Mackinaw River Project

Mackinaw River Subwatershed Management Plan
Upper Mackinaw River

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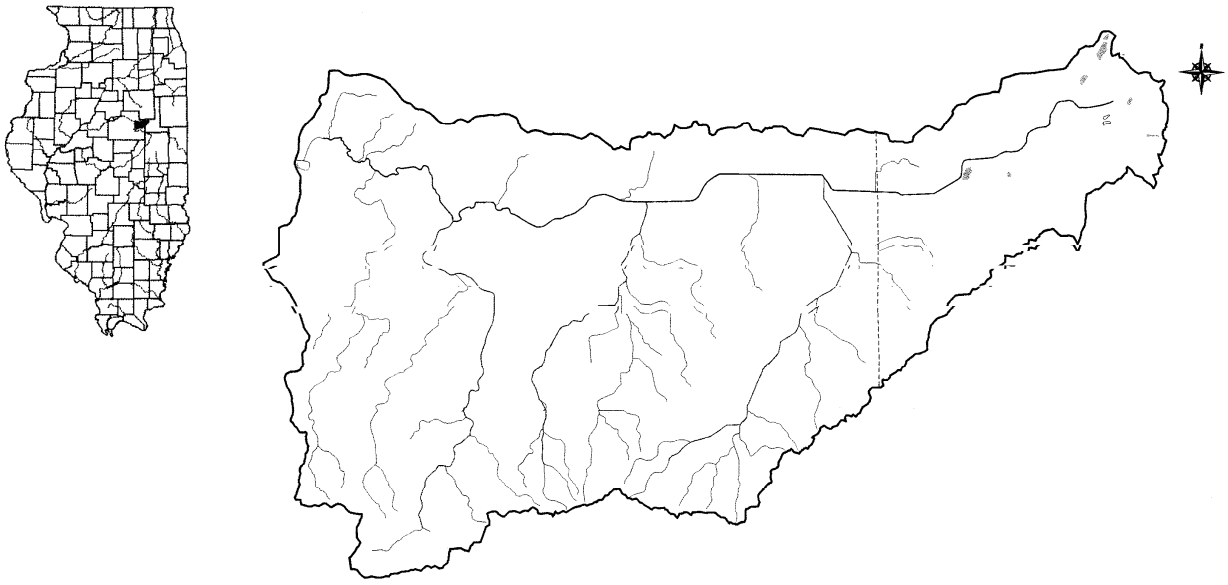

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Component #1
Mission Statement

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.

This mission statement was written and adopted by the Mackinaw River Project (MRP) Planning Team 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 main stem upper Mackinaw River subwatershed is located from the headwaters of the Mackinaw River just east of Sibley, Illinois in Ford County to the Illinois EPA sampling site DK-21 west of Colfax, Illinois in McLean County. The upper Mackinaw River subwatershed contains 14 zero order streams, 52 first order streams, 23 second order streams, 12 third order streams, and 11 fourth order streams. Total zero order stream length is approximately 17 miles, total first order stream length is approximately 253 miles, total second order stream length is approximately 122 miles, total third order stream length is approximately 44 miles, and total fourth order stream length is approximately 39 miles (Brown, 1998).

The drainage area of the upper Mackinaw River subwatershed is 71,864 acres, or approximately 112.3 square miles.

The subwatershed delineation encompasses the Ford and McLean County hydrologic unit 07130004, watershed #010, subwatersheds 14, 18, 19 (USDA, SLS National Mapping Division, 1986).

The watershed is almost entirely privately owned. Public access to the upper Mackinaw River and tributary streams within the upper Mackinaw River subwatershed occurs only at county highway bridges.

Component #3
Watershed Activities

The Illinois EPA has selected the upper Mackinaw River subwatershed as a Priority 1 subwatershed with multiple program interests. The upper Mackinaw River has been selected as a Priority 1 stream based upon preventative criteria. It received a priority rating of 1.1, a Biological Streams Characterization (BSC) rating of an "A", meaning that it has been designated as a unique aquatic resource, and has received a Predicted Index of Biotic Integrity (PIBI) rating of a "C" (Illinois Water Quality Report, Volume II, 1994-1995).

The Illinois EPA has been the primary funding source for the planning phase of the Mackinaw River Project through the section 319 program for nonpoint source pollution, since 1994. This funding has been used for project staff through The Nature Conservancy, and the facilitation of a community based process to write the Mackinaw River Watershed Management Plan. Extensive community outreach and education has been done within the entire Mackinaw River watershed (see details on these activities below), and watershed management planning tools such as a watershed management planning handbook, and a project video have been produced to help 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, so that watershed residents can tour the types of conservation practices recommended in the watershed management plan. The Executive Committee for The Mackinaw River Project has chosen the upper Mackinaw River subwatershed as a section 319 subwatershed priority area with the Illinois EPA for 1998 and 1999. Funding received as a subwatershed priority area will be directed towards landowner cost share for continued application of conservation practices within the three subwatershed priority areas, and the entire Mackinaw River watershed.

The entire Mackinaw River watershed was designated by the United States Department of Agriculture (USDA) as an interim Environmental Quality Incentive Program (EQIP) priority area in 1996, and an EQIP priority area for 1997 and 1998. Approximately $337,000 was allocated to the Mackinaw River watershed and made available for conservation practice cost share with landowners. Over 300 EQIP landowner applications were received, and over 100 conservation practices were funded with the 1997 money. In 1998, USDA allocated $167,000 to the Mackinaw River watershed through EQIP. The number of conservation practices funded with this money is not yet available (Schuler, 1998). An application for redesignation as an EQIP priority area has been submitted to USDA for 1999 (Bohnhoff, 1998).

The upper Mackinaw River subwatershed has qualified for the Illinois Department of Natural Resources (IDNR) C2000 funding from 1996 to present and is part of a larger Ecosystem Partnership priority area for the entire Mackinaw River watershed. The Mackinaw River Ecosystem Partnership received over $250,000 in 1997 and the money was made available to cost share over fifteen conservation practices with private landowners. In 1998, the Mackinaw River Ecosystem Partnership received $90,000 in funding to construct five more conservation projects. In the upper Mackinaw River subwatershed. Agricultural landowners have been able to access additional C2000 funding through the Conservation Practice Program (CPP) administered by the McLean Soil and Water Conservation District (SWCD) office. The USDA Conservation Reserve Enhancement Program (CREP) priority area in Illinois includes the entire Mackinaw River watershed and the sign up for this program has just started. Information concerning landowner participation is not yet available. There have been five Conservation Reserve Program (CRP) sign ups since 1995. Two of the sign ups have been continuous; the other three sign ups have been concentrated (Bohnhoff, 1998). McLean County SWCD did not have information concerning the success of these sign up periods, nor the amount of acreage that was enrolled for each sign up. More detailed information concerning acreage in CRP for McLean County can be found in the **Land Use** section of this report.

