Mackinaw River Project

Mackinaw River Subwatershed Management Plan
Little Mackinaw River

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Component #1
Mission Statement

> *We intend to preserve and enhance the natural resources of the Mackinaw River watershed through education, good management practices and voluntary cooperation while respecting property owner rights.*

The Mackinaw River Watershed Council adopted this mission statement in 1996. Restoration is a strong component of enhancement and is included in the goals, objectives, and strategies of this subwatershed plan.

Component #2
Watershed Description

The Little Mackinaw River is a fourth order tributary of the Mackinaw River. It flows through Tazewell County with the headwaters in McLean County. The mouth is located at Mackinaw River mile 30.0 (Short et al. 1996).

The drainage area of the Little Mackinaw River is approximately 51.4 square miles (32,922 acres) or approximately 4.5% of the entire Mackinaw River drainage (IDNR CTAP 1997). The river is 17.13 miles long, and its major tributary, Sargent Slough is 9.43 miles long (Illinois EPA 1996). The eastern extension of the River is referred to as the Whitten Branch. There are 68.8 river miles within the basin (IDNR CTAP 1997). The watershed and its location within the larger Mackinaw River basin are illustrated in Map 1.

The state waterbody identification number is ILDKE01 (Illinois EPA 1996). The watershed delineation includes the McLean and Tazewell counties' hydrologic unit river basin number 07130004, watershed number 080, McLean county subwatershed number 12, and Tazewell county subwatershed numbers 19 and 21 (USDA SCS 1986a, 1986b).

There are two small (< 7 acres) ponds in the area, but no large lakes.

The watershed is almost entirely in private ownership, public access to the river is at county highway bridges.

Component #3
Watershed Activities

The Mackinaw River Watershed Council identified the Little Mackinaw River watershed as a priority area for work under the Section 319 of the Clean Water Act.

Since 1994 the Illinois Environmental Protection Agency (Illinois EPA) has been the primary funding source for the planning phase of the Mackinaw River Project through the Section 319 of the Clean Water Act program for nonpoint source pollution. This funding has been used for project staff through The Nature Conservancy, and the facilitation of a community-based process to develop and write the Mackinaw River Watershed Management Plan (MRP 1998). Extensive community outreach and education has been done within the entire Mackinaw River watershed, and watershed management planning tools such as a watershed management planning handbook and a project video have been produced to assist other watershed planning efforts within Illinois. The funding from the Illinois EPA has also been used to establish fifteen demonstrations of best management practices within the Mackinaw River watershed. These demonstrations provide watershed residents with on-the-ground examples of conservation practices recommended in the watershed management plan.

The confluence of the Little Mackinaw River with the main stem of the Mackinaw River has been designated a Zone B priority site by The Nature Conservancy (TNC 1999). Potential work in the area may include encouraging partners to promote available conservation programs that assist landowners in restoring the natural hydrologic function of the floodplain and wetlands.

In 1997 and 1998 the entire Mackinaw River watershed was designated an EQIP (Environmental Quality Incentives Program) priority area. Over $400,000 were made available for cost share programs to install conservation structures or implement conservation practices through this United States Agriculture Department (USDA) program (C. Myers, Tazewell County NRCS District Conservationist, personal communication 1999). Some of these practices may have been implemented in the Little Mackinaw River watershed. Further information has been requested from concerned agencies.

Other federal and state programs available to landowners wishing to improve conservation practices on their land are promoted and administered through the Tazewell and McLean County Soil and Water Conservation Districts (SWCD) and the Natural Resources Conservation Service (NRCS). These include:

- The *Conservation Practices Cost-Share Program* (CPP), a part of the state's Conservation 2000 (C2000) initiative. The objective is to assist landowners in installing conservation practices designed to conserve soil, protect water quality, and reduce flooding. Up to 60% of the cost may be covered under the cost share program (INRCC 1997).

- The *Conservation Reserve Program* (CRP) is a federally funded program designed to reduce soil erosion and reduce farming on fragile lands. This program assists landowners in establishing permanent cover on fragile lands and providing cash incentives for removing land from production. Contracts are established for 10 to 15 years (INRCC 1997).

- When landowners enroll in the CRP program they have the option of extending their commitment to the conservation measures by enrolling in the state-funded *Conservation Reserve Enhancement Program* (CREP). Landowners can elect to continue their participation in the program for 15 or 35 years, or in perpetuity (Myers, personal communication 1999).

- The *Streambank Stabilization and Restoration Program* (SSRP) is an Illinois Department of Agriculture (IDOA) program administered through the SWCD that provides technical assistance and cost sharing to demonstrate and encourage low-cost streambank restoration practices such as planting willow posts (INRCC 1977).

- The *Wildlife Habitat Incentives Program* (WHIP) provides cost-share funds for non-traditional conservation works including wetland restoration, native grassland plantings, or provision of water for livestock. Structural works are not included (Myers, personal communication 1999).

- The SWCD and NRCS provide technical assistance to all landowners that request it. These projects may or may not come under one of the cost share programs. For example, agricultural producers desiring technical advice on gully erosion control may seek counsel and undertake action independent of state or federal cost share programs.

Agricultural producers in the McLean county portion of the upper watershed have reportedly implemented several Best Management Practices (BMPs) including terraces and waterways (J. Rutherford, McLean county SWCD, personal communication 1999).

The Mackinaw River Watershed Management Plan provides information on the federal, state, and local entities, and existing legislation and ordinances that serve to promote the protection of the river and its environs (MRP 1998).

Component #4
Watershed Resource Inventory

Waterbodies

The Little Mackinaw River (ILDKE01) is 17.13 miles long, and its major tributary, Sargent Slough (ILDKEA) is 9.43 miles long (Illinois EPA 1996). There are 68.8 river miles within the watershed (IDNR CTAP 1997). The Little Mackinaw River is a fourth order tributary of the Mackinaw River. Stream monitoring has periodically taken place at station DKE-01, located two miles northwest of Hopedale (Short et al. 1996).

An understanding of the characteristics of the stream habitat are important to understanding the make up of the ecosystem and any changes over time. Physical characteristics may be measured in several ways (see Table 1 and Table 2). The Predicted Index of Biotic Integrity (PIBI), an index based on habitat characteristics,

calculated at station DKE-01 was 40.1 in 1987 and 40.9 in 1994, indicating that the river has the biotic potential of a moderate aquatic resource (Short 1988; Short et al. 1996).

Table 1. Habitat characteristics of The Little Mackinaw River station DKE-01. (Source: Short 1988; Short et al. 1996)

	1987	**1994**
Hydraulic Features		
Stream order	4	4
Station length (ft.)		620
Increment width		2
Mean stream width (ft.)	10.0	35
Mean stream depth (ft.)	0.5	0.82
Mean thalweg velocity (ft/s)	0	0
Discharge (cfs)	0	0
Mean discharge (ft/s)		0
Channel width (ft.)		52
Pool (%)	0	0
Riffle (%)	22	0
Substrate		
Silt/mud (%)	7	15.9
Sand (%)	16	11.1
Fine gravel (%)	25	18
Medium gravel (%)	16	12.7
Coarse gravel (%)	16	15.3
Small cobble (%)	13	2.6
Large cobble (%)	1	1.1
Boulder (%)	0	1.6
Bedrock (%)	0	0
Claypan (%)	0	3.2
Plant detritus (%)	3	6.9
Vegetation (%)	3	11.1
Submerged logs (%)	0	0.5
Other (%)	0	0
Other		
Instream cover (%)	6	1.77
Shading (%)	16	69
Predicted IBI	40.1	40.9
Biotic Potential Category	C	C

During the 1994 intensive survey data were collected for the qualitative stream habitat assessment procedure (SHAP). The overall stream habitat assessment score in 1994 for the Little Mackinaw River was 89 (see Table 2). Values in the entire Mackinaw River watershed ranged from 67 to 169 (Short et al. 1996).

Table 2. Qualitative stream habitat assessment score for station DKE-01, 1994. Source: Short et al. 1996.

Metric	Score	Assessment
Bottom substrate	16	excellent
Deposition	7	good
Substrate stability	9	good
Instream cover	4	fair
Pool substrate	1	poor
Pool quality	1	poor
Pool variability	1	poor
Canopy cover	12	excellent
Bank vegetation	13	excellent
Bank land use	2	poor
Flow refugia	6	fair
Channel alteration	6	good
Channel sinuosity	4	fair
Width/depth	1	poor
Hydrologic diversity	6	fair
Total score	89	

Water quality is another important parameter in understanding the stream and any changes over time due to natural or human causes. The Little Mackinaw River had a water quality index of 53.1 when sampled in 1987, meaning that there were moderate water quality problems (Short 1988). The index was not calculated during the 1994 survey, though data on some of the same parameters were collected (Table 3).

Table 3. Water quality data collected at station DKE-01 on the Little Mackinaw River in 1987 and 1994 (Source: Short 1988; Short et al. 1996)

			1994		
Category	**Parameter**	**1987**	07:55	14:00	11:00
Temperature	temperature (°C)	27	20.3	11.7	4.9
Oxygen	dissolved oxygen (mg/l)	2.7	10.4	5.8	9.9
PH	pH	7.1	8.4	7.6	7.7
Trophic/Nutrients	total phosphorus (mg/l)	0.12	0.14	0.06	0.121
Turbidity	total suspended solids (mg/l)	19	35	11	19
Dissolved solids	conductivity (umhos/cm)	555	453	677	556
Inorganic toxicity	un-ionized ammonia (mg/l)	0.001	0.002	0.007	0.000
Metals toxicity*	cadmium (ug/l)	<3	<3	<3	<3
	chromium (ug/l)	<5	<5	<5	<5
	copper (ug/l)	<5	<5	<5	<5
	lead (ug/l)	<100	<5	<5	<5
	mercury (ug/l)	na	<.05	<0.05	<0.05

zinc (ug/l)	<50	<100	<100	130
Water quality index	53.1	na	na	na

* The worst measured value for one of the six metals is used to compute metals toxicity.
na: not available

The Little Mackinaw River had the highest levels of ammonia nitrogen (.0.82mg/l) of any of the Mackinaw River sites sampled in 1994. Though this level is below the established limits (Short et al. 1996). The ammonium could be a result of poor septic systems or livestock operations, as high ammonium may be associated with organic waste (Retzer 1997b). These high ammonium levels may be related to the lack of living mussels in the River [(Retzer 1997b) see Wildlife section below]. Further information is needed to fully understand the situation.

