feet. Twenty-foot overflow shelves planted with emergent wetland vegetation will capture additional sediment, add stability to the sides of the sediment trap, and serve as a foundation for future maintenance (sediment dredging). Additionally, a series of three check dams will be installed on the bottom of the newly constructed channel to further slow the water and deposit sediment. Figure 5 presents a plan view and longitudinal cross sectional view of the project, and Figure 6 shows a cross sectional view of the proposed channel.

3.4.3 Permit Requirements

Two permits are required before construction on the project can begin. The project is within the legal drain easement of Turkey Creek, thereby requiring a permit from the Steuben County Drainage Board. The IDNR requires a permit for ditch work within one-half mile of Big Turkey Lake and for construction in a floodway. Section 401 and 404 permits will also be required from the Corps and IDEM.

3.4.4 Landowner Agreements

One individual owns the land on the western side of Turkey Creek. This individual has verbally agreed to proceed with the proposed project. At the time of final report submittal the landowner had not yet provided full support for the project.

3.4.5 Unusual Physical and Social Costs

The project will result in the loss of approximately one acre of cropland along the west side of Turkey Creek. This ground is currently within the drainage board right-of-way; however, it has been farmed in the past. The muck soils make construction access somewhat difficult, which increases the cost of excavation and maintenance. Annual dredging of the sediment trap will be necessary, causing continued disturbance to the site. The disposal of dredged sediment loads may also be a burden unless an agreement is reached with the property owner to dispose of the dredged sediment on-site.

3.4.6 Environmental Assessment

A former wetland drained for agriculture and an existing channelized ditch (Turkey Creek) comprise the project site. A vegetation survey indicated that giant ragweed (*Ambrosia trifida*), tall nettle (*Urtica dioica*), and reed canary grass (*Phalaris arundinacea*) dominate the site. No organizations have completed a biological inventory of the stream at the proposed project site. Harza (1990) indicated that no ETR species occur in this area. The project will increase wetland and open water habitat and improve water quality, both of which will benefit aquatic life use in this system.

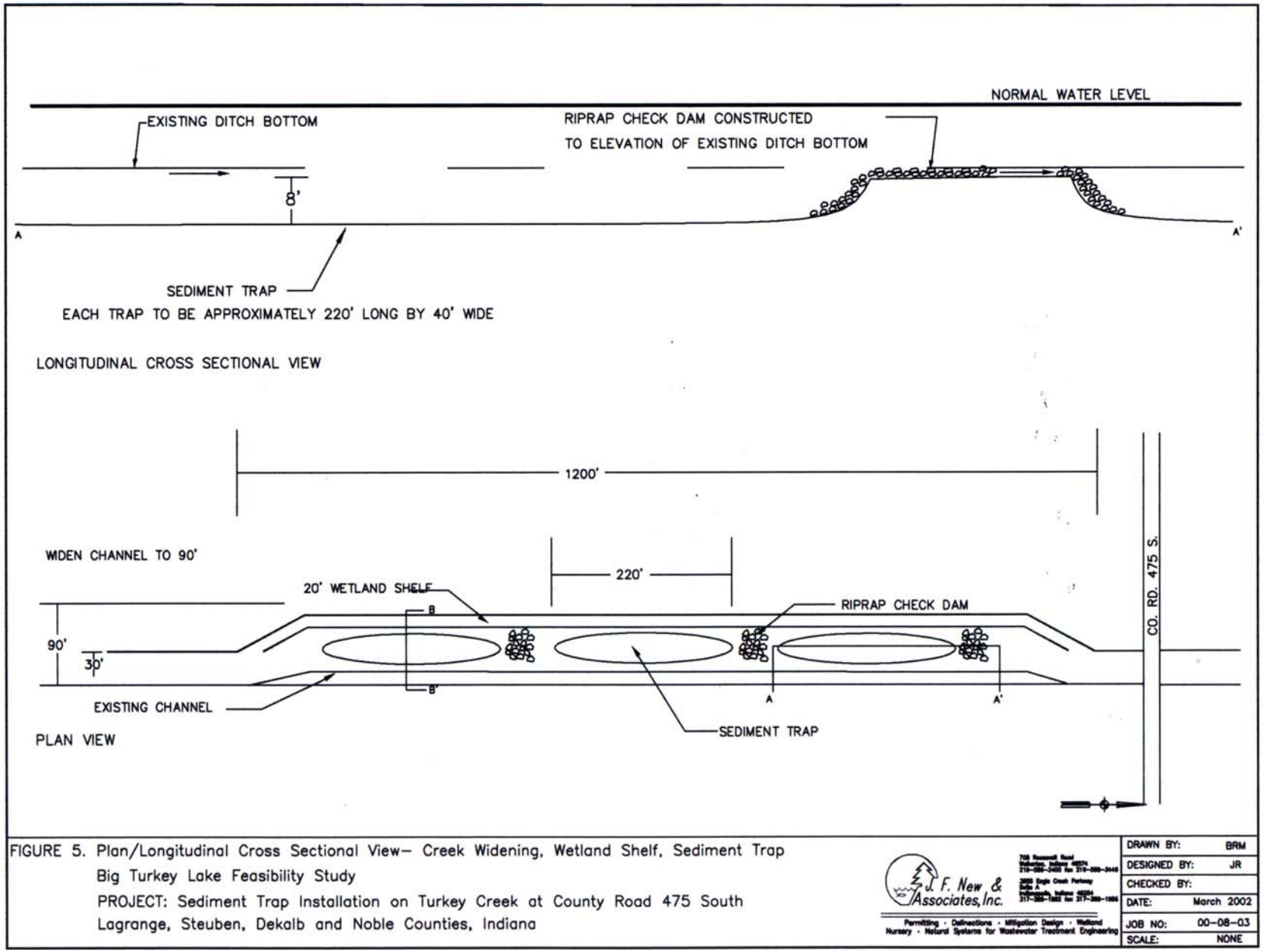

FIGURE 5. Plan/Longitudinal Cross Sectional View– Creek Widening, Wetland Shelf, Sediment Trap
Big Turkey Lake Feasibility Study
PROJECT: Sediment Trap Installation on Turkey Creek at County Road 475 South
Lagrange, Steuben, Dekalb and Noble Counties, Indiana

Emergent Wetland Vegetation to be Installed

Botanical Name	Common Name
Scirpus fluviatilis	River Bulrush
Scirpus validus	Softstem Bulrush
Scirpus acutus	Hardstem Bulrush
Carex comosa	Bristly Sedge
Sagittaria latifolia	Arrowhead
Pontedaria cordata	Pickerel Weed
Peltandra virginica	Arrow Arum
Nuphar advena	Spatterdock
Nymphaea tuberosa	White Water Lily

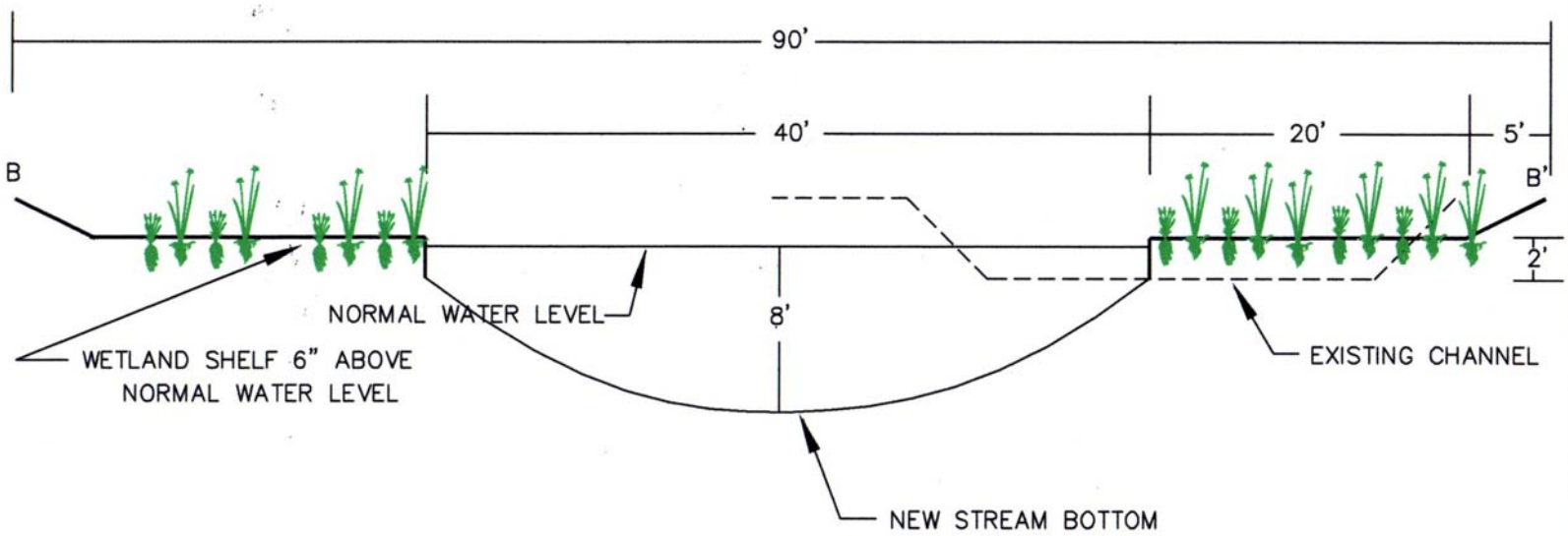

FIGURE 6. Channel Cross Section
Big Turkey Lake Watershed Feasibility Study
PROJECT: Sediment Trap Installation on Turkey Creek at County Road 475 South
Lagrange, Steuben, Dekalb, and Noble Counties, Indiana

J. F. New & Associates, Inc.
Permitting · Delineations · Mitigation Design · Wetland Nursery · Natural Systems for Wastewater Treatment Engineering

DRAWN BY:	BRM
DESIGNED BY:	JR
CHECKED BY:	
DATE: February 27, 2002	
JOB NO:	00-08-03
SCALE:	NONE

3.4.7 Project Cost

The estimated cost of constructing a sediment trap is $148,450 (Table 7).

TABLE 7. Probable Cost Estimate for sediment trap installation on Turkey Creek at CR 475 South.

Item	Cost	Unit	Quantity	Total
Earth work*	$4	Cubic yard	21,350	$85,350
Check dam rock	$25	Per ton	300	$7,500
Erosion control	$2,500	Lump sum	1	$2,500
Planting	$6,000	Per acre	0.5	$3,000
Mobilization	$1,500	Lump sum	1	$1,500
Construction Sub-total				**$99,850**
Engineering and permitting	15%	Construction cost	$97,150	$14,575
Construction services	10%	Construction cost	$97,150	$9,725
Contingency	25%	Construction cost	$97,150	$24,300
Sub-total				**$48,600**
Total				**$148,450**

*Estimated by multiplying the length of the project (1200 ft) by the width added (60 ft) by the maximum depth (8 ft). This estimate is conservative (high or worst case scenario) since 8 feet of dirt will not be removed along the entire project length.

3.4.8 Project Justification

Sediment traps are designed to slow the flow of water allowing heavy sediments from the water column to settle in the trap. The sediment trap is designed to remove a majority of the heavier sediments before entering Big Turkey Lake. According to Harza (1990), a sediment trap at the proposed project location could trap 4,100 tons of sediment annually.

3.5 LAKE DEPTH ALTERATIONS

3.5.1 Site Description and Alternatives

The legal lake level of Big Turkey Lake is 926.61 feet above mean sea level (Christie Kiefer and Ryan Kennedy, IDNR Division of Water, personal communication). A concrete spillway maintains the legal lake level and is located approximately ¼ mile west of Big Turkey Lake, adjacent to County Road 1175 East (Figure 1). Silt originating from the Big Turkey Lake Watershed is filling in areas of the lake that were previously used for boating and fishing activities. Boaters continually agitate the shallow sediments, increasing the amount of suspended sediment in the water column and releasing nutrients. Figure 7 depicts the location of shallow areas where sediments and muck deposits affect boater access on Big Turkey Lake.

The alternatives considered to increase the recreational value of the lake include:

1) Localized dredging
2) Raising the lake level by manipulating the existing spillway
3) No action

Alternative 1 is feasible. Under this alternative, two to three feet of sediment would be removed from localized areas to increase usable areas for boating and fishing activities. Alternative 2 is

also feasible and would result in raising the water level of Big Turkey Lake approximately six inches to allow for increased boating activity in shallow areas. Lake level changes will affect individuals with property bordering Big Turkey and Henry Lakes as well as landowners that utilize Mud and Turkey Creeks for drainage. If no actions were taken (Alternative 3), shallow areas would remain shallow and continue to limit boating activity. After consideration, the feasibility of Alternatives 1 and 2 were pursued in an attempt to reach a final management decision.

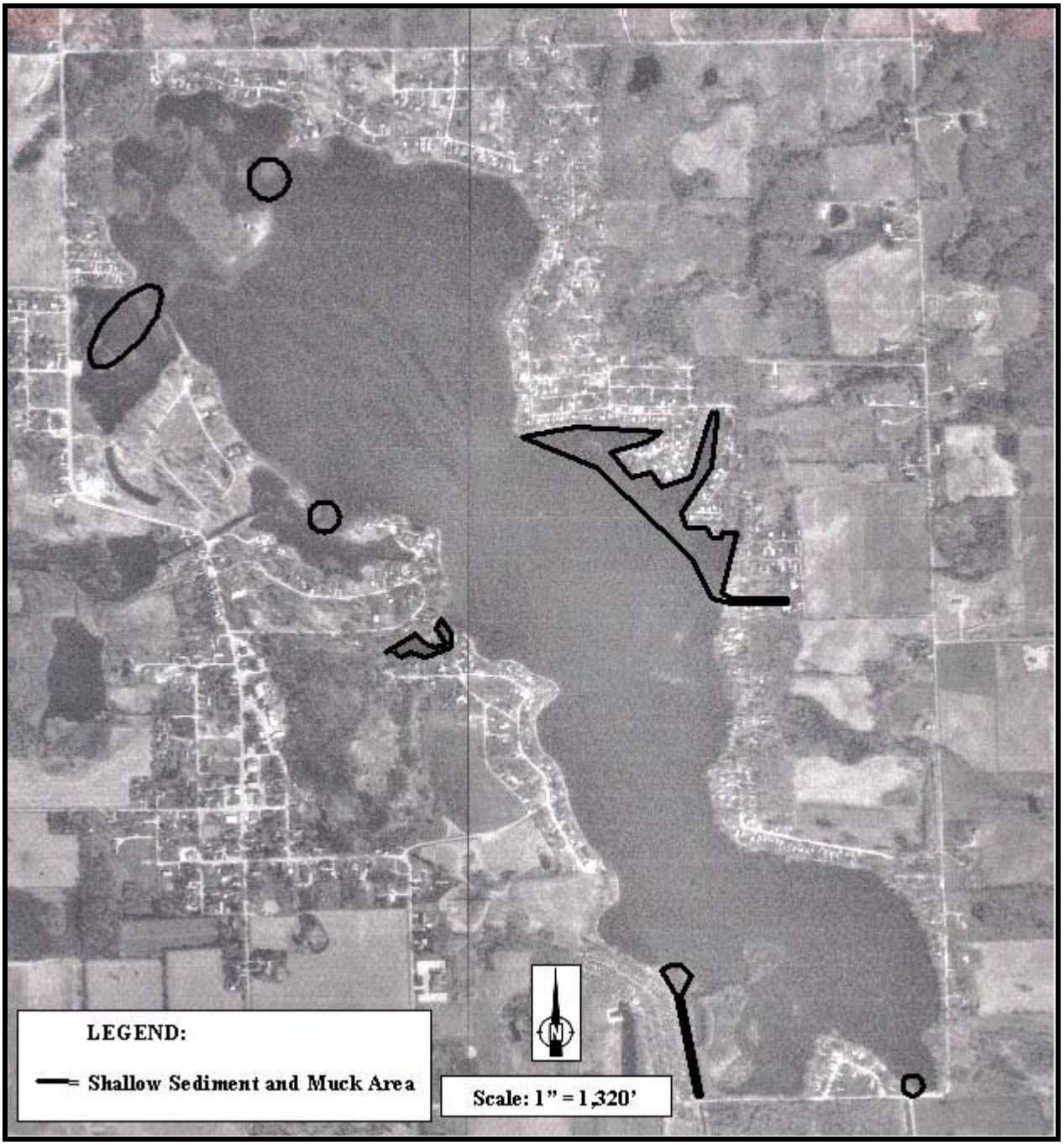

FIGURE 7. Shallow sediment and muck areas in Big Turkey Lake.

3.5.2 Preliminary Design

Sediment and Muck Removal (Dredging)

Sediment and muck would be removed using a hydraulic dredge.

Lake Level Alterations

Raising the lake's water level is relatively easy. By placing boards in existing I-beams located on the spillway structure, the lake level can be easily manipulated (Figure 8). The state could use the water control structure to manipulate the maximum lake level and draw down the lake level if necessary.

FIGURE 8. Existing concrete spillway at County Road 1175 East.

3.5.3 Permit Requirements

Sediment and Muck Removal (Dredging)

Dredging would require a permit from IDNR for work within a public freshwater lake and from the Corps under CWA Sections 401 and 404.

Lake Level Alterations

The rules which regulate lake levels in Indiana are found in the Indiana Administrative Code (IAC) 14-26-8. Two methods exist by which the lake level can be legally changed. The first method entails petitioning the IDNR. The petition must provide environmental justification for the lake level change, contain an explanation of how the petitioners or some other entity will mitigate drainage problems caused by the increased lake level, and demonstrate that at least 50% of property owners approve the project. The second method requires that 20% of lakeside residents approve a petition that will be filed directly with the County Circuit Court for court approval. The court appoints "viewers", including one of the County Commissioners, a representative of the County Clerk's office, a representative of the IDNR, the County Surveyor,

and "objective" citizens from outside the watershed. The "viewers" must make an inspection of the project site, consider the feasibility of the project, and report their findings to the Court. The Court then determines whether the lake level change will be enacted. Appendix F contains the regulations regarding lake level changes.

3.5.4 Landowner Agreements

Sediment and Muck Removal (Dredging)

No landowner permission is required for dredging work within the lake. However, landowner permission is needed at the sediment disposal site. An acceptable disposal site has not yet been located although several possibilities exist. The feasibility of disposal at these sites is currently being explored.

Lake Level Alterations

Lake level changes will affect individuals with property bordering Big Turkey and Henry Lakes as well as all property owners that utilize Mud and Turkey Creeks for drainage. Construction work on the existing spillway will affect two landowners. The work is entirely within the 75-foot drainage easement; therefore, permission from the two landowners is not required. Construction access could occur off Dutch's Landing on the south side of the spillway. Both landowners will be contacted prior to future work on the spillway.

3.5.5 Unusual Physical and Social Costs

Sediment and Muck Removal (Dredging)

Limited unusual physical and social costs are associated with sediment and muck removal (dredging) and disposal. A temporary increase in noise and decline in water clarity may occur during dredging. Equipment access could occur from a public access site located on the east side of the lake. Steps should be taken to properly inform lakeside residents and users of Big Turkey Lake regarding the dredging process and its time frame. A disposal area containing one meter or more of muck must be tested to determine its ability to support heavy equipment. The disposal area should be fenced off or posted for safety where required.

Lake Level Alterations

Several unusual physical and social costs are associated with raising the lake level. Increasing the lake level will increase the surface area of the lake. Some shoreline areas could be flooded or eroded by higher water levels leading to property owner losses. Property owners will have to modify in-lake structures such as docks and boat lifts to accommodate the new lake level. Temporary loss of land use for material storage and spillway construction will affect the landowners to the north and south of the spillway. Agricultural production may be lost if drainage tiles upstream from the lake are flooded.

3.5.6 Environmental Assessment

Sediment and Muck Removal (Dredging)

Peterson (1979) found that a number of environmental impacts are associated with sediment removal (dredging). Dredging results in sediment resuspension. Sediment suspension can release nutrients or toxins into the water column that may lead to algal blooms or bioaccumulation of toxins by aquatic organisms. However, sediment resuspension is generally short lived. A diked, upland area must be chosen for sediment disposal and dewatering. Before choosing the sediment

disposal site, ground water contamination, disposal area capacity, and safety issues should be considered.

Lake Level Alterations

Much of the research on the impacts of lake alterations on a lake's flora and fauna has been conducted in reservoir or modified natural systems where water levels can be easily manipulated (Kallemeyn, 1987; Cohen and Radomski, 1993; Bryan et al., 1995). Most studies occurred in large reservoir systems and involved water level increases upwards of two feet. General observations gathered by the above researchers may be applicable to this situation. However, the proposed water level increase at Big Turkey Lake is only six inches. The following discusses potential impacts to the lake and near shore environment due to the proposed water level increase of six inches.

How the proposed increase in water level will affect Big Turkey Lake macrophytes depends upon the morphometry of the lake and its immediate shoreline. The increase in water level will affect lake areas with a shallow gradient (gently sloped) shoreline differently than steeply sloped areas. In gently sloped areas, like around the public boat launch on the northwest shore of the lake, water will flood shallow areas. In the short-term, flooded upland vegetation die due to its inability to respire. Existing emergent shoreline and shallow submergent vegetation could also die due to the higher water level. The die-off of both emergent shoreline and shallow submergent vegetation coupled with an increase in water depth may create open, non-vegetated areas that could be colonized by invasive species such as Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*). In the long term, gently sloped areas along the shoreline could simply experience a shift in the location of emergent, submergent, and open water zones. In steeply sloped areas, like the eastern shore of Big Turkey Lake, higher water levels are not likely to impact the shoreline vegetation, and little, if any, change in the shoreline environment will occur. A topographical survey of the shoreline would be beneficial in determining the exact nature of the shoreline alteration due to rising water levels.

Rising water levels could modify the lake's fauna as well. Macroinvertebrate colonization of any new shoreline habitat created as a result of raising the lake level will depend upon any changes in the water chemistry regime, thermal conditions, and available refuges created by the altered macrophyte population (Cohen and Radomski, 1993). If the macroinvertebrate population density changes, then the distribution and abundance of prey fish could also change (Bryan, 1995). This, in turn, could alter the lake's top predator structure. How the food web will change is unknown at this point given the uncertainty of how the change in water level will affect macrophytes and macroinvertebrates.

3.5.7 Project Costs

Sediment and Muck Removal (Dredging)

The cost estimate of dredging localized areas in Big Turkey Lake is approximately $260,900 (Table 8a). Note: Cooke et al (1993) found that when dredged material can be used as potting soil or topsoil dressing, utilizing this disposal mechanism will reduce the overall project cost.

TABLE 8a. Probable Cost Estimate for sediment and muck removal (dredging).

Item	Cost	Unit	Quantity	Total
Hydraulic dredging	≈ $5	Per m^3	≈ 31,467	$157,335
Mobilization/demobilization	$4,000	Lump sum	1	$4,000
Land acquisition (sediment disposal)	$2,500	Per acre	≈ 10	$25,000
Construction sub-total				**$186,335**
Engineering design/permitting	15%	Construction costs	$186,335	$27,950
Contingency	25%	Construction costs	$186,335	$46,600
Total				**$260,900**

Lake Level Alterations
The cost estimate of pursuing an increase in Big Turkey Lake's water level is $147,000 (Table 8b)

TABLE 8b. Probable Cost Estimate for the pursuit of raising Big Turkey Lake's water level.

Item	Cost	Unit	Quantity	Total
Dam construction	$15,000	Lump sum	1	$15,000
Attorney fees	$40,000	Lump sum	1	$40,000
Surveyor fees	$72,000	Lump sum	1	$72,000
Consulting biologist	$20,000	Lump sum	1	$20,000
Total				**$147,000**

3.5.8 Project Justification
After reviewing both alternatives designed to change the water depth in Big Turkey Lake, sediment and muck removal (dredging) was determined to be the most feasible option. Lake level alterations are not recommended at this time because a change in the water level of six inches or more may have a negative effect on biological communities, lakeside property owners, and landowners along Mud and Turkey Creeks. Additionally, the cost estimate above only covers the pursuit of the lake level increase and does not guarantee the permits or results will be obtained. Dredging, on the other hand, will only impact localized areas rather than the entire lake and feeder streams. Dredging is also reasonably efficient at moving large volumes of sediment and muck with little long-term environmental impact. Pierce (1970) and Cooke et al. (1993) indicate that almost all projects designed to deepen a lake are successful at the time of their completion. Furthermore, dredging can be a successful lake restoration technique if: 1) the lake is first evaluated, 2) the proper equipment is chosen, 3) proper disposal sites are chosen, and 4) dredging is conducted by experienced operators.

3.6 STABILIZATION OF ISLAND SHORELINES

3.6.1 Site Description and Alternatives
Wave action from boats and natural winds is eroding approximately 2,400 lineal feet of island shoreline on five islands (Figures 1 and 9). The majority of the eroding shoreline exists on the southern and western shores of the islands. Identified erosional areas generally have six inches of visible vertical erosion when water levels are low.

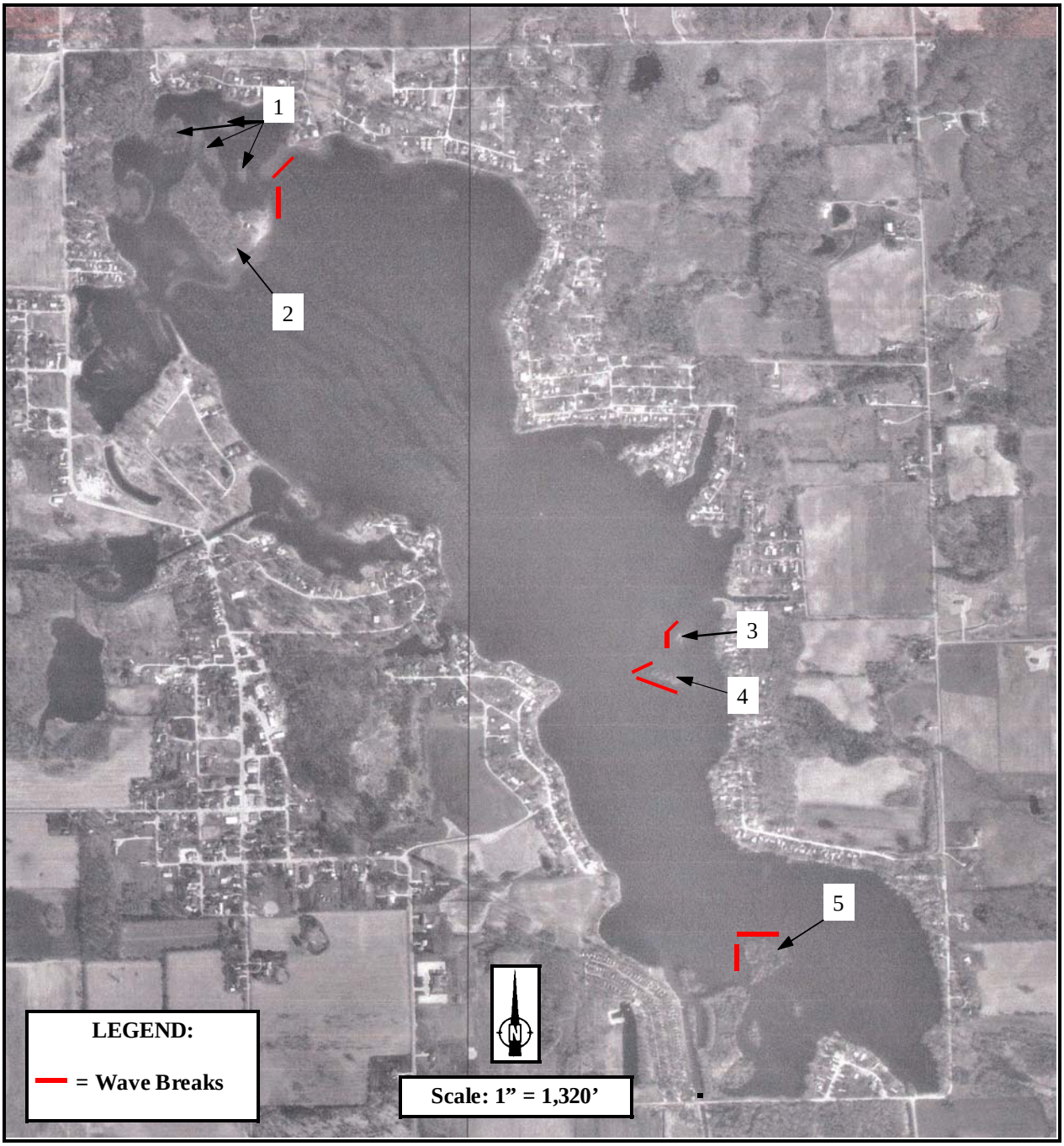

FIGURE 9. Eroded islands and proposed log break structures.

The alternatives considered to stabilize island shorelines include:

1) Rock (riprap or glacial stone)
2) Pre-planted coconut fiber logs
3) Wave breaks
4) No action

If Alternative 1 was employed, rock would be transported to the islands and installed by hand or using a barge mounted excavator. The cost of rock armoring may exceed $100.00 per foot. Alternative 2 utilizes pre-planted coconut fiber logs to stabilize island shorelines. Severe wave action may reduce the viability of this option. Alternative 3 utilizes wave breaks, which protect the shorelines by reducing wave height and strength. One wave break construction and installation technique promoted by the Corps in Midwestern reservoirs involves lashing together fallen timber and anchoring it 10 to 30 feet off shore. This option greatly reduces the wave energy reaching the island shorelines and adds additional fish habitat to the lake. If no action were taken, the island shorelines will continue to erode. After consideration, Alternative 3 was pursued.

3.6.2 Preliminary Design

The preliminary wave-break design involves lashing together existing downed or fresh-cut trees with steel cables then anchoring the trees with concrete blocks (Figure 10). The tree or log wave breaks float on the surface or sit on the bottom depending upon water height. As waves hit these revetments, their energy is dissipated, thereby reducing erosional action on the islands. Furthermore, these wave breaks provide fish habitat, an advantage over direct shoreline applications. Implementation will occur in the winter months. Personnel will tow trees and blocks into place using snowmobiles or all terrain vehicles while the lake is frozen. Once the lake begins to melt, the structures fall into place.