Activities in the upper Mackinaw River subwatershed have included sixteen slide presentations of the Mackinaw River Project by The Nature Conservancy staff to residents of all ages. School students from throughout the subwatershed have been involved in conservation efforts since 1995. Ridgeview High School Agriculture students have monitored water quality on the upper Mackinaw river since 1996, collecting data on nutrients such as nitrogen and phosphorus levels in the water, and conducting macroinvertebrate monitoring through the IDNR's RiverWatch Program. Sibley students from the local boy scout troop, and the sixth grade class from Melvin have toured the Sibley Burr Oak Grove Project and collected Burr Oak acorns for distribution and planting throughout the entire Mackinaw River watershed. There have been five work days at the Sibley Burr Oak Grove since 1996 and Sibley residents have demonstrated strong community support for restoration of the Burr Oak Grove.

There are currently two completed best management practice (BMP) demonstration projects in this subwatershed; the Sibley Burr Oak Grove restoration, and the restoration of a 12 acre wetland at the same location. Grant applications have been written for approximately seven more C2000 projects designed to meet the objectives of The Mackinaw River Project, as outlined in the Mackinaw River Watershed Management Plan .

Component #4
Watershed Resource Inventory

Waterbodies

There are 112 stream segments in the upper Mackinaw River subwatershed. These stream segments comprise a total length of 475 miles (Brown, 97). Stream orders and their respective frequencies and lengths are provided in the **Component #2: Watershed Description** section of this report. First through fourth order streams are perennial with continuous flow during the year. Zero order streams are ephemeral and do not have continuous flow during the year.

Lake Sibley is the only significant lake waterbody within the upper Mackinaw River subwatershed. It is located on the north side of the village of Sibley, has a surface acreage of approximately 15 acres, and is approximately 4 feet deep. Lake Sibley is used for storm water storage and recreation.

Biological and Chemical Data

According to the Illinois EPA's Intensive Survey of the Mackinaw River Basin, 1987, the Macroinvertebrate Biotic Index (MBI) rating for DK21 was 4.9, indicating excellent water quality (Short, 1987). This rating is based upon macroinvertebrate analysis. When the survey was repeated in 1994, an MBI rating of 4.3 was calculated (Short et al. 1994). These ratings indicate that the invertebrate fauna has not been significantly affected by in-stream sedimentation. Three endangered freshwater mussel species that are intolerant to high siltation levels are also found in small numbers in the upper Mackinaw River subwatershed. *Lampsilis siliquoidea*, a silt tolerant freshwater mussel, is the dominant species found, however, and indicates a subtle decline in water quality from historical conditions (Retzer, unpubl. manusc.)

Water turbidity refers to the amount of suspended material in the water. The greater the turbidity of the water, the greater the amount of suspended material. Turbidity can be caused by suspended solids, such as sediment and silt, as well as increased biological matter in the water. Within the upper Mackinaw River subwatershed, turbidity has not been monitored. Freshwater mussel monitoring during the spring, summer, and fall of 1995, 1996, and 1997 has revealed high levels of in-stream silt and sedimentation that has settled out of the water during periods of low flow. Stream sedimentation can result in a loss of habitat diversity, as the bottom morphology becomes dominated by fine grained sediments. The immediate effect on the biota can be acute suffocation of the invertebrate fauna (USEPA Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses).

In 1987, Illinois EPA issued a WQI rating of 51, indicating moderate water quality, with elevated concentrations of iron, fecal coliform., and fecal streptococci. A more detailed table of water quality data for DK21 can be referenced in the Illinois EPA document "An Intensive Survey of the Mackinaw River Basin, 1987", by Matthew Short. In 1994, a WQI was not calculated for DK21. However, there were no significant trends detected in concentrations of dissolved oxygen, total nitrate+nitrite nitrogen, total phosphorus, total suspended solids or total sulfates in the Mackinaw River (Short et al. 94).

Water Temperature

Water temperature data is known for the DK21 site in the upper Mackinaw River subwatershed. Water temperature was taken by the Illinois EPA on three occasions in 1994 and ranged from 14.8 Deg.C. to 23.6 Deg.C. (Short, 1994). In the headwater ditches and the areas of the main stem of the Mackinaw River, temperature data was obtained by Jim McMahon from The Nature Conservancy. He reported a water temperature of 23.3 Deg. C. in the main stream of the drainage ditch, and a water temperature of 13 Deg. C. at the tile outlet. Temperature differences could be attributed to lack of riparian tree cover; the water in the main stream of the drainage ditch is exposed to sunlight during daylight hours. This exposure causes increased water temperatures. Increased water temperatures can have significant effects on many chemical and biological processes. Chemical reaction rates are temperature dependent and increase as the temperature increases influencing decomposition rates and nutrient recycling dynamics. Aquatic organisms have specific temperature requirements for metabolic and reproductive processes (USEPA Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses). Increased biological, chemical and temperature monitoring will be needed to determine the effect of increased water temperatures on the riverine ecosystem of the upper Mackinaw River subwatershed.

Physical Data

In the uplands near Sibley, Illinois, the Mackinaw River is classified as a low slope headwater stream with no developed floodplain. During presettlement times, no distinct channel was present and the area consisted largely of rolling wet prairie and prairie pothole wetlands. These wetlands were drained during the late 1800's through subsurface tiling and ditching.