No water quality violations were found in the Little Mackinaw River in 1994 and there were no elevated levels of pollutants or measured chemicals in the sediment (Short et al.1996). Further data on chemical analyses of water and sediment may be found in *An Intensive Survey of the Mackinaw River Basin 1994* (Short et al. 1996).

During the 1994 intensive survey of the Mackinaw River, The Little Mackinaw River had an Index of Biotic Integrity (IBI) of 52. This gives the Creek a Biological Stream Characterization (BSC) of "A" or unique aquatic resource, meaning that the quality of the biotic resources of the stream are excellent. During previous studies the river had been characterized as being a "B" stream (Short et al. 1996). The discrepancy between the habitat and the biological indices needs further exploration. (Please see Designated Use section below for a fuller explanation of IBI and PIBI.)

Designated Use

The Illinois Environmental Protection Agency has designated the Little Mackinaw River and its tributary Sargent Slough as full support overall and for aquatic life (Illinois EPA 1996). There were no data available to assess the designated uses of fish consumption and swimming; the river is not used as a public water supply (Illinois EPA 1996). This designated use assessment for the Little Mackinaw River is based on current ecological and habitat surveys and combined sampling of water, sediment and biota for chemical analyses. The designated use assessment for Sargent Slough is based on an evaluation of land use information and professional judgement (Illinois EPA 1996). Testing on the main branch of the Little Mackinaw River was primarily done at site DKE-01 on the downstream portion of the River, not far from its confluence with the larger Mackinaw River. Further chemical and biological assessments need to be preformed upstream for a more accurate assessment of water quality within this subwatershed.

Several indices were calculated as part of the assessment of aquatic life use support for the Little Mackinaw River. The Index of Biotic Integrity (IBI) is based on analyses of fish species richness and composition, trophic composition, and fish abundance and condition. The Predicted Index of Biotic Integrity (PIBI) is based on habitat assessment

criteria, including that outlined above (Waterbodies). The IBI for the Little Mackinaw River during the 1994 assessment was 52, while the PIBI was 40.9. The IBI value of 52 indicates a Biological Stream Classification (BSC) rating of "A" or unique aquatic resource. The Macroinvertebrate Biotic Index (MBI) for the River was 6.1 (Illinois EPA 1996; Short et al. 1996).

Impairments

The Illinois Environmental Protection Agency water quality report does not list any causes or sources of impairment for the Little Mackinaw River (Illinois EPA 1996). However, potential sources are known and can be inferred from surrounding land uses. Both point and nonpoint pollution may influence water quality. For example, nonpoint source pollution such as runoff from agricultural fields, livestock operations, and roads may have detrimental effects on water quality. Point source pollution may come from the wastewater treatment facility in Hopedale, or other selected identifiable locations. Sources identified in this report are only *potential* sources of impairment, and further study is needed to determine how much of an impact each of these sources may have on water quality.

Retzer (1997a) lists potential stressors for the aquatic community types in the Little Mackinaw River. He described the upper portion of the Little Mackinaw River as a low-slope headwater stream, and the lower portion as a low-slope small creek tributary. Retzer (1997a) identified the latter as a community type in need of protection. Table 4 highlights those stressors considered "high" and their potential impacts. See Retzer (1997a) for a more detailed list of other potential stressors.

Table 4. Ecosystem stresses and biological implications on low-slope headwater streams and low-slope small creek tributaries such as the Little Mackinaw River. (Source: Retzer 1997a)

Stress	**Biological Implications**
Agriculture	
Excess phosphorus and nitrogen	Directly toxic, indirectly reduces community diversity
Drainage or filling in of wetlands and bottomland lakes and oxbows	Loss of habitat
Alteration of hydrologic regime	Loss of habitat stability
Sedimentation	Covering and infiltration of gravel and sand substrates which smothers fish eggs and other invertebrates
Increased total suspended solids and turbidity	Stresses sight dependent species; interferes with gills and other filtering processes
Loss of natural riparian zone	Increased water temperatures and loss of nutrient sources
Commercial, residential, and urban land use activities	

Stormwater pollutants from lawns, streets, and parking lots	Sedimentation and chemical pollutants
Stormwater runoff from impermeable roofs, roads, and parking lots	Increased flood flows and lower base flows which increase habitat instability
Industrial wastes (especially barium, boron, strontium, alkaline compounds)	Mortality at high levels; increased susceptibility to disease; lower reproductive output levels
Reservoirs for drinking water and recreation	Permanent loss of stream habitat
Human sewage and septic discharge	Excess nutrients increase eutrophication
Livestock	
Waste discharges	Excess nutrients are toxic; enhances eutrophication process
Stream substrate trampling	Mortality of benthic species; mechanical crushing of substrate
Bank erosion increases sedimentation and turbidity	Sediments smother substrates; turbidity interferes with vision, gill and filtering activities
Exotic species	
Garlic mustard	Competitive with native plants

In 1994, 23 potential sources of impairment were identified in the Little Mackinaw River subwatershed by the Illinois Environmental Protection Agency (Short et al. 1996). Five of these sources had a high potential as a source of impairment, ten were identified as having moderate potential, while eight had a slight potential as a source of impairment. Criteria for determining the potential source magnitude were the pollutant source, the pollutant transport process, and the existing water resource (Short et al.1996). The distribution of these sites is relatively uniform throughout the subwatershed. The potential sources of impairment included 20 agricultural sites (87.0%), one municipal site (4.3%), and two other sites (8.7%) (Short et al. 1996). Agricultural impairments are from livestock sources only, cropland is not included. Municipal sources include wastewater treatment facilities and other urban point sources. Other sites may include chemical facilities, rock quarries, landfills and other point or nonpoint sources (Short et al. 1996).

Hopedale is on the southern boundary of the subwatershed, and is mostly located in the Indian Creek subwatershed. However, due to local topography some activities in Hopedale may directly impact the Little Mackinaw River subwatershed. In addition, the two subwatersheds share the same aquifer and groundwater impacts of potential point source pollution sites are shared. Farrell (1995) provides specific information on potential sources of impairment. Using a variety of sources his planning report lists nine registered underground storage tanks in Hopedale and two leaking underground storage tanks, which were later removed as part of improvements to Interstate 55. Two wastewater treatment plants operate in Hopedale, one treats municipal waste, the other

industrial waste (Farrell 1995). Any impact these may have on the Little Mackinaw River is unknown.

Surface impoundments are lined or unlined lagoons used for storing liquids, or a mixture of liquids and solids. The risk of contamination of groundwater from these lagoons is significant. The sewerage system in Hopedale is included in the Surface Impoundment Inventory (IDNR CTAP 1997).

Groundwater

Aquifers in the Mackinaw River watershed are generally sand and gravel, confined and separated by till or clay. Water below the glacial deposits is generally of insufficient quantity or too mineralized for human use. In some areas sand and gravel aquifers are "cradled" in bedrock valleys, for example the Danvers Bedrock Valley that runs along the southern edge of the Little Mackinaw River subwatershed (IDNR CTAP 1997). See the Geology section below for further information on geological formations.

The Sankoty-Mahomet Sand Aquifer, part of the Banner Formation, is the most widespread and productive sand and gravel aquifer in the Mackinaw River watershed. The sub-Sankoty-Mahomet and Sankoty-Mahomet units which make up this aquifer are separated by glacial lake deposits, but behave as one aquifer (IDNR CTAP 1997). In the vicinity of the mouth of the Little Mackinaw River, where the Danvers Bedrock Valley joins the Mackinaw Bedrock Valley the aquifer is 150 feet thick, it may thin to 25 feet or less within 5 miles (IDNR CTAP 1997). Sand and gravel associated with the Glasford Formation may contribute to the yield of the Sankoty-Mahomet Sand Aquifer, but they are generally too thin and coarse-grained to serve as a source of public water supply (IDNR CTAP 1997). In some areas sand and gravel from the Glasford Formation and Wedron Group may combine to provide small to moderate water supplies (IDNR CTAP 1997).

Two types of wells are used to extract groundwater for domestic and farm use: large-diameter wells dug to depths of less than 100 feet and small-diameter drilled wells that tap deposits at depths greater than 100 feet. In the Tazewell County portion of the Mackinaw River watershed there are a reported 692 large-diameter wells and 955 small-diameter wells (IDNR CTAP 1997). US Census Bureau data indicate that of the Tazewell County houses using individual wells nearly 92% use drilled wells, with the remainder using dug wells (US Census Bureau 1999). There are additional wells in McLean County (IDNR CTAP 1997). Data specific to the Little Mackinaw River watershed are unavailable.

Public water supply wells are drilled wells that generally tap deposits that range in depth from 35 to over 400 feet. No records of pubic water supply wells located within the watershed were found (IDNR CTAP 1997). Over 88% of Tazewell County housing units receive public system or private company water; the remaining housing units uses drilled or dug wells or other sources (US Census Bureau 1999).

Groundwater studies have demonstrated no degradation of the water within the entire Mackinaw River watershed in respect to iron, total dissolved solids, sulfate, nitrate, chloride, and hardness (IDNR CTAP 1997). However, local contamination may still be present and must be examined at a site-specific level (IDNR CTAP 1997).

Irrigation

No irrigation is being practiced in the Little Mackinaw River subwatershed (Myers, personal communication 1999; Rutherford, personal communication 1999).

Drainage

Subsurface tiling is extensive, however tile maps do not exist for many areas. The purpose of tiling is to remove water from saturated fields and farmed wetlands in order to facilitate agricultural activity and increase productivity. The effect of this is to increase river discharge after a storm event. Tiles serve to drain the land after the peak event and therefore contribute to a higher sustained discharge. This then lowers the general water table in the area, effectively reducing base flows during dry periods. Historically, wetlands would have held water on the land and probably contributed significant amounts of water to the river during periods of low precipitation. Further study of the effects of subsurface tiling on the river after a storm event and during base flow periods is needed.

There are no active Drainage Districts within this watershed (Myers, Rutherford, personal communications 1999).