3.6.3 Permit Requirements

A permit from the IDNR is required to install wave breaks in the lake. The work may not require notification of the Corps or IDEM. Appendix C contains copies of the permit application forms.

3.6.4 Land Owner Agreements

Landowners of individual islands will be contacted prior to project implementation near their islands. The IDNR owns Islands 1, 3, 4, and 5 (Figure 9) according to the Steuben County Auditors Office, (personal communication). Members of one family own Island 2 (Figure 9).

3.6.5 Unusual Physical and Social Costs

Wave break structures are potential boat hazards. Although the wave breaks will be located in shallow areas (water depths of less than three feet), they should be marked with buoys.

3.6.6 Environmental Assessment

JFNew did not complete any environmental assessments in the lake as part of this study. However, past IDNR fisheries surveys found no ETR fish species in the lake. When completed, the tree revetments will provide additional habitat for several fish species.

3.6.7 Project Costs

The cost estimate for installation of wave break structures in Big Turkey Lake is $9,460 (Table 9)

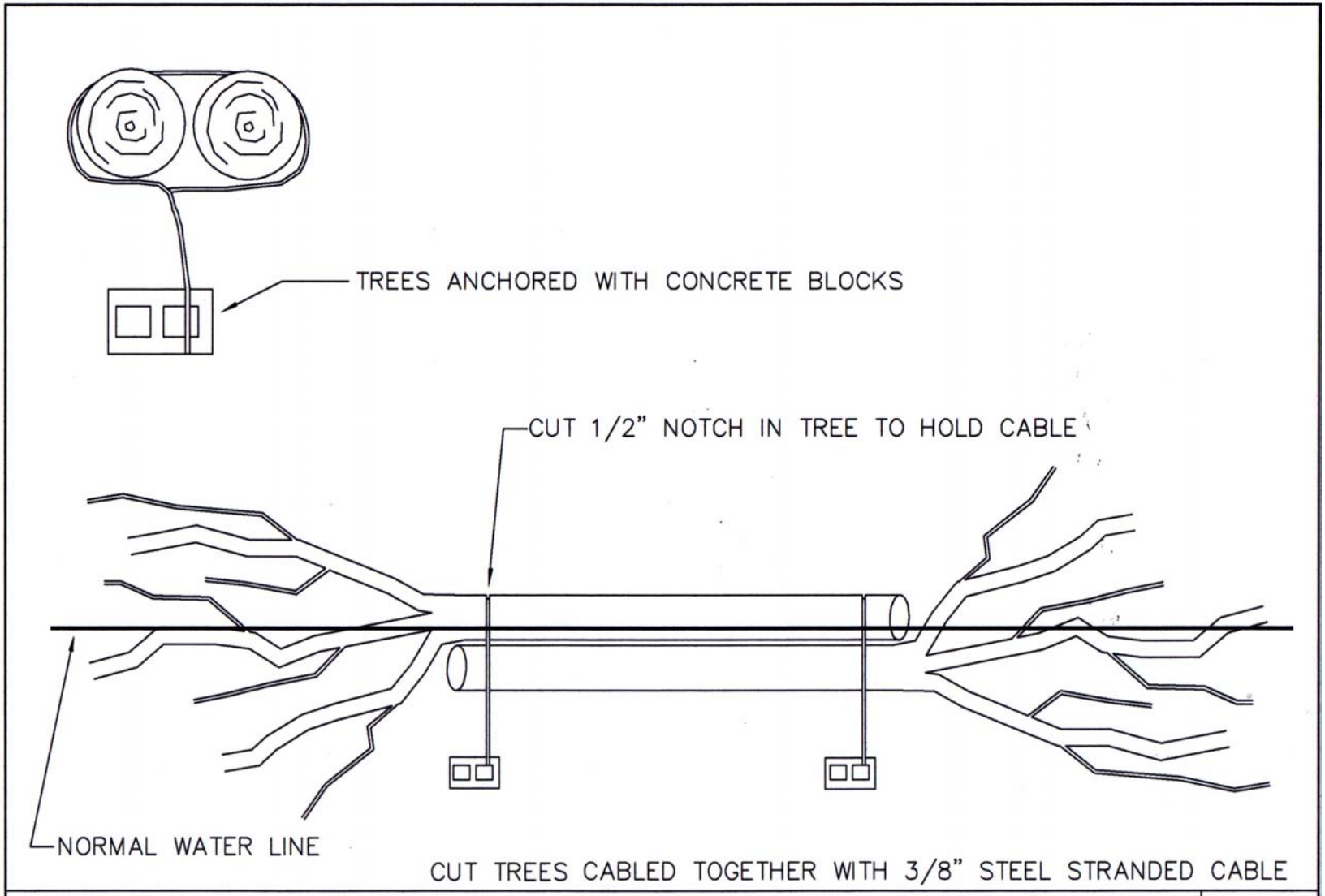

FIGURE 10: Log Break Structures
Big Turkey Lake Watershed Feasibility Study
PROJECT: Lake Level Alterations
LaGrange, Steuben, Dekalb, and Noble Counties, Indiana

J. F. New & Associates, Inc.
Permitting · Delineations · Mitigation Design · Wetland Nursery · Natural Systems for Wastewater Treatment Engineering

DRAWN BY:	BRM
DESIGNED BY:	JR
CHECKED BY:	
DATE:	February 27, 2002
JOB NO:	00-08-03
SCALE:	NONE

TABLE 9. Probable Cost Estimate for installation of wave break structures.

Item	Cost	Unit	Quantity	Total
Labor	$35	Per hour	6 people (16 hours)	$3,360
Equipment	$500	Lump sum	1	$500
Material	$800	Per 600-feet of island	7	$5,600
Total				**$9,460**

3.6.8 Project Justification

The project can be justified for several reasons. First, the wave break structures will protect island shorelines. Second, the cost is minimal. Lastly, the structures will create habitat for gamefish and forage species.

4.0 SUMMARY OF PROBABLE COST ESTIMATES, PROJECT SCHEDULES, AND FUNDING SOURCES

This study examined six potentially feasible projects to improve the water quality, habitat, and recreational value of Big Turkey Lake. Of these six projects four were considered feasible. These projects include: 1) bank stabilization along Dewitt Weicht Sparks Drain between Henry Lake and Big Turkey Lake, 2) sediment trap installation on Turkey Creek at County Road 475 South, 3) lake depth alterations (dredging), and 4) stabilization of island shorelines. Table 10 lists cost estimates for each of the four feasible restoration projects mentioned above and outlined in previous sections of this report. Table 11 displays a schedule for designing and implementing each feasible project. Table 12 contains appropriate funding sources for each project. Table 13 lists all potential funding sources and contact information. Note: Wetland restoration near the headwaters of Mud Creek along County Road 700 West and wetland restoration at the corner of State Road 4 and State Road 327 were not feasible due to landowner objections to the proposed projects.

TABLE 10. Summary of project budgets.

Project	Report Section	Construction	Services	Engineering/ Permitting	Contingency	Total
Bank stabilization along Dewitt Weicht Sparks Drain between Henry Lake and Big Turkey Lake	3.1	$89,600	$8,960	$13,440	N/A	**$112,000**
Sediment trap installation on Turkey Creek at County Road 475 South	3.4	$97,150	$9,725	$14,575	$24,300	**$148,450**
Lake depth alterations (dredging)	3.5	$186,335	N/A	$27,950	$46,600	**$260,885**
Stabilization of island shorelines	3.6	$9,460	N/A	N/A	N/A	**$9,460**
Total		**$382,545**	**$18,685**	**$55,965**	**$70,900**	**$528,095**

TABLE 11. Proposed project schedule.

Project	2002				2003				2004				2005
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	
Bank stabilization along Dewitt Weicht Sparks Drain between Henry Lake and Big Turkey Lake	G		D	P/C									
Sediment trap installation on Turkey Creek at County Road 475 South					G			D	P/C				
Lake depth alterations (dredging)									P			D	C
Stabilization of island shorelines					C								

G = Grant Application, D = Design, P = Permitting, C = Construction

TABLE 12. Appropriate funding sources for each project.

Project Description	LARE	Drainage Board Match	Private Organizations or Individuals	Total
Bank stabilization along Dewitt Weicht Sparks Drain along Mud Creek between Henry Lake and Big Turkey Lake	75% @ $84,000	20% @ $22,400	5% @ $5,600	**$112,000**
Sediment trap installation on Turkey Creek at County Road 475 South	75% @ $109,312	20% @ $29,150	5% @ $7,290	**$145,750**
Lake depth alterations (dredging)			100% @ $260,885	**$260,885**
Stabilization of island shorelines			100% @ $9,460	**$9,460**
Total	**$241,207**	**$64,322**	**$286,425**	**$591,954**

TABLE 13. Potential sources of funding.

Grant Name	Name	Address	City	State	Zip	Phone	Internet Address
Lilly Endowment, Inc.	N/A	P.O. Box 88068	Indianapolis	IN	46208	317-924-5471	
Golden Eagle Grant	N/A	One Monument Circle	Indianapolis	IN	46206-1595	317-261-8261	http://www.ipalco.com
Nina Mason Pulliam Charitable Trust	Harriet Ivey	135 N. Pennsylvania Suite 1200	Indianapolis	IN	46204	317-231-6075	http://www.nmpct.org
Central Indiana Community Foundation	N/A	615 N. Alabama St. Suite 119	Indianapolis	IN	46204	317-634-CICF	http://www.cicf.org/
Wabash River Heritage Corridor	N/A	402 West Washington Rm. W271	Indianapolis	IN	46204-2739	317-232-4070	http://www.state.in.us/wrhcc/
NiSource Environmental Challenge	N/A	801 E. 86th St.	Merrillville	IN	46410	219-647-5246	http://www.nisouce.com/enviro/ecf.asp
Lake and River Enhancement	Jim Ray	402 W. Washington St.	Indianapolis	IN	46204	317-233-3870	http://www.state.in.us/dnr/soilcons/lare
US Fish and Wildlife Service	Dan Sparks	620 S. Walker	Bloomington	IN	47403	812-334-4261	
IDEM 319 Grant	Jill Reinhart	100 N. Senate Ave.	Indianapolis	IN	4206-6015	888-233-7745	http://www.state.in.us/idem/owm

5.0 RECOMMENDATIONS

1) Apply for a LARE grant in 2002 for final design and construction of bank stabilization between Henry Lake and Big Turkey Lake.

2) Apply for a LARE grant to fund construction of the sediment trap on Turkey Creek at County Road 475 South in 2003. Construct the sediment trap in 2003-2004.

3) Apply for permits to install wave breaks along the eroding islands in Big Turkey Lake by Fall 2002. Install the wave breaks during winter of 2002/2003.

3) Continue to support and encourage the work of the LaGrange and Steuben County SWCD.

4) Establish a dialog with owners of the two potential wetland restoration sites. A long-term, trusting relationship with these landowners may result in eventual restoration on these sites.

5) Begin the process of developing a watershed management plan for the entire watershed. Matt Jarvis is the appointed watershed coordinator for this area, who will help with this task. Mr. Jarvis can be contacted at 765-564-4480.

6) Pursue aquatic plant management and sediment consolidation in the lake by working with Jed Pearson, fisheries biologist with the IDNR-Division of Fish and Wildlife. Advocate for periodic winter drawdowns on the lake to accomplish these tasks. Mr. Pearson can be contacted at 260-691-3181.

7) Dredge those portions of the lake where sand and silt have accumulated from erosion in the watershed. Permit applications should be submitted in 2004 after construction of the above projects. Dredging could then proceed in fall of 2004 or summer of 2005.

6.0 LITERATURE CITED

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APPENDIX A

PUBLIC MEETINGS

BIG TURKEY LAKE WATERSHED
FEASIBILITY STUDY

LAGRANGE, STEUBEN, DEKALB,
AND NOBLE COUNTIES, INDIANA

PUBLIC MEETINGS

On May 5, 2001, the Big Turkey Lake Improvement Association held its first public meeting to discuss public interest in the Big Turkey Lake Feasibility Study. Forty-four individuals attended the meeting. J. F. New & Associates (JFNew) introduced the Feasibility Study, discussed the lake's four- county watershed, and suggested general options for watershed improvement projects. JFNew displayed aerial photographs showing locations of identified problem areas within the Big Turkey Lake watershed. General watershed solutions discussed include:

1. Reductions in fertilizer usage in individual yards.
2. Possible methods for reducing phosphorus loading to the lake.
3. Reduction of phosphorus and sediment loading from subwatersheds which contribute large pollutant loads to the lake including: Smathers Ditch near Hudson, Upper Mud Creek, and the Turkey Creek area near Helmer.
4. Infeasible lake improvement projects.

On August 4, 2001, the Big Turkey Lake Improvement Association held its second public meeting attended by JFNew and forty-six other individuals. JFNew stressed the need to determine locations of phosphorus and sediment loading to the lake. Attendees discussed locations of several potential projects including:

1. Wetland filter and/or sediment trap installation on Turkey Creek (across from Schuler's campground).
2. Wetland restoration at the corner of State Road 4 and State Road 327.
3. Wetland restoration at the upper end of Mud Creek along County Road 700 West.
4. Bank stabilization along Mud Creek from Henry Lake to Big Turkey Lake.
5. Lake level alterations.

On November 15, 2001, the Big Turkey Lake Improvement Association held its third public meeting. JFNew and thirty-two other individuals attended the meeting. JFNew discussed several issues including:

1. Stabilization of Mud Creek culvert/possible sediment trap.
2. DNR dredging permits.
3. Island stabilization-contact Kelly Bushong.
4. Final report: drainage board issues, letters of support, permit status.

APPENDIX B

AERIAL SITE PHOTOS (HARZA, 1990)

BIG TURKEY LAKE WATERSHED
FEASIBILITY STUDY

LAGRANGE, STEUBEN, DEKALB,
AND NOBLE COUNTIES, INDIANA

Refer to Figure 3.

N
W E
S

1"=400'

JFNA #00-08-03

Proposed Wetland Location 1 (Harza, 1990)
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb and Noble Counties, Indiana

J.F. New & Associates
wetland consultants / environmental engineers

Refer to Figure 3.

N
W E
S

1"=400'

JFNA #00-08-03

Proposed Wetland Location 2 (Harza, 1990)
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb, and Noble Counties, Indiana

J.F. New & Associates
wetland consultants / environmental engineers

Refer to Figure 3.

N
W E
S

1"=400'

JFNA #00-08-03

Proposed Wetland Location 3a (Harza, 1990)
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb and Noble Counties, Indiana

J.F. New & Associates
wetland consultants / environmental engineers

Refer to Figure 3.

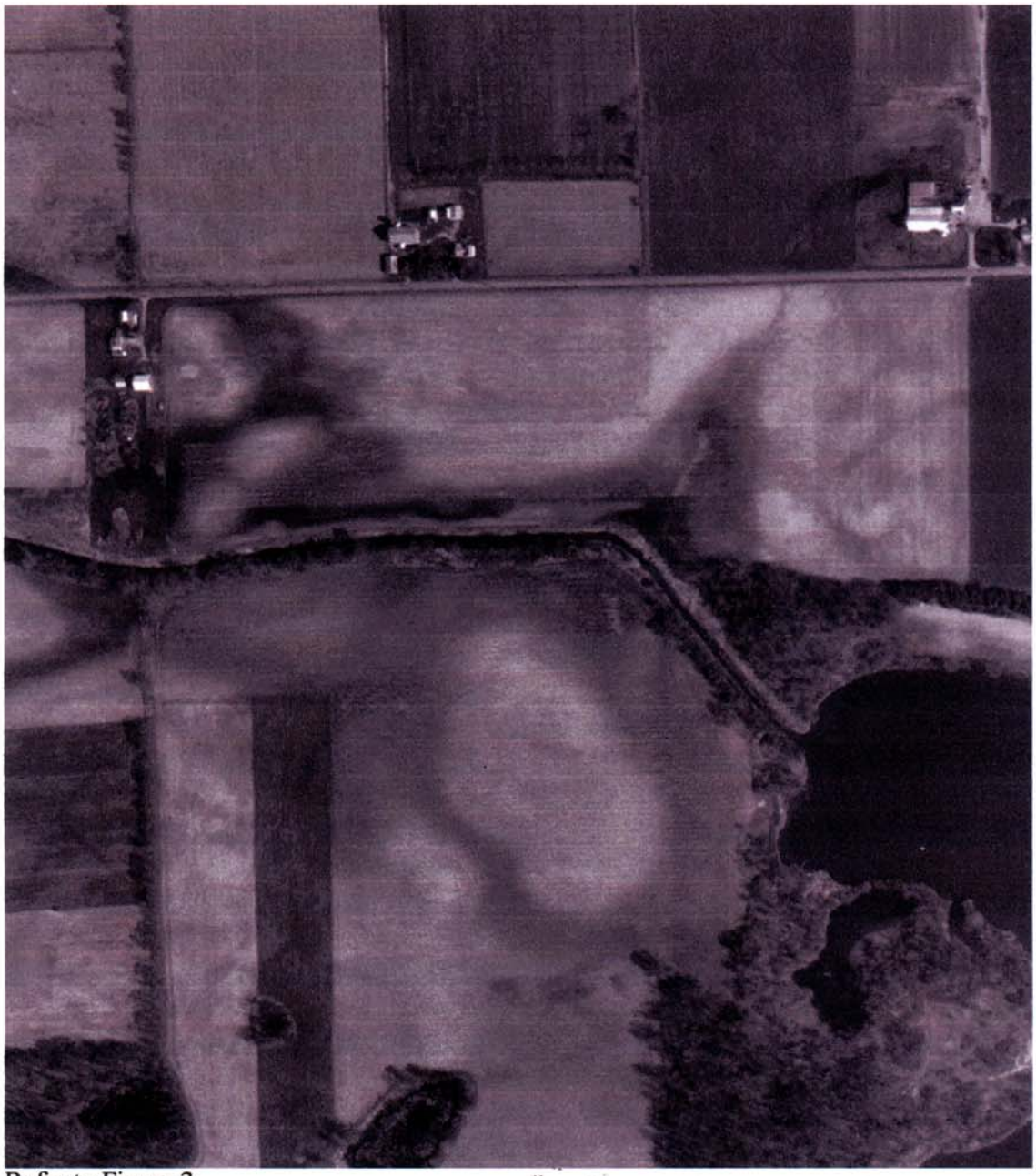
N
W E
S

1"=400'

JFNA #00-08-03

Proposed Wetland Location 3b (Harza, 1990)
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb and Noble Counties, Indiana

J.F. New & Associates
wetland consultants / environmental engineers



Refer to Figure 3.

N
W E
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1"=400'

JFNA #00-08-03

Proposed Wetland Location 4 (Harza, 1990)
Big Turkey Lake Feasibility Study
Lagrange, Steuben, Dekalb, and Noble Counties

J.F. New & Associates
wetland consultants / environmental engineers

Refer to Figure 3.

N
W E
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1"=400'

JFNA #00-08-03

Proposed Wetland Location 5 (Harza, 1990)
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb and Noble Counties, Indiana

J.F. New & Associates
wetland consultants / environmental engineers

Refer to Figure 3.

N
W E
S

1"=400'

JFNA #00-08-03

Proposed Wetland Location 6 (Harza, 1990)
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb and Noble Counties, Indiana

J.F. New & Associates
wetland consultants / environmental engineers

Refer to Figure 3.

N
W E
S

1"=400'

JFNA #00-08-03

Proposed Wetland Location 7 (Harza, 1990)
Big Turkey Lake Feasibility Study
Lagrange, Steuben, Dekalb, and Noble Counties

J.F. New & Associates
wetland consultants / environmental engineers

Refer to Figure 3.

N
W E
S

1"=400'

JFNA #00-08-03

Proposed Wetland Location 8 (Harza, 1990)
Big Turkey Lake Watershed Feasibility Study
Lagrange, Steuben, Dekalb, and Noble Counties, Indiana

J.F. New & Associates
wetland consultants / environmental engineers

APPENDIX C

PERMIT APPLICATION FORMS

BIG TURKEY LAKE WATERSHED
FEASIBILITY STUDY

LAGRANGE, STEUBEN, DEKALB,
AND NOBLE COUNTIES, INDIANA

Office of Water Management
Section 401 Water Quality
Certification Program

Application Form and Instructions for Section 401 Water Quality Certification

Note to applicants:

Applicants should also contact the Indiana Department of Natural Resources (DNR) regarding potential permit requirements associated with construction in a floodway or a public freshwater lake. According to 1998 figures, approximately 9% of the projects that required a Section 401 Water Quality Certification also required a permit from the DNR. You can reach the DNR Division of Water at 317-232-4160 or toll free at 1-877-WATER55.

Revised February 14, 2000

Application for Water Quality Certification

Address all applications or questions to:

Indiana Department of Environmental Management
Section 401 Water Quality Certification Program
100 North Senate Avenue P.O. Box 6015 Indianapolis, Indiana 46206-6015
1-800-451-6027 or 317-233-8488

PLEASE PULL OUT APPLICATION FROM PACKET

Failure to provide the information requested in this application may result in a delay of processing or denial of your application.

For office use only
Project Manager:
Date Received:
IDEM I.D. Number:
County:

1. APPLICANT INFORMATION	2. AGENT INFORMATION
Name of Applicant	Name of Agent
Mailing address (Street/ PO Box/ Rural Route, City, State, Zip)	Mailing address (Street/ PO Box/ Rural Route, City, State, Zip)
Daytime Telephone Number	Daytime Telephone Number
Fax Number	Fax Number
E-mail address (optional)	E-mail address (optional)
Contact person: (required)	Contact person:

3.PROJECT LOCATION

County		Nearest city or town	
U.S.G.S. Quadrangle map name (Topographic map)		Project street address (if applicable)	
Quarter	Section	Township	Range
Type of aquatic resource(s) to be impacted (lake, river, stream, ditch, wetland, etc. include name if applicable)		Project name or title (if applicable)	
		UTM North	UTM East

Other location descriptions or driving directions

4. PROJECT PURPOSE and DESCRIPTION

Use additional sheet(s) if required

Has any construction been started? YES NO	Anticipated start date

If yes, how much work is completed?

Project purpose and description

5.	**Project Information: Applicants must answer all the following questions**.

What is the linear feet of impacts to the waterbody below the ordinary high water mark (OHWM) and/or bank clearing?

What is the acreage or square footage of wetlands or other water resources that are proposed to receive a discharge of material (ie. fill), mechanically cleared, or to be excavated?

What is the area of wetlands or other water resources on the site, in acreage or square feet?

Describe the type, composition and quantity (in cubic yards) of fill material to be placed in the wetland or below the OHWM of the water to receive the material (wetland or other water to be filled).

Describe the type, composition and quantity (in cubic yards) of material proposed to be removed from the wetland or below the OHWM of the water resource.

6.	**Drawing/Plan Requirements** (applicants must provide the following)

a. Top/aerial/overhead view of the project site

b. Cross sectional view

c. North arrow, scale, property boundaries

d. Include wetland delineation boundary (if applicable). Label the impact wetlands as I-1, I-2, etc. and mitigation areas as M-1,etc.

e. Location of all surface waters, including wetlands, proposed works, erosion control measures, existing structures, disposal area for excavated material, fill locations, including quantities, and wetland mitigation (if applicable)

f. Approximate water depths and bottom configurations (if applicable)

g. Provide plans on 8 2 by 11 inch paper, unless directed otherwise

7.	**Documentation Requirements** (applicants must provide the following)

a. A Corps of Engineers approved wetland delineation for projects with wetland impacts

b. Photographs of the project site. Indicate where they were taken on the overhead view of the project plans

8.	**Additional information that MAY be required** (IDEM will notify you if needed)

a. Erosion control and/or storm water management plans

b. Sediment analysis

c. Wetland mitigation plan including: type, size, location, methods of construction, planting and monitoring plans

d. Species surveys for fish, mussels, plants and threatened or endangered species

e. Any other information IDEM deems necessary to determine the impact to water quality

9. Permitting Requirements

a. Have you applied for an Army Corps of Engineers Section 404 permit? _____ Yes _____ No If yes, please supply the Corps of Engineers ID Number, the Corps of Engineers District, the project manager, and a copy of any correspondence with the Corps. **If no, contact** the Army Corps of Engineers regarding the possible need for a permit application. (See instructions 11.)

b. Have you applied for, received, or been denied any other federal, state, or local permits, variances, licenses, or certifications for this project? Please give the permit name, agency from which it was obtained, permit number, and date of issuance or denial.

10. Adjoining Property Owners and Addresses

List the names and addresses of landowners adjacent to the property on which your project is located and the names and addresses of other persons (or entities) potentially affected by your project. Use additional sheet(s) if required.

Name Address City State Zip	Name Address City State Zip
Name Address City State Zip	Name Address City State Zip
Name Address City State Zip	Name Address City State Zip
Name Address City State Zip	Name Address City State Zip
Name Address City State Zip	Name Address City State Zip

11. Signature - Statement of Affirmation

I hereby request a Water Quality Certification to authorize the activities described in this application. I certify

that I am familiar with the information contained in this application and to the best of my knowledge and belief, such information is true and accurate. I certify that I have the authority to undertake and will undertake the activities as described in this application. I am aware that there are penalties for submitting false information. I understand that any changes in project design subsequent to IDEM's granting of WQC are not covered by the WQC, and I may be subject to civil and criminal penalties for proceeding without proper authorization. I agree to allow representatives of the IDEM to enter and inspect the project site. I understand that the granting of other permits by local, state, or federal agencies does not release me from the requirement of obtaining the WQC requested herein before commencing the project.

Applicant's Signature: _____ Date: _____

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES

JOINT PERMIT APPLICATION FOR CONSTRUCTION WITHIN A FLOODWAY OF A STREAM OR RIVER; NAVIGABLE WATERWAY; PUBLIC FRESH WATER LAKE; AND DITCH RECONSTRUCTION

*** INSTRUCTIONS ***

This joint application can be used to apply for: (1) alteration of the bed or shoreline of a public freshwater lake; (2) construction or reconstruction of any ditch or drain having a bottom depth lower than the normal water level of a freshwater lake of 10 acres or more and within 1/2 mile of the lake; (3) construction within the floodway of any river or stream; (4) placing, filling, or erecting a permanent structure in; water withdrawal from; or material extraction from; a navigable waterway; (5) extraction of mineral resources from or under the bed of a navigable waterway; and (6) construction of an access channel. **You must submit readable copy of the completed application form together with items stated in the "Application Checklist" (attached).**

Use the following checklist to determine which permit(s) to apply for. If you have trouble deciding which permit(s) you need, please contact the Permit Administration Section at (317) 233-5635.

Your project may require one or more of the following permits. **IF YOU CHECK ANY BOX UNDER A PERMIT TITLE, THEN YOU MUST APPLY FOR THAT PERMIT.**

❒ IC 14-26-2: **Lake Preservation Act** states that no person may change the level of the water or shoreline of a public freshwater lake by excavating, filling in, or otherwise causing a change in the area or depth or affecting the natural resources scenic beauty or contour of the lake below the waterline or shoreline, without first securing the written approval of the Department of Natural Resources. A written permit from the Department is also required for construction of marinas; new seawall; seawall refacing; underwater beaches; boatwells; boat well fills; fish attractors; and any permanent structures within the waterline or shoreline of a public freshwater lake. The Act further states that **each permit application must be accompanied by a non-refundable $25 fee.**

❒ IC 14-26-5: **Lowering of the Ten Acre Lake Act also know as the "Ditch" Act** states that no person may order or recommend the location, establishment, construction, reconstruction, repair, or recleaning any ditch or drain having a bottom depth lower than the normal water level of a freshwater lake of 10 acres or more and within 1/2 mile of the lake without first securing the written approval of the Department of Natural Resources. The Act further states that **each permit application must be accompanied by a non-refundable $25 fee.**

❒ IC 14-28-1: **Flood Control Act** requires that any person proposing to construct a structure, place fill, or excavate material within the floodway of any river or stream must obtain the written approval of the Department of Natural Resources prior to initiating the activity. The Act further states that **each permit application must be accompanied by a non-refundable $50 fee.**

❒ IC 14-29-1: **Navigable Waterways Act** requires that prior written approval be obtained from the Department of Natural Resources for placing, filling, or erecting a permanent structure in; water withdrawal from; or mineral extraction from; a navigable waterway or Lake Michigan. **No Fee**

❒ IC 14-29-3: **Sand and Gravel Permits Act** requires that prior written approval be obtained from the Department of Natural Resources for removal of sand, gravel, stone, or other mineral or substance from or under the bed of a navigable waterway. The Act further states that **each permit application must be accompanied by a non-refundable $50 fee.**

❒ IC 14-29-4: **Construction of Channels Act** requires that prior written approval of the Department of Natural Resources be obtained for construction of an artificial; or the improved channel of a natural watercourse; connecting to any river or stream for the purpose of providing access by boat or otherwise to public or private industrial, commercial, housing, recreational, or other facilities. **Each permit application must be accompanied by a non-refundable $100 fee.**

Mail To: Division of Water
Department of Natural Resources
402 West Washington Street, Room W264
Indianapolis, Indiana 46204-2748
Telephone Number: (317) 233-5635
Fax Number: (317) 233-4579

PERMIT APPLICATION

Approved by the State Board of Accounts(Pending)

AGENCY USE ONLY		
Application # _____	Section Coordinates	UTM North_____ UTM East_____
30 Day Notice _____	Fee Submitted $_____ Check # _____	Receipt # _____

Based on the "INSTRUCTIONS", I am submitting this application to perform work under:

- ☐ *IC 14-26-2 Lake Preservation Act*
- ☐ *IC 14-26-5 Lowering of the Ten Acre Lake Act*
- ☐ *IC 14-28-1 Flood Control Act*
- ☐ *IC 14-29-1 Navigable Waterways Act*
- ☐ *IC 14-29-3 Sand and Gravel Permits Act*
- ☐ *IC 14-29-4 Construction of Channels Act*

PLEASE TYPE OR PRINT

1. APPLICANT INFORMATION

Name of Applicant _____ Name of Contact Person _____

Mailing Address _____
(Street, P.O. Box or Rural Route)

_____
City State Zip Code

Daytime Telephone Number ( ) _____ Fax Number ( ) _____

2. AGENT INFORMATION

Name of Authorized Agent _____ Name of Contact Person _____

Mailing Address _____
(Street, P.O. Box or Rural Route)

_____
City State Zip Code

Daytime Telephone Number ( ) _____ Fax Number ( ) _____

3. PROPERTY OWNER INFORMATION

Name of Property Owner _____ Name of Contact Person

Mailing Address _____
(Street, P.O. Box or Rural Route)

_____
City State Zip Code

Daytime Telephone Number ( ) _____ Fax Number ( ) _____

Relationship of applicant to property: ☐ Owner ☐ Purchaser ☐ Leesee ☐ Other_____

AFFIRMATION OF PERSONAL SERVICE, 1ST CLASS MAIL SERVICE, OR CERTIFIED MAIL SERVICE

I have provided public notice to the listed property owners in conformance with the provisions of IC 14-11-4 and 310 IAC 0.6 through the method indicated below.
(Check the appropriate Box - *Please make copies of this blank page if additional pages are required*)

_____ Property Owner (if not applicant or adjacent landowner) _____ Address _____ _____ _____ City State Zip Code	☐ Personal Service was provided on :_____ (date) ☐ 1st Class Mail Service was provided on: _____(date) I affirm that 21 days have passed without the mailing returned as undelivered or undeliverable. PS Form 3817 is attached as proof of mailing. ☐ Certified Mail service was provided on:_____(date) PS Form 3811 (green card) is attached as proof of mailing.
_____ Adjacent Landowner: _____ Address _____ _____ _____ City State Zip Code	☐ Personal Service was provided on :_____ (date) ☐ 1st Class Mail Service was provided on: _____(date) I affirm that 21 days have passed without the mailing returned as undelivered or undeliverable. PS Form 3817 is attached as proof of mailing. ☐ Certified Mail service was provided on:_____(date) PS Form 3811 (green card) is attached as proof of mailing.
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_____ Adjacent Landowner: _____ Address _____ _____ _____ City State Zip Code	☐ Personal Service was provided on : _____ (date) ☐ 1st Class Mail Service was provided on: _____(date) I affirm that 21 days have passed without the mailing returned as undelivered or undeliverable. PS Form 3817 is attached as proof of mailing. ☐ Certified Mail service was provided on: _____(date) PS Form 3811 (green card) is attached as proof of mailing.
_____ Adjacent Landowner: _____ Address _____ _____ _____ City State Zip Code	☐ Personal Service was provided on : _____ (date) ☐ 1st Class Mail Service was provided on: _____(date) I affirm that 21 days have passed without the mailing returned as undelivered or undeliverable. PS Form 3817 is attached as proof of mailing. ☐ Certified Mail service was provided on:_____(date) PS Form 3811 (green card) is attached as proof of mailing.