West of Sibley, the Mackinaw River channel becomes wider and a narrow floodplain is present adjacent to the channel. The depth and extreme width of the ditch render the floodplain dysfunctional except for very extreme rain events. Average channel width from the headwaters to east of Anchor, Illinois are 3 meters to 15 meters. West of Anchor to DK21, bankfull widths are generally between 20 and 30 meters. Depth ratios remain rather low, and have values

below 11 (Gough, 1997). Streambank materials consist primarily of silt and clay and are densely vegetated with agricultural grasses. The streambed materials are predominantly of sand with gravel cobbles. Cobble riffles are present below the tributary junctions. Table 1 provides more detailed information of the geologic description for the Illinois EPA monitoring station DK21, which is at the western border of the upper Mackinaw River subwatershed. The table provides a comparison of the geologic information recorded in 1987 and 1994 by the Illinois EPA (Short et al. 1987, 1994).

Table 1 - Geological Table (Short et al., 1987, 1994)

Geological Table	DK 21: 1987	DK 21: 1994
Hydraulic Features:		
Stream Order	4.0	4.0
Station Length (ft)		930.0
Increment Width (ft)		3.0
Mean Stream Width (ft)	19.0	33.0
Mean Stream Depth (ft)	0.7	0.8
Mean Thalweg Velocity (ft/s)	1.0	0.1
Discharge (cfs)	13.3	20.4
Mean Discharge (ft/s)		0.5
Channel Width (ft)		46.0
Pool (%)	5.0	0.0
Riffle (%)	40.0	2.0
Substrate:		
Silt/Mud (%)	15.0	27.9
Sand (%)	26.0	18.0
Fine Gravel (%)	19.0	22.5
Medium Gravel (%)	15.0	18.9
Coarse Gravel (%)	15.0	7.2
Small Cobble (%)	3.0	0.0
Large Cobble (%)	0.0	0.9
Boulder (%)	2.0	0.0
Bedrock (%)	0.0	0.0
Claypan (%)	0.0	0.0
Plant Detrius (%)	3.0	4.5
Vegetation (%)	0.0	0.0
Submerged Logs (%)	2.0	0.0
Other (%)	0.0	0.0
Other:		
Shading (%)	50.0	33.0
Instream Cover (%)	4.0	4.2
Predicted IBI (PIBI)	**40.2**	**39.6**
Biotic Potential Category	**C**	**C**

West of Colfax, the riparian corridor is absent to thin and degraded until a point just east of DK21. Mature, healthy trees are present to the low water level and tree root collar positions show very high vertical and lateral stability along reaches where a riparian corridor exists (Gough, 1994). The average channel width is approximately 25 feet wide and U shaped in the upper reaches of the river, however, the width increases to approximately 46 feet at DK21 (Short et al. 94). Presettlement notes for the area show the first defined channel for the river beginning at or west of Colfax.

Designated Use/Designated Use Support

The Illinois EPA has designated the streams in the upper Mackinaw River subwatershed as full support overall for aquatic life (Illinois Water Quality Report, Volume II, 1994-1995). This designated use support was based upon testing at DK21 only, which is located approximately three miles west of Colfax. Further chemical and biological assessments need to be performed upstream for a more accurate assessment of water quality within this subwatershed.

Surface water within the upper Mackinaw River subwatershed is used primarily for fishing and swimming. Public water supplies for the three communities within the upper Mackinaw River subwatershed, as well as private rural residences are provided through groundwater accessed through public and private wells.

Impairments

The Illinois EPA does not list any sources or causes of impairment for the upper Mackinaw River subwatershed in the "Illinois Water Quality Report, Volume II, 1994-1995".

Both point source and nonpoint source pollution influence water quality in the upper Mackinaw River subwatershed, however. Examples of nonpoint source pollution are runoff from livestock operations, chemical facilities, roadways, agricultural fields, and so on. Point and nonpoint sources of stream impairment throughout the subwatershed are identified in this report, however these are only potential sources of impairment, and further study is needed to determine how much of an impact each of these sources have on water quality.

As of 1994, the Illinois EPA had identified five potential sources of high impairment, one source of moderate impairment, and two sources of slight impairment within the upper Mackinaw River subwatershed. Please see figure 14 attached to this report for locations of these identified sources of impairment. (Short et al. 1994). These impairments can be classified as agricultural, municipal, or other. Please note that agricultural impairments include all livestock facilities in the watershed, not cropland and other nonpoint sources of pollution. Municipal impairments include wastewater treatment plants and other urban point sources, and other impairments include agricultural chemical facilities, rock quarries, landfills and other point source and nonpoint sources of pollution (Short et al. 1994).

Please find a list of causes and sources of impairment identified for the upper Mackinaw River subwatershed. This list was compiled using data collected upstream from DK21. This data is summarized in the report "Assessment of the Water Quality, Fish, and Mussel Communities in the Mackinaw River, Illinois", by Dr. Michael Retzer.

Causes and Sources of Impairment in the Upper Mackinaw River Subwatershed (Retzer, 1997)

Causes	Sources
Sediment Increased total suspended solids Increased turbidity	Altered hydrology, Ag and urban stormwater runoff, high volumes and velocities of water entering the river after a storm event, loss of riparian cover and wetlands
Stormwater	Altered hydrology, Ag and urban stormwater runoff, increased flow from rural and urban impermeable surfaces, subsurface tiling
Increased water temperatures	Altered hydrology, reduced base flows due to subsurface tiling and loss of wetlands, loss of shade providing riparian cover
Fecal bacteria Fecal coliform, fecal streptococci	Human sewage and septic discharge

Groundwater

Aquifers in the Mackinaw River watershed are primarily sand and gravel, confined and separated by till or clay. Tills were deposited in layers by ancient glaciers, and are now named through geologic formations. In the upper Mackinaw River subwatershed, end glacial moraines of the Wedron Group and the Henry Formation consist primarily of tills and limited sand and gravel deposits, ranging from only a few feet to more than 100 feet thick (CTAP, 1997). Water is drawn through wells from these sand and gravel deposits at various depths providing both private and municipal water supplies. Please see a map of Glacial Geology taken from the CTAP, 1997 report, at the end of this report.

Groundwater for domestic and agricultural use is mostly obtained from two types of wells: large-diameter dug-and-bored wells and small-diameter drilled wells (CTAP, 1997). Large-diameter wells are usually less than 100 feet deep, and tap layers of water-saturated silt, sand, or gravel only a few inches thick. Wells of this type normally are capable of producing only a few hundred gallons of water each day, and water levels may fluctuate seasonally as much as 10 feet in response to variations in precipitation recharge. Their large diameter permits storage of several hundred gallons of water (CTAP, 1997). Small-diameter wells range in depth from less that 100 feet deep to almost 400 feet deep. These types of wells draw water from water saturated sand and gravel deposits within the unconsolidated materials above bedrock.