Floodplain Boundaries

Based on an examination of soil types, the Little Mackinaw River is bordered by a narrow floodplain, except in the upper reaches of the Whitten Branch. Flooding is not a large concern within this subwatershed. There may be occasional flooding along the lower 2-½ miles of the River (Myers, personal communication 1999). An unmaintained levy exists along the sides of the river near the mouth, extending for over a mile on the northern bank.

Municipal/Industrial

The watershed is rural with a relatively low population density. Additional information on population and land use may be found in the Land Use and Socioeconomic/Human Resources sections of this report.

Industrial sites within a watershed are potential sources of point source pollution, though there may only be some light industry within this subwatershed. No record of NPDES permits within the watershed was located. In 1992 a sand and gravel pit was located south of the mouth of the river (IDNR CTAP 1997). Past and present small industries have been identified for Hopedale, which is located just outside of the watershed

boundary (Table 5). A commercial campground operates near the northeast corner of Hopedale. Some of these establishments may be within the Little Mackinaw River watershed; further investigation is needed. Mention of these industries does not imply that they are adversely affecting the watershed and its resources.

Table 5. Industrial activities in Hopedale (Source: Farrell 1995).

Town	Industries
Hopedale	Small engine repair, underground tanks, machine shop, manufacture of flush tanks for livestock manure removal

Please refer to the section entitled "Impairments" above for additional information.

Riparian Corridors

The riparian corridor of the Little Mackinaw River varies from less than 25 meters wide to more than 75 meters wide along the majority of the River. It is over 75 meters wide along over 50% of the river length (Short et al. 1996). Land cover along the riparian corridor varies from predominantly woodland downstream, to a combination of woodland, grassland, and mixed vegetation in the middle stretches, to predominantly grassland with some mixed vegetation upstream. Predominant land cover in the entire 300 meters bordering the river shows woodland and mixed vegetation downstream changing to a dominance of cropland as one moves upstream, the furthest reaches are a combination of grassland, cropland, and mixed vegetation (Short et al. 1996).

Hydrologic Modifications

Unmaintained levees are found near the mouth of the river, they extend for over one mile on the northern edge. There is some channelization of the tributaries to the Little Mackinaw River. Channeled streams can play a role in downstream flooding and sedimentation because of their efficiency in carrying stormwater. These channeled streams do not have floodplains, therefore water storage capacity is limited. Subsurface tiling in the subwatershed also impacts the hydrology of the River.

Stormwater Management

Tazewell County has adopted the *Model Soil Erosion Ordinance* developed by the Tri-County Regional Planning Commission. This ordinance, called the Tazewell County Erosion, Sediment, and Storm Water Control Ordinance, describes the types of land projects that are subject to the requirements of a permit, and describes specific standards for the design and maintenance of control measures for soil erosion, sediment, and stormwater. The ordinance states that "no land surface shall be disturbed unless an erosion and sediment control permit, or an erosion, sediment and storm water control permit, has been issued for that project." Exceptions to this are:

1. Land disturbing activities which do no involve the construction of any new single or two-family dwellings, and for which the disturbed area is less than 5,000 square feet.
2. Normal agricultural practices.
3. Routine maintenance of roads, accesses, and utility service lines.

Furthermore, "the Erosion Control Administrator reserves the right to require any non-agricultural, construction development activity, regardless of disturbed area or type of activity, to comply with this article if it is determined to be the cause of or a contributor to an existing or potential erosion, sediment, or storm water impact. "

Those applying for a permit must file the application with the County, in addition to paying a fee and providing a site-specific plan. Any commercial, institutional, multi-family, or industrial project with an area of more than one-half acre, or a project requiring subdivision approval by a unit of local government with an area of more than one-half acre must also provide the additional information listed below:

1. Existing site conditions map
2. Plan of final site conditions
3. Sediment and erosion control practices
4. Storm water management plans and controls
5. Schedule or sequence of development of installation of the elements of the site management control measures proposed
6. A detailed estimate of quantities and estimated costs
7. A plan of the continued management and maintenance of such permit control structures

The issuance of permits, the inspection of control measures, and the enforcement of the ordinance is the duty of an appointed Erosion Control Administrator. The Erosion Control Administrator can revoke any permit if the rules, regulations, or standards of the permit issued are being violated. Any violation is subject to a fine not to exceed $500 per day. There is an Appeals Board of five members appointed by the County Board Chairman, the Soil and Water Conservation District, and the Tri-County Regional Planning Commission.

Wetlands

Wetlands are an important part of the landscape because they provide critical habitat for many plants and animals and serve an important role in mitigating the effects of storm flow in streams. The hydrogeology of wetlands allows water to accumulate in them longer than in the surrounding landscape, with far-reaching consequences for the natural environment. Wetland sites are important to organisms that require or can tolerate moisture for extended periods of time, and the wetland itself becomes the breeding habitat and nursery for many organisms that require water for early development.

The configuration of wetlands enables them to retain excess rainwater, extending the time the water spends on the upland area. The effect of this retention on the watershed is

to delay the delivery of water to the main stream. This decreases the peak discharges of storm flow or floods, thus reducing flood damages and the resulting costs. Wetlands also provide valuable water to the stream during periods of low flow. Water seeps from the wetland into the stream, increasing base flows and reducing elevated stream temperatures. The destruction of wetland areas has the opposite effect, increasing peak flood flows and thereby increasing flood damages and associated costs. During periods of low flow, water does not seep into the stream from upland areas. In-stream temperatures increase, and base flows of the stream decrease.

The Little Mackinaw River watershed contains 190 acres of wetlands, or approximately 0.6% of the total drainage area. Nearly three-quarters of the wetlands are forested (IDNR CTAP 1997). These wetlands represent 2.2% of the wetlands within the entire Mackinaw River watershed (IDNR CTAP 1997).

Fish

The Mackinaw River has 66 known fish species (IDNR CTAP 1997). During an intensive survey of the watershed in 1994 59 species and two hybrids were recorded (Short et al. 1996). The 28 native species found in the Little Mackinaw River are listed in Table 6. A hybrid sunfish was also collected. The blacknose shiner (*Notropis heterolepis*) was last recorded in the river in 1880 and is assumed to be extirpated (IDNR CTAP 1997). No other state endangered or threatened species have been recorded in the river.

Table 6. Abundance of fish species recorded in the Little Mackinaw River, 1994 (Source: Short et al. 1996).

Common name	Scientific name	Abundance
creek chub	*Semotilus atromaculatus*	33
hornyhead chub	*Nocomis biguttatus*	8
central stoneroller	*Campostoma anomalum*	430
suckermouth minnow	*Phenacobius mirabilis*	77
red shiner	*Cyprinella lutrensis*	10
bluntnose minnow	*Pimephales notatus*	153
rosyface shiner	*Notropis rubellus*	1
bigmouth shiner	*Hybopsis dorsalis*	2
sand shiner	*Notropis ludibundus*	102
quilllback	*Carpiodes cyprinus*	29
white sucker	*Catostomus commersoni*	33
northern hogsucker	*Hypentelium nigricans*	13
shorthead redhorse	*Moxostoma macrolepidotum*	79
black redhorse	*Moxostoma duquesnei*	134
golden redhorse	*Moxostoma erythrurum*	11
silver redhorse	*Moxostoma anisurum*	42
channel catfish	*Ictalurus punctatus*	19

yellow bullhead	*Ameiurus natalis*	1
stonecat	*Noturus flavus*	1
rock bass	*Ambloplites rupestris*	1
largemouth bass	*Micropterus salmoides*	1
smallmouth bass	*Micropterus dolomieui*	55
green sunfish	*Lepomis cyanellus*	6
bluegill	*Lepomis macrochirus*	3
longear sunfish	*Lepomis megalotis*	29
sauger	*Stizostedion canadense*	1
blackside darter	*Percina maculata*	6
Johnny darter	*Etheostoma nigrum*	14

Priority Waterbody

The Mackinaw River Watershed Council identified the Little Mackinaw River watershed as a priority area for work under the Section 319 of the Clean Water Act.

The confluence of the Little Mackinaw River with the main stem of the Mackinaw River has been designated a Zone B priority site by The Nature Conservancy (TNC 1999). Potential work in the area may include encouraging partners to promote available conservation programs that assist landowners in restoring the natural hydrologic function of the floodplain and wetlands.

Soil Classification

Five soil associations are identified within the subwatershed. The Ipava-Sable Association covers 15,803 acres. This association is made up primarily of Ipava and Sable soils with minor areas of Tama and Harpster soils in nearly level areas. In most areas the major soils are used for cultivation, and they are well suited to this use. These soils are poorly suite to unsuitable for dwellings and septic systems (USDA NRCS 1996). The Birbeck-Miami-Hennepin Association covers 5,926 acres with the subwatershed. This association is found in sloping to very steep areas and is characterized by well drained and moderately well drained soils. It is suitable for woodland and wildlife habitat, particularly in the steep areas. Less sloping areas may be used for pastureland or cultivation. Soils in this association are moderately to poorly suited for dwellings and septic tanks (USDA NRCS 1996). The Tama-Ipava-Sable Association covers 5,267 acres of nearly level to sloping land. These soils are well suited to crops in level and gently sloping areas and most areas are cultivated. Sable and Ipava soils are unsuitable to poorly suited to dwellings and septic systems while the Tama soils are moderately to well suited to such uses depending on the slope (USDA NRCS 1996).

The Rozetta-Stronghurst Association covers 3,621 acres of nearly level and gently sloping land in the subwatershed. The soils in this association are well suited to cultivation and primarily used for that purpose; they are moderately to poorly suited for dwellings and septic systems (USDA NRCS 1996). The Plano-Elburn-Sable Association covers 2,305 acres. It is found on nearly level and gently sloping land. These soils are well suited to cultivation and most areas are cultivated. They are unsuitable to moderately suitable for dwellings and septic systems depending on the individual soil (USDA NRCS 1996).

Table 7 provides descriptive data on the soil types found in the Little Mackinaw River subwatershed.

Table 7. Soil types found in the Little Mackinaw River subwatershed. Source: USDA NRCS 1996, 1998.