5.	PROJECT DESCRIPTION

5.1 Description Narrative: (See Application Information Packet)

6.	PROJECT LOCATION

6-1 Location Narrative: (See Application Information Packet)

Stream/Lake Name

6-2 Driving Directions: (See Application Information Packet)

6-3 Special Information: (See Application Information Packet)

6-4 Project Location Map: (See Application Information Packet)

6-5 Project Site Map: (See Application Information Packet)

7.	DISTURBED AREA DRAWING
7.1 Drawing Requirements: (See Application Information Packet)	

8.	PROJECT PHOTOGRAPHS
8-1 Images: (See Application Information Packet)	
8-2 Photo Orientation Map: (See Application Information Packet)	
8-3 Photo Documentation: (See Application Information Packet)	

9.	RELATED PROJECT INFORMATION
Department of Natural Resources	
Administrative Cause #	Related Application(s) #
Early Coordination #	Utility Exemption #
Recommendation #	Violation #
Department of Environmental Management	
Section 401 #	
Corps of Engineers	
Public Notice #	Section 10 Application #
Section 404 Application #	

10. STATEMENT OF AFFIRMATION

I hereby swear or affirm, under the penalties for perjury, that the information submitted herewith is to the best of my knowledge and belief, true, accurate and complete, and that the property owner (s), and adjoining landowners have been notified of the activity. I further certify that I possess the authority to undertake the proposed or completed activities. I hereby grant to the Department of Natural Resources, the right to enter the above-described location to inspect the proposed or completed work.

_____ _____

Signature of Applicant or Authorized Agent *(REQUIRED)* **Date**

11.	REGULATORY FEES
11-1 Regulatory Fees Submitted: (See Application Information Packet)	
11-3 Payment Method: (See Application Information Packet)	

REQUIREMENT FOR ADDITIONAL INFORMATION AND PERMITS

Application made to and approval granted by the Department of Natural Resources does not in any way relieve the applicant of the necessity of securing easements or other property rights, permits and approvals from affected property owners and other local, state, and federal agencies.

Form N2

Public Notice

Board of Commissioners Office
2293 North Main Street
Crown Point, Indiana 46307
Attn: John S. Dull

Date__November 28, 2000_

Indiana Code 14-11-4 was enacted to ensure that adjacent property owners are notified of permit applications and provided with an opportunity to present their views to the Department of Natural

Under the legislation, the applicant or agent is responsible for providing notice to the owner of the real property owned by a person, other than the applicant, which is both of the following: 1.) located within one-fourth (1/4) mile of the site where the licensed activity would take place, and 2.) has a border or point in common with the exterior boundary of the property where the licensed activity would take place. Included is property which would share a common border if not for the separation caused by a roadway, stream, channel, right-of-way, easement, or railroad.

Resources prior to action.

Due to your proximity to the project site, you are considered to be an adjacent property owner; therefore, notice is being provided in conformance with the provisions of IC 14-11-4 and 310 IAC 0.6.

Applicant's Name, Address, and Telephone

Agent's Name, Address, and Telephone

_

Stream or Lake Name____

Project Description and Location__

Check relevant Statute or Rule:

- ☐ Flood Control Act, IC 14-28-1
- ☐ Lake Preservation Act, IC 14-26-2
- ☐ "Ditch Act", IC 14-26-5
- ☐ Channels Act, IC 14-29-4
- ☐ Removal of Sands or Gravel, IC 14-29-3

Questions relating to the project should be directed to:

You may request an informal public hearing, pre-AOPA (Administrative Orders and Procedures Act) hearing, on this application by filing a petition with the Division of Water. The petition must conform to administrative rule 310 IAC 0.6-3-2.3 as follows:

(a) This section establishes the requirements for a petition to request a public hearing under IC 14-11-4-8(a)(2).

(b) The petition shall include the signatures of at least twenty-five (25) individuals who are at least eighteen (18) years of age and who reside in the county where the licensed activity would take place or who own real property within one (1) mile of the site of the proposed or existing licensed activity.

(c) The complete mailing addresses of the petitioners shall be typed or printed legibly on the petition.

(d) Each individual who signs the petition shall affirm that the individual qualifies under subsection (b).

(e) The petition shall identify the application for which a public hearing is sought, either by application number or by the name of the applicant and the location of the project.

A pre-AOPA public hearing on the application will be limited to the Department's authority under the permitting statues. Only the issues relevant to the Department's jurisdiction directly related to this application for construction will be addressed. Under permitting statues, the Department has no authority in zoning, local drainage, burning, traffic safety, etc.; therefore, topics beyond the Department's jurisdiction will not be discussed during the public hearing.

You may also request that the Department notify you in writing when an initial determination is made to issue or deny the permit. Following the receipt of the post action notice, you may request administrative review of the determination by the Natural Resources Commission under IC 14-21.5 and 310 IAC 0.6.

A request for a pre-AOPA public hearing or notice of initial determination should be addresses to:

Permit Administration Section
Division of Water
Department of Natural Resources
402 West Washington Street, Room W264
Indianapolis, Indiana 46204-2748
Telephone: (317) 233-5635

The Department's jurisdiction under the Flood Control Act is confined to the floodway of the stream and its review limited to the following criteria.

To be approvable a project must demonstrate that it will:

(a) not adversely affect the efficiency or unduly restrict the capacity of the floodway; defined as, the project will not result in an increase in flood stages of more than 0.14 feet above the base 100-year regulatory flood elevation.

(b) not constitute an unreasonable hazard to the safety of life or property; defined as, the project will not result in either of the following during the regulatory flood: (1) the loss of human life, (2) damage to public or private property to which the applicant has neither ownership nor a flood easement;

(c) not result in unreasonably detrimental effects upon fish, wildlife or botanical resources.

Additionally, the Department must consider the cumulative effects of the above items.

The Department’s jurisdiction under the Lakes Preservation Act is confined to the area at or lakeward of the shoreline of the lake and any impact which the project may have on:

(a) the natural resources and/or scenic beauty of the lake;
(b) the water level or contour of the lake below the waterline;
(c) fish, wildlife or botanical resources.

Additionally, the department must consider the cumulative effects of the above items.

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT (33 CFR 325)	OMB APPROVAL NO. 0710-003 Expires October 1996

Public reporting burden for this collection of information is estimated to average 5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003), Washington, DC 20503. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: 33 U.S.C. 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine Uses: Information provided on this form will be used in evaluating the application for a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT=S NAME	8. AUTHORIZED AGENT=S NAME AND TITLE (AN AGENT IS NOT REQUIRED) J.F. New & Associates, Inc. c/o
6. APPLICANT=S ADDRESS	9. AGENT=S ADDRESS 708 Roosevelt Road, Walkerton, IN 46574
7. APPLICANT=S PHONE NOS. W/ AREA CODE a. Business b. Fax	10. AGENT=S PHONE NOS. W/ AREA CODE a. Business 219-586-3400 b. Fax 219-586-3446

11.STATEMENT OF AUTHORIZATION

I hereby authorize J.F. New & Associates, Inc. to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT=S SIGNATURE DATE

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

13. NAME OF WATERBODY, IF KNOWN (see instructions)

14. PROJECT STREET ADDRESS (If applicable)

15. LOCATION OF PROJECT

COUNTY STATE

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

17. DIRECTIONS TO THE SITE:

18. NATURE OF ACTIVITY (Description of project, include all features)

19. PROJECT PURPOSE (Describe the reason or purpose of the project, see instructions)

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. REASON(S) FOR DISCHARGE

21. TYPE(S) OF MATERIAL BEING DISCHARGED AND THE AMOUNT OF EACH TYPE IN CUBIC YARDS

22. SURFACE AREA IN ACRES OF WETLANDS OR OTHER WATERS FILLED (see instructions)

23. IS ANY PORTION OF THE WORK ALREADY COMPLETE? YES ___ NO _ IF YES, DESCRIBE THE COMPLETED WORK.

24. ADDRESSES OF ADJOINING PROPERTY OWNERS, LESSEES, ETC., WHOSE PROPERTY ADJOINS THE WATERBODY (If more than can be entered here, please attach a supplemental list).

25. LIST OF OTHER CERTIFICATIONS OR APPROVALS/DENIALS RECEIVED FROM OTHER FEDERAL, STATE OR LOCAL AGENCIES FOR WORK DESCRIBED IN THIS APPLICATION.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building and flood plain permits.

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT DATE SIGNATURE OF AGENT DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

APPENDIX D

COMMUNICATION WITH AGENCIES AND PROPERTY OWNERS

BIG TURKEY LAKE WATERSHED
FEASIBILITY STUDY

LAGRANGE, STEUBEN, DEKALB,
AND NOBLE COUNTIES, INDIANA

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

BLOOMINGTON FIELD OFFICE (ES)
620 South Walker Street
Bloomington, Indiana 47403-2121
(812) 334-4261 FAX 334-4273

May 17, 2002

Mr. John B. Richardson
J.F. New & Associates, Inc
708 Roosevelt Road
P.O. Box 243
Walkerton, Indiana 46574

Project: Big Turkey Lake Feasibility Study
Waterway: Big Turkey Lake and tributaries
Work Type: Habitat, water quality, and recreation improvement projects
County(ies): LaGrange, Steuben, DeKalb, and Noble

Dear Mr. Richardson:

This responds to your letter dated April 9, 2002, requesting our comments on the aforementioned project.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et. seq.) and are consistent with the intent of the National Environmental Policy Act of 1969, the Endangered Species Act of 1973, and the U. S. Fish and Wildlife Service's Mitigation Policy.

The proposed project will have no significant adverse effect on wetlands, streams or lakes and will in fact improve habitats and water quality within Big Turkey Lake. No Federally endangered species will be affected. Based on a review of the information you provided, the U.S. Fish and Wildlife Service has no objections to the 4 projects as currently proposed.

We appreciate the opportunity to comment at this early stage of project planning. Please keep us informed as project plans progress. For further discussion, please call Elizabeth McCloskey at (219) 983-9753.

Sincerely yours,

Elizabeth S. McCloskey
for Scott E. Pruitt
Supervisor

DEPARTMENT OF THE ARMY
DETROIT DISTRICT, CORPS OF ENGINEERS
REGULATORY OFFICE
SOUTH BEND FIELD OFFICE
2422 VIRIDIAN DRIVE SUITE # 101
SOUTH BEND, INDIANA 46628

May 13, 2002

IN REPLY REFER TO

File No. 02-176-015-1

John B. Richardson
J.F. New & Associates, Inc.
708 Roosevelt Road
P.O.Box 243
Walkerton, Indiana 46574-0243

Dear Mr. Richardson:

This is in response to your request for comments regarding the draft *Big Turkey Lake Watershed Feasibility Study* for selected water quality and habitat improvement projects. Based on our review of the information you submitted, we provide the following comments and potential permit requirements on the four projects your report has determined were feasible.

The first of your recommended projects considered feasible, labeled 3.1, is for bank stabilization along the Weicht Sparks Drain (Mud Creek) between Henry Lake and Big Turkey Lake. This project is currently under review for a permit by our office. From our initial review it appears the project would qualify for the Indiana Regional General Permit (RGP) for New Construction (file number 02-176-015-0).

The second project considered feasible, labeled 3.4, involves the installation of a series of sediment traps on Turkey Creek at County Road 475 South. The proposal indicates that the creek would be widened from 30 feet to 90 feet for approximately 1200 feet of Turkey Creek. The project would also include construction of 20 feet overflow shelves installed on both sides of the creek and planted with emergent wetland vegetation. In addition, three check dams will be constructed within the channel down stream of the three sediment traps. Because this project involves such a lengthy stream reach and several channel modifications within that area, our permit evaluation will require that you submit detailed plan drawings and provide precise calculations of the area of stream channel to be impacted.

Project 3.5, the third project you deemed feasible, involves the lake depth alterations. This project is divided into three alternatives with the last being a no action alternative. Alternative 1 involves localized dredging of the lake. This alternative may be outside the jurisdiction of the Corps of Engineers, however depending on the dredging methods, disposal area, and equipment used a Department of the Army permit may be required. We would ask for detailed plans, methods, and disposal areas for our review prior to issuing a decision as to potential permit

requirements.

The second alternative listed under the lake depth alteration, Project 3.5, is raising the lake level by manipulating the existing spillway by approximately 6-inches. While the primary impacts of this alternative may only result in a small area of discharges, the secondary effects of the project could affect a large area, therefore our permit evaluation will require that you submit detailed plan drawings and provide precise calculations of the area of all impact areas for permit review. It is likely based on the current information submitted to this office that this alternative may require a Standard Permit review.

The fourth project considered feasible, labeled 3.6, involves the stabilization of island shoreline. Four alternatives for the island stabilization were reviewed with the fourth being the no action alternative. Alternative 1 involves the discharging of riprap or glacial stone, alternative 2 involves the discharge of bioengineered material along the shoreline, and alternative 3 involves the discharge of wave breakers. While your report states that a Department of the Army Permit may not be required for these projects, each of the first three proposed alternatives involve the discharge of fill or dredge material below the Ordinary High Water Mark and therefore each of these proposals would require a Department of the Army Permit prior to commencing work. Because this project involves such lengthy bank stabilization, our permit evaluation will require that you submit detailed plan drawings and provide precise calculations of the area of stream channel to be impacted.

In summary, each of the projects will require a Department of the Army (DA) permit except as noted above. Some of the work may qualify for the Indiana RGP provided you obtain a site specific 401 Water Quality Certification from IDEM. You should be cautioned, however, that a final determination cannot be made until the final design has been completed indicating the exact area of impacts resulting from each project. Prior to implementation of any of the projects, you must submit final, detailed plan drawings along with a completed DA permit application.

Should you have any questions, please contact John C. Ritchey at the above address or telephone (574) 232-1952. Please refer to File Number: 02-176-015-1.

Sincerely,

Gregory A. McKay

Gregory A. McKay
Project Manager
South Bend Field Office

STEUBEN COUNTY DRAINAGE BOARD
317 S. WAYNE ST. • SUITE 3K
ANGOLA, INDIANA 46703

May 28, 2002

Mr. John B. Richardson, Senior Project Manager
J.F. New & Associates, Inc.
708 Roosevelt Road PO Box 243
Walkerton IN 46574

RE: Big Turkey Lake Improvement Projects

Dear Mr. Richardson,

On March 7, 2002 the Steuben County Drainage Board voted to support the Sediment Trap Project at Big Turkey Lake and the Bank Stabilization Project along the Dewitt-Weicht-Sparks County Regulated Drain, which the Big Turkey Lake Improvement Association is undertaking. The Board also voted to guarantee $15,000 toward the funding of the Channel Bank Stabilization Project. I've enclosed a copy of the minutes from the Drainage Board Meeting on March 7, 2002, when these projects were approved.

If you have any questions or comments, please feel free to contact us at (260) 668-1000, Extension 1800.

Sincerely,

Pat Jackson

Pat Jackson, Secretary
Steuben County Drainage Board

Enc.

J. F. New & Associates, Inc.

708 Roosevelt Road • P.O. Box 243 • Walkerton, IN 46574
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22 December 2001

Mr. Rodney Parr
100269 W. 475 S.
Hudson, IN 46747

Dear Mr. Parr:

Thank you for meeting with me last Friday to discuss the sediment trap issue on Turkey Creek. I believe we can put together a package that will make the lake owners happy and will benefit you. I expect to have a plan that includes the new culvert to you by the second week in January at the latest.

As we briefly discussed before I left, you have an excellent opportunity to develop your land for residential use with lake access south of 475 S. Road. If you were serious about pursuing the issue, the developer's attorney that I mentioned would like to meet with you. We have tentatively set a time of 1:00 pm on Jan 3rd at your house or in Indianapolis. The attorney's name and address is Joseph Montel, Kreig-DeVault LLP. One Indiana Square, Suite 2800, Indianapolis, Indiana 46204-2017. His phone number is 317-238-6265. Joe would like the following information prior to that meeting if you want to go forward with this: A plat of your property and a copy of the deed. I am sending him this letter with a copy of the plat book showing the lake and stream.

I hope we can continue to work together on these issues. Please call me on the 2nd of January if you do not want to go forward with the meeting. Thank you.

Sincerely,

John B. Richardson
Senior Project Manager

C: Joseph Montel w/attach

November 26, 2001

J.F. New & Associates, Inc.
708 Roosevelt Road
PO Box 243
Walkerton, IN 46574
Attn: John B. Richardson

Dear Mr. Richardson,

I have reviewed the engineering sketch and feel that this is a project that needs to be completed.

Per our phone conversation, John, you and I spoke that the sketch should include at least 100 ft or more to each side of the mouth of the ditch. And also that the slope would not be on my property.

When these two items have been changed on the sketch, you have my full support of this project.

Sincerely,

Estil Gayheart

Estil Gayheart

J. F. New & Associates, Inc.

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19 November 2001

Wayne and Anne Marie Schurr
10030 W. 500 S.
Hudson, Indiana 46747

Dear Mr. and Mrs. Schurr:

We have completed our preliminary design for stabilizing the ditch between Henry Lake and Big Turkey Lake. Enclosed is the engineering sketch of how the ditch would be stabilized. After reviewing the design please consider sending us a statement supporting the project. If you object to the design in any way please tell me and make suggestions for alternate methods. Without your support it will be difficult to obtain the funding necessary for final design and construction. We will apply for a grant in January, which will allow us to move forward with the final design and construction. The money would not be available until July.

The conceptual design involves deepening the centerline of the ditch to a maximum of three feet and stabilizing the toe of the side slopes using gabion baskets. Gabion baskets are woven wire rectangles filled with stone. A layer of live cuttings or bare root shrubs will be laid on top of the baskets and a fabric encapsulated lift of soil will be placed on top of the shrubs and baskets. The fabric is a woven coconut fabric that is meant to hold a slope in place long enough (5-7 years) for vegetation to be established. The vegetation we are using will be primarily prairie cord grass. It is native to the site, as I found several patches at the top of the bank when I was there, and it has an extremely deep and dense root mass for long-term soil stabilization. This method will permanently stabilize the banks from wave wash and high ditch flows and allow boater access.

Please call me if you need additional information to make your decision. Thank you.

Sincerely,

John B. Richardson
Senior Project Manager

c. Jack Hollowell-Big Turkey Lake Improvement Association

J. F. New & Associates, Inc.

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19 November 2001

Mr. Estil Gayheart
10045 W. 500 S.
Hudson, Indiana 46747

Dear Mr. Gayheart:

We have completed our preliminary design for stabilizing the ditch between Henry Lake and Big Turkey Lake. Enclosed is the engineering sketch of how the ditch would be stabilized. After reviewing the design please consider sending us a statement supporting the project. If you object to the design in any way please tell me and make suggestions for alternate methods. Without your support it will be difficult to obtain the funding necessary for final design and construction. We will apply for a grant in January, which will allow us to move forward with the final design and construction. The money would not be available until July.

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Please call me if you need additional information to make your decision. Thank you.

Sincerely,

John B. Richardson
Senior Project Manager

c. Jack Hollowell-Big Turkey Lake Improvement Association

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19 November 2001

Richard and Betty Schuhler
10410 W. 475 S.
Hudson, Indiana 46747

Dear Mr. and Mrs. Schuhler:

We have completed our preliminary design for stabilizing the ditch between Henry Lake and Big Turkey Lake. Enclosed is the engineering sketch of how the ditch would be stabilized. After reviewing the design please consider sending us a statement supporting the project. If you object to the design in any way please tell me and make suggestions for alternate methods. Without your support it will be difficult to obtain the funding necessary for final design and construction. We will apply for a grant in January, which will allow us to move forward with the final design and construction. The money would not be available until July.

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Please call me if you need additional information to make your decision. Thank you.

Sincerely,

John B. Richardson
Senior Project Manager

c. Jack Hollowell-Big Turkey Lake Improvement Association

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26 June 2001

Wayne and Anne Marie Schurr
10030 W. 500 S.
Hudson, In 46747

Dear Mr. and Mrs. Schurr;

The Big Turkey Lake Improvement Association (Association) recently hired J. F. New and Associates to complete an engineering feasibility study on water quality improvement projects that would benefit Big and Little Turkey Lake. We have identified the banks of Mud Creek between Henry Lake and Big Turkey Lake as one of the areas needing bank stabilization.

Since you are an owner of land adjacent to the creek, I am writing this letter to establish contact with you and open discussions about the possibilities for stabilizing the creek banks. We will not recommend a project unless you agree to it. Project construction funds will likely come from grants that the Association will obtain. We will also be seeking permission for the project from the Steuben County Drainage Board, Indiana Department of Natural Resources, Indiana Department of Environmental Management and the Corps of Engineers as part of this study.

Please call or write to let me know that you approve so that we can prepare some conceptual ideas that I could present to you in a few weeks for your comments. A stamped return envelope is enclosed for your convenience. Thank you for your cooperation.

Sincerely,
J. F. New and Associates, Inc.

original signed

John B. Richardson
Senior Project Manager

c. Jack Hollowell –President, Big Turkey lake Improvement Association

J. F. New & Associates, Inc.

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26 June 2001

Edwin and Alitza Reinholt
2513 Bellvue Dr.
Fort Wayne, IN 46825

Dear Mr and Mrs. Reinholt;

The Big Turkey Lake Improvement Association (Association) recently hired J. F. New and Associates to complete an engineering feasibility study on water quality improvement projects that would benefit Big and Little Turkey Lake. We have identified the banks of Mud Creek between Henry Lake and Big Turkey Lake as one of the areas needing bank stabilization.

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Sincerely,
J. F. New and Associates, Inc.

John B. Richardson
Senior Project Manager

c. Jack Hollowell –President, Big Turkey lake Improvement Association

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26 June 2001

Richard and Betty Schuhler
10410 W. 475 S.
Hudson, In 46747

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Sincerely,
J. F. New and Associates, Inc.

John B. Richardson
Senior Project Manager

c. Jack Hollowell –President, Big Turkey lake Improvement Association

P.S. Thank you for your call last week

J. F. New & Associates, Inc.

708 Roosevelt Road • P.O. Box 243 • Walkerton, IN 46574
Phone: 219-586-3400 • Fax: 219-586-3446
Web: www.jfnew.com • E-Mail: info@jfnew.com

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26 June 2001

Estil Gayhart
10045 W. 500 S.
Hudson, In 46747

Dear Ms. Gayhart;

The Big Turkey Lake Improvement Association (Association) recently hired J. F. New and Associates to complete an engineering feasibility study on water quality improvement projects that would benefit Big and Little Turkey Lake. We have identified the banks of Mud Creek between Henry Lake and Big Turkey Lake as one of the areas needing bank stabilization.

Since you are an owner of land adjacent to the creek, I am writing this letter to establish contact with you and open discussions about the possibilities for stabilizing the creek banks. We will not recommend a project unless you agree to it. Project construction funds will likely come from grants that the Association will obtain. We will also be seeking permission for the project from the Steuben County Drainage Board, Indiana Department of Natural Resources, Indiana Department of Environmental Management and the Corps of Engineers as part of this study.

Please call or write to let me know that you approve so that we can prepare some conceptual ideas that I could present to you in a few weeks for your comments. A stamped return envelope is enclosed for your convenience. Thank you for your cooperation.

Sincerely,
J. F. New and Associates, Inc.

John B. Richardson
Senior Project Manager

c. Jack Hollowell –President, Big Turkey lake Improvement Association

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August 28, 2001

Melvin and Marcia Helmuth
2655 S. 700 W.
Hudson, Indiana 46747

MAILED

Dear Mr. and Mrs. Helmuth,

The Big Turkey Lake Improvement Association has retained J. F. New and Associates, Inc. to complete engineering feasibility on water quality improvement projects in the Big Turkey Lake Watershed. As part of our efforts, we are pursuing the feasibility for restoration of wetlands, construction of sediment traps or other conservation practices in or adjacent to Mud Creek.

Your land, at the headwaters of Mud Creek, is ideally suited for the restoration of a wetland. One of the primary functions of wetlands is to store water, which will reduce peak discharge and potential erosion of ditch banks downstream. If you are willing, I would like to meet with you and discuss the funding opportunities available to you for wetland restoration and other conservation practices. I will contact you the first week of September to see if you are interested in meeting with me.

Sincerely,

John Richardson

Project Manager

cc. Jack Hollowell-Big Turkey Lake Association
Kelly Bushong-SWCD

Native Plant Nursery • 128 Sunset • Walkerton, IN 46574 • Phone: 219-586-2412 • Fax: 219-586-2718
Indianapolis • 3955 Eagle Creek Parkway, Suite A • Indianapolis, IN 46254 • Phone: 317-388-1982 • Fax: 317-388-1986
Illinois • 722 West Exchange, Suite 4 • Crete, Illinois 60417 • Phone: 708-367-1130 • Fax: 708-367-1132

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MAILED

August 28, 2001

Ted and Ruth Beer
5985 S. 725 W.
Pleasant Lake, Indiana 46779

Dear Mr. and Mrs. Beer,

The Big Turkey Lake Improvement Association has retained J. F. New and Associates, Inc. to complete engineering feasibility on water quality improvement projects in the Big Turkey Lake Watershed. As part of our efforts, we are pursuing the feasibility for restoration of wetlands, construction of sediment traps or other conservation practices in or adjacent to Mud Creek.

Your land, at the headwaters of Mud Creek, is ideally suited for the restoration of a wetland. One of the primary functions of wetlands is to store water, which will reduce peak discharge and potential erosion of ditch banks downstream. If you are willing, I would like to meet with you and discuss the funding opportunities available to you for wetland restoration and other conservation practices. I will contact you the first week of September to see if you are interested in meeting with me.

Sincerely,

John Richardson

Project Manager

cc. Jack Hollowell-Big Turkey Lake Association
Kelly Bushong-SWCD

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August 28, 2001

MAILED

Ken Stoy
6515 S. 400W.
Ashley, Indiana 46705

Dear Mr. Stoy,

The Big Turkey Lake Improvement Association has retained J. F. New and Associates, Inc. to complete engineering feasibility on water quality improvement projects in the Big Turkey Lake Watershed. As part of our efforts, we are pursuing the feasibility for restoration of wetlands, construction of sediment traps or other conservation practices in or adjacent to Mud Creek.

Your land, at the headwaters of Mud Creek, is ideally suited for the restoration of a wetland. One of the primary functions of wetlands is to store water, which will reduce peak discharge and potential erosion of ditch banks downstream. If you are willing, I would like to meet with you and discuss the funding opportunities available to you for wetland restoration and other conservation practices. I will contact you the first week of September to see if you are interested in meeting with me.

Sincerely,

John Richardson

Project Manager

cc. Jack Hollowell-Big Turkey Lake Association
Kelly Bushong-SWCD

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MAILED

August 28, 2001

John and Elfriede Hughes
3120 S. 800 W.
Hudson, Indiana 46747

Dear Mr. and Mrs. Hughes,

The Big Turkey Lake Improvement Association has retained J. F. New and Associates, Inc. to complete engineering feasibility on water quality improvement projects in the Big Turkey Lake Watershed. As part of our efforts, we are pursuing the feasibility for restoration of wetlands, construction of sediment traps or other conservation practices in or adjacent to Mud Creek.