In the upper Mackinaw River subwatershed, approximately 958 reported private wells exist that are 100 feet deep or less. There are 600 private wells that are between 101 and 400 feet deep (CTAP, 1997). Please find additional ground water information for the communities within the upper Mackinaw River subwatershed below.

Water Use Information per Public Water Supply within the Upper Mackinaw River Basin (CTAP, 1997)

County	City	Population	#Wells	Well Depths (ft)	1995 Total Water Use (gal)
Ford	Sibley	359	2	116, 170	9,540,000
McLean	Anchor	178	1	83	5,300,000
McLean	Colfax	854	2	102, 103	33,248,000

The villages of Sibley, Anchor and Colfax have confined aquifers, no capture zones or recharge areas, and phase I wellhead protection (wellhead protection areas of 1,000 feet radius around the wells (Dulka, 1998).

Irrigation

There is no irrigation within the upper Mackinaw River subwatershed (Bohnhoff, 1998).

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 increase agricultural 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 system after a storm event and during base flow periods is needed.

The upper Mackinaw River subwatershed is drained through the Mackinaw River drainage district that has been in existence since 1920. The drainage district is approximately 13 to 15 miles long and drains an area of approximately 29 square miles. In addition, a 2 to 3 mile tile district exists. An

annual tax of $.50/farm acre per year is imposed onto landowners to maintain drainage (Meiner, 97).

Surface water is drained from the villages of Sibley, Anchor, and Colfax directly into the upper Mackinaw River. Impermeable surfaces within these communities contribute significantly to peak flow levels after a storm event.

Floodplain Boundaries

Flooding Frequency

No data on flooding frequency was available at the time of this report. This data will need to be obtained during 1998.

Flood Structures

None located within this subwatershed. The headwater ditches in the upper Mackinaw River subwatershed do not have well developed floodplains, as regular dredging prevents floodplain formation. In headwater ditches where dredging has not recently occurred, some small channel "shelves" exist (Gough, 1997). These headwater ditches connect to larger low-slope creek tributaries. At DK21, the Mackinaw River is classified as a low slope tributary (Retzer, 1997). Although a wide floodplain exists at this location, it is not connected to the river, and is only accessed by the river during periods of high flow. One hundred year flood plains are marked on the FIRM maps for the upper Mackinaw River subwatershed in McLean County. Please see the maps attached to this report.

Municipal/Industrial

Heavy industry is not located within the upper Mackinaw River subwatershed and therefore does not pose a potential threat to water quality. Small industries have been identified within the communities of the upper Mackinaw River subwatershed. These are listed below.

Small Industries within the Communities of the Upper Mackinaw River Subwatershed (Schneider et al., 1995)

County	Town	Small Businesses or Industries
Ford	Sibley	Bus garage, oil pumping station, Ag supply facility, concrete block factory, printing, lumber yard, 18 underground storage tanks (2 leaking)
McLean	Anchor	Egg processing plant, grain company, bulk fuel storage area, Ag chemical facility (just east of Anchor), abandon coal mine, gear clutch and hydraulics manufacturer, 3 underground storage tanks
McLean	Colfax	Gas station, car dealer, automotive testing equipment manufacturer, feed company, concrete block manufacturer, 2 abandon coal mines, 13 underground storage tanks (4 leaking)

Other specific potential sources of waste generation and disposal in the upper Mackinaw River subwatershed have been identified. There are 17 towns in the entire Mackinaw River watershed shown in the Historical Hazards database. Each town contains one or more possible sources of pollutants from historical industrial facilities, based on research into historical industrial practices and occupational health literature. Colfax and Sibley are shown in the database, however, detailed analysis is beyond the scope of this report (CTAP, 1997).

Landfills are a very common means of disposal for solid waste, both past and present. Watershed wide, 31 landfills are recorded - 4 permitted and 27 unpermitted. Of the 27 unpermitted, two occur in the upper Mackinaw River subwatershed. Colfax Manufacturing contains waste in secured containers, and Sibley Farm Service Company has a landfill with a status of CFC, or Closed Final Cover (CTAP, 1997).

One National Pollutant Discharge Elimination System (NPDES) site is listed for the upper Mackinaw River subwatershed, and is identified as the Village of Colfax, permit # IL0036943, Standard Industrial Classification Code 4952, and is described as Sewerage systems (CTAP, 1997).

Riparian Corridors

In the upper Mackinaw River subwatershed, there are approximately 475 miles of streams (Brown, 1998). Zero and first order streams are primarily drainage ditches between 10 and 50 feet wide, lined with agricultural grasses, and are generally stable (Gough, 1997). These streams are adjacent to agricultural fields and there are no trees providing shade to the stream.

Filter strips can be seen lining many of the headwater ditches. We do not have specific information on the number of filter strips in the upper Mackinaw River subwatershed, and a detailed survey will need to be conducted in 1998 to provide that information.

Meanders begin to occur on the main stem of the Mackinaw River approximately 3 miles east of Colfax. A thin band of trees begin to line the streambank approximately 2 miles east of Colfax. The riparian corridor is between 100 and 200 feet wide, lining the south side of the river only, until just south of Colfax. At this location, trees and agricultural grasses line both sides of the river and the corridor is about 100 feet wide on each bank (Brown, 1998). As the river meanders, areas of streambank erosion are evident, however, none are mapped.

West of Colfax, thicker bands of riparian area can be found. Exposed streambanks occur at meander points and in areas where the forest canopy is dense enough to cause shade suppression of forest floor vegetation. These areas will need to be further surveyed so that specific landowners can be identified and targeted for cost-share programs.

Hydrologic Modifications

All zero and first order streams (270 miles) within the upper Mackinaw River subwatershed are channeled and ditched (Brown, 1998). Channeled streams undoubtedly play a role in downstream flooding and sedimentation problems because of their efficiency in carrying stormwater. These channeled ditches do not have floodplains, therefore any capacity for water storage currently does not exist. Dredging maintenance is a common practice to maintain stream-bed depth and to keep drain tile outlets clear. Most tile outlets observed in this area enter channels at elevations greater than three feet above the bed and are in little danger of blockage by sediment deposition (Gough, 1997).