Soil Classification	Soil Composition	Water Table (ft)	Land Use Capability Class	Hydric Soils	Slope	Permeability	Erodibility Index
Miami	silt loam	>6	IIIe, IVe	no	5-15%	M to MS	11.80
Tama	silt loam	4->6	I, IIe, IIIe	no	1-10%	M	2.19
Ipava	silt loam	1-3	I	no	0-2%	MS	1.92
Atterberry	silt loam	1-3	I	no	0-2%	M	2.19
Sable	silty clay loam	0.5-2	IIw	yes	0-2%	M	1.21
Saybrook	silt loam	>6	IIIe	no	5-12%	M to MS	4.61
Proctor	silt loam	>6	I	no	0-2%	M to MR	4.61
Catlin	silt loam	3.5-6	IIIe	no	4-10%	M	4.61
Elburn	silt loam	1-3	I	no	0-2%	M	1.92
Plano	silt loam	3->6	I, IIe	no	0-5%	M	2.19
Strawn	loam	>6	IVe	no	15-20%	M to MS	58.00
Birkbeck	silt loam	3-6	IIIe	no	5-10%	M to MS	13.60
St. Charles	silt loam	>6	IIIe	no	5-10%	M	4.66
Edington	silt loam	.5-2	IIw	yes	0-2%	S	na
Stronghurst	silt loam	1-3	IIw	no	0-2%	M	2.54
Rozetta	silt loam	4-6	IIe	no	1-5%	M	3.86

Downs	silt loam	4-6	IIe	no	1-5%	M	na
Radford	silt loam	1-3	IIIw	yes	0-2%	M	1.21
Sawmill	silty clay loam	0-2	IIIw	yes	0-2%	M	1.21

Land Capability classes: I – few limitations that restrict use; II – moderate limitations that reduce plant choice or require moderate conservation practices; III – severe limitations that reduce plant choice or require conservation measures, or both; IV – very severe limitations that reduce plant choice or require careful management or both; an "e" indicates that erosion is the main potential hazard, a "w" indicates that water may interfere with cultivation; **Permeability**: S—slow 0.06-0.2 inches/hour; MS – moderately slow 0.2-0.6 inches/hour; M – moderate – 0.6-2.0 inches/hour; MR – moderately rapid – 2.0 –6.0 inches/hour

Soil Erosion

Erosion in the Little Mackinaw River subwatershed is largely due to row crop agricultural practices that expose soil. Several different types of erosion occur within the Mackinaw River watershed, and by extension, the Little Mackinaw River subwatershed. Sheet and rill erosion are the most significant (USDA/NRCS 1997). Sheet erosion occurs when soil is detached by the impact of raindrops and moves uniformly downhill. Rill erosion occurs when stormwater runoff concentrates in shallow channels or rills, often between crop rows or in tillage channels. These rills can sometimes form into gullies. Sheet and rill erosion on farmland can often be controlled through appropriate tillage operations.

Ephemeral gully erosion also occurs in areas where stormwater runoff concentrates, though gullies are larger than rills. Ephemeral gullies can still be controlled through appropriate farming practices. Gully erosion is the formation of channels too deep to cross with farm equipment. Significant and increasing damage can occur where gullies become established. Streambank erosion is the sloughing of banks due to streamflow (sometimes intensified after storm events), unstable banks or channel bottoms, channel obstructions, livestock trampling, heavy equipment or a combination of factors (USDA/NRCS 1997).

In 1996 erosion rates were estimated for the Mackinaw River watershed (USDA/NRCS 1997). Erosion rates were based on "T" (tolerable soil loss), the rate at which soil is formed. While "T" will maintain soil productivity those rates of erosion may contribute to sedimentation in waterways. In the Mackinaw River watershed "T" is most commonly 5 tons/acre/year (USDA/NRCS 1997). Estimates of rates of erosion in the Little Mackinaw River watershed are given in Table 8; while sedimentation estimates, by type of erosion are given in Table 9.

Table 8. Erosion rate and land affected in Little Mackinaw River (Data are extrapolated from USDA/NRCS 1997).

Erosion rate	**Acres of land affected**
0 – 1T	27,328
1T – 2T	3,385
Over 2T	824
Total	31,537

Table 9. Annual erosion and sedimentation estimates for Little Mackinaw River (Data are extrapolated from USDA/NRCS 1997).

Erosion type	Erosion (tons)	Sediment delivery rate	Sedimentation (tons)	Sediment transport rate (%)	Sedimentation transported (tons)
Sheet and rill	133,396	0.70	93,377.2		
Ephemeral	12,320	0.80	9,856		
Gully	11,000	0.85	9,350		
Streambank erosion	3,775	1.00	3,775		
Total	156,716		116,358.2	0.25	29,089.55

Geology

The geologic foundation of the entire Mackinaw River watershed is bedrock and glacially derived sediments that lie directly beneath the soils and modern sediments of the land surface. The topography of the bedrock surface partly determines the type and distribution of the overlying glacial deposits. These sediments, in turn, determine the area's groundwater resources, form the parent material of the region's soils, and play a role in the development of the watershed's wetland areas. Together these geologic factors govern the development of the entire range of plant and animal communities within the watershed.

The underlying bedrock in the Little Mackinaw River subwatershed is of relatively recent Pennsylvanian age (320-286 million years ago). Both the Modesto and Carbondale Formations are found in the watershed. The Modesto Formation is characterized by widespread relatively thick clayey limestones and thin coals, while the Carbondale formation has the thickest coal beds in Illinois (IDNR CTAP 1997).

Buried valleys, lowlands, and uplands are part of the complex topographic surface of the bedrock. The Little Mackinaw River subwatershed is on the northern side of the buried Danvers Valley. The bedrock ranges from 450 to 350 feet above sea level (IDNR CTAP 1997).

The bedrock is overlaid by glacial sediments (or glacial drift) deposited by a succession of glaciers during the Pleistocene epoch. Glacial till is made up of particles of all sizes deposited at the base of the glacier. Outwash, or sand and gravel that washed off the glacier, is a potential source of construction sand and gravel found in certain areas within the Mackinaw River watershed. Lacustrine, or lake deposits, are fine-grained sediments deposited in temporary lakes. Windblown silt (loess) from the late- and post-glacial age overlays these glacial deposits, and is the parent material for the areas productive soils.

Successive glaciers passed over the area. Tills of pre-Illinois glacial episodes are called the Banner Formation. Glaciers of the Illinois Episode, referred to as the Glasford Formation, followed these. The surface of the Little Mackinaw River watershed was primarily influenced by till deposited during the Wisconsin Episode of glaciation belonging to the Wedron Group. The deposits of glacial origin in the watershed vary in thickness from 100 –300 feet near the mouth of the River to 300-400 feet in the major portion of the watershed (IDNR CTAP 1997).

Construction sand and gravel are produced in the Mackinaw River watershed. Significant deposits are located near the mouth of the Little Mackinaw River and there may have been an active pit located there in 1992 (IDNR CTAP 1997).

Topography

The Little Mackinaw River drains an area of 32,922 acres or approximately 51.4 square miles. The river flows from northeast to southwest (see Map X). The elevation varies from 800 feet at the headwaters to approximately 540 feet at the mouth, the average steam gradient is 14.9 feet per mile (Short et al. 1996).

The drainage density of the Little Mackinaw River watershed was calculated by dividing the total acreage for the watershed by the total stream length. The resultant drainage density is approximately 478.5 acres of watershed per mile of stream.

Land Use

Land cover in the Little Mackinaw River subwatershed gives an initial indication of land use activities. The vast majority of the land is devoted to agriculture, with grasslands that may support livestock as next greatest in area. Table 10 provides data on major land use categories. Also see Map X.

Table 10. Land cover by percent in The Little Mackinaw River subwatershed. (Source: IDNR CTAP 197:1-19).

Land Cover	Acres	Percent of subwatershed
Agricultural Land	**30,673**	**93.2**
Cropland	26,097	79.3
Rural grassland	4,576	13.9
Forest & Woodland	**1,333**	**4.1**
Urban & Built-up Land	**264**	**0.8**
Urban/Built-up	258	0.8
Urban grassland	6	0.0
Wetland	**190**	**0.6**
Forested	137	0.4
Non-forested	53	0.2

Lakes & Streams	**459**	**1.4**

The primary agricultural crops in the subwatershed are soybeans and corn. In 1994 it was estimated that 152,900 acres of corn and 129,000 acres of soybeans were planted in Tazewell County and that 357,900 acres of corn and 308,200 acres of soybeans were planted in McLean County. This represented approximately 4.4% of the Illinois land area planted to corn that year and 4.6% of the land area planted to soybeans (IDNR CTAP 1997). Per acre yields are variable, but generally higher than the state average. For example, in 1994 the average corn production per acre in Tazewell County was 172 bushels, compared to a state average of 156, while the average soybean production was 49 bushels per acre compared to a state average of 46 (IDNR CTAP 1997). Smaller amounts of wheat, hay, and other crops are also grown in the watershed.

In general, the Mackinaw River watershed has a small number of cattle (44,800 head in 1994) and a relatively large number of hogs [304,000 head in 1994 (IDNR CTAP 1997). The trend in Tazewell County has been toward increased hog production, while the trend in McLean County has been towards decreasing production (IDNR CTAP 1999). Cattle are also raised in the subwatershed. There are an estimate 12 livestock operations in the Little Mackinaw River subwatershed (Myers, personal communication 1999). It is not known how the recent slump in hog prices has impacted the number of animals or operations.

The average farm size in Tazewell County is just over 300 acres and there are approximately 1,000 farms in the County (Farrell 1995). Over 75% of agricultural producers have been on their current farm for more than 10 years (Farrell 1995). There are an estimated 70 agricultural producers working in the Little Mackinaw River subwatershed (Myers, personal communication 1999).

Agricultural land in the subwatershed is rented for between $130 and $195 per acre, and large amounts of land are rented out. That trend is expected to continue (Myers, personal communication 1999). There is little if any crop sharing in the subwatershed (Myers, personal communication 1999). In Tazewell County just over 20% of agricultural producers lease all of the land they farm, just under 40% own some land and lease the rest, while over 40% own all of the land they farm (Farrell 1995).

Transect survey data from the Bureau of Soil and Water Conservation (IDOA) revealed that in 1995 no-till was practiced on 23% of the land in Tazewell County and 14% of the land in McLean County. Conservation tillage in which 30% or more of the crop residue remained on the field was practiced on less than 1% of the land in Tazewell County and 24% of the land in McLean County. Reduced tillage where 15-30% of the crop residue is left on the field was practiced on 17% of the land in Tazewell County and 29% of the land in McLean County; the remainder of the land was under conventional tillage (USDA NRCS 1997).