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Sincerely,

John Richardson

Project Manager

cc. Jack Hollowell-Big Turkey Lake Association
Kelly Bushong-SWCD

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MAILED

August 29, 2001

Harold and Patricia Smith
8620 W. SR 4
Hudson, Indiana 46747

Dear Mr. and Mrs. Smith,

The Big Turkey Lake Improvement Association has retained J. F. New and Associates, Inc. to complete engineering feasibility on water quality improvement projects in the Big Turkey Lake Watershed. As part of our efforts, we are pursuing the feasibility for restoration of wetlands, construction of sediment traps or other conservation practices in or adjacent to Turkey Creek and its tributaries.

A portion of the land you farm at SR 327 and SR 4 is ideally suited for the restoration of a wetland. One of the primary functions of wetlands is to store water, which will reduce peak discharge and potential erosion of ditch banks downstream. If you are willing, I would like to meet with you and discuss the funding opportunities available to you for wetland restoration and other conservation practices. I will contact you the first week of September to see if you are interested in meeting with me.

Sincerely,

John Richardson

Project Manager

cc. Jack Hollowell-Big Turkey Lake Association
Kelly Bushong-SWCD

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August 29, 2001

MAILED

Chris and Cyndi Lochamire
RR 1
Hudson, Indiana 46747

Dear Mr. and Mrs. Lochamire,

The Big Turkey Lake Improvement Association has retained J. F. New and Associates, Inc. to complete engineering feasibility on water quality improvement projects in the Big Turkey Lake Watershed. As part of our efforts, we are pursuing the feasibility for restoration of wetlands, construction of sediment traps or other conservation practices in or adjacent to Turkey Creek and its tributaries.

A portion of the land you farm at SR 327 and SR 4 is ideally suited for the restoration of a wetland. One of the primary functions of wetlands is to store water, which will reduce peak discharge and potential erosion of ditch banks downstream. If you are willing, I would like to meet with you and discuss the funding opportunities available to you for wetland restoration and other conservation practices. I will contact you the first week of September to see if you are interested in meeting with me.

Sincerely,

John Richardson

Project Manager

c. Jack Hollowell-Big Turkey Lake Association
Kelly Bushong-SWCD

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August 29, 2001

MAILED

Robert Lochamire
7660 S. 900 W.
Hudson, Indiana 46747

Dear Mr. Lochamire,

The Big Turkey Lake Improvement Association has retained J. F. New and Associates, Inc. to complete engineering feasibility on water quality improvement projects in the Big Turkey Lake Watershed. As part of our efforts, we are pursuing the feasibility for restoration of wetlands, construction of sediment traps or other conservation practices in or adjacent to Turkey Creek and its tributaries.

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Sincerely,

John Richardson

Project Manager

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August 29, 2001

Rodney Parr
10069 W. 475 S.
Hudson, Indiana 46747

MAILED

Dear Mr. Parr,

The Big Turkey Lake Improvement Association has retained J. F. New and Associates, Inc. to complete engineering feasibility on water quality improvement projects in the Big Turkey Lake Watershed. As part of our efforts, we are pursuing the feasibility for restoration of wetlands, construction of sediment traps or other Best Management Practices (BMP's) in or adjacent to Turkey Creek.

Your land is ideally suited for implementing some of these BMP's. If you are willing, I would like to meet with you and discuss the funding opportunities available to you for implementation of BMP's and other conservation practices. I will contact you the first week of September to see if you are interested in meeting with me.

Sincerely,

John Richardson

Project Manager

c. Jack Hollowell-Big Turkey Lake Association
Kelly Bushong-SWCD

APPENDIX E

BIOLOGICAL/HABITAT ASSESSMENT REPORT

BIG TURKEY LAKE WATERSHED
FEASIBILITY STUDY

LAGRANGE, STEUBEN, DEKALB,
AND NOBLE COUNTIES, INDIANA

BIOLOGICAL/HABITAT ASSESSMENT REPORT

BIG TURKEY LAKE FEASIBILITY STUDY

December 3, 2002

Prepared For:
Big Turkey Lake Improvement Association

Prepared By:
J.F. New & Associates, Inc.
708 Roosevelt Road
Walkerton, Indiana 46574
(219) 586-3400

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BIOLOGICAL/HABITAT ASSESSMENT REPORT
BIG TURKEY LAKE WATERSHED FEASIBILITY STUDY

INTRODUCTION

The Big Turkey Lake Watershed has been the subject of a sizeable amount of biological research (Table 1). Most of the studies have been aimed at protecting and enhancing the beneficial uses of the numerous lakes within the drainage basin. According to Indiana Clean Lakes data (IDEM, 2000), most of the lakes within the basin are eutrophic to hypereutrophic, and the Big Turkey and Little Turkey Lake Enhancement Feasibility Study (Harza Engineering Company, 1990) suggested that best management practices (BMPs) be implemented and wetland filters be constructed within the watershed before in-lake restoration processes be considered.

TABLE 1. Research and investigations conducted in the Big Turkey Lake Watershed from 1968 to present.

Year	Entity	Study/Investigation
various	IDNR	Fish community and macrophyte survey in Big Turkey Lake
various	IDNR	Fish community and macrophyte survey in Little Turkey Lake
various	IDNR	Fish community and macrophyte survey in Upper and Lower Story Lakes
various	IDNR	Fish community and macrophyte survey in Lake of the Woods
various	IDNR	Fish community and macrophyte survey in Big Long Lake
various	IDNR	Fish community and macrophyte survey in Pretty Lake
1990	HEC	Big and Little Turkey Lake Enhancement Feasibility Study
1990	IDEM-BSS	Collection of macroinvertebrates and calculation of mIBI for Turkey Creek at intersection with SR 327
1991	IDEM-BSS	Collection of fish and calculation of IBI for Turkey Creek at intersection with CR 275 S upstream of bridge
1991	IDEM-BSS	Collection of fish and calculation of IBI for Turkey Creek at intersection with CR 150 N downstream of bridge
1991	IDEM-BSS	Collection of fish and calculation of IBI for Turkey Creek at intersection with SR 327
1999	IDNR	Survey of fish harvested at Big Turkey Lake
2000	HRW	Macroinvertebrate collection, water quality analysis, and calculation of a water quality index
2000	IDNR	Mussel collection in Big and Little Turkey Lakes

IDNR = Indiana Department of Natural Resources
HEC=Harza Engineering Company
IDEM-BSS=Indiana Department of Environmental Management-Biological Studies Section
HRW=Hoosier Riverwatch
IDEM-CLP=Indiana Department of Environmental Management-Clean Lakes Program
mIBI=macroinvertebrate index of biotic integrity
IBI=Index of Biotic Integrity

During this study, J.F. New conducted additional biological surveys of benthic macroinvertebrates and habitat throughout the watershed. Standard indices including the Family-level Hilsenhoff Biotic Index (FBI), macroinvertebrate Index of Biotic Integrity (mIBI), and Qualitative Habitat Evaluation Index (QHEI) were used to determine the existing level of ecological integrity and predict impacts on sensitive species, biological communities, and water quality. These studies were established to provide baseline data for comparison after stream improvement projects are completed.

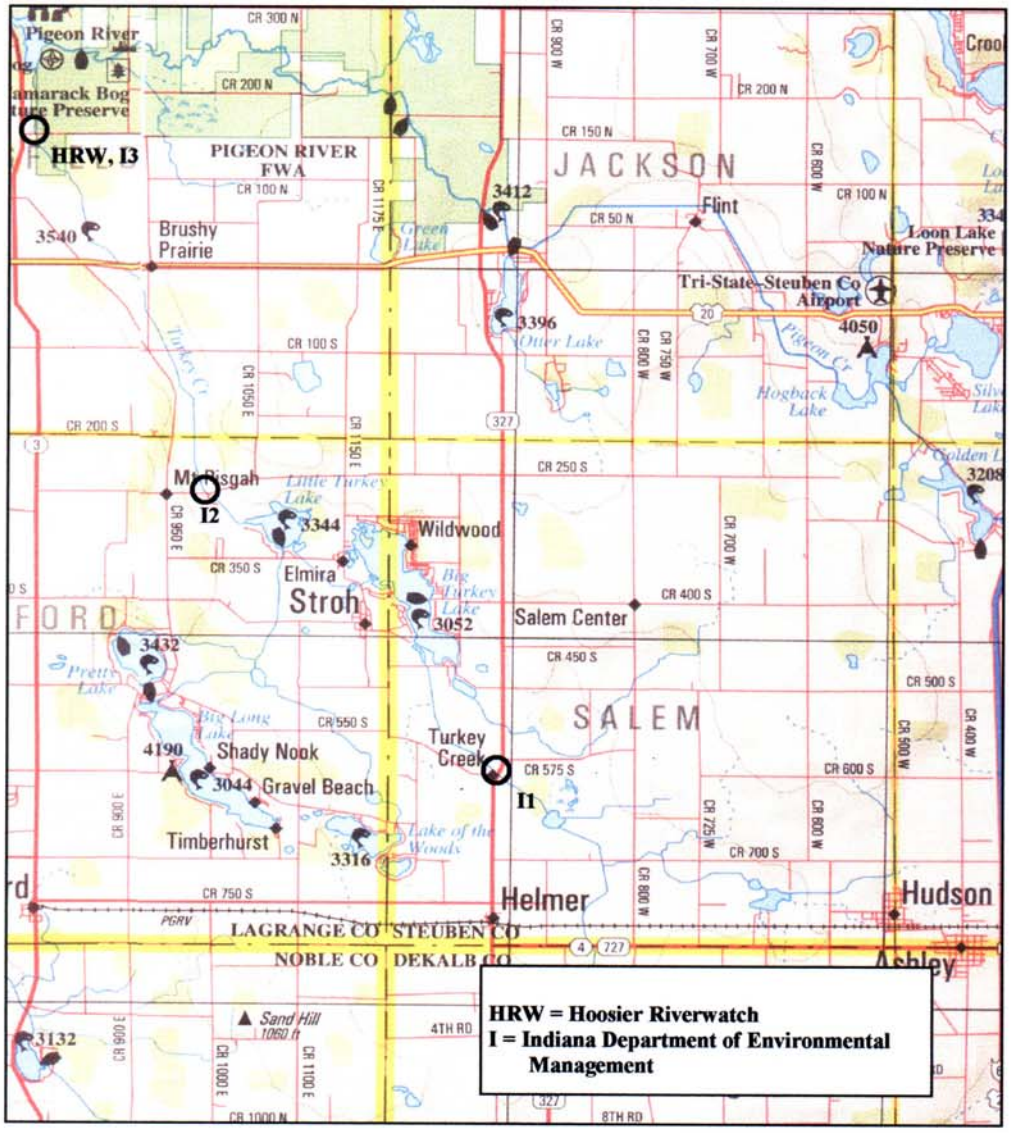
Macroinvertebrate Data

Macroinvertebrates have been sampled two times at two different sites by the Lakeland Middle School, Hoosier Riverwatch Program, and by the IDEM Biological Studies Section. The Hoosier Riverwatch water quality index for the Turkey Creek site downstream of Little Turkey Lake (Figure 1; Site HRW) estimated stream quality to be "good" within this reach on 7/7/2000. Three high quality taxa including mayfly nymphs, caddis fly larvae, and right-handed snails were collected in the sample. The insect sample collected at the juncture of SR 327 and Turkey Creek by IDEM (Figure 1; Site I1) in August of 1990 placed water quality within the stream on the low end of the moderately impaired range. The site received a mIBI score of 2.2 out of a possible 8 points. (As will be explained in more detail in the Methods Section, the mIBI is a measure of biological stream health.) The pollution tolerant Chironomidae family composed >50% of the sample. Metrics based on numbers of pollution intolerant taxa received poor to very poor scores.

Stream Fish Community Data

Although the IDNR has regularly sampled the fish communities in all of the large, public lakes in the watershed since the 1960s, very little work has been done to characterize the fish communities of streams and creeks within the watershed. The IDEM Biological Studies Section has sampled fish and calculated an Index of Biotic Integrity (IBI) for three different sites in the watershed. Karr (1981) first developed the IBI for evaluating biotic integrity of fish communities. Simon (1997) further modified and calibrated the IBI for use in the Northern Indiana Till Plain Ecoregion of Indiana. Biological integrity is defined as, "the ability of a aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the best natural habitats within a region" (Karr and Dudley, 1981).

The IBI is designed to assess biotic integrity directly through twelve attributes of fish communities in streams. These attributes fall into such categories as species richness and composition, trophic composition, and fish abundance, and condition. After data from sampling sites have been collected, values for the twelve metrics are compared with their corresponding expected values (Simon, 1997) and a rating of 1, 3, or 5 is assigned to each metric based on whether it deviates strongly from, somewhat from, or closely approximates the expected values. The sum of these ratings gives a total IBI score for the site. The best possible IBI score is 60 (Table 2).



Scale: 1" = 1.87 Miles

FIGURE 1. Historical Study Locations Map
Biological/Habitat Assessment Report
Big Turkey Lake Improvement Association
Lagrange, Steuben, Noble, and Dekalb Counties, Indiana

JFNA# 00-08-03

J.F. New & Associates
wetland consultants / environmental engineers

TABLE 2. Attributes of Index of Biotic Integrity classification.

IBI	Integrity Class	Attributes
58-60	Excellent	Comparable to the best situation without human disturbance.
48-52	Good	Species richness somewhat below expectations.
40-44	Fair	Signs of additional deterioration include loss of intolerant forms.
28-34	Poor	Dominated by omnivores, tolerant forms, and habitat generalists.
12-22	Very Poor	Few fish present. Mostly introduced or tolerant forms.
0	No Fish	Repeat sampling finds no fish.

Source: Index of Biotic Integrity Expectations -Ecoregions of Indiana III. Northern Indiana Till Plain (Simon, 1997).

In 1991, the IDEM Biological Studies Section conducted three fish community surveys on Turkey Creek (Sites I1, I2, and I3; Figure 1). A total of 149 fish representing 20 species and 7 families were collected (Table 3). Bluntnose minnow (*Pimephales notatus*) dominated the catch at 32% of the total. Bluegill (*Lepomis macrochirus*), rock bass (*Ambloblites rupenstris*), and johnny darter (*Etheostoma nigrum*), were also important components of the community at 9%, 9%, and 6% respectively. The minnow family (Cyprinidae) comprised 40% of the total sample followed by the sunfish family (Centrarchidae) with 32%. Of the 149 fish collected, 68 (46%) were highly tolerant while 18 (12%) were highly intolerant (sensitive). No state or federally listed endangered species were collected during the survey.

TABLE 3. Trophic guild, tolerance, lithophile, and pioneer status of members of the Turkey Creek Watershed fish community.

Common Name	Site	Trophic Guild	Tolerance	Lithophilic	Pioneer
Blackside darter	I3	insectivore	moderately tolerant	yes	no
Bluegill	I1,2	insectivore	moderately tolerant	no	no
Bluntnose minnow	I1,3	omnivore	highly tolerant	no	yes
Central mudminnow	I2	omnivore	highly tolerant	no	no
Common carp	I1,3	omnivore	highly tolerant	no	no
Golden shiner	I1	insectivore	highly tolerant	no	no
Grass pickerel	I2	piscivore	moderately tolerant	no	no
Green sunfish	I2,3	insectivore	highly tolerant	no	yes
Hornyhead chub	I2	insectivore	intolerant	no	no
Johnny darter	I1,2	insectivore	intermediate	no	yes
Largemouth bass	I1,2,3	carnivore	moderately tolerant	no	no
Mottled sculpin	I2	insectivore	intermediate	no	no
Northern hog sucker	I2,3	insectivore	intolerant	yes	no
Orangethroat darter	I2	insectivore	moderately tolerant	yes	yes
Pumpkinseed	I1,2,3	insectivore	moderately tolerant	no	no
Rock bass	I2,3	carnivore	moderately intolerant	no	no
Striped shiner	I1,3	insectivore	moderately tolerant	yes	no
Warmouth	I2	carnivore	moderately tolerant	no	no
White sucker	I1,2,3	omnivore	highly tolerant	yes	no
Yellow bullhead	I1,2,3	insectivore	moderately tolerant	no	no

Source: Index of Biotic Integrity Expectations- Ecoregions of Indiana III. Northern Indiana Till Plain (Simon, 1997).

IBI scores were calculated based on data collected by IDEM and are included in Table 4. IBI values ranged from a high of 32 (poor) at Site I3 to a low of 26 (poor-very poor) at Site I2. Site I1 scored a 28 (poor). No scores fell between 40 (fair) and 60 (excellent) or below 22 (very poor-no fish). These results indicate that overall stream fish communities within Turkey Creek were of poor quality in 1991. Poor quality fish communities are typically dominated by omnivores, tolerant forms, and habitat generalists. Usually few top predators exist, and growth rates and condition factors are depressed (Simon, 1997).

TABLE 4. IBI score and integrity class by site on Turkey Creek.

Site (Location)	IBI	Integrity Class
I1 (S.R. 327 Bridge)	28	Poor
I2 (C.R. 275 S Bridge)	26	Poor-Very Poor
I3 (C.R. 150 N Bridge)	32	Poor

The lack of darter/madtom/sculpin (DMS) species, low percent of headwater species, small proportion of sensitive species, low numbers of lithophilic individuals, and low catch per unit effort (CPUE) negatively affected the IBI score (28) at Site I1. Lack of DMS species and simple lithophilic individuals indicates that clean gravel or cobble substrates were lacking. (Lithophilic individuals are those requiring gravel or other small pebble surfaces for successful spawning.) Sensitive species typically comprise 5-10% of common species sampled in Indiana (Simon, 1997). No sensitive species were collected at Site I1 suggestive of water quality conditions not suitable for pollution intolerant forms. Because presence of headwater species indicates that stable habitat and low environmental stress exist in the stream, the lack of these individuals at Site I1 is a reflection of an unstable system.

A fish community similar to that at Site I1 was also sampled at Site I2 in 1991. Lack of darter, sensitive, and lithophilic individuals and a low CPUE resulted in the poor-very poor IBI score of 26. Anthropogenic disturbances can interfere with the food chain in aquatic systems resulting in the absence of top predators from the fish community. However, at Site I2 the number of sunfish and percent carnivore IBI metrics received strong scores indicating that the food chain remained intact.

Site I3 lies just downstream of the Turkey Creek Watershed just prior to Turkey Creek's confluence with the Pigeon River. Though not technically in the watershed, fish community health downstream is related to Big Turkey Lake Watershed health and the quality of water exported from the area. The IBI score of 32 places Turkey Creek in the poor integrity class. Although the fish community was fairly diverse (16 species were collected), the CPUE was low, suggesting anthropogenic disturbance, poor habitat, and/or degraded water quality.

Natural Communities and Endangered, Threatened, and Rare Species

The Indiana Natural Heritage Data Center database provides information on the presence of endangered, threatened, or rare species, high quality natural communities, and natural areas in Indiana. The database was developed to assist in documenting the presence of special species and significant natural areas and to serve as a tool for setting management priorities in areas

where special species or habitats exist. The database relies on observations from individuals rather than systematic field surveys by the IDNR. Because of this, it does not document every occurrence of special species or habitat. At the same time, the listing of a species or natural area does not guarantee that the listed species is present or that the listed habitat is in pristine condition. To assist users, the database includes the date that the species or special habitat was last observed and reported in a specific location.

According to the database search, the Big Turkey Lake Watershed supports the state-significant wetland/fen community type. The state-rare grove meadow grass (*Poa alsodes*) was documented in the area in 1929, and the American badger (*Taxidea taxus*), a state endangered species was listed in 1994. Big Long Lake, Lake of the Woods, and McClish Lake are listed in the database as fostering populations of the native fish cisco (*Coregonus artedi*). The database lists the species as of "special concern" in Indiana.

Cisco are thought to be the only salmonid native to inland waters of Indiana (Pearson, 2001). Due to cool temperature (68°F) and minimum dissolved oxygen (3 mg/l) requirements, in Indiana the species is living at the southern-most edge of its natural geographic range (Frey, 1955). Eutrophication, which results in the destruction of the "cisco layer" (a layer where oxygen-containing waters are not too warm for cisco survival), has led to the extirpation of cisco from many northern Indiana lakes (Pearson, 2001; IDNR, personal communication).

According to an IDNR report on cisco population status in the state, Big Long Lake, Lake of the Woods, and McClish Lake have fostered populations of cisco (Pearson, 2001). Table 5 taken from the IDNR report (Pearson, 2001) gives population status of cisco in these three lakes since 1955. Big Long Lake and Lake of the Woods both contained cisco in the recent past; however, the species is believed to be extirpated from the two lakes now. McClish Lake is the only lake within the study area that has been found to still support the species. It is not certain if Big Turkey, Little Turkey, or Pretty Lake ever supported cisco populations (IDNR, personal communication).

TABLE 5. Population status of ciscos in Turkey Creek Watershed lakes since 1955. The data was taken directly from Pearson, 2001.

Lake	County	1955	1975	1994	2000
Big Long	LaGrange	R	E	E	E
Lake of the Woods	Steuben/LaGrange	C	C	E	E
McClish	Steuben/LaGrange	C	C	C	C

C=common
R=rare
E=extirpated

METHODS

Sampling Timing and Locations

On June 19 and November 2, 2001, J.F. New conducted macroinvertebrate and habitat surveys throughout the Big Turkey Lake Watershed. The sampling times were targeted at collection of filter/scraper-type organisms in the spring and shredder-type organisms in the fall. The fall sampling was later than is desirable; however, base flow conditions at least one week prior to collection are required for an unbiased sample, and base flow during the month of October never occurred. (Due to rain events throughout the October, sampling trips were cancelled four times.) Six sampling locations (Table 6 and Figure 2) were chosen. Table 6 contains descriptions of the sampling locations including their UTM zone 16 NAD 1983 coordinates.

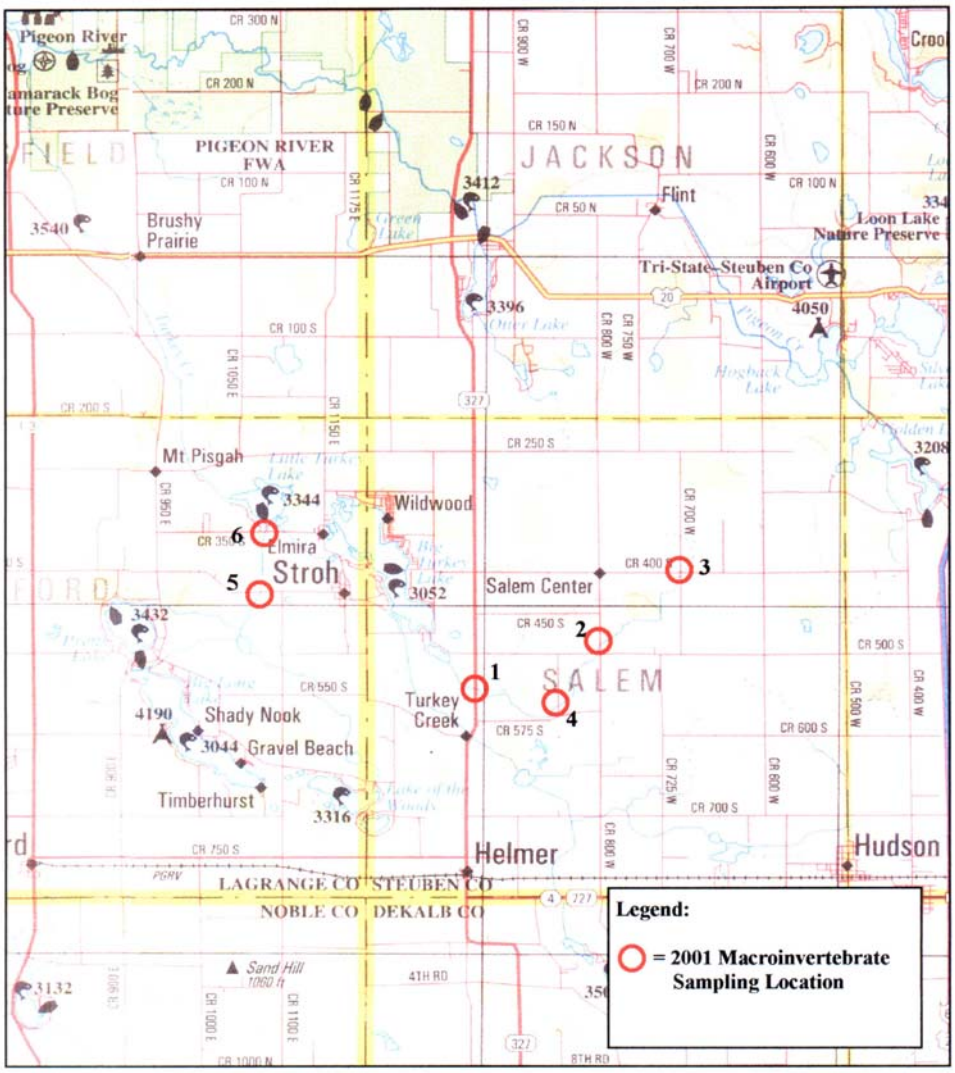
TABLE 6. Detailed sampling location information for the Turkey Creek Watershed.

Site #	Stream Name	Road Location	Place Sampled	UTM Zone 16 NAD 1983 Coordinates
1	Mud Creek	intersection with SR 327	upstream of bridge	652,730.89 x 4,603,009.89
2	Mud Creek	intersection with CR 800 W	upstream of road crossing	655,113.52 x 4,603,966.41
3	Mud Creek	intersection with CR 400 S	downstream of road crossing	656,632.22 x 4,605,399.47
4	Mud Creek	intersection with CR 850 W	downstream of road crossing	654,329.20 x 4,602,702.01
5	Cochran Ditch	intersection with CR 425 S	downstream of bridge	648,469.84 x 4,604,824.42
6	Cochran Ditch	Intersection with CR 350 S	downstream of bridge	648,519.90 x 4,606,047.82

Macroinvertebrate Sampling Methods

Macroinvertebrate samples from each of the six sites were used to calculate an index of biotic integrity using methods established by the Environmental Protection Agency (EPA) and IDEM (Barbour et al., 1999 and IDEM, 1996). Aquatic macroinvertebrates are important indicators of environmental change. The insect community composition reflects water quality, and research shows that different macroinvertebrate orders and families react differently to pollution sources. Indices of biotic integrity are valuable because aquatic biota integrate cumulative effects of sediment and nutrient pollution (Ohio EPA, 1999).

Macroinvertebrates were collected during base flow conditions on June 19 and November 2, 2001 using the multihabitat approach detailed in the USEPA Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers, 2nd edition (Barbour et al., 1999). Kick nets were utilized to sample available habitat types. Greater than 100 organisms were obtained from each site and preserved in 70-80% alcohol. Kick nets were carefully examined and rinsed for any remaining organisms prior to leaving the site.In the laboratory the sample was evenly spread into a pan of 1,925 cm^2 in discreet 5 cm x 5 cm quadrats numbered 1-77 (IDEM, 1996). Organisms in random squares were counted and sorted.



Scale: 1" = 1.87 Miles

JFNA# 00-08-03

FIGURE 2. 2001 Macroinvertebrate Sampling Locations
Biological/Habitat Assessment Report
Big Turkey Lake Improvement Association
Lagrange, Steuben, Noble, and Dekalb Counties, Indiana

J.F. New & Associates
wetland consultants environmental engineers

Sorting continued until all organisms had been removed from the last quadrat necessary to obtain 100 organisms. Sorted organisms were identified to the family level, and IDEM datasheets were completed for each sampling event (Appendix A). The family-level approach was used: 1) to collect data comparable to that collected by IDEM in the state; 2) because it allows for increased organism identification accuracy; 3) because several studies support the adequacy of family-level analysis (Furse et al. 1984, Ferraro and Cole 1995, Marchant 1995, Bowman and Bailey 1997, Waite et al. 2000).

Macroinvertebrate data were used to calculate the Family-level Hilsenhoff Biotic Index (FBI). Calculation of the FBI involves applying assigned macroinvertebrate family tolerance values to all taxa present that have an assigned FBI tolerance value, multiplying the number of organisms present by their family tolerance value, summing the products, and dividing by the total number of organisms present (Hilsenhoff, 1988). Organisms of greater tolerance to organic pollution were assigned a greater value on a scale from 1 to 9; therefore, a higher value on the FBI scale indicates greater impairment (levels or organic pollution).

In addition to the FBI, macroinvertebrate results were analyzed using the IDEM mIBI (IDEM, 1996). mIBI scores allow comparison with data compiled by IDEM for wadeable riffle-pool streams in Indiana. Table 7 lists the ten scoring metrics with classification scores of 0-8. The mean of the ten metrics is the mIBI score. mIBI scores of 0-2 indicate the sampling site is severely impaired; scores of 2-4 indicate the site is moderately impaired, scores of 4-6 indicate the site is slightly impaired, and scores of 6-8 indicate that the site is not impaired. IDEM developed the classification criteria based on five years of wadeable riffle-pool data collected in Indiana. The data were lognormally distributed for each of the ten metrics. Each of the ten metric's lognormal distribution was then pentasected with scoring based on five categories using 1.5 times the interquartile range around the geometric mean. All ten of the metrics were used for the mIBI calculation in this study: family-level FBI, 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 total number of individuals to number of square sorted. (EPT stands for individuals of the Ephemeroptera, Plecoptera, and Trichoptera Orders.)

TABLE 7. Benthic macroinvertebrate scoring metrics and classification scores used by IDEM in evaluation of riffle-pool streams in Indiana.