Second, third and fourth order streams (205 miles) are not channeled, however all have experienced downcutting, isolating the streams from their floodplains (Brown,1998). Downcutting also results in increased streambank erosion and sedimentation.

Other types of hydrologic modifications include subsurface tiling. Please refer to the **Drainage** section of this report for a discussion about subsurface tiling and its effects on the upper Mackinaw River subwatershed.

The upper Mackinaw River subwatershed contains 55 county bridges. These bridges are located on county roadways that cross the main stem of the upper Mackinaw River, or tributaries within the subwatershed.

Stormwater Management

County stormwater control ordinances exist for Ford and McLean Counties. These ordinances have not been adopted by the communities within the upper Mackinaw River subwatershed. Stormwater control practices include drainage from the land through surface and subsurface tiling. Tile outlets direct stormwater into the headwater ditches, or the main channel of the river. The locations of these tile outlets are not mapped and would provide valuable water quality data and hydrologic data, if monitored.

Colfax is the only municipality within the upper Mackinaw River subwatershed with a public wastewater treatment system. Stormwater is directed southwest towards the river, and does not pass through any formal treatment system. Stormwater from the villages of Anchor and Sibley is directly tiled to the stream (Schneider et al. 1995).

Wetlands

Wetlands are an important part of our 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 basin 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 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 upper Mackinaw River subwatershed contains approximately 218 acres of existing wetlands. These wetlands are categorized as shallow marsh/wet meadow (62 acres), deep marsh (10 acres), forested (104 acres), and shallow water (42 acres) (Brown, 1998). Please see the watershed land cover map attached to this report for a detailed description of existing wetland locations.

Fish

The Index of Biological Integrity (IBI) is an aquatic assessment tool used by the Illinois EPA. The IBI evaluates fisheries data by assessment of community structure. The IBI for DK21 was 54 in 1994. This score indicates that at this site, water quality is considered to be excellent. A total of 976 individuals were collected, consisting of 28 different species (Short et al., 1994). No fish kills have been reported in the area of the upper Mackinaw River subwatershed. Please find a list of the fish collected below, along with their abundance.

Fish Species Occurring in 1994 at DK21
(Short et al., 1994)

Common name	Abundance	Common name	Abundance
Gizzard shad	37	Golden redhorse	135
Creek chub	73	Silver redhorse	8
Hornyhead chub	53	Yellow bullhead	1
Central stoneroller	136	Stonecat	2
Suckermouth minnow	7	White bass	1
Striped shiner	125	Rock bass	5
Bluntnose minnow	46	Smallmouth bass	5
Rosyface shiner	75	Green sunfish	5
Bigmouth shiner	24	Bluegill	2
Sand shiner	72	Longear sunfish	12
Quillback	34	Blackside darter	3
White sucker	35	Johnny darter	3
Northern hogsucker	53	Banded darter	12
Shorthead redhorse	8	Orangethroat darter	4

Habitat data was not indicated as a part of this collection. Three types of habitat are generally found within the upper Mackinaw River subwatershed. Pools, riffles, and runs provide different habitat types for fishes and freshwater mussels.

Priority Waterbody

The Illinois EPA has selected the upper Mackinaw River subwatershed as a Priority 1 subwatershed with multiple program interests. The upper Mackinaw River has been selected as a Priority 1 stream based upon preventative criteria. It received a priority rating of 1.1, a BSC rating of an “A”, meaning that it has been designated as a unique aquatic resource, and has received a PIBI rating of a “C” (Illinois Water Quality Report, Volume II, 1994-1995). The Executive Committee for The Mackinaw River Project has chosen the upper Mackinaw River

subwatershed as a section 319 subwatershed priority area with the Illinois EPA for 1998 and 1999.

The upper Mackinaw River subwatershed has been designated by the USDA as an interim EQIP priority area in 1996, and an EQIP priority area for 1997 and 1998. An application for redesignation as an EQIP priority area has been submitted to USDA for 1999 (Bohnhoff, 1998).

The upper Mackinaw River subwatershed has qualified for the IDNR C2000 funding from 1996 to present and is part of a larger Ecosystem Partnership priority area for the entire Mackinaw River watershed. In the upper Mackinaw River subwatershed, agricultural landowners have been able to access additional C2000 funding through the Conservation Practice Program (CPP) administered by the McLean Soil and Water Conservation District office. The USDA Conservation Reserve Enhancement Program (CREP) priority area in Illinois includes the entire Mackinaw River watershed.

Soil Classification

Soil Classifications for Ford County in Upper Mackinaw River Subwatershed (Ford County Soil and Water Conservation District, 1998)

Soil Classification	Total Acres in subwatershed	Soil Composition	Water Table (ft)	Land Use Compatibility	Hydric Soils	Slope	Permeability	Erodibility Index
#3: Elliot-Ashkum	7642							
Elliot	3592	silt loam	1-3	2e	no	0-2%	moderately to slowly	5
Ashkum	3592		1-2	2w	yes	nearly level, depression	moderately to slowly	1.3
#6: Drummer-Dana-Raub	3645							
Drummer	1786	silt clay loam	0.5-2	2w	yes	nearly level	slowly	
Dana	802	silt loam	3-6	2e	no	moderately sloping	moderately to slowly	4.6
Raub	656	silt loam	1-3	1	no	nearly level	moderately to slowly	1.3
#9: Drummer-Brenton	4006							
Drummer	2163	silty clay loam	0.5-2	2w	yes	nearly level	slowly	1.2
Brenton	880	silt loam	1-3	1	yes	nearly level	slowly	1.6

Soil Classifications for McLean County in the Upper Mackinaw River Watershed (McLean County Soil and Water Conservation District, 1998)