In Tazewell County over 950 acres were enrolled in the Conservation Reserve Program by 1997, though nearly half of those contracts have ended (Table 11). Little Mackinaw River subwatershed specific data were unavailable.

Table 11. Conservation Reserve Program enrollment in Tazewell County (Source: USDA NRCS 1997).

Year contract ends	No. of contracts	Acres
1997	9	22.8
1998	10	217.9
1999	11	147.6
2000	2	12.5
2001	11	106.6
2002	9	132.4
2005-6	9	111.3
Total	61	950.2

In 1998, 90 structural practices were completed in Tazewell County under a variety of different state and federal programs (Table 12). Data specific to the Little Mackinaw River subwatershed were not available.

Table 12. Structural practices completed in Tazewell County in 1998 (Source: Myers, personal communication 1999)

Practice	Programs*+	No. of projects	Quantity
Waterways	CPP, CRP, EQIP	45	53.6 acres
Ponds	EQIP	4	14,307 yd^3
Wetlands	CREP,WHIP	1	4,912 yd^3
Dry dams	EQIP	3	3,847 yd^3
Streambank	EQIP, SSRP	3	28 weirs
Terraces	CPP, CRP, EQIP, LTA	10	17,300 feet
Water/sediment control basin	CPP, CRP, EQIP	14	12,150 feet

*Programs: CPP–Conservation Practices Program; CRP—Conservation Reserve Program; SSRP—Streambank Stabilization and Restoration Program, WHIP—Wildlife Habitat Incentives Program; EQIP—Environmental Quality Incentives Program; LTA—Long term agreement.
+ Some of this work is also under the Conservation Reserve Enhancement Program (CREP)

There are no Natural Areas or Nature Preserves within the subwatershed (IDNR CTAP 1997). The 1,248 acre Mackinaw River Fish and Wildlife Area is just north of the subwatershed.

There likely is not a significant amount of fishing in the Little Mackinaw River. Most fishing in the Mackinaw River watershed occurs in the main channel and a few selected tributaries. In 1993 nearly 24,000 fishing licenses were sold in the three counties that contain the majority of the Mackinaw River watershed. The number of licenses sold to

non-residents was lower than the state average (IDNR CTAP 1997). This suggests that local county residents do the vast majority of fishing in the Mackinaw River.

Forest and woodlands cover over 1,300 acres in the subwatershed. Though data specific to the Little Mackinaw River are not available, in the whole of the Mackinaw River basin only 0.1% of the forest is considered to be of high ecological quality (IDNR CTAP 1997). Habitat degradation and fragmentation, the introduction of exotic species, and altered fire regimes contribute to ecological problems in forested areas. Overgrazing can be a serious factor in forest degradation through alteration of species composition and structure (IDNR CTAP 1997).

Road density in the subwatershed insures that most areas are reached relatively easily by road. Many of the roads cross the Little Mackinaw River and its tributaries. State Route 9 passes through the northern portion of the watershed and State Route 122 passes through the southern edge of the subwatershed, leading to Hopedale (see Map1). There are plans to widen Route 9 to four lanes, which would have a significant impact on the watershed and the upper reaches of the River and its tributaries. The number of miles of road in Tazewell County increased from 1,594 to 1,699 miles between 1973 and 1993 (IDNR CTAP 1997). Much of that may have been in the several large population centers (e.g., Pekin, East Peoria, and Morton) in the county.

There are no large airports within the subwatershed, though there may be landing strips for crop planes. No railroads, pipelines, or power lines appear to cross the subwatershed.

Hopedale is located on the southern edge of the subwatershed, it had an estimated population of 950 in 1996. Minier, also just outside the southern edge of the subwatershed had a 1996 estimated population of 1,184 (US Census Bureau 1999). Please see the section on socioeconomic characteristics of the watershed for further information on population.

There is a permitted landfill in Hopedale that accepts demolition debris, incinerator ash, and special and industrial wastes. It has a clay and plastic liner. There is monitoring of the groundwater at the site, but no data were available (IDNR CTAP 1997). There may, however, be illegal dumping in some areas. No documentation on the magnitude of this could be found. In 1995 there were nine registered underground storage tanks in Hopedale and another along the upper middle portion of the River (its exact location was not available). Of those there were two reported leaking underground storage tanks in Hopedale (Farrell 1995). The Hopedale tanks may not be within the Little Mackinaw River subwatershed, though the aquifer is the same on both sides of the ridge.

The 1990 U.S. Census data shows 41,034 housing units, or 83.2% of Tazewell County using public sewers, another 8,133 housing units or 16.5% use septic tanks or cesspools. The remaining 0.3% use other methods which are not specified (US Census Bureau 1999).

Air Quality

There are no USEPA air quality measurement stations in the Mackinaw River watershed (IDNR CTAP 1997). Data on estimated annual stationary point source emissions of selected pollutants do however provide a measure of air quality. In 1995 point source emissions estimates were calculated for McLean County (see Table 13). Much of this pollution may be due to activity outside the Little Mackinaw River subwatershed in urban areas such as Bloomington-Normal, Pekin, Morton, East Peoria, and Washington.

Table 13. Estimated 1995 point source emissions in Tazewell and McLean County (Source IDNR CTAP 1997).

Pollutant	Tazewell Tons/year	McLean Tons/year
particulate matter	2,723	1,103
sulfur dioxide	47,503	37
nitrogen oxides	76,255	904
volatile organic matter	1,539	3,807
carbon monoxide	1,721	132

Most climatic data for the Mackinaw River watershed are from the Bloomington-Normal National Weather Service Coop site, which has the longest continuous weather records in the vicinity. The area has a continental climate with temperature highs averaging between 80˚F and 90˚F in the summer months and 30-40˚F in the winter months. Average monthly temperature lows range from 15.5˚F in January to 65.4˚F in July (IDNR CTAP 1997).

Precipitation is heaviest during the growing season, with mean annual precipitation at 37.75 inches. Average precipitation ranges from 1.61 inches per month in January to 4.41 inches in July. The average number of days per month with precipitation ranges from 8-12 (IDNR CTAP 1997). The watershed averages 48 thunderstorms each year, with a range of 35 to 60 (IDNR CTAP 1997). Since data were collected beginning in 1959, the Mackinaw River watershed has received, on average, two tornadoes per year, with a range of 0 to 6 (IDNR CTAP 1997).

Wildlife

Threatened or Endangered Species

Table 14 lists threatened and endangered species known or thought to occur in the Mackinaw River watershed. Specific locations of many of these organisms were not provided in order to protect their existence.

In 1996, 28 state endangered river otters (*Lontra canadensis*) were released into the Mackinaw River watershed, though there has been no systematic monitoring of the population (IDNR CTAP 1997). The Indiana bat (*Myotis sodalis*) and the bobcat (*Lynx rufus*), two state threatened or endangered species, may occur in forested parts of the Mackinaw River watershed, though no sightings within the watershed have been confirmed (IDNR CTAP 1997).

Table 14. Threatened and endangered species occurring in the Mackinaw River watershed (Sources: IDNR CTAP 1997; Retzer 1997)

Plants	**Scientific Name**	**Status**
heart-leaved plantain	*Plantago cordata*	state endangered
spreading sedge	*Carex laxiculmis*	state threatened
tall sunflower	*Helianthus giganteus*	state endangered
Birds		
long-eared owl	*Asio otus*	state endangered
short-eared owl	*Asio flammeus*	state endangered
veery	*Catharus fuscescenc*	state threatened
loggerhead shrike	*Lanius ludovicianus*	state threatened
Mammals		
river otter	*Lontra canadensis*	state endangered
Reptiles		
Kirtland's snake	*Clonophis kirtlandii*	state threatened
Illinois chorus frog	*Pseudacris streckeri*	state threatened
Illinois mud turtle	*Kinosternon flavescens*	state endangered
western hognose snake	*Heterodon nasicus*	state threatened
Musssels		
slippershell mussel	*Alasmidonta viridis*	state endangered
rainbow mussel	*Villosa iris*	state endangered
round pigtoe mussel	*Pleurobema sintoxia*	state endangered
elktoe mussel	*Alasmidonta marginata*	state endangered

Birds

At least 264 of the 299 bird species that regularly occur in Illinois are found in the Mackinaw River watershed. Of those, 134 or 50.8% have been recorded as breeding in the watershed. Of the breeding birds, 37 or 27.6% are locally extinct or extremely rare during the breeding season. Habitat loss may be a major contributing factor (IDNR

CTAP 1997). The passenger pigeon (*Ectopistes migratorius*) and Carolina parakeet (*Conuropis carolinensis*), both globally extinct, once occurred in the Mackinaw river watershed. Other species which are extinct or nearly extinct in Illinois which formerly occurred in the Mackinaw include Bachman's sparrow (*Aimophila awstivalis*), Bewick's wren (*Thryothorus bewickii*), and the American swallow-tailed kite (*Elanoides forficatus*) (IDNR CTAP 1997). For a complete list of bird species found in the Mackinaw River watershed, with a description of their associated habitat, please see the Mackinaw River Area Assessment, Volume 1 (IDNR CTAP 1997).

Mammals

There have not been any systematic surveys of mammals in the Mackinaw River watershed. Forty-five mammal species are expected to occur in the Mackinaw River watershed (Table 15) based on range maps and records contained in Hoffmeister (1989 in IDNR CTAP 1997) and the Illinois Natural Heritage database (IDNR CTAP 1997). Their occurrence is dependent upon adequate habitat and the population status of these species is not known with confidence. Data were not available as to which species are known or likely to occur within the Little Mackinaw River subwatershed.