	SCORING CRITERIA FOR THE FAMILY LEVEL MACROINVERTEBRATE INDEX OF BIOTIC INTEGRITY (mIBI) USING PENTASECTION AND CENTRAL TENDENCY ON THE LOGARITHMIC TRANSFORMED DATA DISTRIBUTIONS OF THE 1990-1995 RIFFLE KICK SAMPLES				
		CLASSIFICATION SCORE			
	0	**2**	**4**	**6**	**8**
Family Level FBI	5.63	5.62- 5.06	5.05-4.55	4.54-4.09	4.08
Number of Taxa	7	8-10	11-14	15-17	18
Number of Individuals	79	129-80	212-130	349-213	350
Percent Dominant Taxa	61.6	61.5-43.9	43.8-31.2	31.1-22.2	22.1
EPT Index	2	3	4-5	6-7	8
EPT Count	19	20-42	43-91	92-194	195
EPT Count To Total Number of Individuals	0.13	0.14-0.29	0.30-0.46	0.47-0.68	0.69
EPT Count To Chironomid Count	0.88	0.89-2.55	2.56-5.70	5.71-11.65	11.66
Chironomid Count	147	146-55	54-20	19-7	6
Total Number of Individuals To Number of Squares Sorted	29	30-71	72-171	172-409	410

Where 0-2 = Severely Impaired; 2-4 = Moderately Impaired; 4-6 = Slightly Impaired; 6-8 = Nonimpaired

Habitat Sampling Methods

During the spring sampling, physical habitat was evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989, 1995). The QHEI focuses on general habitat characteristics known to be important to successful fish survival and reproduction. Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrates, amount and quality of in-stream cover, channel morphology, extent and quality of riparian vegetation, pool, run, and riffle development and quality, and gradient are some of the metrics used to determine the QHEI score. Scores typically range from 20 to 100.

The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of stream segments in Ohio have indicated that values greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 typify habitat conditions that have the ability to support exceptional warmwater faunas (Ohio EPA, 1999).

RESULTS

Macroinvertebrates

mIBI scores for each sampling site are given in Tables 8 (June) and 9 (October). Detailed mIBI results and bench sheets are included in Appendix A. The mIBI scores ranged from 1.4 to 3.0. June scores for two of the sites indicate severe impairment, while the remaining four sites were classified as moderately impaired. Scores calculated for the November collection resulted in poorer ratings for Sites 2 and 3, while scores for the remaining sites either increased slightly (Sites 4 and 6) or remained the same (Sites 1 and 5).

TABLE 8. Classification scores and mIBI score for sampling sites in Mud Creek and Cochran Ditch as sampled in the spring of 2001 (19Jun01).

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
FBI	2	6	2	6	0	0
Number of Taxa (families)	2	4	2	2	0	4
Number of Individuals	2	2	2	2	2	2
% Dominant Taxa	4	4	2	2	4	8
EPT Index	2	2	4	2	4	2
EPT Count	0	0	2	2	0	0
EPT Count/Total Count	0	2	4	2	0	2
EPT Count/Chironomid Count	0	2	4	4	0	0
Chironomid Count	4	6	6	6	6	4
Total Count/Number Squares Sorted	0	0	0	0	0	0
mIBI Score	**1.6**	**2.8**	**2.8**	**2.8**	**1.6**	**2.2**

TABLE 9. Classification scores and mIBI score for sampling sites in Mud Creek and Cochran Ditch as sampled in fall of 2001 (02Nov01).

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
FBI	0	6	2	2	0	0
Number of Taxa (families)	0	0	0	4	2	4
Number of Individuals	2	2	2	2	2	2
% Dominant Taxa	6	2	2	4	0	0
EPT Index	0	0	0	4	4	6
EPT Count	0	0	0	0	0	0
EPT Count/Total Count	0	0	0	0	0	0
EPT Count/Chironomid Count	0	0	0	6	0	4
Chironomid Count	8	8	8	8	8	8
Total Count/Number Squares Sorted	0	0	0	0	0	0
mIBI Score	**1.6**	**1.8**	**1.4**	**3.0**	**1.6**	**2.4**

Table 10 presents the families collected during the spring and fall sampling events and their corresponding tolerance values. In general, organisms collected during both events have been assigned high tolerance values (larger numbers), and more tolerant individuals were collected than intolerant. The low number of individuals and low total number of individuals to number of squares sorted metrics lowered the mIBI scores. Additionally, relatively small numbers of

individuals belonging to the Ephemeroptera, Plecoptera, and Trichoptera orders were collected. Organisms belonging to these three orders are typically pollution intolerant and indicate conditions of higher quality.

TABLE 10. Macroinvertebrate families collected during the spring and fall sampling events and their corresponding tolerance values (IDEM, 1996). The smaller the value, the less pollution-tolerant the family is. NS indicates that the family has not been scored in available literature.

Spring	
Family	**Tolerance Value**
Ephemerellidae	1
Cordulegastridae	3
Hydropsychidae	1
Leptoceridae	4
Elmidae	4
Chironomidae	6
Simuliidae	6
Gammaridae	4
Talitridae	8
Helisoma	6
Sphaeriidae	8
Planorbidae	NS
Baetidae	4
Perlidae	1
Perlodidae	2
Hydrophilidae	NS
Physa	8
Amnicola	8
Hydroptilidae	4
Erpobdellidae	NS
Brachycentridae	1

Fall	
Family	**Tolerance Value**
Perlodidae	2
Hydropsychidae	4
Elmidae	4
Chironomidae	6
Chironomidae (Blood Red)	8
Tabanidae	6
Ephydridae	6
Gammaridae	4
Lymnaea	6
Amnicola	8
Physa	8
Planorbidae	NS
Oligochaeta	NS
Baetidae	4
Coenagrionidae	9
Haliplidae	NS
Taltridae	8
Sphaeriidae	8
Heptageniidae	4
Caenidae	7
Notenectidae	NS
Sialidae	4
Polycentropodidae	6
Hydrophilidae	NS

Habitat

QHEI scores are listed in Table 11 for each of the six sampling sites. (The QHEI was scored during the spring sampling only.) QHEI datasheets may be found in Appendix B. Sites 1 and 5 scored the lowest at 43, while Site 4 scored the highest at 65.75. All QHEI scores except that scored at Site 4 were lower than the minimum score of 60 found by the Ohio EPA to be conducive to aquatic life support in Ohio streams. In general, a lack of or very poor pool-riffle-run development lowered QHEI scores for reaches within the Big Turkey Lake Watershed.

TABLE 11. QHEI scores for sampling sites on Mud Creek and Cochran Ditch as sampled in spring of 2001 (19Jun01).

Site	Substrate Score	Cover Score	Channel Score	Riparian Score	Pool Score	Riffle Score	Gradient Score	Total Score
Maximum Possible Score	20	20	20	10	12	8	10	**100**
Site 1	13	9	7	6	0	0	8	**43**
Site 2	15	9	10	5.5	0	4	10	**53.5**
Site 3	16	14	10	5.5	0	5	8	**58.5**
Site 4	16	10	14	7.75	5	3	10	**65.75**
Site 5	7	15	6	7	0	0	8	**43**
Site 6	16	10	7	5	0	0	8	**46**

DISCUSSION

Macroinvertebrate, and Habitat Data

In general, macroinvertebrate communities were dominated by tolerant forms (Table 10). Delong and Brusven (1998) suggest that agricultural non-point source pollution results in a relatively homogeneous assemblage of insects capable of tolerating agricultural alteration. Far fewer organisms were collected per sample and per sampling grid than would be expected from a more healthy community (Tables 8 and 9 and Appendix A).

The relative impairment of Mud Creek and Cochran Ditch may be placed into context by comparing three of the mIBI metrics to data collected in Otter Creek in Vigo County, Indiana. Otter Creek has been suggested as a reference stream because it appears to have good water quality, contains a high quality fish and mussel fauna, and is in close proximity to people living in Terre Haute (Wente, 1995). Table 12 displays the results of the comparison. Three of the macroinvertebrate metrics calculated during this study for Mud Creek and Cochran Ditch are generally poor in comparison to the average of samples collected in Otter Creek in 1991 and 1994. Numbers of individuals belonging to the EPT orders are significantly lower in the two streams in the Turkey Creek Watershed. Even though Mud Creek contains relatively few families belonging to the EPT orders, chironomid numbers are also low giving the stream a better EPT/chironomid metric than either Cochran Ditch or Otter Creek. The FBI indices of both Mud Creek and Cochran Ditch are higher (poorer) than that of Otter Creek.

TABLE 12. Comparison of three mIBI metrics for Mud Creek, Cochran Ditch, and Otter Creek. Otter Creek was sampled by Wente of Lake Hart Research (Wente, 1995) as part of another LARE study in 1994 and by IDEM in 1991. Numbers represent averages of all available data.

Waterbody	EPT	EPT/Chiromonid	FBI
Mud Creek	3.25	2.13	5.13
Cochran Ditch	0.45	1.28	7.16
Otter Creek	40.72	1.58	4.72

June and November data was similar for most sites; however, scores calculated for Sites 2 and 3 dropped significantly from June to November by one and 1.4 points respectively. Although the exact reason from the decrease cannot be known with certainty, two possible reasons exist. First, the two sites are located in fairly small streams that are poorly buffered from agriculture in the immediate watershed. The immediate areas adjacent to Sites 2 and 3 had experienced disturbance due to crop harvest near the time of the November sample collection. Between the June and November site visits, an increase in sediment deposition was visible at Site 3. The stream at the other four sites was either ponded and flowing slowly due to proximity to Little Turkey Lake (Sites 5 and 6) or was buffered from agricultural areas by larger riparian zones (Sites 1 and 4). Secondly, due to relative lack of riparian buffer zones around Sites 2 and 3, the large rain events of October may have disproportionately affected the insect communities at the two locations. Because riparian buffer zones and filter strips encourage water infiltration, they slow velocity and decrease water delivery to stream channels. They also offer water filtration capabilities that can improve water quality in runoff. The lack of such zones in the vicinity of Sites 2 and 3 may have allowed runoff from the strong rainfall events of October to

disproportionately and adversely affect the macroinvertebrate communities living there. Additionally, non-existent or limited riparian zones decrease the amount of organic material reaching the stream. Food limitation may have negatively impacted shredder-type macroinvertebrates and interfered with the streams' food web.

Although poor water quality cannot be dismissed as a causative factor, Karr (1995) lists several other common causes of resource degradation: 1) altered supply of organic material for food and habitat from the riparian corridor; 2) sedimentation of substrate spaces causing a loss of habitat; 3) lack of coarse woody debris; 4) destruction of riparian vegetation and natural bank structure; 5) lack of deep pool areas; 6) altered abundance and distribution of pool-riffle-run complexes; 7) altered flow regime. These factors can also affect a stream's ability to support a healthy biological community including insects, shellfish, other invertebrates, amphibians, and fish.

Based on the habitat data, it is likely that Turkey Creek Watershed streams also suffered from many of the factors listed by Karr. Collectively, all six stream reaches received the lowest percentage of possible QHEI points in the pool, riffle, and channel morphology categories. Pool development was not noted for any reach except at Site 4. Riffles were only present at three of the six sites and were poorly developed at those sites. Channel morphology scores indicated that the streams suffer from low sinuosity, low stability, and other modifications like canopy removal and bank shaping.

SUMMARY AND RECOMMENDATIONS

In summary, according to Indiana Department of Environmental Management (IDEM) 305(b) report assessment criteria (IDEM, 2000), Mud Creek and Cochran Ditch are probably incapable at this time of supporting a "well-balanced, warm water aquatic community" (Indiana Administrative Code 2-1-3). Habitat quality (as scored using the QHEI) was also degraded and heavily influenced by agricultural drainage and maintenance activities. In fact, two of the three stream habitat characteristics found to be the most impaired (channel structure and pool presence) were also the most influential in explaining macroinvertebrate community integrity.

Due to the limited scope of this study, only general recommendations can be proposed at this time. These prioritizations are simply guidelines based on conditions documented during this study. These conditions may change as land use or other watershed-level factors change.

1. Implement planned Best Management Practices (BMPs) in locations throughout the watershed. Coordinate these projects with the county drainage boards to ensure that the project meets the goals of both the Soil and Water Conservation District (SWCD) and the drainage board. For example, a SWCD planting project in an area that is scheduled for drainage project de-brushing will not result in the optimum use of resources.
2. Continue the monitoring program as BMPs are installed in the watershed. Post-construction monitoring will be necessary in order to determine if watershed treatment is having a measurable impact on the stream biota.
3. Extend management to the watershed-level. Although streamside localized BMPs are important, research conducted in Wisconsin shows that the biotic community mostly responds to large-scale watershed influences rather than local riparian land use changes (Weigel et al., 2000). Examples of working at the watershed-level include coordinating with producers to implement nutrient, pesticide, tillage, and coordinated resource management plans. Large-scale reductions in agricultural non-point source pollutions are necessary for stream health improvement (Osmond and Gale, 1995).
4. Provide information about streams within the Big Turkey Lake Watershed to local landowners. Landowners will be more likely to conserve and protect the creeks if they understand their value. The outreach program could include pointers on how landowners themselves can help protect the waterways.

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ATTACHMENT A

DETAILED mIBI RESULTS
AND BENCH SHEETS

BIG TURKEY LAKE WATERSHED FEASIBILITY STUDY

TABLE A1. Mud Creek at SR 327 (Site 1) spring mIBI metrics.

		Metric Score
HBI	5.31	2
Number of Taxa (families)	10	2
Number of Individuals	100	2
% Dominant Taxa	36.9	4
EPT Index	3.6	2
EPT Count	5	0
EPT Count/Total Count	0.05	0
EPT Count/Chironomid Count	0.23	0
Chironomid Count	22	4
Total Count/Number Squares Sorted	14.7	0
mIBI Score		**1.6**

TABLE A2. Mud Creek at CR 800 W (Site 2) spring mIBI metrics.

		Metric Score
HBI	4.53	6
Number of Taxa (families)	11	4
Number of Individuals	103	2
% Dominant Taxa	40.8	4
EPT Index	3.4	2
EPT Count	15	0
EPT Count/Total Count	0.15	2
EPT Count/Chironomid Count	1.15	2
Chironomid Count	13	6
Total Count/Number Squares Sorted	9.4	0
mIBI Score		**2.8**

TABLE A3. Mud Creek at CR 400 S (Site 3) spring mIBI metrics.

		Metric Score
HBI	5.31	2
Number of Taxa (families)	9	2
Number of Individuals	119	2
% Dominant Taxa	56.3	2
EPT Index	4	4
EPT Count	36	2
EPT Count/Total Count	0.3	4
EPT Count/Chironomid Count	3.6	4
Chironomid Count	10	6
Total Count/Number Squares Sorted	23.8	0
mIBI Score		**2.8**

TABLE A4. Mud Creek at CR 850 W (Site 4) spring mIBI metrics.

		Metric Score
HBI	4.18	6
Number of Taxa (families)	10	2
Number of Individuals	124	2
% Dominant Taxa	52.4	2
EPT Index	3.25	2
EPT Count	24	2
EPT Count/Total Count	0.19	2
EPT Count/Chironomid Count	2.67	4
Chironomid Count	9	6
Total Count/Number Squares Sorted	20.67	0
mIBI Score		**2.8**

TABLE A5. Cochran Ditch at CR 425 S (Site 5) spring mIBI metrics.

		Metric Score
HBI	6.76	0
Number of Taxa (families)	7	0
Number of Individuals	104	2
% Dominant Taxa	33.7	4
EPT Index	4	4
EPT Count	1	0
EPT Count/Total Count	0.01	0
EPT Count/Chironomid Count	0.07	0
Chironomid Count	14	6
Total Count/Number Squares Sorted	4.95	0
mIBI Score		**1.6**

TABLE A6. Cochran Ditch at CR 350 S (Site 6) spring mIBI metrics.

		Metric Score
HBI	6.26	0
Number of Taxa (families)	11	4
Number of Individuals	101	2
% Dominant Taxa	20.8	8
EPT Index	3.47	2
EPT Count	17	0
EPT Count/Total Count	0.17	2
EPT Count/Chironomid Count	0.81	0
Chironomid Count	21	4
Total Count/Number Squares Sorted	5.1	0
mIBI Score		**2.2**

TABLE A7. Mud Creek at SR 327 (Site 1) fall mIBI metrics.

		Metric Score
HBI	6.68	0
Number of Taxa (families)	7	0
Number of Individuals	106	2
% Dominant Taxa	27	6
EPT Index	0	0
EPT Count	0	0
EPT Count/Total Count	0	0
EPT Count/Chironomid Count	0	0
Chironomid Count	0	8
Total Count/Number Squares Sorted	9.6	0
mIBI Score		**1.6**

TABLE A8. Mud Creek at CR 800 W (Site 2) fall mIBI metrics.

		Metric Score
HBI	4.43	6
Number of Taxa (families)	5	0
Number of Individuals	100	2
% Dominant Taxa	58	2
EPT Index	0	0
EPT Count	0	0
EPT Count/Total Count	0	0
EPT Count/Chironomid Count	0	0
Chironomid Count	4	8
Total Count/Number Squares Sorted	4	0
mIBI Score		**1.8**

TABLE A9. Mud Creek at CR 400 S (Site 3) fall mIBI metrics.

		Metric Score
HBI	5.14	2
Number of Taxa (families)	6	0
Number of Individuals	107	2
% Dominant Taxa	52	2
EPT Index	0	0
EPT Count	0	0
EPT Count/Total Count	0	0
EPT Count/Chironomid Count	0	0
Chironomid Count	0	8
Total Count/Number Squares Sorted	4.28	0
mIBI Score		**1.4**

TABLE A10. Mud Creek at CR 850 W (Site 4) fall mIBI metrics.

		Metric Score
HBI	5.23	2
Number of Taxa (families)	14	4
Number of Individuals	100	2
% Dominant Taxa	34	4
EPT Index	3.56	4
EPT Count	9	0
EPT Count/Total Count	0.09	0
EPT Count/Chironomid Count	9	0
Chironomid Count	1	8
Total Count/Number Squares Sorted	5.56	0
mIBI Score		**3.0**

TABLE A11. Cochran Ditch at CR 425 S (Site 5) fall mIBI metrics.

		Metric Score
HBI	7.65	0
Number of Taxa (families)	12	4
Number of Individuals	102	2
% Dominant Taxa	73	0
EPT Index	5.75	6
EPT Count	8	0
EPT Count/Total Count	0.08	0
EPT Count/Chironomid Count	4	4
Chironomid Count	2	8
Total Count/Number Squares Sorted	6.38	0
mIBI Score		**2.4**

TABLE A12. Cochran Ditch at CR 350 S (Site 6) fall mIBI metrics.

		Metric Score
HBI	7.95	0
Number of Taxa (families)	8	2
Number of Individuals	106	2
% Dominant Taxa	89	0
EPT Index	4	4
EPT Count	1	0
EPT Count/Total Count	0.9	0
EPT Count/Chironomid Count	0.25	0
Chironomid Count	4	8
Total Count/Number Squares Sorted	11.8	0
mIBI Score		**1.6**

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 1 ____ SITE: Mud Creek at SR 327 COUNTY: Steuben CREW CHIEF:
LOCATION: upstream of bridge HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19 Jun 01
ECOREGION: IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

PLECOPTERA
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) 1 CHLOROPERLIDAE (1) ____

HEMIPTERA
MACROVELIIDAE () ____ VELIIDAE () ____ GERRIDAE () ____ BELOSTOMATIDAE () ____ NEPIDAE () ____ CORIXIDAE () ____
NOTONECTIDAE () ____ PLEIDAE () ____ SALDIDAE () ____ HEBRIDAE () ____ NAUCORIDAE () ____ MESOVELIIDAE () ____

MEGALOPTERA SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE () ____

TRICHOPTERA
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) 2
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) 2

LEPIDOPTERA PYRALIDAE (5) ____ NOCTUIDAE () ____

COLEOPTERA
GYRINIDAE() ____ HALIPLIDAE() ____ DYTISCIDAE() ____ HYDROPHILIDAE() 2 PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) ____
SCIRTIDAE () ____ STAPHYLINIDAE () ____ CHRYSOMELIDAE () ____ CURCULIONIDAE () ____ HYDRAENIDAE () ____

DIPTERA
BLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) ____ ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) 22 SYRPHIDAE (10) ____ EPHYDRIDAE (6) ____ MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) 11 CHAOBORIDAE () ____

COLLEMBOLA ISOTOMIDAE () ____ PODURIDAE () ____ SMINTHURIDAE () ____ ENTOMOBRYIDAE () ____

OTHER ARTHROPODA
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) 38 TALITRIDAE (8) ____ ASTACIDAE (6) ____

MOLLUSCA
GASTROPODA FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) ____ AMNICOLA (8) 9 PLEUROCERIDAE () ____ VIVIPARIDAE () ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) 1 PLANORBIDAE () 12 HYDROBIIDAE () ____ ANCYLIDAE () ____
PELECYPODA SPHAERIIDAE (8) ____ CORBICULA () ____ DRIESSENIA () ____

PLATYHELMINTHES TURBELLARIA (4) ____ ANNELIDA () ____ OLIGOCHAETA () ____ TUBIFICIDAE () ____ NAIDIDAE () ____
HIRUDINEA () ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA () ____ ERPOBDELLIDAE () ____ NEMATODA () ____

NUMBER OF VIALS FORWARDED: 12 PRELIMINARY NUMBER OF TAXA: 12 NUMBER OF INDIVIDUALS: 103
HBI: 5.21 EPT COUNT: 5 EPT ABUN./CHIR. ABUN.: 0.23 CHIRONOMID COUNT: 22
% DOMINANT TAXON: 36.9% EPT INDEX: 3.6 EPT/TOTAL COUNT: 0.05
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 6/26/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: 1 ____ SITE: Mud Creek at COUNTY: Steuben CREW CHIEF:
LOCATION: upstream of SR 327 HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: bridge IASNRI: SORTER: SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

PLECOPTERA
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) ____ CHLOROPERLIDAE (1) ____

HEMIPTERA
MACROVELIIDAE () ____ VELIIDAE () ____ GERRIDAE () ____ BELOSTOMATIDAE () ____ NEPIDAE () ____ CORIXIDAE () ____
NOTONECTIDAE () ____ PLEIDAE () ____ SALDIDAE () ____ HEBRIDAE () ____ NAUCORIDAE () ____ MESOVELIIDAE () ____

MEGALOPTERA SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE () ____

TRICHOPTERA
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) ____
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) ____

LEPIDOPTERA PYRALIDAE (5) ____ NOCTUIDAE () ____

COLEOPTERA
GYRINIDAE() ____ HALIPLIDAE() ____ DYTISCIDAE() ____ HYDROPHILIDAE() ____ PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) ____
SCIRTIDAE () ____ STAPHYLINIDAE () ____ CHRYSOMELIDAE () ____ CURCULIONIDAE () ____ HYDRAENIDAE () ____

DIPTERA
BLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) ____ ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) ____ SYRPHIDAE (10) ____ EPHYDRIDAE (6) ____ MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) ____ CHAOBORIDAE () ____

COLLEMBOLA ISOTOMIDAE () ____ PODURIDAE () ____ SMINTHURIDAE () ____ ENTOMOBRYIDAE () ____

OTHER ARTHROPODA
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) 18 TALITRIDAE (8) ____ ASTACIDAE (6) ____

MOLLUSCA
GASTROPODA FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) 3 AMNICOLA (8) 29 PLEUROCERIDAE () ____ VIVIPARIDAE () ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) 2 PLANORBIDAE () 24 HYDROBIIDAE () ____ ANCYLIDAE () ____
PELECYPODA SPHAERIIDAE (8) 7 CORBICULA () ____ DRIESSENIA () ____

PLATYHELMINTHES TURBELLARIA (4) ____ ANNELIDA () ____ OLIGOCHAETA () ____ TUBIFICIDAE () ____ NAIDIDAE () ____
HIRUDINEA () ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA () ____ ERPOBDELLIDAE () ____ NEMATODA () ____

NUMBER OF VIALS FORWARDED: 7 PRELIMINARY NUMBER OF TAXA: 7 NUMBER OF INDIVIDUALS: 106
HBI: 6.68 EPT COUNT: 0 EPT ABUN./CHIR. ABUN.: 0 CHIRONOMID COUNT: 0
% DOMINANT TAXON: 27 EPT INDEX: 0 EPT/TOTAL COUNT: 0
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/5/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 2 ___ SITE: Mud Creek at 800 W COUNTY: Steuben CREW CHIEF:
LOCATION: upstream of road crossing HYDROLOGIC UNIT: 04050001-110 DATE OF COLLECTION: 19 Jun 01
ECOREGION: IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) 3 TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) 1 GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

PLECOPTERA
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

HEMIPTERA
MACROVELIIDAE () ___ VELIIDAE () ___ GERRIDAE () ___ BELOSTOMATIDAE () ___ NEPIDAE () ___ CORIXIDAE () ___
NOTONECTIDAE () ___ PLEIDAE () ___ SALDIDAE () ___ HEBRIDAE () ___ NAUCORIDAE () ___ MESOVELIIDAE () ___

MEGALOPTERA SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE () ___

TRICHOPTERA
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) 1
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) 11

LEPIDOPTERA PYRALIDAE (5) ___ NOCTUIDAE () ___

COLEOPTERA
GYRINIDAE() ___ HALIPLIDAE() ___ DYTISCIDAE() ___ HYDROPHILIDAE() ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 13
SCIRTIDAE () ___ STAPHYLINIDAE () ___ CHRYSOMELIDAE () ___ CURCULIONIDAE () ___ HYDRAENIDAE () ___

DIPTERA
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) ___ CHIRONOMIDAE(all other)(6) 13 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) 15 CHAOBORIDAE () ___

COLLEMBOLA ISOTOMIDAE () ___ PODURIDAE () ___ SMINTHURIDAE () ___ ENTOMOBRYIDAE () ___

OTHER ARTHROPODA
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) 42 TALITRIDAE (8) ___ ASTACIDAE (6) ___

MOLLUSCA
GASTROPODA FERRISSIA (6) ___ HELISOMA (6) 1 LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE () ___ VIVIPARIDAE () ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE () ___ HYDROBIIDAE () ___ ANCYLIDAE () ___
PELECYPODA SPHAERIIDAE (8) 1 CORBICULA () ___ DRIESSENIA () ___

PLATYHELMINTHES TURBELLARIA (4) ___ ANNELIDA () ___ OLIGOCHAETA () ___ TUBIFICIDAE () ___ NAIDIDAE () ___
HIRUDINEA () ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA () ___ ERPOBDELLIDAE () ___ NEMATODA () ___

NUMBER OF VIALS FORWARDED: 11 PRELIMINARY NUMBER OF TAXA: 12 NUMBER OF INDIVIDUALS: 103
HBI: 4.51 EPT COUNT: 15 EPT ABUN./CHIR. ABUN.: 1.15 CHIRONOMID COUNT: 13
% DOMINANT TAXON: 40.8% EPT INDEX: 3.4 EPT/TOTAL COUNT: 0.15
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 2 Jul 01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: 2 SITE: Mud Creek at CR 800 W. COUNTY: Steuben CREW CHIEF:
LOCATION: upstream of road crossing HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASAQI: SORTER: SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

PLECOPTERA
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) ____ CHLOROPERLIDAE (1) ____

HEMIPTERA
MACROVELIIDAE () ____ VELIIDAE () ____ GERRIDAE () ____ BELOSTOMATIDAE () ____ NEPIDAE () ____ CORIXIDAE () ____
NOTONECTIDAE () ____ PLEIDAE () ____ SALDIDAE () ____ HEBRIDAE () ____ NAUCORIDAE () ____ MESOVELIIDAE () ____

MEGALOPTERA SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE () ____

TRICHOPTERA
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) ____
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) ____

LEPIDOPTERA PYRALIDAE (5) ____ NOCTUIDAE () ____

COLEOPTERA
GYRINIDAE() ____ HALIPLIDAE() ____ DYTISCIDAE() ____ HYDROPHILIDAE() ____ PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) 14
SCIRTIDAE () ____ STAPHYLINIDAE () ____ CHRYSOMELIDAE () ____ CURCULIONIDAE () ____ HYDRAENIDAE () ____

DIPTERA
BLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) ____ ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) 4 SYRPHIDAE (10) ____ EPHYDRIDAE (6) ____ MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) ____ CHAOBORIDAE () ____

COLLEMBOLA ISOTOMIDAE () ____ PODURIDAE () ____ SMINTHURIDAE () ____ ENTOMOBRYIDAE () ____

OTHER ARTHROPODA
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) 58 TALITRIDAE (8) ____ ASTACIDAE (6) ____

MOLLUSCA
GASTROPODA FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) ____ AMNICOLA (8) ____ PLEUROCERIDAE () ____ VIVIPARIDAE () ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) ____ PLANORBIDAE () ____ HYDROBIIDAE () ____ ANCYLIDAE () ____
PELECYPODA SPHAERIIDAE (8) 7 CORBICULA () ____ DRIESSENIA () ____

PLATYHELMINTHES TURBELLARIA (4) ____ ANNELIDA () ____ OLIGOCHAETA () 17 TUBIFICIDAE () ____ NAIDIDAE () ____
HIRUDINEA () ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA () ____ ERPOBDELLIDAE () ____ NEMATODA () ____

NUMBER OF VIALS FORWARDED: 5 PRELIMINARY NUMBER OF TAXA: 5 NUMBER OF INDIVIDUALS: 100
HBI: 4.43 EPT COUNT: 0 EPT ABUN./CHIR. ABUN.: 0 CHIRONOMID COUNT: 4
% DOMINANT TAXON: 58 EPT INDEX: 0 EPT/TOTAL COUNT: 0
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/5/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 3 ____ SITE: Mud Creek at 400 S COUNTY: Steuben CREW CHIEF:
LOCATION: downstream of road crossing HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19Jun01
ECOREGION: IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

PLECOPTERA
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) ____ CHLOROPERLIDAE (1) ____

HEMIPTERA
MACROVELIIDAE () ____ VELIIDAE () ____ GERRIDAE () ____ BELOSTOMATIDAE () ____ NEPIDAE () ____ CORIXIDAE () ____
NOTONECTIDAE () ____ PLEIDAE () ____ SALDIDAE () ____ HEBRIDAE () ____ NAUCORIDAE () ____ MESOVELIIDAE () ____