Soil Classification	Total Acres in subwatershed	Soil Composition	Water Table (ft)	Land Use Compatibility	Hydric Soils	Slope	Permeability	Erodibility Index
#4: Strawn-Mayvill-Birbeck	560							
Strawn	196	loan	6	3e and 4e	no	moderately sloping	very	12.5
Mayvill	168	silt loam	2-6	3e	no	moderately sloping	moderately	11.6
Birbeck	140	silt loam	3-6	2e	no	moderately sloping	moderately	6.8
#5: Parr-Lisbon-Drummer	52,300							
Parr	20,920	silt loam	6	2e	no	moderately sloping	very	9.5
Lisbon	13,075	silt loam	1-3	1	no	nearly level	slowly	1.6
Drummer	12,130	silt clay loam	0.5-2	2w	yes	nearly level	slowly	1.2
#8: Chenoa-Drummer-Graymontr	2,800							
Chenoa	1,120	silt loam	1-3	2e	no	gently sloping	moderately	3.5
Drummer	840	silt loam	.0.5-2	2w	yes	nearly level	slowly	1.2
Graymont	560	silt loam	4-6	2e	no	gently sloping	moderately	5.3
#9: Drummer-Brenton	1,660							
Drummer	830	silt clay loam	0.5-2	2w	yes	nearly level	slowly	1.2
Brenton	500	silt loam	1-3	1	yes	nearly level	slowly	1.6

Soil Erosion

Soil erosion is a significant nonpoint source pollution concern in this section of the Mackinaw River. Intensive agricultural production occurs in ninety-six percent of the upper Mackinaw River subwatershed where common tillage practices expose soil to erosion. Erosion problems also exist on pasture land, forest land, and urban development areas within the subwatershed. Soil erosion is commonly measured in tons per acre. In the upper Mackinaw River subwatershed, some soil erosion is natural and land that is at a tolerable soil loss level is said to be at "T". While this rate of erosion will sustain soil productivity, it still may be detrimental to water quality. Therefore, the total amount of soil erosion, regardless of the cause or whether acres of farmland are at "T" should be considered.

USDA's Natural Resource Conservation Service (NRCS) estimates that land that is at "T" or below erodes on average at a rate of 3.5 tons/acre/year. In the upper Mackinaw River subwatershed, 57,994 acres of land is at "T" or below. Acreage above "T" erodes at rates from 7.5 tons/acre/year to 15 tons/acre/year. Approximately 13,870 acres of land in the upper Mackinaw River subwatershed is above "T" (1996 BSWC Transect Survey Data, McLean County SWCD). Soil

types above "T" are primarily Parr-Lisbon-Drummer Association. This association consists of gently sloping ridgetops and shoulders, nearly level interflows with some shallow depressions, and gently sloping foot slopes and side slopes. Slopes range from zero to ten percent (McLean County SWCD, 1997).

There are four distinct types of erosion occurring in the upper Mackinaw River subwatershed; sheet and rill, ephemeral/gully, classic gully, and streambank. Approximately 301,871 tons of sediment erode annually from agricultural land into ditches and streams from sheet and rill erosion, the most prominent type of erosion occurring within this subwatershed. Sheet erosion occurs when unprotected soil is detached by the impact of raindrops and moves uniformly, or in a "blanket" effect from its original location in the field. Rill erosion occurs when stormwater runoff concentrates between crop rows, or in tillage channels, and cuts shallow areas of soil away (Brown et al. 1997). Cropland is the most susceptible to sheet and rill erosion because of frequent periods where the soil is unprotected. In the upper Mackinaw River subwatershed, ninety-six percent of the land is cropped. Cropland that is between 0 to "1T" is subject to sheet and rill erosion at a rate of 3.5 tons/acre/year; 57,994 acres are in this category, eroding approximately 202,979 tons of soil annually. Cropland from "1T" to "2T" erodes at a rate of 7.5 tons/acre/year; 9,984 acres are in this category, eroding approximately 74,880 tons of soil annually. Cropland over "2T" erodes at a rate of 15 tons/acre/year; 1,437 acres of land are in this category, eroding approximately 21,563 tons of soil annually. Sheet and rill erosion in urban areas, forested land, and pasture land is calculated at 1 ton/acre/year, eroding an additional 2,449 tons of soil annually (1996 BSWC Transect Survey Data, McLean County SWCD). Sheet and rill erosion occurring on cropland can usually be reduced significantly through a change in tillage operations.

Ephemeral/gully erosion occurs where stormwater runoff concentrates in an area forming large gullies that can still be eliminated by tillage operations. Ephemeral/gully erosion is calculated for acres of cropland with sheet and rill erosion, and is greater than "1T" (Brown et al., 1997). In the upper Mackinaw River subwatershed 34,675 tons of soil erode annually due to ephemeral/gully erosion (1996 BSWC Transect Survey Data, McLean County SWCD).

Classic gully erosion occurs when eroded channels too deep to cross with farm equipment are formed in the land. Classic gully erosion causes significant damage, as deep areas of soil are removed where concentrated water flow is unchecked (Brown et al. 1997). Classic gully erosion is calculated at 24,150 tons of soil annually (1996 BSWC Transect Survey Data, McLean County SWCD).

Streambank erosion occurs when streambanks slough into the stream channel. Sloughing is caused by a number of potential sources including streamflows, overbank flows, unstable soil material, heavy equipment use in the floodplain, obstructions in the stream channel, unstable channel bottoms, and livestock trampling. Streambank erosion is of particular concern because one-hundred percent of the sediment eroded enters the river channel (Brown et al. 1997). For the upper Mackinaw River subwatershed, streambank erosion has been estimated at 15,000 tons of soil annually. This calculation was made by the McLean County Soil and Water Conservation District staff in 1997, and was estimated from a review of aerial photos of the upper Mackinaw River subwatershed and its tributaries. More accurate calculations will be made within the next two years, as more knowledge is gained from accessing the actual streambanks, and assessing their condition.

The following table summarizes sheet, rill, ephemeral/gully, classic gully, and streambank erosion in the upper Mackinaw River subwatershed. These types of erosion contribute an additional 68,644 tons of sediment annually to the upper Mackinaw River (Bohnhoff, 1998).

Soil Erosion (Brown et al., 1995)

Type	Erosion (tons)	Sediment Delivery Rate	Sedimentation (tons)	Sedimentation transported (tons)	Sedimentation transported (%)
Sheet and Rill	301,871	0.70	211,310		
Ephemeral	34,675	0.80	27,740		
Gully	24,150	0.85	20,527		
Streambank	15,000	1.00	15,000		
Total	**375,696**		**274,577**	**68,644**	**25%**

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 at the land surface. The topography of the bedrock surface partly determined the type and distribution of the overlying glacial deposits. These sediments, in turn, determine the area's groundwater resources, form the parent materials of the region's rich 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.