Table 15. Mammal species known or likely to occur in the Mackinaw River watershed. (Adapted from IDNR CTAP 1997:4-55--4-56)

Common Name	**Order** ***Scientific name***	**Status**
Marsupials	**Didelphimorphia**	
Virginia opossum	*Didelphis Virgiana*	common
Insectivores	**Insectivora**	
masked shrew	*Sorex cinereus*	common
northern short-tailed shrew	*Blarina brevicauda*	common
Least shrew	*Cryptotis parva*	common
Eastern mole	*Scalopus aquaticus*	common
Bats	**Chiroptera**	
little brown bat	*Myotis lucifugus*	common
northern long-eared bat	*Myotis septentrionalis*	common
silver-haired bat	*Lasionycteris noctivagans*	? uncommon
eastern pipistrelle	*Pipistrellus subflavus*	common
big brown bat	*Eptesicus fuscus*	common
red bat	*Lasiurus borealis*	common
hoary bat	*Lasiurus cinereus*	? uncommon
evening bat	*Nycticeius humeralis*	? uncommon
Rabbits	**Lagomorpha**	
eastern cottontail	*Sylvilagus floridanus*	common
Rodents	**Rodentia**	
eastern chipmunk	*Tamius striatus*	common
woodchuck	*Marmota monax*	common
thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	common

Franklin ground squirrel	*Spermophilus franklinii*	? uncommon
gray squirrel	*Sciurus carolinensis*	common
fox squirrel	*Sciurus niger*	common
southern flying squirrel	*Glaucomys volans*	common
plains pocket gopher	*Geomys bursarius*	common
beaver	*Castor canadensis*	common
western harvest mouse	*Reithrodontomys megalotis*	common
deer mouse	*Peromyscus maniculatus*	common
white-footed mouse	*Peromyscus leucopus*	common
meadow vole	*Microtus pennsylvanicus*	common
prairie vole	*Microtus ochrogaster*	common
pine vole	*Microtus pinetorum*	? uncommon
muskrat	*Ondatra zibethicus*	common
southern bog lemming	*Synaptomys cooperi*	common
Norway rat*	*Rattus norvegicus*	common
house mouse*	*Mus musculus*	common
meadow jumping mouse	*Zapus hudsonius*	? uncommon
Carnivores	**Carnivora**	
coyote	*Canis latrans*	common
red fox	*Vulpes vulpes*	common
gray fox	*Urocyon cinereoargenteus*	? uncommon
raccoon	*Procyon lotor*	common
least weasel	*Mustela nivalis*	? uncommon
long-tailed weasel	*Mustela frenata*	common
mink	*Mustel vison*	common
badger	*Taxidea taxus*	uncommon
striped skunk	*Mephitis mephitis*	common
river otter	*Lontra canadensis*	uncommon
Even-toed ungulates	**Artiodactyla**	
White-tailed deer	*Odocoileus virginianus*	common

* exotic species

Butterflies and Skippers

There have not been any systematic surveys of butterflies in the Mackinaw River watershed. Though there are known collections by county, population status is unavailable (IDNR CTAP 1997). Table 16 lists two species known to occur in the Mackinaw River watershed in Tazewell County. These species may be found in the Little Mackinaw River subwatershed. The Mackinaw River Area Assessment lists other species likely to occur in the area (IDNR CTAP 1997:Table 4-13).

Table 16. Butterflies and skippers known to occur in Tazewell County in the Mackinaw River watershed (adapted from IDNR CTAP 1997:4-72—4-76)

Common name	Scientific name

little copper	*Lycaena phlaeas*
tawny-edged skipper	*Polites themistocles*

Freshwater Mussels

Historically the Mackinaw River watershed has supported 31 species of mussels; some species may have been extirpated in the last few decades (IDNR CTAP 1999). However, during a 1995-96 survey no living mussels were found in the Little Mackinaw River (Retzer 1997b). The lack of living mussels in the Little Mackinaw River may be related to the relatively high mean levels of total ammonia nitrogen (Retzer 1997b).

Amphibians and Reptiles

There are 13 amphibian species and 25 reptile species known or likely to occur in the Mackinaw River watershed (IDNR CTAP 1997). The eastern massasauga (*Sistrurus massasauga*) has been extirpated from the watershed, probably due to loss of prairie wetland habitat (IDNR CTAP 1997). State threatened or endangered species known to occur in a small portion of the Mackinaw watershed include the Illinois chorus frog, Illinois mud turtle and Illinois hognose snake. The state threatened Kirtland's snake and smooth softshell turtle (*Apalone mutica*) have both been located near the Mackinaw River watershed and may also occur there (IDNR CTAP 1997). Table 17 lists amphibians and reptiles known or likely to occur in the Mackinaw River watershed, no information on presence within the Little Mackinaw River is available.

Table 17. Amphibian and reptile species known or likely to occur in the Mackinaw River watershed. (Adapted from IDNR CTAP 1997:4-63)

Common name	Scientific name	Abundance
Amphibians		
smallmouth salamander	*Ambystoma texanum*	common
tiger salamander	*Ambystoma tigtinum*	uncommon
eastern newt	*Notophthalmus viridescens*	uncommon
American toad	*Bufo americanus*	common
Fowler's toad	*Bufo woodhousii*	common
cricket frog	*Acris crepitans*	common
striped chorus frog	*Pseudacris triseriata*	common
Illinois chorus frog	*Pseudacris streckeri*	rare
Cope's gray treefrog	*Hyla chrysoscelis*	common
eastern gray treefrog	*Hyla versicolor*	common
bullfrog	*Rana catesbeiana*	common
northern leopard frog	*Rana pipiens*	uncommon
plains leopard frog	*Rana blairi*	uncommon
Reptiles		
snapping turtle	*Chelydra serpentina*	common
painted turtle	*Chrysemys picta*	common
Blanding's turtle	*Emydoidea blandingii*	rare

Illinois mud turtle	*Kinosternon flavescens*	rare
map turtle	*Graptemys geographica*	uncommon
spiny softshell turtle	*Apalone spinifer*	uncommon
ornate box turtle	*Terrapene ornata*	rare
slender glass lizard	*Ophisaurus attenuatus*	rare
six-lined racerunner	*Cnemidophorus sexlineatus*	rare
eastern hognose snake	*Heterodon platirhinos*	uncommon
western hognose snake	*Heterodon nasicus*	rare
racer	*Coluber constrictor*	uncommon
smooth green snake	*Opheodrys vernalis*	uncommon
rat snake	*Elaphe obsoleta*	uncommon
fox snake	*Elaphe vulpina*	common
bullsnake	*Pituophis catenifer*	uncommon
milk snake	*Lampropeltis triangulum*	uncommon
prairie kingsnake	*Lampropeltis calligaster*	common
western ribbon snake	*Thamnophis proximus*	uncommon
plains garter snake	*Thamnophis radix*	common
common garter snake	*Thamnophis sirtalis*	common
brown snake	*Storeria dekayi*	common
red-bellied snake	*Storeria occipitomaculata*	uncommon
Graham's crayfish snake	*Regina grahamii*	uncommon
northern water snake	*Nerodia sipedon*	common

Socioeconomic/Human Resources

At the time of the 1990 census the population of Tazewell County was 123,692 people living in 47,234 households (US Census Bureau 1999). In 1996 the US Census Bureau estimated the county population at 128,366 people (US Census Bureau 1999). The vast majority (76.8%) of Tazewell County is urban (US Census Bureau 1999), however the Little Mackinaw River subwatershed is a rural area with no notable population centers. In 1989, in Tazewell County, persons living on farms totaled 2,352. The racial make-up of the population is primarily white (99.2%), with 1,019 individuals or 0.8% being of black, Native American, or other minority races. Over half of the population (58.5%) did not change their residence between 1985 and the census, while another 25.6% resided within the county in 1985 but had since changed housing unit. The remaining 15.9% of county residents moved into the county between 1985 and 1990, two-thirds of those people moved from elsewhere in Illinois (US Census Bureau 1999).

Over 78.5% of adults over the age of 25 have a high school diploma or equivalent, with over one quarter of those individuals (25.5%) having obtained an Associate degree or higher. Fewer than 2.8% of employed persons over 16 years old work in agriculture, forestry, or fisheries (see Table 18).

Table 18. Tazewell County employment by industry, 1989. (Source: US Census Bureau 1999)

Industry	**No. of people over 16 years old**
Agriculture, forestry and fisheries	1547
Mining	59
Construction	3178
Manufacturing, nondurable goods	2408
Manufacturing, durable goods	11506
Transportation	2438
Communications and public utilities	1417
Wholesale trade	2473
Retail trade	10788
Finance, insurance, real estate	3565
Business and repair services	2317
Personal services	1578
Entertainment and recreation services	666
Health services	5374
Educational services	4134
Other professional and related services	3062
Public administration	1329

Per capita income in 1989 was $13,516. Median household income in 1989 was $30,933, it was estimated at $37,862 in 1996. In 1996 it was estimated that 7.8% of the population was living in poverty (US Census Bureau 1999).

The median value of owner-occupied housing units in Tazewell County 1989 was $48,400 (US Census Bureau 1999).

In 1989 76.5% of households had wage or salary income. In 1989 3.1% of households had some farm self-employment income (US Census Bureau 1999). In 1993 farm cash receipts for Tazewell County totaled $112,046,000 (see Table 19)

Table 19. 1993 Farm cash receipts, Tazewell County (in thousand dollars). Adapted from IDNR CTAP 1997 Table 1-31).

	Receipts (in thousand dollars)
Corn	42,042
Soybeans	33,301
Wheat	909
Other	5,727
Crop total	**81,980**
Cattle	4,000
Hogs & pigs	22,790
Other	3,276

Livestock total	**30,066**

A variety of state and local organizations have outreach programs operating within Tazewell and McLean Counties, and by extension within the Little Mackinaw River subwatershed. Some of the specific programs available to landowners are highlighted in the Watershed Activities section of this report. The United States Department of Agriculture Natural Resources Conservation Service, the Soil and Water Conservation Service and the University of Illinois Extension Service provide services in the watershed. The state Department of Natural Resources is also an important resource for county residents. The County Farm Bureaus are another important resource. The Nature Conservancy through the Mackinaw River Partnership continues to conduct outreach activities in the entire Mackinaw River watershed.

There are no conservancy districts and no drainage districts within this subwatershed.

Watershed residents have access to the *Pekin Daily Times*, the *Peoria Journal Star*, and the *Bloomington Panatagraph* which carry regular agriculture features and some stories from the area.

A study of farm operators' perceptions and attitudes concerning the Mackinaw River was completed in 1995 (Rendziak 1995; Farrell 1995). A mail survey was carried out watershed wide and in-depth interviews were held with some landowners. While the data are not specific to the Little Mackinaw River subwatershed the information collected does represent an average over the entire watershed and is of particular importance in gaining a better understanding of farm operators' attitudes. The information reported below was all collected as part of this effort (see Rendziak 1995 and Farrell 1995 for additional information on study design and results).