MEGALOPTERA SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE () ____

TRICHOPTERA
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) 33
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) 1 PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) 2

LEPIDOPTERA PYRALIDAE (5) ____ NOCTUIDAE () ____

COLEOPTERA
GYRINIDAE() ____ HALIPLIDAE() ____ DYTISCIDAE() ____ HYDROPHILIDAE() 1 PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) 1
SCIRTIDAE () ____ STAPHYLINIDAE () ____ CHRYSOMELIDAE () ____ CURCULIONIDAE () ____ HYDRAENIDAE () ____

DIPTERA
BLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) ____ ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) 10 SYRPHIDAE (10) ____ EPHYDRIDAE (6) ____ MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) 67 CHAOBORIDAE () ____

COLLEMBOLA ISOTOMIDAE () ____ PODURIDAE () ____ SMINTHURIDAE () ____ ENTOMOBRYIDAE () ____

OTHER ARTHROPODA
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) 3 TALITRIDAE (8) ____ ASTACIDAE (6) ____

MOLLUSCA
GASTROPODA FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) ____ AMNICOLA (8) ____ PLEUROCERIDAE () ____ VIVIPARIDAE () ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) ____ PLANORBIDAE () ____ HYDROBIIDAE () ____ ANCYLIDAE () ____
PELECYPODA SPHAERIIDAE (8) ____ CORBICULA () ____ DRIESSENIA () ____

PLATYHELMINTHES TURBELLARIA (4) ____ ANNELIDA () ____ OLIGOCHAETA () ____ TUBIFICIDAE () ____ NAIDIDAE () ____
HIRUDINEA () ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA () ____ ERPOBDELLIDAE () 1 NEMATODA () ____

NUMBER OF VIALS FORWARDED: 8 PRELIMINARY NUMBER OF TAXA: 9 NUMBER OF INDIVIDUALS: 119
HBI: 5.31 EPT COUNT: 36 EPT ABUN./CHIR. ABUN.: 3.6 CHIRONOMID COUNT: 10
% DOMINANT TAXON: 56.3% EPT INDEX: 4 EPT/TOTAL COUNT: 0.30
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 7/2/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: 3 ____ SITE: Mud Creek at COUNTY: Steuben CREW CHIEF:
LOCATION: downstream of road crossing CR 400S. HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASNRI: SORTER: SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

PLECOPTERA
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) ____ CHLOROPERLIDAE (1) ____

HEMIPTERA
MACROVELIIDAE () ____ VELIIDAE () ____ GERRIDAE () ____ BELOSTOMATIDAE () ____ NEPIDAE () ____ CORIXIDAE () ____
NOTONECTIDAE () ____ PLEIDAE () ____ SALDIDAE () ____ HEBRIDAE () ____ NAUCORIDAE () ____ MESOVELIIDAE () ____

MEGALOPTERA SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE () ____

TRICHOPTERA
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) ____
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) ____

LEPIDOPTERA PYRALIDAE (5) ____ NOCTUIDAE () ____

COLEOPTERA
GYRINIDAE() ____ HALIPLIDAE() ____ DYTISCIDAE() ____ HYDROPHILIDAE() 1 PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) 13
SCIRTIDAE () ____ STAPHYLINIDAE () ____ CHRYSOMELIDAE () ____ CURCULIONIDAE () ____ HYDRAENIDAE () ____

DIPTERA
BLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) ____ ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) ____ SYRPHIDAE (10) ____ EPHYDRIDAE (6) ____ MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) ____ CHAOBORIDAE () ____

COLLEMBOLA ISOTOMIDAE () ____ PODURIDAE () ____ SMINTHURIDAE () ____ ENTOMOBRYIDAE () ____

OTHER ARTHROPODA
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) 17 TALITRIDAE (8) ____ ASTACIDAE (6) ____

MOLLUSCA
GASTROPODA FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) ____ AMNICOLA (8) ____ PLEUROCERIDAE () ____ VIVIPARIDAE () ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) ____ PLANORBIDAE () 12 HYDROBIIDAE () ____ ANCYLIDAE () ____
PELECYPODA SPHAERIIDAE (8) 12 CORBICULA () ____ DRIESSENIA () ____

PLATYHELMINTHES TURBELLARIA (4) ____ ANNELIDA () ____ OLIGOCHAETA () 52 TUBIFICIDAE () ____ NAIDIDAE () ____
HIRUDINEA () ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA () ____ ERPOBDELLIDAE () ____ NEMATODA () ____

NUMBER OF VIALS FORWARDED: 6 PRELIMINARY NUMBER OF TAXA: 6 NUMBER OF INDIVIDUALS: 107
HBI: 5.14 EPT COUNT: 0 EPT ABUN./CHIR. ABUN.: 0 CHIRONOMID COUNT: 0
% DOMINANT TAXON: 52% EPT INDEX: 0 EPT/TOTAL COUNT: 0
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/5/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 4 ___ SITE: Mud Creek at 850 W COUNTY: Steuben CREW CHIEF:
LOCATION: downstream of road crossing HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19 Jun 2001
ECOREGION: IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) 2 BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) 5 TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

PLECOPTERA
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) 1 PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

HEMIPTERA
MACROVELIIDAE ( ) ___ VELIIDAE ( ) ___ GERRIDAE ( ) ___ BELOSTOMATIDAE ( ) ___ NEPIDAE ( ) ___ CORIXIDAE ( ) ___
NOTONECTIDAE ( ) ___ PLEIDAE ( ) ___ SALDIDAE ( ) ___ HEBRIDAE ( ) ___ NAUCORIDAE ( ) ___ MESOVELIIDAE ( ) ___

MEGALOPTERA SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE ( ) ___

TRICHOPTERA
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) 15
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) 1

LEPIDOPTERA PYRALIDAE (5) ___ NOCTUIDAE ( ) ___

COLEOPTERA
GYRINIDAE( ) ___ HALIPLIDAE( ) ___ DYTISCIDAE( ) ___ HYDROPHILIDAE( ) ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 15
SCIRTIDAE ( ) ___ STAPHYLINIDAE ( ) ___ CHRYSOMELIDAE ( ) ___ CURCULIONIDAE ( ) ___ HYDRAENIDAE ( ) ___

DIPTERA
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) ___ CHIRONOMIDAE(all other)(6) 9 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) 9 CHAOBORIDAE ( ) ___

COLLEMBOLA ISOTOMIDAE ( ) ___ PODURIDAE ( ) ___ SMINTHURIDAE ( ) ___ ENTOMOBRYIDAE ( ) ___

OTHER ARTHROPODA
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) 65 TALITRIDAE (8) ___ ASTACIDAE (6) ___

MOLLUSCA
GASTROPODA FERRISSIA (6) ___ HELISOMA (6) 2 LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE ( ) ___ VIVIPARIDAE ( ) ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE ( ) ___ HYDROBIIDAE ( ) ___ ANCYLIDAE ( ) ___
PELECYPODA SPHAERIIDAE (8) ___ CORBICULA ( ) ___ DRIESSENIA ( ) ___

PLATYHELMINTHES TURBELLARIA (4) ___ ANNELIDA ( ) ___ OLIGOCHAETA ( ) ___ TUBIFICIDAE ( ) ___ NAIDIDAE ( ) ___
HIRUDINEA ( ) ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA ( ) ___ ERPOBDELLIDAE ( ) ___ NEMATODA ( ) ___

NUMBER OF VIALS FORWARDED: 11 PRELIMINARY NUMBER OF TAXA: 11 NUMBER OF INDIVIDUALS: 125
HBI: 4.29 EPT COUNT: 24 EPT ABUN./CHIR. ABUN.: 2.67 CHIRONOMID COUNT: 9
% DOMINANT TAXON: 52% EPT INDEX: 3.25 EPT/TOTAL COUNT: 0.19
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 6/25/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
CWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: 4 ____ SITE: Mud Creek at COUNTY: Steuben CREW CHIEF:
LOCATION: downstream of road crossing CR 850 W HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASNRI: SORTER: SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) ____
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

ODONATA ZYGOPTERA
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

PLECOPTERA
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) 2 CHLOROPERLIDAE (1) ____

HEMIPTERA
MACROVELIIDAE () ____ VELIIDAE () ____ GERRIDAE () ____ BELOSTOMATIDAE () ____ NEPIDAE () ____ CORIXIDAE () ____
NOTONECTIDAE () ____ PLEIDAE () ____ SALDIDAE () ____ HEBRIDAE () ____ NAUCORIDAE () ____ MESOVELIIDAE () ____

MEGALOPTERA SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE () ____

TRICHOPTERA
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) 7
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) ____ LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) ____

LEPIDOPTERA PYRALIDAE (5) ____ NOCTUIDAE () ____

COLEOPTERA
GYRINIDAE() ____ HALIPLIDAE() ____ DYTISCIDAE() ____ HYDROPHILIDAE() ____ PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) 14
SCIRTIDAE () ____ STAPHYLINIDAE () ____ CHRYSOMELIDAE () ____ CURCULIONIDAE () ____ HYDRAENIDAE () ____

DIPTERA
SLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) 2 ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) 1 SYRPHIDAE (10) ____ EPHYDRIDAE (6) 1 MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) ____ CHAOBORIDAE () ____

COLLEMBOLA ISOTOMIDAE () ____ PODURIDAE () ____ SMINTHURIDAE () ____ ENTOMOBRYIDAE () ____

OTHER ARTHROPODA
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) 34 TALITRIDAE (8) ____ ASTACIDAE (6) ____

MOLLUSCA
GASTROPODA FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) 2 AMNICOLA (6) 8 PLEUROCERIDAE () ____ VIVIPARIDAE () ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) 1 PLANORBIDAE () 5 HYDROBIIDAE () ____ ANCYLIDAE () ____
PELECYPODA SPHAERIIDAE (8) ____ CORBICULA () ____ DREISSENIA () ____

PLATYHELMINTHES TURBELLARIA (4) ____ ANNELIDA () ____ OLIGOCHAETA () 5 TUBIFICIDAE () ____ NAIDIDAE () ____
HIRUDINEA () ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA () ____ ERPOBDELLIDAE () ____ NEMATODA () ____

NUMBER OF VIALS FORWARDED: 14 PRELIMINARY NUMBER OF TAXA: 14 NUMBER OF INDIVIDUALS: 100
HBI: 5.23 EPT COUNT: 9 EPT ABUN./CHIR. ABUN.: 9 CHIRONOMID COUNT: 1
% DOMINANT TAXON: 34 EPT INDEX: 3.56 EPT/TOTAL COUNT: 0.09
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/5/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 5 ___ SITE: Cochran Ditch at 425 S COUNTY: LaGrange CREW CHIEF:
LOCATION: downstream of bridge HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19Jun01
ECOREGION: IASNRI: SORTER: LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

PLECOPTERA
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

HEMIPTERA
MACROVELIIDAE () ___ VELIIDAE () ___ GERRIDAE () ___ BELOSTOMATIDAE () ___ NEPIDAE () ___ CORIXIDAE () ___
NOTONECTIDAE () ___ PLEIDAE () ___ SALDIDAE () ___ HEBRIDAE () ___ NAUCORIDAE () ___ MESOVELIIDAE () ___

MEGALOPTERA SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE () ___

TRICHOPTERA
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) 1
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) ___

LEPIDOPTERA PYRALIDAE (5) ___ NOCTUIDAE () ___

COLEOPTERA
GYRINIDAE() ___ HALIPLIDAE() ___ DYTISCIDAE() ___ HYDROPHILIDAE() ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 5
SCIRTIDAE () ___ STAPHYLINIDAE () ___ CHRYSOMELIDAE () ___ CURCULIONIDAE () ___ HYDRAENIDAE () ___

DIPTERA
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) ___ CHIRONOMIDAE(all other)(6) 14 SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE () ___

COLLEMBOLA ISOTOMIDAE () ___ PODURIDAE () ___ SMINTHURIDAE () ___ ENTOMOBRYIDAE () ___

OTHER ARTHROPODA
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) ___ TALITRIDAE (8) ___ ASTACIDAE (6) ___

MOLLUSCA
GASTROPODA FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (8) ___ PLEUROCERIDAE () ___ VIVIPARIDAE () ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (6) 7 PLANORBIDAE () 27 HYDROBIIDAE () ___ ANCYLIDAE () ___
PELECYPODA SPHAERIIDAE (8) 15 CORBICULA () ___ DRIESSENIA () ___

PLATYHELMINTHES TURBELLARIA (4) ___ ANNELIDA () ___ OLIGOCHAETA () ___ TUBIFICIDAE () ___ NAIDIDAE () ___
HIRUDINEA () ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA () ___ ERPOBDELLIDAE () ___ NEMATODA () ___

NUMBER OF VIALS FORWARDED: 7 PRELIMINARY NUMBER OF TAXA: 7 NUMBER OF INDIVIDUALS: 104
HBI: 6.76 EPT COUNT: 1 EPT ABUN./CHIR. ABUN.: 0.07 CHIRONOMID COUNT: 14
% DOMINANT TAXON: 33.7% EPT INDEX: 4 EPT/TOTAL COUNT: 0.01
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 7/2/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
CWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: 5 ___ SITE: Cochran Ditch e COUNTY: CREW CHIEF:
LOCATION: downstream of bridge CR 425S. HYDROLOGIC UNIT: 0405000110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASNRI: SORTER: SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) 1 BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) ___
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) ___ OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) 1

PLECOPTERA
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

HEMIPTERA
MACROVELIIDAE () ___ VELIIDAE () ___ GERRIDAE () ___ BELOSTOMATIDAE () ___ NEPIDAE () ___ CORIXIDAE () ___
NOTONECTIDAE () ___ PLEIDAE () ___ SALDIDAE () ___ HEBRIDAE () ___ NAUCORIDAE () ___ MESOVELIIDAE () ___

MEGALOPTERA SIALIDAE (4) ___ CORYDALIDAE (1) ___ SISYRIDAE () ___

TRICHOPTERA
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) ___ HYDROPSYCHIDAE (4) ___
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) ___

LEPIDOPTERA PYRALIDAE (5) ___ NOCTUIDAE () ___

COLEOPTERA
GYRINIDAE() ___ HALIPLIDAE() 1 DYTISCIDAE() ___ HYDROPHILIDAE() ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) ___
SCIRTIDAE () ___ STAPHYLINIDAE () ___ CHRYSOMELIDAE () ___ CURCULIONIDAE () ___ HYDRAENIDAE () ___

DIPTERA
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) 1 ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) 4 CHIRONOMIDAE(all other)(6) ___ SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE () ___

COLLEMBOLA ISOTOMIDAE () ___ PODURIDAE () ___ SMINTHURIDAE () ___ ENTOMOBRYIDAE () ___

OTHER ARTHROPODA
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) ___ TALITRIDAE (8) 94 ASTACIDAE (6) ___

MOLLUSCA
GASTROPODA FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) ___ AMNICOLA (6) ___ PLEUROCERIDAE () ___ VIVIPARIDAE () ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE () ___ HYDROBIIDAE () ___ ANCYLIDAE () ___
PELECYPODA SPHAERIIDAE (8) 3 CORBICULA () ___ DREISSENIA () ___

PLATYHELMINTHES TURBELLARIA (4) ___ ANNELIDA () ___ OLIGOCHAETA () ___ TUBIFICIDAE () ___ NAIDIDAE () ___
HIRUDINEA () ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA () ___ ERPOBDELLIDAE () ___ NEMATODA () ___

NUMBER OF VIALS FORWARDED: 8 PRELIMINARY NUMBER OF TAXA: 8 NUMBER OF INDIVIDUALS: 106
HBI: 7.95 EPT COUNT: 1 EPT ABUN./CHIR. ABUN.: 0.25 CHIRONOMID COUNT: 4
% DOMINANT TAXON: 89 EPT INDEX: 4 EPT/TOTAL COUNT: 0.9
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/6/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: Site 6 SITE: Cochran Ditch at 350S COUNTY: LaGrange CREW CHIEF:
LOCATION: downstream of bridge HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 19 Jun 2001
ECOREGION: IASNRI: SORTER: CS, SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ____ METRETOPODIDAE (2) ____ BAETIDAE (4) ____ BAETISCIDAE (3) ____ HEPTAGENIIDAE (4) 7
EPHEMERELLIDAE (1) ____ TRICORYTHIDAE (4) ____ CAENIDAE (7) ____ OLIGONEURIIDAE (2) ____ LEPTOPHLEBIIDAE (2) ____
POTAMANTHIDAE (4) ____ EPHEMERIDAE (4) ____ POLYMITARCYIDAE (2) ____

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ____ GOMPHIDAE (1) ____ AESHNIDAE (3) ____ MACROMIIDAE (3) ____ CORDULIIDAE (3) ____
LIBELLULIDAE (9) ____ CALOPTERYGIDAE (5) ____ LESTIDAE (9) ____ COENAGRIONIDAE (9) ____

PLECOPTERA
PTERONARCYIDAE (0) ____ TAENIOPTERYGIDAE (2) ____ NEMOURIDAE (2) ____ LEUCTRIDAE (0) ____ CAPNIIDAE (1) ____
PERLIDAE (1) ____ PERLODIDAE (2) ____ CHLOROPERLIDAE (1) ____

HEMIPTERA
MACROVELIIDAE () ____ VELIIDAE () ____ GERRIDAE () ____ BELOSTOMATIDAE () ____ NEPIDAE () ____ CORIXIDAE () ____
NOTONECTIDAE () ____ PLEIDAE () ____ SALDIDAE () ____ HEBRIDAE () ____ NAUCORIDAE () ____ MESOVELIIDAE () ____

MEGALOPTERA SIALIDAE (4) ____ CORYDALIDAE (1) ____ SISYRIDAE () ____

TRICHOPTERA
PHILOPOTAMIDAE (3) ____ PSYCHOMYIIDAE (2) ____ POLYCENTROPODIDAE (6) ____ HYDROPSYCHIDAE (4) 4
RHYACOPHILIDAE (0) ____ GLOSSOSOMATIDAE (0) ____ HYDROPTILIDAE (4) ____ PHRYGANEIDAE (4) ____
BRACHYCENTRIDAE (1) 3 LEPIDOSTOMATIDAE (1) ____ HELICOPSYCHIDAE (3) ____ SERICOSTOMATIDAE (3) ____
ODONTOCERIDAE (0) ____ MOLANNIDAE (6) ____ LIMNEPHILIDAE (4) ____ LEPTOCERIDAE (4) 3

LEPIDOPTERA PYRALIDAE (5) ____ NOCTUIDAE () ____

COLEOPTERA
GYRINIDAE() ____ HALIPLIDAE() ____ DYTISCIDAE() ____ HYDROPHILIDAE() ____ PSEPHENIDAE (4) ____ DRYOPIDAE(5) ____ ELMIDAE(4) 4
SCIRTIDAE () ____ STAPHYLINIDAE () ____ CHRYSOMELIDAE () ____ CURCULIONIDAE () ____ HYDRAENIDAE () ____

DIPTERA
BLEPHARICERIDAE (0) ____ TIPULIDAE (3) ____ PSYCHODIDAE (10) ____ TABANIDAE (6) ____ ATHERICIDAE (2) ____
CHIRONOMIDAE(blood red)(8) ____ CHIRONOMIDAE(all other)(6) 21 SYRPHIDAE (10) ____ EPHYDRIDAE (6) ____ MUSCIDAE (6) ____
DOLICHOPODIDAE (4) ____ EMPIDIDAE (6) ____ CERATOPOGONIDAE (6) ____ SIMULIIDAE (6) ____ CHAOBORIDAE () ____

COLLEMBOLA ISOTOMIDAE () ____ PODURIDAE () ____ SMINTHURIDAE () ____ ENTOMOBRYIDAE () ____

OTHER ARTHROPODA
ACARI (4) ____ ASELLIDAE (8) ____ GAMMARIDAE (4) ____ TALITRIDAE (8) 18 ASTACIDAE (6) ____

MOLLUSCA
GASTROPODA FERRISSIA (6) ____ HELISOMA (6) ____ LYMNAEA (6) ____ AMNICOLA (8) 10 PLEUROCERIDAE () ____ VIVIPARIDAE () ____
BITHYNIA (8) ____ GYRAULUS (8) ____ PHYSA (8) ____ PLANORBIDAE () 17 HYDROBIIDAE () ____ ANCYLIDAE () ____
PELECYPODA SPHAERIIDAE (8) 8 CORBICULA () ____ DRIESSENIA () ____

PLATYHELMINTHES TURBELLARIA (4) ____ ANNELIDA () ____ OLIGOCHAETA () ____ TUBIFICIDAE () ____ NAIDIDAE () ____
HIRUDINEA () ____ HELOBDELLA (10) ____ BRANCHIOBDELLIDA () ____ ERPOBDELLIDAE () ____ NEMATODA () ____

NUMBER OF VIALS FORWARDED: 11 PRELIMINARY NUMBER OF TAXA: 11 NUMBER OF INDIVIDUALS: 101
HBI: 6.26 EPT COUNT: 17 EPT ABUN./CHIR. ABUN.: 0.81 CHIRONOMID COUNT: 21
% DOMINANT TAXON: 20.8 EPT INDEX: 3.47 EPT/TOTAL COUNT: 0.17
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 6/26/01 COUNTS & CALCULATION CHECK: SZ CS

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
CWM - BIOLOGICAL STUDIES
BENTHIC MACROINVERTEBRATE BENCH SHEET
PHASE 1 TAXONOMY

SAMPLE NUMBER: 6 ___ SITE: Cochran Ditch @ CR 350 S. COUNTY: Steuben CREW CHIEF:
LOCATION: downstream of bridge HYDROLOGIC UNIT: 04050001110 DATE OF COLLECTION: 11/2/01
ECOREGION: IASNRI: SORTER: SZ LABEL CHECK: ✓

EPHEMEROPTERA
SIPHLONURIDAE (7) ___ METRETOPODIDAE (2) ___ BAETIDAE (4) ___ BAETISCIDAE (3) ___ HEPTAGENIIDAE (4) 2
EPHEMERELLIDAE (1) ___ TRICORYTHIDAE (4) ___ CAENIDAE (7) 2 OLIGONEURIIDAE (2) ___ LEPTOPHLEBIIDAE (2) ___
POTAMANTHIDAE (4) ___ EPHEMERIDAE (4) ___ POLYMITARCYIDAE (2) ___

ODONATA **ZYGOPTERA**
CORDULEGASTRIDAE (3) ___ GOMPHIDAE (1) ___ AESHNIDAE (3) ___ MACROMIIDAE (3) ___ CORDULIIDAE (3) ___
LIBELLULIDAE (9) ___ CALOPTERYGIDAE (5) ___ LESTIDAE (9) ___ COENAGRIONIDAE (9) ___

PLECOPTERA
PTERONARCYIDAE (0) ___ TAENIOPTERYGIDAE (2) ___ NEMOURIDAE (2) ___ LEUCTRIDAE (0) ___ CAPNIIDAE (1) ___
PERLIDAE (1) ___ PERLODIDAE (2) ___ CHLOROPERLIDAE (1) ___

HEMIPTERA
MACROVELIIDAE () ___ VELIIDAE () ___ GERRIDAE () ___ BELOSTOMATIDAE () ___ NEPIDAE () ___ CORIXIDAE () ___
NOTONECTIDAE () 1 PLEIDAE () ___ SALDIDAE () ___ HEBRIDAE () ___ NAUCORIDAE () ___ MESOVELIIDAE () ___

MEGALOPTERA SIALIDAE (4) 1 CORYDALIDAE (1) ___ SISYRIDAE () ___

TRICHOPTERA
PHILOPOTAMIDAE (3) ___ PSYCHOMYIIDAE (2) ___ POLYCENTROPODIDAE (6) 4 HYDROPSYCHIDAE (4) ___
RHYACOPHILIDAE (0) ___ GLOSSOSOMATIDAE (0) ___ HYDROPTILIDAE (4) ___ PHRYGANEIDAE (4) ___
BRACHYCENTRIDAE (1) ___ LEPIDOSTOMATIDAE (1) ___ HELICOPSYCHIDAE (3) ___ SERICOSTOMATIDAE (3) ___
ODONTOCERIDAE (0) ___ MOLANNIDAE (6) ___ LIMNEPHILIDAE (4) ___ LEPTOCERIDAE (4) ___

LEPIDOPTERA PYRALIDAE (5) ___ NOCTUIDAE () ___

COLEOPTERA
GYRINIDAE() ___ HALIPLIDAE() ___ DYTISCIDAE() ___ HYDROPHILIDAE() ___ PSEPHENIDAE (4) ___ DRYOPIDAE(5) ___ ELMIDAE(4) 2
SCIRTIDAE () ___ STAPHYLINIDAE () ___ CHRYSOMELIDAE () ___ CURCULIONIDAE () ___ HYDRAENIDAE () ___

DIPTERA
BLEPHARICERIDAE (0) ___ TIPULIDAE (3) ___ PSYCHODIDAE (10) ___ TABANIDAE (6) ___ ATHERICIDAE (2) ___
CHIRONOMIDAE(blood red)(8) 2 CHIRONOMIDAE(all other)(6) ___ SYRPHIDAE (10) ___ EPHYDRIDAE (6) ___ MUSCIDAE (6) ___
DOLICHOPODIDAE (4) ___ EMPIDIDAE (6) ___ CERATOPOGONIDAE (6) ___ SIMULIIDAE (6) ___ CHAOBORIDAE () ___

COLLEMBOLA ISOTOMIDAE () ___ PODURIDAE () ___ SMINTHURIDAE () ___ ENTOMOBRYIDAE () ___

OTHER ARTHROPODA
ACARI (4) ___ ASELLIDAE (8) ___ GAMMARIDAE (4) ___ TALITRIDAE (8) 75 ASTACIDAE (6) ___

MOLLUSCA
GASTROPODA FERRISSIA (6) ___ HELISOMA (6) ___ LYMNAEA (6) 1 AMNICOLA (6) ___ PLEUROCERIDAE () ___ VIVIPARIDAE () ___
BITHYNIA (8) ___ GYRAULUS (8) ___ PHYSA (8) ___ PLANORBIDAE () ___ HYDROBIIDAE () ___ ANCYLIDAE () ___
PELECYPODA SPHAERIIDAE (8) 3 CORBICULA () ___ DRIESSENIA () ___

PLATYHELMINTHES TURBELLARIA (4) ___ ANNELIDA () ___ OLIGOCHAETA () 2 TUBIFICIDAE () ___ NAIDIDAE () ___
HIRUDINEA () ___ HELOBDELLA (10) ___ BRANCHIOBDELLIDA () ___ ERPOBDELLIDAE () ___ NEMATODA () ___

NUMBER OF VIALS FORWARDED: 12 PRELIMINARY NUMBER OF TAXA: 12 NUMBER OF INDIVIDUALS: 102
HBI: 7.65 EPT COUNT: 8 EPT ABUN./CHIR. ABUN.: 4 CHIRONOMID COUNT: 2
% DOMINANT TAXON: 73 EPT INDEX: 5.75 EPT/TOTAL COUNT: 0.08
PHASE 1 IDENTIFICATION COMPLETED BY: SZ DATE COMPLETED: 11/6/01 COUNTS & CALCULATION CHECK: SZ CS

ATTACHMENT B

QHEI DATA SHEETS

BIG TURKEY LAKE WATERSHED FEASIBILITY STUDY

STREAM: Mud Creek at SR 327 (Site 1) RIVER MILE _____ DATE: 19Jun2001 QHEI SCORE 43

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE 13

TYPE		POOL	RIFFLE			POOL	RIFFLE
[ ]	[ ] BLDER/SLAB(10)			[ ]	[ ] GRAVEL(7)		
[ ]	[ ] BOULDER(9)			[X]	[X] SAND(6)		
[ ]	[ ] COBBLE(8)			[ ]	[ ] BEDROCK(5)		
[ ]	[ ] HARDPAN(4)			[ ]	[ ] DETRITUS(3)		
[ ]	[ ] MUCK/SILT(2)			[ ]	[ ] ARTIFIC(0)		

TOTAL NUMBER OF SUBSTRATE TYPES: [ ] >4(2) [X] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all)
- [ ] LIMESTONE(1)
- [ ] RIP/RAP(0)
- [X] TILLS(1)
- [ ] HARDPAN(0)
- [ ] SANDSTONE(0)
- [ ] SHALE(-1)
- [ ] COAL FINES(-2)

SILT COVER (one)
- [ ] SILT-HEAVY(-2)
- [ ] SILT-MOD(-1)
- [X] SILT-NORM(0)
- [ ] SILT-FREE(1)

Extent of Embeddedness (check one)
- [ ] EXTENSIVE(-2)
- [ ] MODERATE(-1)
- [X] LOW(0)
- [ ] NONE(1)

COMMENTS: _____

2) INSTREAM COVER: COVER SCORE 9

TYPE (Check all that apply)
- [ ] UNDERCUT BANKS(1)
- [ ] DEEP POOLS(2)
- [ ] OXBOWS(1)
- [X] OVERHANGING VEGETATION(1)
- [ ] ROOTWADS(1)
- [X] AQUATIC MACROPHYTES(1)
- [ ] SHALLOWS (IN SLOW WATER)(1)
- [ ] BOULDERS(1)
- [ ] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)
- [ ] EXTENSIVE >75%(11)
- [X] MODERATE 25-75%(7)
- [ ] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE 7

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
[ ] HIGH(4)	[ ] EXCELLENT(7)	[ ] NONE(6)	[ ] HIGH(3)
[ ] MODERATE(3)	[ ] GOOD(5)	[ ] RECOVERED(4)	[ ] MODERATE(2)
[X] LOW(2)	[ ] FAIR(3)	[X] RECOVERING(3)	[X] LOW(1)
[ ] NONE(1)	[X] POOR(1)	[ ] RECENT OR NO RECOVERY(1)	

MODIFICATION/OTHER
- [ ] SNAGGING
- [ ] IMPOUND
- [ ] RELOCATION
- [ ] ISLAND
- [X] CANOPY REMOVAL
- [ ] LEVEED
- [ ] DREDGING
- [X] BANK SHAPING
- [ ] ONE SIDE CHANNEL MODIFICATION