Most of the bedrock that occurs directly beneath glacial sediment within the entire Mackinaw River watershed area is of Pennsylvanian age (forming between 286 and 320 million years ago). Older strata form the bedrock surface only near the headwaters of the Mackinaw River watershed in Ford County. Silurian- and Middle Devonian-age dolomite or limestone subcrop in this area (forming between 360 to 438 million years ago) because the watershed crosses a regional composite upfold in the bedrock, called the LaSalle Anticlinorium (Nelson, 1995; cited in CTAP, 1997).

The top of the bedrock surface is a complex topographic surface containing buried valleys, lowlands and uplands. Within the upper Mackinaw River subwatershed minor buried bedrock valleys can be found and are tributaries to the buried Mahomet Valley. These minor valleys range in depth from 500 to 600 feet (CTAP, 1997).

The sediments that overlie bedrock were deposited by a succession of glaciers that advanced across the area during the Pleistocene Epoch, or Great Ice Age. These sediments fall into two major categories: till and outwash. Overlying the deposits of glacial origin is a windblown silt (loess) of late glacial and postglacial age. Collectively, glacial sediments are called glacial drift.

The upper Mackinaw River subwatershed was primarily influenced by the tills deposited during the Wisconsin Episode of glaciation belonging to the Wedron Group (CTAP, 1997). These tills occur at or near the surface and compose the landforms seen on the present land surface, primarily end moraines and ground moraines.

The only mineral produced in the Mackinaw River watershed is construction sand and gravel. There are no active gravel pits in the upper Mackinaw River subwatershed, however there is a significant sand and gravel deposit from the headwaters in Ford County to Anchor, Illinois (CTAP, 1997).

Topography

The upper Mackinaw River subwatershed drains an area of approximately 71,860 acres or 112.3 square miles. The elevation of the watershed changes from 794.4 feet above mean sea level (ft. msl) at Sibley, to 742.92 ft. msl at Colfax. Drainage pattern maps have been drawn for all first, second, third and fourth order streams in the upper Mackinaw River subwatershed, and are attached to this report.

The drainage density was calculated for the upper Mackinaw River subwatershed by dividing the total acreage for the watershed by the total stream length. The drainage density is approximately equal to 151.5 acres of watershed per mile of stream (Brown, 1998).

Land Use

Rural

The agricultural industry dominates the current upper Mackinaw River subwatershed with 62,210 acres in rowcrop production, 945 acres in small grains, and 6,394 acres in rural grassland. (Brown, 1998). At the time of this report, information concerning the amount of land in alternative crop production, cover crop usage, specialty crops, and orchards was unavailable.

Approximately 160 farmsteads exist within the upper Mackinaw River subwatershed. Average farm size is 450 acres (Schneider et al. 1995). Seventy-eight percent of the farmers have been in operation for 10 or more years, and earn over $25,000.00 per year (IL. Ag. Stats, 1992). Thirty-three percent of the operators own their own farms, forty percent operate on ground they own and lease, and twenty-seven percent operate on ground that is leased only (Schneider et al. 1995). Cropland is valued at between $2,800.00 and $3,000.00 per acre, and is typically cash rented at $120.00 to $125.00 per acre (Meyer, 1997).

As in the rest of the state, corn and soybeans are the predominant crops in the upper Mackinaw River subwatershed. McLean County is the largest corn producer in Illinois, with a high of 59 million bushels in 1994. McLean County was also the largest soybean producer in Illinois, with a high of 15.4 million bushels in 1985 (CTAP, 1997).

Livestock, primarily consisting of pork and cattle are produced throughout the upper Mackinaw River subwatershed. The number of hogs and pigs peaked in 1991 in McLean County at 76,900 animals (CTAP, 1997). Within the upper Mackinaw River subwatershed, an estimated 7,500 head of pork are produced (IL. Ag. Stats, 1996). In 1994, McLean County had the largest inventory of cattle with 18,500 head (CTAP, 1997). However, within the upper Mackinaw River subwatershed, an estimated 1,000 head of cattle are produced, and many graze areas adjacent to the river (IL. Ag. Stats, 1996).

Approximately 457 acres of broadleaf deciduous forest exists within the upper Mackinaw River subwatershed. An additional 104 acres are classified as forested wetlands (Brown, 1998). Logging is not a primary industry within the subwatershed.

Urban

While ninety-six percent of the upper Mackinaw River watershed is in agricultural production, sixty percent of the watershed's population lives in three small urban communities. Please see a listing of the small villages within the upper Mackinaw River subwatershed, and their populations. (1990 U.S. Census).

Small Villages and their Human Populations within the Upper Mackinaw River Subwatershed (1990 U.S. Census)

County	Village	Population
Ford	Sibley	359
McLean	Anchor	178
McLean	Colfax	854

McLean County's population is expected to increase by over twenty-three percent by the year 2015, however the small rural communities of Sibley, Anchor, and Colfax are not expected to increase significantly in size because of their distance from Bloomington-Normal (Dirks, 1994). Even though 52 miles of major roadways exist within the upper Mackinaw River subwatershed, and 24 miles of active railroads run throughout the landscape, neither the roadways or the railways provide efficient commuting into the Bloomington-Normal metropolitan area and are not expected to influence population growth in the future (Dirks, 1994).

General Land Use Information

Specific zoning information was not available. Industry (number, type, size, NPDES permit number) and Commercial business types are listed in the **Municipal/Industrial** section of this report for the upper Mackinaw River subwatershed. There are no known airports within the upper Mackinaw River subwatershed.

Conservation Reserve Program (CRP) data is not specifically known for the upper Mackinaw River subwatershed, however information is known for the acreage in McLean County that is in the Mackinaw River watershed. Five CRP programs have been conducted within the upper Mackinaw River subwatershed and were administered by the McLean County Soil and Water Conservation District office since August of 1995 (Bohnhoff, 1998). The following table provides an indication of the current CRP contracts in McLean County within the watershed, number of acres enrolled, and the year the contracts end.

Conservation Reserve Program Information for McLean County (Brown et al., 1997)

Year Contract Ends	Number of Contracts	Acres Enrolled
1998	21	921
1999	7	235
2000	9	592
2001	9	217
2002	13	461
2006	32	362
2007	5	193
2010	3	31

Landfill data and illegal dump data can be found in the **Municipal/Industrial** section of this report.