Farm operators identified a number of problems with waterways in the Mackinaw River watershed, their causes and potential solutions. These are highlighted in Tables 20, 21, and 22.

Table 20. Identified River, Creek, and Stream Problems

Flooding (mostly along the main stem)
Increased water velocity
Sedimentation
Crop residue deposited on farm land after flood events
Land lost to the river
Chemicals in the river

Table 21. Identified Causes of River, Creek and Stream Problems

Natural weather patterns
Natural river features
Inadequately maintained levees

Traditional farming practices
Urbanization
Tree removal from the riparian zone
Agricultural chemicals

Table 22. Identified Solutions to River, Creek and Stream Problems

Levee construction and maintenance
Construction of detention basins
Conservation farming practices
Proper chemical application
Tree planting
Setting aside land for conservation
Streambank stabilization
Conservation easements
Increasing fish and wildlife populations

While farm operators are able to identify some key issues affecting the waterways in the Mackinaw River watershed, on average farm operators do not feel that the problems associated with the waterways have increased or decreased recently, though there was variation in responses. Those who felt the river has changed cited that the river has become higher and faster with a deeper channel; that flooding was more rapid and there was increased crop residue; and that meandering had increased.

Farm operators are generally knowledgeable about some of the causes of river problems. Though the desire to blame events on "natural causes" beyond their control exists. Most farm operators agreed that conservation measures could be beneficial. However, farm operators generally support structural measures such as channelization and streambank stabilization with rip-rap, rather than more ecologically-based solutions such as planting trees or creating wetlands. Farm operators expressed mixed opinions on activities such as conservation easements or taking land out of production. While farm operators expressed an interest in technical advice, most were not interested in receiving assistance.

Farm operators are interested in maximizing the long-term productivity, efficiency and profitability of their farms while also maximizing the quality of their products. Protection of private property rights is a paramount concern of all farm operators.

Component #5
Problem Statement

Problem #1

Point and non-point source pollution and high velocity and volume of water after storm events that results in increased streambank erosion and sedimentation and threatens water quality in the Little Mackinaw River. Of particular concern is the potential impact of ammonium levels on mussels in the river.

Problem #2

Water quality and aquatic biota within the Little Mackinaw River are also threatened by excess nutrients, the loss of wetlands and degraded riparian areas.

Problem #3

Awareness of the relationship between land management practices and River conditions, and appreciation of this unique aquatic resource, are erratic and poorly documented. Lack of awareness among some landowners can lead to land management practices that do not protect, and may degrade, the Little Mackinaw River.

Component #6
Goals and Objectives

Goal #1

To reduce the potential of pollutants and sediment entering the Little Mackinaw River through proactive, participatory best management practices to reduce sediment loads and streambank erosion potential, thereby improving water quality and ensuring long-term adoption of appropriate practices. To better understand what role ammonium levels may play in the survival of mussel populations.

Objective #1

- Reduce potential pollution sources through dialogue with concerned parties and the implementation of appropriate practices.
- Increase the use of nutrient management techniques.
- Reduce and retain surface and subsurface runoff by promotion of such best management practices as conservation tillage, water and sediment control basins, contouring, waterways, filter strips, stormwater detention basins, and wetlands on 60% of agricultural land.
- Restore appropriate areas to wetlands or wet prairie.
- Stabilize ten percent of streambanks within the watershed.
- Study the relationship between ammonium levels and mussels populations and propose mitigation practices if appropriate.

Goal #2

To increase the number and acreage of functioning wetlands and restore and improve riparian zones in the Little Mackinaw River subwatershed using participatory techniques,

and thereby improving the quality of aquatic habitats and stream water and ensuring the long term implementation and management of appropriate practices.

Objective #2

- Restore appropriate areas to wetlands or wet prairie through dialogue with landowners and encouraging the use of appropriate cost share measures where available.
- Improve the riparian zone through land amelioration practices, including woodland management, woodland development, streambank stabilization and other appropriate means, encouraging the use of appropriate cost share measures where available.

Goal #3

To increase awareness and pride among land managers and other residents of the importance of this unique water resource and to increase the use of appropriate land management practices to maintain and improve the resource.

Objective #3

- Provide educational opportunities for watershed residents to learn more about the natural resources in their midst and their present and future value.
- Increase participation in programs providing technical and financial assistance for the implementation of best management practices.

Component #7
Implementation Strategies

Strategies

Addressing the objectives outlined in Component #6 demands an integrated approach that includes the sensitization of agricultural producers and the implementation of appropriate land management practices in the Little Mackinaw River subwatershed. A variety of strategies need to be employed taking into account the conditions in different portions of the subwatershed and the willingness of agricultural producers to participate. Planning farm-based activities based on individual farm conditions is essential, and integrating several practices into one farm management plan may sometimes be desirable. The strategies outlined below are not exclusive[*], other practices may also be appropriate to individual situations and should be employed when needed. Flexibility in implementation is essential if sustainable, long-term results are to be realized.

Strategy #1: Promote Dialogue

[*] Further information on many appropriate land management practices, including some included in these strategies, may be found in *Conservation Choices*, USDA SCS 1993.

Identify potential and known point source pollution sites and begin a dialogue aimed at the mitigation of pollutants entering the waterway. In some instances relatively straightforward nutrient management techniques may be appropriate (see below), while at other times more innovative solutions may be needed. The feasibility of this approach will be dependent on the interest of the concerned parties, the perceived attitudes of subwatershed and other residents, and the cooperation of government bodies when required. Activities will be undertaken on an as-needed basis.

Implementation of this strategy will lead to the formation of new partnerships of individuals and organizations interested in conserving the water resource and the reduction in point source pollutants entering the River, thus improving water quality. This strategy addresses Objective #1.

Strategy #2: Nutrient Management
Provide and promote nutrient management techniques for livestock producers and work with agricultural producers and chemical dealers to reduce over application of fertilizers and pesticides. Nutrient management will be practiced by one-third of the livestock operations and on one-half of the agricultural land in row crop production (approximately 15,000 acres) by the end of the five-year period.

Implementation of this strategy will lead to a reduction in nutrient loading and a consequent improvement in water quality as well as improved soils for farming. Proper practice will also reduce crop management costs. This strategy addresses Objective #1.

Strategy #3: Conservation tillage
Promote conservation tillage on 7,500 acres of agricultural land. Leaving crop residue on the fields provides benefits directly to agricultural producers in reduced management costs and improved soils while also improving water quality.

Implementation of this strategy will lead to a reduction in water volume and velocity after storms, a reduction in sheet and rill erosion and consequent sedimentation, leading to improved water quality. Farm management costs will also be reduced and soil texture and fertility improved. This strategy addresses Objective #1.

Strategy #4: Contouring and terracing
Promote contouring on 100 acres of agricultural land and the construction of 5,000 feet of terraces on agricultural land. Contour farming helps to reduce water flow over agricultural lands and aids in infiltration. Combining contour farming with the planting of buffer strips or construction of terraces along the contour can increase the potential benefits from these practices.

Implementation of this strategy will lead to a reduction in water volume and velocity after storm events, a reduction in sheet and rill erosion, and consequently reduced sedimentation, leading to improved water quality. This strategy addresses Objective #1.

Strategy #5: Water and sediment control basins

Install 50 water and sediment control basins. By trapping water and sediment being carried across farmland water and sediment control basins assist in controlling erosion and reduce the quantity of water entering waterways after storm events. These basins may be combined with contour farming and terracing or buffer strips for maximum advantage.

Implementation of this strategy will lead to a reduction in water volume and velocity after storm events, a reduction in sheet and rill erosion, and consequently reduced sedimentation, leading to improved water quality. This strategy addresses Objective #1.

Strategy #6: Waterways
Protect natural waterways on farmland through smooth-grading the area and planting appropriate grasses. Waterways will be established on 150 acres of agricultural land.

The implementation of this strategy will reduce soil erosion and protect cropland from gully formation, leading to reduced sedimentation and improved water quality. This strategy addresses Objective #1.

Strategy #7: Filter strips
On lands with a gentle slope filter strips of grasses and trees or shrubs will be planted adjacent to waterways. Filter strips will be established on 300 acres of agricultural land.

Implementation of this strategy will reduce soil erosion and filter potential contaminants before they reach the waterway. This strategy addresses Objective #1.

Strategy #8: Wetlands
Wetlands provide a variety of benefits to the rural landscape, protecting soil and water and promoting wildlife. By constructing wetlands in areas where they once existed naturally diverse benefits may be realized by the landowner and all subwatershed residents. Wetlands will be constructed, restored, and/or protected on 1500 acres of land.

Implementation of this strategy will reduce runoff and provide water storage after storms, remove contaminants from water, collect sediment, and ultimately improve water quality and promote biodiversity. This strategy addresses Objectives #1 and #2.

Strategy #9: Streambank stabilization.
Stabilize streambanks where needed, encouraging the use of natural materials and native vegetation. Approximately ten percent of the streambanks within the subwatershed (6.5 miles) will be stabilized by the end of five years.

The implementation of this strategy will reduce streambank erosion and subsequent sedimentation. Aquatic and terrestrial habitats will be enhances. This strategy addresses Objectives #1 and #2.

Strategy #10: Riparian zone management

Establish or enhance riparian zones along ten percent of the waterways within 5 years. Approximately 400 acres will be managed for native vegetation. Practices will vary depending on the specific areas chosen for this effort but may include the establishment of wetland, woodland, prairie, or savanna areas or the restoration or management of existing riparian areas.

The implementation of this strategy will enhance aquatic and terrestrial habitats, stabilize streambanks, reduce erosion, and contribute to improved water quality. This strategy addresses Objective #2.

Strategy #11: Study of impact of ammonium on mussels
Conduct a scientific investigation of any possible impact of ammonium levels on mussel species predicted to occur in the Little Mackinaw River. The study will be conducted in conjunction with an appropriate research institution. If appropriate, measures to mitigate ammonium levels will be proposed and integrated into watershed management practices.

The implementation of this strategy will increase understanding of specific pollutants on mussel populations. It address Objective #1.