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank) RIPARIAN SCORE 6

River Right Looking Downstream

RIPARIAN WIDTH (per bank)

L	R	(per bank)
[ ]	[ ]	WIDE >150 ft.(4)
[ ]	[ ]	MODERATE 30-150 ft.(3)
[ ]	[X]	NARROW 15-30 ft.(2)
[X]	[ ]	VERY NARROW 3-15 ft.(1)
[ ]	[ ]	NONE(0)

EROSION/RUNOFF-FLOODPLAIN QUALITY

L	R	(most predominant per bank)
[ ]	[ ]	FOREST, SWAMP(3)
[ ]	[ ]	OPEN PASTURE/ROW CROP(0)
[X]	[ ]	RESID.,PARK,NEW FIELD(1)
[ ]	[ ]	FENCED PASTURE(1)

L	R	(per bank)
[ ]	[ ]	URBAN OR INDUSTRIAL(0)
[ ]	[X]	SHRUB OR OLD FIELD(2)
[ ]	[ ]	CONSERV. TILLAGE(1)
[ ]	[ ]	MINING/CONSTRUCTION(0)

BANK EROSION

L	R	(per bank)
[X]	[X]	NONE OR LITTLE(3)
[ ]	[ ]	MODERATE(2)
[ ]	[ ]	HEAVY OR SEVERE(1)

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE 0

MAX.DEPTH (Check 1)
- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [ ] 1.2-2.4 ft.(2)
- [ ] <1.2 ft.(1)
- [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)
- [ ] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)
- [ ] TORRENTIAL(-1)
- [ ] EDDIES(1)
- [ ] FAST(1)
- [ ] INTERSTITIAL(-1)
- [ ] MODERATE(1)
- [ ] INTERMITTENT(-2)
- [ ] SLOW(1)

COMMENTS: _____

RIFFLE SCORE 0

RIFFLE/RUN DEPTH
- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [ ] GENERALLY >4 in. MAX.<20 in.(3)
- [ ] GENERALLY 2-4 in.(1)
- [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE
- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [ ] MOD.STABLE (e.g., Pea Gravel)(1)
- [ ] UNSTABLE (Gravel, Sand)(0)
- [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS
- [ ] EXTENSIVE(-1)
- [ ] NONE(2)
- [ ] MODERATE(0)
- [ ] NO RIFFLE(0)
- [ ] LOW(1)

COMMENTS: **reach is 100 glide; no pool-riffle-run development is evident**

6) GRADIENT (FEET/MILE): 13.5 % POOL 0 % RIFFLE 0 % RUN 0 GRADIENT SCORE 8

STREAM: Mud Creek at CR 800 W (Site 2) RIVER MILE _____ DATE: 19Jun2001 QHEI SCORE 53.5

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE 15

TYPE		POOL	RIFFLE			POOL	RIFFLE
	BLDER/SLAB(10)				X GRAVEL(7)		
	BOULDER(9)				X SAND(6)		
	COBBLE(8)				BEDROCK(5)		
	HARDPAN(4)				DETRITUS(3)		X
	MUCK/SILT(2)		X		ARTIFIC(0)		

TOTAL NUMBER OF SUBSTRATE TYPES: X >4(2) <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all): LIMESTONE(1), RIP/RAP(0), X TILLS(1), HARDPAN(0), SANDSTONE(0), SHALE(-1), COAL FINES(-2)

SILT COVER (one): SILT-HEAVY(-2), X SILT-MOD(-1), SILT-NORM(0), SILT-FREE(1)

Extent of Embeddedness (check one): EXTENSIVE(-2), MODERATE(-1), X LOW(0), NONE(1)

COMMENTS: _____

2) INSTREAM COVER: COVER SCORE 9

TYPE (Check all that apply): UNDERCUT BANKS(1), X OVERHANGING VEGETATION(1), SHALLOWS (IN SLOW WATER)(1), DEEP POOLS(2), ROOTWADS(1), BOULDERS(1), OXBOWS(1), X AQUATIC MACROPHYTES(1), LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE): EXTENSIVE >75%(11), X MODERATE 25-75%(7), SPARSE 5-25%(3), NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE 10

SINUOSITY: HIGH(4), MODERATE(3), X LOW(2), NONE(1)

DEVELOPMENT: EXCELLENT(7), GOOD(5), X FAIR(3), POOR(1)

CHANNELIZATION: NONE(6), RECOVERED(4), X RECOVERING(3), RECENT OR NO RECOVERY(1)

STABILITY: HIGH(3), X MODERATE(2), LOW(1)

MODIFICATION/OTHER: SNAGGING, RELOCATION, X CANOPY REMOVAL, DREDGING, ONE SIDE CHANNEL MODIFICATION, IMPOUND, ISLAND, LEVEED, X BANK SHAPING

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE 5.5

RIPARIAN WIDTH (per bank): WIDE >150 ft.(4), MODERATE 30-150 ft.(3), X X NARROW 15-30 ft.(2), VERY NARROW 3-15 ft.(1), NONE(0)

EROSION/RUNOFF-FLOODPLAIN QUALITY (most predominant per bank): FOREST, SWAMP(3), X OPEN PASTURE/ROW CROP(0), RESID.,PARK,NEW FIELD(1), FENCED PASTURE(1), URBAN OR INDUSTRIAL(0), SHRUB OR OLD FIELD(2), X CONSERV. TILLAGE(1), MINING/CONSTRUCTION(0)

BANK EROSION (per bank): X X NONE OR LITTLE(3), MODERATE(2), HEAVY OR SEVERE(1)

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY NO POOL = 0 POOL SCORE 0

MAX.DEPTH (Check 1): >4 ft.(6), 2.4-4 ft.(4), 1.2-2.4 ft.(2), <1.2 ft.(1), <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1): POOL WIDTH>RIFFLE WIDTH(2), POOL WIDTH=RIFFLE WIDTH(1), POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply): TORRENTIAL(-1), FAST(1), MODERATE(1), SLOW(1), EDDIES(1), INTERSTITIAL(-1), INTERMITTENT(-2)

COMMENTS: _____

RIFFLE SCORE 4

RIFFLE/RUN DEPTH: GENERALLY >4 in. MAX.>20 in.(4), X GENERALLY >4 in. MAX.<20 in.(3), GENERALLY 2-4 in.(1), GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE: STABLE (e.g., Cobble,Boulder)(2), MOD.STABLE (e.g., Pea Gravel)(1), X UNSTABLE (Gravel, Sand)(0), NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS: EXTENSIVE(-1), MODERATE(0), X LOW(1), NONE(2), NO RIFFLE(0)

COMMENTS: **reach is 15% riffle and 85% run; no pools are evident**

6) GRADIENT (FEET/MILE): 15.6 % POOL 0 % RIFFLE 15% % RUN 85% GRADIENT SCORE 10

STREAM: **Mud Creek at CR 400 S (Site 3)** RIVER MILE _____ DATE: **19Jun2001** QHEI SCORE **58.5**

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE **16**

TYPE		POOL	RIFFLE			POOL	RIFFLE
	BLDER/SLAB(10)			X	GRAVEL(7)		
	BOULDER(9)				X SAND(6)		
	COBBLE(8)				BEDROCK(5)		
	HARDPAN(4)				DETRITUS(3)		
	MUCK/SILT(2)		X		ARTIFIC(0)		

TOTAL NUMBER OF SUBSTRATE TYPES: [X] >4(2) [ ] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all): [ ] LIMESTONE(1) [ ] RIP/RAP(0) [X] TILLS(1) [ ] HARDPAN(0) [ ] SANDSTONE(0) [ ] SHALE(-1) [ ] COAL FINES(-2)

SILT COVER (one): [ ] SILT-HEAVY(-2) [ ] SILT-MOD(-1) [X] SILT-NORM(0) [ ] SILT-FREE(1)

Extent of Embeddedness (check one): [ ] EXTENSIVE(-2) [ ] MODERATE(-1) [X] LOW(0) [ ] NONE(1)

COMMENTS: **the small amount of artificial substrate is a mixture of glacial stone and rip-rap**

2) INSTREAM COVER: COVER SCORE **14**

TYPE (Check all that apply): [ ] UNDERCUT BANKS(1) [ ] DEEP POOLS(2) [ ] OXBOWS(1) [ ] OVERHANGING VEGETATION(1) [ ] ROOTWADS(1) [X] AQUATIC MACROPHYTES(1) [ ] SHALLOWS (IN SLOW WATER)(1) [ ] BOULDERS(1) [X] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE): [X] EXTENSIVE >75%(11) [ ] MODERATE 25-75%(7) [ ] SPARSE 5-25%(3) [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE **10**

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATION/OTHER	
[ ] HIGH(4)	[ ] EXCELLENT(7)	[ ] NONE(6)	[ ] HIGH(3)	[X] SNAGGING	[ ] IMPOUND
[ ] MODERATE(3)	[ ] GOOD(5)	[ ] RECOVERED(4)	[X] MODERATE(2)	[ ] RELOCATION	[ ] ISLAND
[X] LOW(2)	[X] FAIR(3)	[X] RECOVERING(3)	[ ] LOW(1)	[X] CANOPY REMOVAL	[ ] LEVEED
[ ] NONE(1)	[ ] POOR(1)	[ ] RECENT OR NO RECOVERY(1)		[ ] DREDGING	[X] BANK SHAPING
				[ ] ONE SIDE CHANNEL MODIFICATION	

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE **5.5**

RIPARIAN WIDTH (per bank)

L	R	(per bank)
		WIDE >150 ft.(4)
		MODERATE 30-150 ft.(3)
		NARROW 15-30 ft.(2)
X	X	VERY NARROW 3-15 ft.(1)
		NONE(0)

EROSION/RUNOFF-FLOODPLAIN QUALITY

L	R	(most predominant per bank)	L	R	(per bank)
		FOREST, SWAMP(3)			URBAN OR INDUSTRIAL(0)
		OPEN PASTURE/ROW CROP(0)	X		SHRUB OR OLD FIELD(2)
		RESID.,PARK,NEW FIELD(1)			CONSERV. TILLAGE(1)
	X	FENCED PASTURE(1)			MINING/CONSTRUCTION(0)

BANK EROSION

L	R	(per bank)
X	X	NONE OR LITTLE(3)
		MODERATE(2)
		HEAVY OR SEVERE(1)

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE **0**

MAX.DEPTH (Check 1): [ ] >4 ft.(6) [ ] 2.4-4 ft.(4) [ ] 1.2-2.4 ft.(2) [ ] <1.2 ft.(1) [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1): [ ] POOL WIDTH>RIFFLE WIDTH(2) [ ] POOL WIDTH=RIFFLE WIDTH(1) [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply): [ ] TORRENTIAL(-1) [ ] EDDIES(1) [ ] FAST(1) [ ] INTERSTITIAL(-1) [ ] MODERATE(1) [ ] INTERMITTENT(-2) [ ] SLOW(1)

COMMENTS: _____

RIFFLE SCORE **5**

RIFFLE/RUN DEPTH: [ ] GENERALLY >4 in. MAX.>20 in.(4) [X] GENERALLY >4 in. MAX.<20 in.(3) [ ] GENERALLY 2-4 in.(1) [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE: [ ] STABLE (e.g., Cobble,Boulder)(2) [X] MOD.STABLE (e.g., Pea Gravel)(1) [ ] UNSTABLE (Gravel, Sand)(0) [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS: [ ] EXTENSIVE(-1) [ ] NONE(2) [ ] MODERATE(0) [ ] NO RIFFLE(0) [X] LOW(1)

COMMENTS: **reach is about 50% riffle and 50% run; no pools are evident**

6) GRADIENT (FEET/MILE): **12.3** % POOL **0** % RIFFLE **50** % RUN **50** GRADIENT SCORE **8**

STREAM: **Mud Creek at CR 850 W (Site 4)** RIVER MILE _____ DATE: **19Jun2001** QHEI SCORE **65.8**

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE **16**

TYPE		POOL	RIFFLE			POOL	RIFFLE
	BLDER/SLAB(10)			X	GRAVEL(7)		
	BOULDER(9)				X SAND(6)		
	COBBLE(8)	X	X		BEDROCK(5)		
	HARDPAN(4)				DETRITUS(3)		
	MUCK/SILT(2)	X			ARTIFIC(0)		

SUBSTRATE ORIGIN (all): [ ] LIMESTONE(1) [ ] RIP/RAP(0) [X] TILLS(1) [ ] HARDPAN(0) [ ] SANDSTONE(0) [ ] SHALE(-1) [ ] COAL FINES(-2)

SILT COVER (one): [ ] SILT-HEAVY(-2) [ ] SILT-MOD(-1) [X] SILT-NORM(0) [ ] SILT-FREE(1)

Extent of Embeddedness (check one): [ ] EXTENSIVE(-2) [ ] MODERATE(-1) [X] LOW(0) [ ] NONE(1)

TOTAL NUMBER OF SUBSTRATE TYPES: [X] >4(2) [ ] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

COMMENTS: **larger stones (cobble) was present both in the riffles and pools; the stones did not appear to be artificial**

2) INSTREAM COVER: COVER SCORE **10**

TYPE (Check all that apply)

- [ ] UNDERCUT BANKS(1)
- [ ] OVERHANGING VEGETATION(1)
- [ ] SHALLOWS (IN SLOW WATER)(1)
- [ ] DEEP POOLS(2)
- [ ] ROOTWADS(1)
- [ ] BOULDERS(1)
- [ ] OXBOWS(1)
- [X] AQUATIC MACROPHYTES(1)
- [X] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)

- [ ] EXTENSIVE >75%(11)
- [X] MODERATE 25-75%(7)
- [ ] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE **14**

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATION/OTHER	
[ ] HIGH(4)	[ ] EXCELLENT(7)	[ ] NONE(6)	[ ] HIGH(3)	[ ] SNAGGING	[ ] IMPOUND
[X] MODERATE(3)	[X] GOOD(5)	[X] RECOVERED(4)	[X] MODERATE(2)	[ ] RELOCATION	[ ] ISLAND
[ ] LOW(2)	[ ] FAIR(3)	[ ] RECOVERING(3)	[ ] LOW(1)	[X] CANOPY REMOVAL	[ ] LEVEED
[ ] NONE(1)	[ ] POOR(1)	[ ] RECENT OR NO RECOVERY(1)		[ ] DREDGING	[X] BANK SHAPING
				[ ] ONE SIDE CHANNEL MODIFICATION	

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE **7.75**

RIPARIAN WIDTH (per bank)

L	R	(per bank)
	X	WIDE >150 ft.(4)
X		MODERATE 30-150 ft.(3)
		NARROW 15-30 ft.(2)
		VERY NARROW 3-15 ft.(1)
		NONE(0)

EROSION/RUNOFF-FLOODPLAIN QUALITY

L	R	(most predominant per bank)	L	R	(per bank)
		FOREST, SWAMP(3)			URBAN OR INDUSTRIAL(0)
X		OPEN PASTURE/ROW CROP(0)	X	X	SHRUB OR OLD FIELD(2)
	X	RESID.,PARK,NEW FIELD(1)			CONSERV. TILLAGE(1)
		FENCED PASTURE(1)			MINING/CONSTRUCTION(0)

BANK EROSION

L	R	(per bank)
X	X	NONE OR LITTLE(3)
		MODERATE(2)
		HEAVY OR SEVERE(1)

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE **5**

MAX.DEPTH (Check 1)

- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [X] 1.2-2.4 ft.(2)
- [ ] <1.2 ft.(1)
- [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)

- [X] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)

- [ ] TORRENTIAL(-1)
- [ ] FAST(1)
- [X] MODERATE(1)
- [ ] SLOW(1)
- [ ] EDDIES(1)
- [ ] INTERSTITIAL(-1)
- [ ] INTERMITTENT(-2)

COMMENTS: _____

RIFFLE SCORE **3**

RIFFLE/RUN DEPTH

- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [ ] GENERALLY >4 in. MAX.<20 in.(3)
- [X] GENERALLY 2-4 in.(1)
- [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE

- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [X] MOD.STABLE (e.g., Pea Gravel)(1)
- [ ] UNSTABLE (Gravel, Sand)(0)
- [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS

- [ ] EXTENSIVE(-1)
- [ ] MODERATE(0)
- [X] LOW(1)
- [ ] NONE(2)
- [ ] NO RIFFLE(0)

COMMENTS: **reach is about 50% riffle and 50% run; no pools are evident**

6) GRADIENT (FEET/MILE): **15.6** % POOL **20** % RIFFLE **40** % RUN **40** GRADIENT SCORE **10**

STREAM: Cochran Ditch at CR 425 S (Site 5) RIVER MILE _____ DATE: 19Jun2001 QHEI SCORE 43

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE 7

TYPE		POOL	RIFFLE			POOL	RIFFLE
	BLDER/SLAB(10)				GRAVEL(7)		
	BOULDER(9)				SAND(6)		
	COBBLE(8)				BEDROCK(5)		
	HARDPAN(4)				DETRITUS(3)		
X	MUCK/SILT(2)				ARTIFIC(0)		

TOTAL NUMBER OF SUBSTRATE TYPES: [ ] >4(2) [X] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

SUBSTRATE ORIGIN (all)
- [ ] LIMESTONE(1)
- [ ] RIP/RAP(0)
- [X] TILLS(1)
- [ ] HARDPAN(0)
- [ ] SANDSTONE(0)
- [ ] SHALE(-1)
- [ ] COAL FINES(-2)

SILT COVER (one)
- [X] SILT-HEAVY(-2)
- [ ] SILT-MOD(-1)
- [ ] SILT-NORM(0)
- [ ] SILT-FREE(1)

Extent of Embeddedness (check one)
- [ ] EXTENSIVE(-2)
- [X] MODERATE(-1)
- [ ] LOW(0)
- [ ] NONE(1)

COMMENTS: _____

2) INSTREAM COVER: COVER SCORE 15

TYPE (Check all that apply)
- [ ] UNDERCUT BANKS(1)
- [ ] DEEP POOLS(2)
- [ ] OXBOWS(1)
- [X] OVERHANGING VEGETATION(1)
- [X] ROOTWADS(1)
- [X] AQUATIC MACROPHYTES(1)
- [ ] SHALLOWS (IN SLOW WATER)(1)
- [ ] BOULDERS(1)
- [ ] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)
- [X] EXTENSIVE >75%(11)
- [ ] MODERATE 25-75%(7)
- [ ] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE 6

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
[ ] HIGH(4)	[ ] EXCELLENT(7)	[ ] NONE(6)	[ ] HIGH(3)
[ ] MODERATE(3)	[ ] GOOD(5)	[ ] RECOVERED(4)	[ ] MODERATE(2)
[ ] LOW(2)	[ ] FAIR(3)	[X] RECOVERING(3)	[X] LOW(1)
[X] NONE(1)	[X] POOR(1)	[ ] RECENT OR NO RECOVERY(1)	

MODIFICATION/OTHER
- [X] SNAGGING
- [ ] IMPOUND
- [ ] RELOCATION
- [ ] ISLAND
- [X] CANOPY REMOVAL
- [ ] LEVEED
- [ ] DREDGING
- [ ] BANK SHAPING
- [ ] ONE SIDE CHANNEL MODIFICATION

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE 7

RIPARIAN WIDTH (per bank)

L	R	(per bank)
X		WIDE >150 ft.(4)
		MODERATE 30-150 ft.(3)
	X	NARROW 15-30 ft.(2)
		VERY NARROW 3-15 ft.(1)
		NONE(0)

EROSION/RUNOFF-FLOODPLAIN QUALITY

L	R	(most predominant per bank)	L	R	(per bank)
X		FOREST, SWAMP(3)			URBAN OR INDUSTRIAL(0)
	X	OPEN PASTURE/ROW CROP(0)			SHRUB OR OLD FIELD(2)
		RESID.,PARK,NEW FIELD(1)			CONSERV. TILLAGE(1)
		FENCED PASTURE(1)			MINING/CONSTRUCTION(0)

BANK EROSION

L	R	(per bank)
X		NONE OR LITTLE(3)
	X	MODERATE(2)
		HEAVY OR SEVERE(1)

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE 0

MAX.DEPTH (Check 1)
- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [ ] 1.2-2.4 ft.(2)
- [ ] <1.2 ft.(1)
- [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)
- [ ] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)
- [ ] TORRENTIAL(-1)
- [ ] EDDIES(1)
- [ ] FAST(1)
- [ ] INTERSTITIAL(-1)
- [ ] MODERATE(1)
- [ ] INTERMITTENT(-2)
- [ ] SLOW(1)

COMMENTS: _____

RIFFLE SCORE 0

RIFFLE/RUN DEPTH
- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [ ] GENERALLY >4 in. MAX.<20 in.(3)
- [ ] GENERALLY 2-4 in.(1)
- [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE
- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [ ] MOD.STABLE (e.g., Pea Gravel)(1)
- [ ] UNSTABLE (Gravel, Sand)(0)
- [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS
- [ ] EXTENSIVE(-1)
- [ ] NONE(2)
- [ ] MODERATE(0)
- [ ] NO RIFFLE(0)
- [ ] LOW(1)

COMMENTS: **reach is 100 glide; no pool-riffle-run development is evident; gradient is lower; stream was just barely flowing**

6) GRADIENT (FEET/MILE): 5.3 % POOL 0 % RIFFLE 0 % RUN 0 GRADIENT SCORE 8

STREAM: **Cochran Ditch at CR 350 S (Site 6)** RIVER MILE _____ DATE: **19Jun2001** QHEI SCORE **46**

1) SUBSTRATE: (Check ONLY Two Substrate Type Boxes: Check all types present) SUBSTRATE SCORE **16**

TYPE			POOL	RIFFLE					POOL	RIFFLE
		BLDER/SLAB(10)			X		GRAVEL(7)			
		BOULDER(9)				X	SAND(6)			
		COBBLE(8)					BEDROCK(5)			
		HARDPAN(4)					DETRITUS(3)			
		MUCK/SILT(2)	X				ARTIFIC(0)		X	

SUBSTRATE ORIGIN (all): [ ] LIMESTONE(1) [ ] RIP/RAP(0) [ ] TILLS(1) [ ] HARDPAN(0) [ ] SANDSTONE(0) [ ] SHALE(-1) [ ] COAL FINES(-2)

SILT COVER (one): [ ] SILT-HEAVY(-2) [ ] SILT-MOD(-1) [X] SILT-NORM(0) [ ] SILT-FREE(1)

Extent of Embeddedness (check one): [ ] EXTENSIVE(-2) [ ] MODERATE(-1) [X] LOW(0) [ ] NONE(1)

TOTAL NUMBER OF SUBSTRATE TYPES: [X] >4(2) [ ] <4(0)

NOTE: (Ignore sludge that originates from point sources: score is based on natural substrates)

COMMENTS: _____

2) INSTREAM COVER: COVER SCORE **10**

TYPE (Check all that apply)

- [ ] UNDERCUT BANKS(1)
- [X] OVERHANGING VEGETATION(1)
- [ ] SHALLOWS (IN SLOW WATER)(1)
- [ ] DEEP POOLS(2)
- [ ] ROOTWADS(1)
- [ ] BOULDERS(1)
- [ ] OXBOWS(1)
- [X] AQUATIC MACROPHYTES(1)
- [X] LOGS OR WOODY DEBRIS(1)

AMOUNT (Check only one or Check 2 and AVERAGE)

- [ ] EXTENSIVE >75%(11)
- [X] MODERATE 25-75%(7)
- [ ] SPARSE 5-25%(3)
- [ ] NEARLY ABSENT <5%(1)

COMMENTS: _____

3) CHANNEL MORPHOLOGY: (Check ONLY ONE per Category or Check 2 and AVERAGE) CHANNEL SCORE **7**

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY	MODIFICATION/OTHER	
[ ] HIGH(4)	[ ] EXCELLENT(7)	[ ] NONE(6)	[ ] HIGH(3)	[ ] SNAGGING	[ ] IMPOUND
[ ] MODERATE(3)	[ ] GOOD(5)	[ ] RECOVERED(4)	[X] MODERATE(2)	[ ] RELOCATION	[ ] ISLAND
[ ] LOW(2)	[ ] FAIR(3)	[X] RECOVERING(3)	[ ] LOW(1)	[X] CANOPY REMOVAL	[ ] LEVEED
[X] NONE(1)	[X] POOR(1)	[ ] RECENT OR NO RECOVERY(1)		[ ] DREDGING	[X] BANK SHAPING
				[ ] ONE SIDE CHANNEL MODIFICATION	

COMMENTS: _____

4) RIPARIAN ZONE AND BANK EROSION: (Check ONE box or Check 2 and AVERAGE per bank)

River Right Looking Downstream RIPARIAN SCORE **5**

RIPARIAN WIDTH (per bank)

L	R	(per bank)
		WIDE >150 ft.(4)
		MODERATE 30-150 ft.(3)
X	X	NARROW 15-30 ft.(2)
		VERY NARROW 3-15 ft.(1)
		NONE(0)

EROSION/RUNOFF-FLOODPLAIN QUALITY

L	R	(most predominant per bank)	L	R	(per bank)
		FOREST, SWAMP(3)			URBAN OR INDUSTRIAL(0)
		OPEN PASTURE/ROW CROP(0)			SHRUB OR OLD FIELD(2)
X	X	RESID.,PARK,NEW FIELD(1)			CONSERV. TILLAGE(1)
		FENCED PASTURE(1)			MINING/CONSTRUCTION(0)

BANK EROSION

L	R	(per bank)
X		NONE OR LITTLE(3)
	X	MODERATE(2)
		HEAVY OR SEVERE(1)

COMMENTS: _____

5) POOL/GLIDE AND RIFFLE/RUN QUALITY **NO POOL = 0** POOL SCORE **0**

MAX.DEPTH (Check 1)

- [ ] >4 ft.(6)
- [ ] 2.4-4 ft.(4)
- [ ] 1.2-2.4 ft.(2)
- [ ] <1.2 ft.(1)
- [ ] <0.6 ft.(Pool=0)(0)

MORPHOLOGY (Check 1)

- [ ] POOL WIDTH>RIFFLE WIDTH(2)
- [ ] POOL WIDTH=RIFFLE WIDTH(1)
- [ ] POOL WIDTH<RIFFLE WIDTH(0)

POOL/RUN/RIFFLE CURRENT VELOCITY (Check all that Apply)

- [ ] TORRENTIAL(-1)
- [ ] FAST(1)
- [ ] MODERATE(1)
- [ ] SLOW(1)
- [ ] EDDIES(1)
- [ ] INTERSTITIAL(-1)
- [ ] INTERMITTENT(-2)

COMMENTS: _____

RIFFLE SCORE **0**

RIFFLE/RUN DEPTH

- [ ] GENERALLY >4 in. MAX.>20 in.(4)
- [ ] GENERALLY >4 in. MAX.<20 in.(3)
- [ ] GENERALLY 2-4 in.(1)
- [ ] GENERALLY <2 in.(Riffle=0)(0)

RIFFLE/RUN SUBSTRATE

- [ ] STABLE (e.g., Cobble,Boulder)(2)
- [ ] MOD.STABLE (e.g., Pea Gravel)(1)
- [ ] UNSTABLE (Gravel, Sand)(0)
- [ ] NO RIFFLE(0)

RIFFLE/RUN EMBEDDEDNESS

- [ ] EXTENSIVE(-1)
- [ ] MODERATE(0)
- [ ] LOW(1)
- [ ] NONE(2)
- [ ] NO RIFFLE(0)

COMMENTS: **reach is 100% glide; no pool-riffle-run development is evident; gradient is lower; Little Turkey Lake is within 0.5 miles**

6) GRADIENT (FEET/MILE): **5.3** % POOL **0** % RIFFLE **0** % RUN **0** GRADIENT SCORE **8**

APPENDIX F

REGULATIONS REGARDING LAKE-LEVEL CHANGES

BIG TURKEY LAKE WATERSHED FEASIBILITY STUDY

LAGRANGE, STEUBEN, DEKALB, AND NOBLE COUNTIES

IC 14-26-8

Chapter 8. Lakes; Changes in Levels

IC 14-26-8-1

Sec. 1. This chapter applies to lakes having an area of at least ten (10) acres.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-2

Sec. 2. As used in this chapter, "shoreline or water line" means the line that is formed around a lake by the intersection of the water in the lake with the adjoining land when the surface elevation of the lake is:

(1) normal;

(2) at the average level; or

(3) at the average normal level established by law.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-3

Sec. 3. (a) If:

(1) at least twenty percent (20%) of the owners of land abutting upon or within one-fourth (1/4) mile of the shoreline or water line of a lake;

(2) the department; or

(3) the board of commissioners of a county in which a lake is located;

desire to stabilize, raise, or establish and maintain the level of the lake by means of a control dam or other structure, diverting water into or away from the lake, pumping water into or out of the lake, or other means, the landowners, department, or county commissioners may apply either separately or jointly for the construction, reconstruction, alteration, and rehabilitation of a control dam or other structure, the construction of pumping stations, the construction, reconstruction, repair, or recleaning of outlet or inlet ditches, or other means by filing a petition with the circuit or superior court of the county in which the greater or greatest area of the lake lies.

(b) A petition must be filed in duplicate with the clerk of the court.

(c) If the petition is approved by the court, attorney's fees become a part of the total costs of the project. If the petition is dismissed, the petitioners shall pay the attorney's fees.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-4

Sec. 4. A petition must do the following:

(1) State the name of the lake.

(2) State the lake's location by section, township, range, and county.

(3) State the lake's approximate surface area in acres.

(4) Describe the nature of the work desired, whether it is:

(A) the construction, reconstruction, alteration, or rehabilitation of a control dam;

(B) the construction of a pumping station or a diversion ditch;

(C) the construction, reconstruction, repair, or recleaning of an outlet ditch;

(D) a combination of any number of purposes permitted by this subdivision; or

(E) another purpose.

(5) Allege that the work is practicable and of public need.

(6) State the level at which it is desired to maintain or stabilize the lake. The level must be stated with reference to at least one (1) of the following:

(A) Sea level datum if ascertainable.

(B) A lawfully established staff gauge installed in the lake from which the desired water level can be readily observed by an interested or affected party.

(7) If the lake lies in more than one (1) county, show the approximate surface area of the lake in acres that lies in each county.

(8) If the lake or any part of the lake lies within a city or town, state the approximate surface area of the lake that lies within the city or town.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-5

Sec. 5. If the lake lies in at least two (2) counties, the surveyor of the county in which the greater or greatest area of the lake lies shall prepare the plans and specifications and the report required by this chapter.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-6

Sec. 6. If the petition is initiated by the owners of land abutting upon or within four hundred forty (440) yards of the shoreline or water line of the lake, the petition must be accompanied by a bond with good and sufficient freehold sureties to be approved by the clerk of the circuit or superior court. The bond must be:

(1) payable to the state; and

(2) conditioned to pay all costs if the court denies the petition.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-7

Sec. 7. (a) Within ten (10) days after the filing of a petition, the clerk shall docket the petition as a cause of action pending in the circuit or superior court. The clerk shall cause notice to be given at least thirty (30) days before the date set for the hearing as follows:

(1) By publication one (1) time each week for two (2) consecutive weeks in not less than two (2) newspapers of general circulation published in each county in which the lake is located. If there are not two (2) newspapers of general circulation published in a county, notice shall be published in one (1) newspaper of general circulation published in the county.

(2) By posting a written or printed notice at the door of the courthouse in each county in which the lake lies.

(3) By sending written notice to the following:
(A) The county surveyor and county commissioners of each county affected.
(B) The department.
(b) The notice must do the following:
(1) Briefly describe the location and nature of the proposed work contained in the petition.
(2) Fix a day for the hearing on the petition.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-8

Sec. 8. Before the date set for the hearing, the names of the viewers of the proposed work described in the petition shall be determined as follows:
(1) The president of the board of commissioners of each county affected shall submit in writing to the clerk of the court in which the petition is filed the name of a member of the board of commissioners of the county who will be a viewer.
(2) The director shall submit to the clerk the name of a representative of the department who will serve as a viewer.
(3) The surveyor of each county affected shall serve as a viewer.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-9

Sec. 9. On the day set for the hearing on the form of a petition, the court shall appoint two (2) viewers who shall, with the viewers designated under section 8 of this chapter, pass upon the project as set out. The two (2) viewers appointed by the court:
(1) must be reputable freeholders;
(2) may not be qualified to sign the petitions;
(3) may not be related to an affected landowner; and
(4) must be residents of a county in which the lake lies.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-10

Sec. 10. If a petition is filed alone by owners of land abutting or within four hundred forty (440) yards of the shoreline or water line of the lake, a member of the board of county commissioners may not serve as a viewer.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-11

Sec. 11. The following have ten (10) days, exclusive of Sundays, from the date of the hearing on the form of a petition to file with the court a remonstrance or an objection to the merits of the petition, notice, or eligibility of any of the viewers:
(1) A person named in the petition.
(2) A person who owns land abutting or within one-fourth (1/4) mile of the shoreline or water line of the lake.
(3) The department.
(4) The board of commissioners of a county in which the lake lies.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-12

Sec. 12. After the ten (10) days prescribed by section 11 of this chapter have elapsed, the court shall consider each remonstrance or objection, if any. If the court finds the petition defective, the court shall dismiss the petition unless the petition is amended within a time fixed by the court.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-13

Sec. 13. If at least one (1) of the viewers is disqualified, the court shall, within ten (10) days of the date of disqualification, appoint an individual having the qualifications required by this chapter to replace the disqualified viewer as follows:

(1) If the surveyor is disqualified, the court may appoint a qualified registered engineer to replace the disqualified surveyor.

(2) If a county commissioner is disqualified, the court shall appoint another county commissioner from the same county to replace the disqualified commissioner.

(3) If the representative of the department is disqualified, the court shall appoint a new representative from the department selected from a list of two (2) representatives recommended by the director.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-14

Sec. 14. The following have ten (10) days, exclusive of Sundays, to file a written objection to the new viewers:

(1) A person named in the petition.

(2) A person who owns land abutting or within one-fourth (1/4) mile of the shoreline or water line of the lake.

(3) The department.

(4) The county in which the lake lies if a joint petition is filed.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-15

Sec. 15. After the ten (10) days prescribed by section 14 of this chapter have elapsed, the court shall consider each objection to the viewers. If the court disqualifies a viewer who was appointed to replace a previously disqualified viewer, the court shall make another appointment and continue under the same procedure until there is no further disqualification of viewers.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-16

Sec. 16. If within ten (10) days, exclusive of Sundays, following the date of the hearing of the petition, at least fifty-one percent (51%) of the landowners abutting or within four hundred forty (440) yards of the shoreline or water line of the lake remonstrate in writing against the proposed project described in the petition, the petition shall be

dismissed at the cost of the petitioners whose land abuts or lies within four hundred forty (440) yards of the shoreline or water line of the lake.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-17

Sec. 17. (a) If:

(1) a remonstrance has not been filed within ten (10) days of the date of the hearing; and

(2) the court considers the petition sufficient;

the court shall make an order referring the petition to the viewers.

(b) An objection to the petition or the acting of the viewers not made within the ten (10) days is considered waived.

(c) In the order referring the matter to the viewers, the court shall fix a time when the viewers shall meet and make a report. The clerk shall deliver to the viewers a duplicate copy of the petition and the order.

(d) A viewer who cannot meet on the date specified by the court may notify the court in writing, and the court shall set another date for the viewers to meet. If it is not possible for all of the viewers to meet on the new day specified by the court, a majority of the viewers may meet and view the proposed project.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-18

Sec. 18. The viewers shall do the following:

(1) Make a personal inspection of the proposed project described in the petition.

(2) Consider whether the project is practicable and is of public need.

(3) File a report within ten (10) days from the time of the inspection. The opinion of the majority prevails.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-19

Sec. 19. If the viewers find that the proposed work is not practicable and of public need:

(1) the viewers shall make a written report of the findings to the court; and

(2) the court shall dismiss the petition at the cost of the petitioners who own land abutting or within one-fourth (1/4) mile of the water or shoreline of the lake.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-20

Sec. 20. If the viewers find that the proposed work is practicable and of public need:

(1) the viewers shall make a written report of the finding to the court; and

(2) the court shall do the following:

(A) Direct the surveyor of the county in which the greatest area of the lake lies to prepare plans and specifications for the proposed project.

(B) Set a date for the surveyor to file the surveyor's preliminary report with the court.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-21

Sec. 21. (a) The surveyor's preliminary report must include the following:

(1) Plans and specifications.

(2) Cost estimates.

(3) Damages.

(4) Assessments.

(5) Other information that is considered necessary and proper.

(b) The department may on request of the surveyor prepare the plans and specifications.

(c) The surveyor in preparing plans and specifications may, upon the recommendation of the department, vary from the general plan described in the petition if necessary to carry out the purpose of the petition, subject to final approval by the court.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-22

Sec. 22. (a) The surveyor shall estimate the cost of the project and assess the benefits or damages to all affected landowners, each county in which the lake lies, and the department if:

(1) the petition is a joint petition between the owners of land abutting or within one-fourth (1/4) mile of the shoreline or water line of the lake and the county or the department; or

(2) the petition has been filed separately or jointly by the department or the county.

(b) If the petition was filed only by the landowners abutting or within one-fourth (1/4) mile of the shoreline or water line of the lake, the county and the department may not be assessed.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-23

Sec. 23. The assessing of benefits or damages is to be made:

(1) on each separate tract of land to be affected;

(2) to easements held by railways or other corporations; and

(3) to cities, towns, and other public or private corporations;

including any land or water right or easement injuriously or beneficially affected.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-24

Sec. 24. (a) The cost of the improvement asked for in the petition shall be paid as follows:

(1) If the petition is filed separately by the owners of land abutting upon or within one-fourth (1/4) mile of the shoreline or water line of the lake, proportionately to the benefits received by the owners.

(2) If the petition is filed jointly by the owners of land abutting upon the lake and the department or the commissioners of each

county in which the lake lies or separately by the department or the commissioners of each county in which the lake lies, as follows:

(A) Twenty-five percent (25%) of the cost of the improvement shall be paid by the property owners abutting or within one-fourth (1/4) mile of the shoreline or water line of the lake.

(B) Twenty-five percent (25%) of the cost shall be paid by the county.

(C) Fifty percent (50%) of the cost shall be paid by the department.

(b) The surveyor shall apportion the cost of the project accordingly in the surveyor's report and notices of assessments and damages shall be sent to all affected parties as prescribed in section 25 of this chapter.

(c) If the lake lies in at least two (2) counties, the cost to be paid by each county must be proportionate to the area of the lake that lies in each county. For the purpose of determining the area of the lake that lies in each county, the surveyor may use aerial photographs made by the United States Department of Agriculture.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-25

Sec. 25. (a) The court shall set a date:

(1) not less than thirty (30); or

(2) more than forty (40);

days after the surveyor's preliminary report has been filed for the surveyor's hearing on the report.

(b) The surveyor shall, within five (5) days after the date for the hearing is set, notify by registered mail, return receipt requested, all owners of land abutting upon or within four hundred forty (440) yards of the shoreline or water line of the lake. The return receipts are prima facie evidence of notice. The notice must give a brief description of the following:

(1) The project.

(2) The project's location.

(3) A description of the owners' land that is assessed or damaged, if any.

(4) The amount of assessment or damages, if any.

(5) The date and place of the hearing.

(c) If the residence of a landowner cannot be ascertained or if a mailed notice is returned undelivered, the surveyor shall publish notice to all persons in this category by one (1) publication:

(1) in a newspaper of general circulation published and printed in the county in which the lake lies; or

(2) if a paper is not published in the county, in a newspaper in an adjoining county;

at least ten (10) days before the date fixed for the hearing.

(d) The mailed and published notices must notify the owners that all remonstrances and claims for compensation or damages must be filed in writing with the clerk on or before the day of the surveyor's hearing.

(e) The clerk shall notify the surveyor of the receipt of remonstrances or claims on or before the day of the surveyor's hearing.

(f) The surveyor shall file the following:

(1) Proof of publication of the published notice in the form of a publisher's affidavit.

(2) Proof of the mailed notice by return receipts.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-26

Sec. 26. (a) On the day fixed by the court for the hearing on the report the surveyor shall do the following:

(1) Be present at the place designated in the notice.

(2) Hear all objections made to damages and assessments.

(b) The surveyor may adjourn the hearing as necessary or to any other suitable or available room in the courthouse of the county that is considered necessary until all objections are heard. All persons interested shall take notice of an adjournment without further notice.

(c) All objections to the damages and assessments must be verified and in writing.

(d) After hearing all objections that are offered to the damages and assessments, the surveyor shall confirm or change the damages and assessments as justice requires. If the damages and assessments are changed, the surveyor shall show the changed amount assessed and the date the change was made.

(e) Upon concluding the hearing the surveyor shall make a final report to the court.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-27

Sec. 27. (a) The following entities have ten (10) days from the date the surveyor's final report is filed with the court to remonstrate against the final report:

(1) An owner of land affected by the work as proposed in the petition or in the surveyor's final report.

(2) The commissioners of a county in which the lake lies.

(3) The department.

(b) A remonstrance must be in writing, must be filed with the court, and may be for any of the following causes:

(1) That the report of the surveyor is not according to law.

(2) That the proposed work as reported by the surveyor will not be sufficient to accomplish the purpose set out in the petition.

(3) That the amount of the assessment is exorbitant.

(4) That the amount of the assessment is too much as compared with other land assessed, specifying the other land.

(5) That the amount of the assessment of others is too low, specifying the others.

(6) That the amount of the damages is inadequate.

(7) That the owner's land will be damaged and the owner has not been given damages.

(8) That the owner's land has been assessed for benefits and the owner's land will not be benefited or will be damaged if the proposed work is accomplished.

(9) That the assessment against a county or the department is

greater than the public benefit to be received.

(10) That the proposed project is not practicable and of public need or utility.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-28

Sec. 28. If after a hearing the court decides that any of the causes of remonstrance described in section 27 of this chapter is true, the court may do either of the following:

(1) Direct the surveyor to amend and perfect the report.

(2) Set aside the report and refer the matter back to the surveyor for a new report.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-29

Sec. 29. (a) In making an order for a new report, the court shall fix the time when the surveyor shall report.

(b) When a new report is made and filed, a person whose land is reported as affected in the report may remonstrate within the same time and for the same causes that are allowed to remonstrate against the first report. However, a second remonstrance may only concern new matters contained in the second or amended report.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-30

Sec. 30. The court shall try all questions of facts arising on a petition, report, or remonstrance without a jury.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-31

Sec. 31. (a) If a remonstrance is sustained by the court, the court may modify and equalize the assessments, as justice requires, by doing the following:

(1) Diminishing the assessments on some tracts and increasing the assessments on other tracts.

(2) Giving or withholding damages.

(b) For purposes of this section each person whose land is:

(1) reported as affected; or

(2) stated in the petition as affected;

is considered to be in court by virtue of the notices originally given to the parties on the pendency of the petition.

(c) If:

(1) the land described in the petition as affected by the proposed work; and

(2) the surveyor has reported the land as neither benefited nor damaged;

the court may, if the facts and justice warrant, make assessments against the land.

(d) The assessments as changed, modified, equalized, or made are valid.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-32

Sec. 32. If the finding and judgment of the court is against each remonstrance:

(1) the assessments made by the surveyor shall be confirmed; and

(2) the order confirming is final and conclusive.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-33

Sec. 33. If the finding and judgment of the court is in support of a remonstrance, the proceedings shall be dismissed at the cost of the petitioners whose land abuts or lies within four hundred forty (440) yards of the shoreline or water line of the lake.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-34

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Sec. 34. If after the ten (10) days allowed for remonstrances there is no appeal or remonstrance, the court shall do the following:

(1) Make an order declaring the proposed work established and approving assessments as made by the surveyor or as equalized and modified as provided in section 31 of this chapter.

(2) Assign the duty of carrying out the order to the county surveyor.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-35

Sec. 35. The order of the court approving and confirming the assessments and declaring the proposed work established is final and conclusive, unless an appeal is taken. An appeal may be taken from the final judgment of the circuit or superior court to the supreme court or court of appeals as in other civil cases.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-36

Sec. 36. (a) The county surveyor shall proceed to have the improvement constructed as provided by section 32 or 34 of this chapter. The county surveyor shall keep in the surveyor's office copies of the plans and specifications, which shall be open for the inspection of any landowner interested or any contractor who may be a prospective bidder on the work.

(b) The county surveyor shall give notice in a newspaper of general circulation printed and published in the following:

(1) Each county in which the lake lies.

(2) Each county where land assessed as benefited is situated.

(c) The notice must state that on a certain day and date, which may not be less than fifteen (15) days from the date of the publication, the surveyor will do the following:

(1) Receive sealed bids for the furnishing of all material and labor necessary for the construction of the work.

(2) Let the contract to the lowest and best bidder or reject all bids

and re-advertise for new bids.

(d) The surveyor may:

(1) let the work as a whole; or

(2) subdivide the work into at least two (2) sections and let the work in separate contracts that will, in the surveyor's best judgment, most speedily and economically accomplish the completion of the work.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-37

Sec. 37. A person who has successfully bid for the whole or a part of the work shall, when the work is awarded to the person, do the following:

(1) Enter into a contract with the surveyor to perform the work.

(2) Give bond that:

(A) must be approved by the court;

(B) is payable to the state; and

(C) is in a proper penalty for the performance of the contract;

that the person will pay all damages occasioned by nonfulfillment of the contract. The damages may be recovered in a court with jurisdiction.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-38

Sec. 38. If a person who is assessed is damaged by reason of the default and failure of the contractor to complete the work within the limit, the contractor in default is liable on the bond to the person damaged to the full extent of the damages. The damages may be recovered in a court with jurisdiction in a suit or an action on the bond by the state on the relation of the person damaged for the use of the person or party injured.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-39

Sec. 39. The surveyor may bring suit on the bond in a court with jurisdiction to recover any increased cost, expense, or damage of or to the work because of the failure of the contractor.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-40

Sec. 40. The aggregate liability of the surety on a bond for all liabilities may not exceed the penalty of the bond.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-41

Sec. 41. A contract may not be let until the court approves the contract.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-42

Sec. 42. When the contractor has finished the contractor's work, the

surveyor shall make a final report to the court showing that the work has been completed and accepted.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-43

Sec. 43. (a) If the surveyor is unable to let a contract and construct the proposed improvement for the estimated cost of construction, the surveyor shall report the fact to the court.

(b) The court shall immediately order a new assessment of benefits and damages if requested in writing by at least two-thirds (2/3) of the original petitioners.

(c) If the order for a new assessment is made:

(1) the procedure provided for following the making of the original assessment shall be followed with respect to the new assessment and subsequent actions; and

(2) the landowners have the same right to remonstrate and appeal as is provided for original assessments.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-44

Sec. 44. The costs and expenses of an improvement petitioned for under this chapter shall be out of the county general fund or the general lake improvement fund as described in this chapter, except the part of the cost to be paid by the department. The costs and expenses include the following:

(1) The contract price for the work.

(2) The traveling expenses of the surveyor.

(3) The expenses of the viewers.

(4) Court costs.

(5) Notices.

(6) Advertising.

(7) Attorney's fees.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-45

Sec. 45. (a) If the surveyor or the surveyor's deputy uses a car owned by the surveyor or the deputy or a hired conveyance in carrying out the improvement petitioned for under this chapter, the surveyor or deputy may include traveling expenses incident to the work at an amount for mileage at a rate determined by the county fiscal body.

(b) The surveyor and the surveyor's deputy:

(1) are not entitled to receive compensation for services in addition to the statutory salary except for expenses as provided in section 44 of this chapter; and

(2) are not required to give any additional bond other than the official bond.

As added by P.L.1-1995, SEC.19. Amended by P.L.10-1997, SEC.19.

IC 14-26-8-46

Sec. 46. The viewers, other than the surveyors, the county commissioners, and the representative of the department, are entitled

to the following:

(1) Six dollars ($6) a day for expenses incurred in viewing the proposed improvement.

(2) An amount for mileage at a rate determined by the county fiscal body.

As added by P.L.1-1995, SEC.19. Amended by P.L.10-1997, SEC.20.

IC 14-26-8-47

Sec. 47. (a) Except as provided in subsections (b) and (c), the attorney's fees paid may not exceed four percent (4%) of the estimated cost of construction.

(b) If an appeal is taken or other extra proceedings are conducted, the court may allow a reasonable additional amount for the extra legal services actually provided.

(c) If:

(1) the aggregate cost is less than one thousand five hundred dollars ($1,500); and

(2) the petition is filed separately by the owners of land abutting or within one-fourth (1/4) mile of the shoreline or water line of the lake;

the court shall fix a reasonable amount instead of the four percent (4%) for the petitioners' attorney's fees.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-48

Sec. 48. (a) A payment may not be made for work done under this chapter until a verified bill has been:

(1) presented to the surveyor;

(2) approved by the surveyor;

(3) filed with the auditor; and

(4) allowed by the commissioners.

(b) A partial payment may not be made to a contractor that exceeds seventy-five percent (75%) of the cost of the improvement.

(c) Full payment may not be made until:

(1) sixty-one (61) days after the completion and acceptance of the work; and

(2) after the contractor has filed with the surveyor an affidavit that all bills for labor, other service, or materials that have been used in the construction of or incorporated in the work have been paid in full.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-49

Sec. 49. (a) The board of county commissioners of each county may establish a general lake improvement fund. The fund shall be used to pay for the construction of dams and other works to raise, stabilize, or maintain lake levels under this chapter. The fund includes the following:

(1) Taxes levied or collected for lake improvement purposes.

(2) The proceeds of bonds issued and sold for lake improvement purposes.

(3) Assessments for benefits to property under this chapter.

(4) Other money that is provided by law to be paid into the fund.

(b) If the board of county commissioners considers it inadvisable to establish a general lake improvement fund, payments for projects under this chapter shall be paid into and shall be paid from the county general fund.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-50

Sec. 50. The fiscal body of a county concerned in work authorized in this chapter may, upon request of the board of county commissioners, approve the levy and collection of a tax upon all real property in the county to raise money to carry out this chapter.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-51

Sec. 51. (a) The surveyor in charge of a project established under this chapter shall, within ten (10) days after letting the contract for construction, carefully compute the entire cost of the improvement, including the following:

(1) Incidental costs, expenses, and damages.

(2) Attorney's fees as allowed by the court.

(b) The surveyor shall apportion the costs and expenses to the tracts of land assessed in proportion to the total assessment against the respective parcels of land benefited by the construction of the work. The apportionment to the respective tracts or parcels of land may not exceed the benefits assessed against the tracts or parcels, respectively.

(c) The surveyor shall certify the assessments, apportionments, and time to make payments to the county auditor. If the improvement affects the landowners in more than one (1) county, the surveyor shall certify the assessments, apportionments, and time to make payments to the auditor of each other county affected.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-52

Sec. 52. The auditor of each county affected shall give notice by publication in a newspaper published in the county, not less than thirty (30) days before the day for payment of assessments, of the following:

(1) That the assessment sheet has been prepared and placed in the hands of the county treasurer for collection.

(2) The time and manner in which the assessments are required to be paid.

(3) That a person affected who desires to pay the assessment to discharge the person's land from all liability to the assessment on or before the day named in the order may do so.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-53

Sec. 53. (a) The auditor shall then extend the assessments upon a special duplicate:

(1) to be provided for the auditor at the expense of the county;

(2) to be known as the lake duplicate; and

(3) for recording all assessments under this chapter in the county.

(b) Except as provided in subsection (c), in extending the assessments upon the duplicates, the auditor shall, in the first instance, extend the assessments for the full period of payment of all assessments, as fixed by the surveyor.

(c) Assessments of less than twenty-five dollars ($25) shall be paid within one (1) year.

(d) The auditor shall calculate and add to each successive installment interest at the rate of six percent (6%) per year until the date fixed for payment.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-54

Sec. 54. (a) The provisions of this chapter permitting the payment of assessments in installments do not apply to assessments of less than twenty-five dollars ($25).

(b) If:

(1) one (1) landowner owns more than one (1) tract of land; and

(2) an assessment of less than twenty-five dollars ($25) is made against at least one (1) of the tracts of land;

all assessments less than twenty-five dollars ($25) shall be paid within one (1) year.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-55

Sec. 55. An assessment constitutes a lien upon the tracts or parcels of land and shall be collected at the same time and in the same manner as taxes are collected. After collection the assessments shall be deposited in the lake improvement fund or the county general fund.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-56

Sec. 56. (a) If an assessment, an installment, or a part of an assessment or installment is not paid when due, the failure to pay results in the same penalties as for the nonpayment of taxes. The land shall be placed upon the list of land to be sold at tax sale, and the land shall be sold at tax sale at the same time and in the same manner as provided under IC 6-1.1-24. The same penalties apply and the same rights are acquired upon purchase at these sales as in other tax sales, including the execution and delivery of tax deeds and the rights and remedies provided in cases of property sold at tax sale.

(b) Personal property or real property other than that assessed may not be sold for the failure to pay an assessment or installment.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-57

Sec. 57. (a) If:

(1) a municipal corporation or other public corporation fails to pay an assessment for benefits or for property the municipal or other public corporation owns; and

(2) there is not a provision for selling the property at tax sale;
the municipal or other public corporation is considered to have elected to pay in installments at the same time and in the same manner as provided in other cases. The assessments shall be included in the respective lists, and the municipal or other public corporation shall pay the installments to the county treasurer in the same manner as provided in other cases.

(b) A municipal or other public corporation that fails to pay an installment is liable for the nonpayment. The auditor shall enforce collection by bringing an action in the name of the state of Indiana, on the relation of the county treasurer in behalf of the county for the installment that is due and unpaid, together with penalties. The recovery is without relief from valuation and appraisement laws and includes reasonable attorney's fees for collecting the installment.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-58

Sec. 58. (a) The amount of an assessment as made or approved and confirmed by the court is a lien upon the land assessed from the time the assessment is approved and confirmed. The lien follows all other improvement liens upon the affected real property in order of priority as to date of attachment.

(b) The surveyor charged with the construction of the work shall keep in the surveyor's office a complete copy of the assessments that may, upon demand, be examined by any interested person.

(c) An owner of land assessed for benefits who desires to transfer the property free and clear of the lien for the assessment may deposit with the county treasurer the full amount of the benefits assessed against the tract or parcel of land. When the surveyor has made the final computation to the county auditor, the treasurer shall pay to the person paying the assessment the surplus, if any, over the actual assessment. Whenever the owner of a tract or parcel of land has paid to the treasurer and the treasurer's books show the payment, the lien for the assessment on the tract or parcel of land is automatically canceled.
As added by P.L.1-1995, SEC.19.

IC 14-26-8-59

Sec. 59. (a) Each subcontractor, laborer, and other person who performs labor or another service or furnishes material that is used in the construction of or incorporated in work under this chapter, including board for laborers and all fuel, oil, and grease used in the operation of machinery used in the construction work, has a lien upon the fund raised for the payment of the work. The lien attaches if written notice is filed with the surveyor:

(1) within sixty (60) days of furnishing the labor or material; and

(2) that states the amount due and describes the article furnished.

(b) After the receipt of notice under subsection (a), the surveyor shall withhold payment to the contractor for the work in an amount sufficient to satisfy the lien until the amount is adjusted and paid.

(c) If a contractor and a person claiming a lien disagree on the amount or validity of the lien, the court ordering the construction of the

work shall, upon motion of the surveyor, contractor, or person claiming the lien, determine the amount to be paid. The surveyor may pay the amount determined, and on payment the surveyor is released from all liability concerning the payment.

(d) If the surveyor fails to comply with this section, the surveyor is liable on the surveyor's bond for the amount improperly paid over to the contractor.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-60

Sec. 60. (a) If a surveyor fails to perform any work required of the surveyor by this chapter, after ten (10) days written notice to the surveyor by any interested person the surveyor is liable with the surveyor's sureties on the surveyor's official bond:

(1) for all damages caused by the failure to perform the duty, including reasonable attorney's fees; and

(2) to the person damaged.

(b) An action on the bond of the surveyor for failure to perform a duty must be brought in the name of the state on the relation of:

(1) the county auditor; or

(2) the person injured.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-61

Sec. 61. (a) If a petition is filed under IC 36-9-27 for the construction, reconstruction, alteration, repair, or recleaning of a drainage ditch that extends into or within one hundred sixty (160) rods of a freshwater lake and has a bottom depth lower than the average normal water level of the lake, the petition may ask that:

(1) the owners of land abutting or within four hundred forty (440) yards of the shoreline or water line of each lake likely to be affected;

(2) each county in which the lake lies; and

(3) the department;

participate in the cost of constructing a dam or structure, diversion ditches, pumping stations, or other appurtenances necessary to protect and preserve the water level of the lake.

(b) If a request is made in a petition under subsection (a), the court having jurisdiction of the drainage proceedings shall appoint additional viewers as prescribed in this chapter to represent the county and the department. The viewers shall file a separate report on whether a dam, other structure, diversion ditch, pumping station, or other appurtenance is practicable and of public need.

(c) If the report of the viewers is in the affirmative, the surveyor for the drainage project shall include in the report plans and specifications for the improvement and apportion assessments and damages in the same manner as prescribed in this chapter governing raising or maintaining lake levels.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-62

Sec. 62. (a) If a petition is filed under section 61 of this chapter for the construction, reconstruction, alteration, repair, or recleaning of a drainage ditch that extends to or within one hundred sixty (160) rods of a freshwater lake and has a bottom depth lower than the average normal water level of the lake and the petition does not request the construction of a dam, other structure, diversion ditch, pumping station, or other appurtenance to protect and preserve the water level of each lake likely to be affected:

(1) twenty percent (20%) of the owners of land abutting or within four hundred forty (440) yards of the shoreline or water line of the lake;

(2) a county in which the lake lies; or

(3) the department;

may file a petition addressed to the court having jurisdiction any time before the court order granting the petition for the drainage project to include a dam, other structure, diversion ditch, pumping station, or other appurtenance necessary to protect and preserve the water level of the lake.

(b) Upon receipt of a petition filed under subsection (a), the court shall set a date for a hearing. On that date the court shall hear all evidence submitted regarding the practicability and public need of a dam, other structure, diversion ditch, pumping station, or other appurtenance to protect and preserve the water level of each lake likely to be affected.

(c) If the court rules that the additional construction is necessary, the same procedure shall be followed for inclusion as if the additional construction were included in the petition for the drainage work.

(d) If the court rules adversely on the practicability or public need of a dam, other structure, diversion ditch, pumping station, or other appurtenance, an appeal may be taken from the final judgment of the circuit or superior court to the supreme court or the court of appeals within thirty (30) days.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-63

Sec. 63. If:

(1) the construction of a dam, other structure, diversion ditch, pumping station, or other appurtenance in connection with the preservation or stabilization of a lake is petitioned for under section 62 of this chapter in connection with a drainage proceeding; and

(2) in the surveyor's opinion, the improvement to the lake will:

(A) be beneficial to any person affected by the drainage project; or

(B) in any way provide better drainage than if the water level of the lake is left uncontrolled or undisturbed;

the surveyor for the drainage project may assess a part of the cost of the improvement that would normally be paid by those persons who own land abutting or within four hundred forty (440) yards of the shoreline or water line of the lake to any person affected by the drainage project.

As added by P.L.1-1995, SEC.19.

IC 14-26-8-64

Sec. 64. (a) The county surveyor shall do the following:

(1) Certify the elevation of a lake level established under this chapter, including the bench mark used for the point of beginning.

(2) Record the elevation of the lake level and the bench mark in the office of the county recorder in each county in which the lake lies.

(b) The elevation of a lake level established under this chapter must refer to at least one (1) of the following:

(1) The United States Coast and Geodetic Survey, first, second, and third order levels.

(2) The United States Geological Survey, third order levels.

As added by P.L.1-1995, SEC.19.