Strategy #12: Workshops and field trips
Promote and encourage regular workshops and meetings to introduce the above mentioned practices to agricultural producers and encourage their participation. Workshops and meetings will be conducted in cooperation with the appropriate agencies (e.g., NRCS and SWCD). One workshop will be held each year with agricultural producers from the subwatershed. Two formal meetings will he held each year, and informal meetings will take place on an as needed basis. Provide opportunities for agricultural producers to view existing conservation practices and discuss costs and benefits with participating agricultural producers. At least two field trips per year will be organized.

Implementation of this strategy will lead to greater awareness among landowners of alternative land management strategies and available assistance; an increased number of agricultural producers adopting best management practices and other appropriate land management techniques; increased enrollment in cost share programs; and a regular and productive dialogue between the MRP, agricultural producers, and concerned government agencies. The long-term implications of this strategy will be the maintenance and improvement of water quality, the enhancement of aquatic habitats, and the conservation of the land and water resource. This strategy directly addresses Objective #3.

Strategy 13: Newsletters
Produce a newsletter three times per year for distribution to agricultural producers within the watershed. Provide other appropriate mailings as needed to inform agricultural producers of activities and events within the watershed and provide them with additional information.

Implementation of this strategy will lead to greater awareness among landowners of activities going on in their area and in other parts of the Mackinaw River watershed. It will serve as another method for encouraging the adoption of land management practices that serve to conserve the water, soil, and other natural resources. This strategy directly addresses Objective #3.

Strategy #14: Extension personnel

Increase the availability of competent extension personnel in the subwatershed by employing a qualified individual to provide outreach assistance. This person is not meant to replace employees of state and federal agencies, but rather to supplement their activities and increase the presence of technical assistance in the subwatershed. The individual employed will work in close collaboration with the government agencies. Their role will be to increase the awareness of subwatershed residents of the value of their local resources and promote the adoption of appropriate land management practices, when appropriate using the assistance of available cost share programs. The Mackinaw River Partnership would employ one person who would work in several areas within the Mackinaw River watershed, thus providing approximately four person months per year of technical assistance in this subwatershed.

Implementation of this strategy will increase the adoption rate of the strategies listed above and therefore insure the conservation of the waterways, soils, riparian vegetation and other natural resources in the watershed. This strategy addresses Objective #3 directly and all of the subwatershed management plan objectives indirectly.

Strategy #15: Monitor progress
Monitor progress on a regular basis by collecting pertinent data and other information needed to assess the implementation of the above detailed strategies. Data to be collected is outlined below in Component #9 – Measuring Progress/Success.

Implementation of this strategy will ensure that this subwatershed management plan is being used to its best advantage and that knowledge gained is used to evaluate and modify targets as needed. This strategy is essential to the success of the implementation of this subwatershed management plan and indirectly addresses all of the objectives.

Timetable

A minimum five-year timetable for strategy implementation has been developed (Table 23). Depending on economic conditions in this rural watershed, this tentative timetable may need to be extended. The number of acres, feet, participants, or events for each strategy has been projected. The overall approach relies on regular outreach efforts leading to the adoption of specific techniques and, by the fifth year, the spontaneous adoption of particular practices by land managers. Once a farmer has adopted a certain practice, such as nutrient management or conservation tillage, it is assumed they will continue with that practice indefinitely.

Table 23. Timetable for subwatershed management plan strategy implementation.

Strategy	Year 1	Year 2	Year 3	Year 4	Year 5
#1 Establish dialogue (ongoing)	XX	X	X	X	X
#2 Nutrient management (acres)	1,500	3,000	4,500	6,000	
#3 Conservation tillage (acres)	1,500	2,000	2,500	1,500	
#4 Contouring & terracing (acres/,000feet)	50/1	50/1.5	0/1.5	0/1.5	
#5 Water & sediment control basins (#)	10	10	10	10	10
#6 Waterways (acres)	30	30	30	30	30
#7 Filter strips (acres)	60	60	60	60	60
#8 Wetlands (acres)		375	375	375	375
#9 Streambank stabilization (miles)	1.0	2.0	1.5	1.0	1.0
#10 Riparian zones (acres)		100	100	200	
#11 Study of ammonium/mussels		X	X		
#12Workshops & field trips (#)	3+2	3+2	3+2	3+2	3+2
#13 Newsletter (#)	3	3	3	3	3
#14 Extension (FT person/months)	4	4	4	4	4
#15 Monitoring (ongoing)	X	X	X	X	XX

Agencies and Organizations

The agencies and organizations mentioned in Component #3 Watershed Activities would continue to coordinate and collaborate on the implementation of these strategies in the subwatershed. Specifically, the Mackinaw River Partnership would employ an extension person and oversee their activities. The MRP would coordinate with The Nature

Conservancy to produce the newsletter and other pertinent mailings, responsibility for this activity will shift toward independent implementation by the MRP by Year 4. Workshops and other meetings would be organized and advertised by the MRP with assistance from TNC. Agency personnel would be an integral part of the workshop process and their active participation is essential for success. In some instances meetings already planned by agencies may serve the purposes of this plan.

The Soil and Water Conservation Districts and Natural Resources Conservation Service will continue to provide technical support and administer cost share programs. In an effort to realize the ambitious goals of this plan, The Nature Conservancy, in consultation with the Mackinaw River Partnership and the government agencies will continue to seek available funds for these activities. Funding sources include the Illinois Environmental Protection Agency, the US Environmental Protection Agency, special program funds through the US Department of Agriculture, the Illinois Department of Natural Resources, the Farm Bureau, private foundations, and private business. Landowners will also provide funding, labor and equipment as appropriate for the activities being undertaken.

Effectiveness and long-term maintenance

The implementation strategies described above are based on current best available information. As new information becomes available plan implementers and funding agencies must remain flexible and integrate new technologies into management of this subwatershed. The Nature Conservancy, through its work in part of the Mackinaw River basin, will be examining the effectiveness of these types of measures in improving water quality and protecting aquatic habitats. This information will be invaluable as these strategies are implemented.

The long-term maintenance of activities will fall to the landowners. Through providing technical assistance and utilizing cost share programs where available agricultural producers' risk levels are reduced. This should help to encourage implementation. During the initial phases of this subwatershed management effort it will be crucial that agricultural producers see tangible results that provide direct benefits to them and their farm management while also improving the waterways in the subwatershed. This will help to increase the rate of adoption of conservation practices while also encouraging agricultural producers to maintain and improve existing conservation practices.

Component #8
Cost Summary,

Costs of implementing the detailed strategies are outlined in Table 24. Present costs are used and no allowances for inflation or price changes have been included. Time sensitive costs must be calculated as implementation proceeds.

Table 24. Estimated costs of strategy implementation.

Strategy	Quantity	Unit	Cost per unit	Five year Total cost

#1 Establish dialogue			na	
#2 Nutrient management (soil testing per acre)[1]	15,000	acre	$6	90,000
#3 Conservation tillage	7,500	acre	$10	75,000
#4 Contouring	100	acre	na	
Terracing	5,000	foot	$5	25,000
#5 Water & sediment control basins	50	each	$1,000	50,000
#6 Waterways	150	acre	$1,300	195,000
#7 Filter strips	300	acre	$150	45,000
#8 Wetlands[2]	1,500	acre	$5,400	6,750,000
#9 Streambank stabilization	6.5	Miles	$110,000	715,000
#9 Riparian zones	400	acre	$1000	400,000
#10 Study of ammonium/mussels	1	Study	$25,000	25,000
#11 Workshops & field trips (3+2 per year)		year	$4,000	20,000
#12 Newsletters & mailings (3+ per year)		year	$1,000	5,000
#13 Extension (4 FT person/months/year)		year	$20,000	100,000
#14 Monitoring (most expenses in year 5)		year	$5,000	25,000
Total Cost				$8,355,000

Notes: [1] – cost is for soil testing to determine nutrient needs; [2] – costs include land acquisition, wetland design and construction, earth works, water level control structures, field tile removal, and seeding

Available cost share programs are detailed in Component #3 of this report – Watershed Activities. Those cost share programs would continue to be utilized as appropriate to realize the implementation strategies. Participating agricultural producers would provide labor, equipment, and materials as required. The costs of technical assistance from state and federal agencies are not calculated here, but are substantial. The Nature Conservancy will continue to provide technical assistance to the Mackinaw River Partnership.

Component #9
Measuring Progress/Success

Monitoring the implementation of this subwatershed management plan is essential to ensuring its success. Monitoring will be done at two temporal scales building on knowledge accumulated to date. Based on realized progress and unforeseen impediments to implementation targets may be adjusted as needed. Estimates of monitoring costs have been integrated into this proposal.

Regular summaries of activities realized in the Little Mackinaw River subwatershed will be compiled. These will consist of details of the numbers of BMPs and other activities implemented, the distance or acreage covered, and the number of individuals

participating. Soil testing will be used to assess changes in nutrient levels and pesticide/herbicide use. Pertinent information as to what worked and what did not will be collected to assist in evaluating and "fine tuning" the approach to better reach implementation goals. As new practices are found promising for meeting the goals of this subwatershed management plan they will be integrated into the plan and included in the monitoring activities.

Relevant information compiled by government agencies will be collected and used in evaluating progress. This will include estimates of soil erosion or soil loss, water quality data, land use data, and others.

Where appropriate surveys to measure water quality or aquatic biota will be undertaken with the assistance of professionals and/or volunteer groups.

The Nature Conservancy's work to monitor the impacts of BMPs on the water resource will be key to developing a better understanding of the different activities on the water resource. This work is being carried out as part of a grant from the Kellogg Foundation, it will be of relevance to activities carried out in all watersheds within the Mackinaw River watershed.

Towards the end of Year 5 a social survey designed to reassess knowledge, attitudes, and practices related to resource management and its affects on the water resource will be carried out. The social survey discussed under Component # 4 – Watershed Resource Inventory will be used as a baseline to assess changes in landowner attitudes. Additional attitudinal data are being collected in 1999 in a small portion of the Mackinaw River watershed as part of the Nature Conservancy program being carried out under the grant from the Kellogg Foundation. That data will be integrated with the original survey. The results of this monitoring activity are key to the long-term success of subwatershed management. Only by enlisting the active participation of watershed residents and land managers in conservation activities will the Little Mackinaw River resource and its surroundings be conserved.

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