There are two fertilizer/chemical facilities within the upper Mackinaw River subwatershed. One is located on the north edge of Sibley, and the other is located just west of Anchor on Route 165.

There are 13 Natural Areas and Nature Preserves within the entire Mackinaw River watershed encompassing 2,783 acres of land. None of these areas are located within the upper Mackinaw River subwatershed (CTAP, 1997).

The Mackinaw River is a primary fishing site in Central Illinois because of the biological integrity of the stream and its supply of smallmouth bass and channel catfish. In 1994, Illinois registered 4,985 boats alone within the watershed (CTAP, 1997). It is not known how many of these were registered within the upper Mackinaw River subwatershed.

Information is available concerning reported hunting activity in the entire Mackinaw River watershed. Within the upper Mackinaw River subwatershed, many residents hunt available grasslands and woodlands, and game harvested is included in these numbers (CTAP, 1997).

Hunting Activity (CTAP, 1997)

Game	# of Hunters	Days Afield	Harvest
Deer (Archery)	2,119	49,006	898
Deer (Shotgun)	3,342	12,541	2,410
Pheasant	6,593	41,375	26,416
Rabbit	5,467	32,392	32,406
Squirrel (Fox)	3,523	20,701	27,134
Squirrel (Gray)	820	3,122	4,395
Dove	2,851	14,372	43,146

**Note - Hunting data is from IDNR's "Hunter Activity and Wildlife Harvest in Illinois: County Averages for 1989-1993.

Elevated fecal coliform and fecal streptococci levels found at DK21 in 1987 indicate that human sewage may be entering the upper Mackinaw River from Sibley, Anchor and private residents that are directly tiling waste to the river. As of 1995, the villages of Sibley and Anchor were using wildcat sewers to remove untreated human waste from the towns. One NPDES permit was issued for the village of Colfax for sewerage and is discussed briefly in the **Municipality/Industrial** section of this report. Colfax has secondary treatment of sewage. The present treatment plant was constructed in the late 1970's and modified in 1990. In 1995, the plant was applying secondary treatment to 0.116 million gallons of waste per day, and discharging effluent into the Mackinaw River (Schneider et al., 1995). In 1994, the Illinois EPA repeated intensive survey work at DK21; unfortunately fecal bacteria counts were not performed. Further biological and chemical testing needs to be done within the upper Mackinaw River subwatershed to determine the sources and amount of fecal bacteria entering the stream.

Surface and underground mining of coal ceased by 1978 in the Mackinaw River watershed. In McLean County alone, 5,544,139 tons of coal were produced between the late 1800's and the late 1970's (Schneider et al., 1995). Three abandoned coal mines are found within the upper Mackinaw River subwatershed. Anchor has one abandoned coal mine, and Colfax has two abandoned coal mines. Runoff from coal mines can be very acidic, high in sulfate, aluminum, manganese, magnesium, and calcium (Schneider et al., 1995). These abandoned coal mines are located upstream from DK21 and many of these chemicals have not been tested for. Further chemical testing is needed near or at these sites to determine the actual effects abandoned coal mines are having on water quality within the upper Mackinaw River subwatershed.

Leaking underground storage tank sites are a significant source of environmental contamination from petroleum products, chemicals, and liquid wastes. Leaking tanks threaten the environment and human health with fire, explosions, harmful vapors, and contamination of soil, groundwater, and surface water.

Within the upper Mackinaw River subwatershed, eight leaking underground storage tanks were found in 1995 (Schneider et al., 1995) Specific data is provided by the Office of the Illinois State Fire Marshal, 1995 and is given for each site below.

Leaking Underground Storage Tanks in the Upper Mackinaw River Subwatershed (Schneider et al., 1995)

County	City	Facility	Location	Date	Incident #
Ford	Sibley	Frank Myer	S. Sciota	1994	942020
Ford	Sibley	Norfold S. Rail	Ohio and Hwy 47	1991	911281
McLean	Colfax	Meier Oil	E. Wood St.	1990	900894
McLean	Colfax	Meyer Bulk Service	201N. Center	1991	910944**
McLean	Colfax	Vi-Amino Feeds Inc.	201 E. Main	1992	923201
McLean	Colfax	Wyant, Ken	515 N. Center	1992	923456
McLean	Cropsey	Crabtree's Garage	Box 71, Main St.	1993	930800
McLean	Cropsey	Cropsey Township	W. Yates St.	1994	940585

**As of 1997, USEPA Region 5 office reported this leaking underground storage tank removed from the site and contamination contained (USEPA, 1997).

An existing inventory of Best Management Practices (BMP's) applied within the subwatershed, such as grade stabilization structures, contour farming, terraces, filter strips grass waterways, stormwater runoff control, detention/retention basins, sedimentation basins, nutrient management, pest management, livestock waste management, was not available from McLean and Ford County Farm Service Agency (FSA), NRCS, and SWCD. An inquiry was made to these offices, however they indicated that these numbers would be very difficult to locate and track. Further information is needed concerning existing agricultural BMP within the upper Mackinaw River subwatershed.

Conservation tillage information is available from the Bureau of Soil and Water Conservation (BSWC) Transect Survey Data in McLean County. As of 1995, fourteen percent of the acreage in McLean County for the Mackinaw River watershed was in no-till, twenty-four percent of the acreage was in conservation tillage where thirty percent of the crop residue remained on the soil surface after planting, twenty-nine percent of the acreage was in reduced tillage where between fifteen and thirty percent of the crop residue remained on the soil surface after planting, and thirty-three percent of the acreage was in conventional tillage where less than fifteen percent of the crop residue remained on the soil surface after planting (Brown et al., 1997). These numbers reflect data taken from the 312,600 acres in McLean County for the Mackinaw River watershed, and are not specific to the upper Mackinaw River subwatershed.

Air Quality

There were no total air releases, total fugitive air releases, total stack air releases for Toxic Release Inventory (TRI) sites within the upper Mackinaw River subwatershed (CTAP, 1997).

Wildlife

Threatened or Endangered Species

The following is a list of the threatened and endangered species that occur or are likely to occur in the entire Mackinaw River watershed. Specific locations of many of these organisms were not provided with the data in order to further protect their existence. This information is provided by Dr. Michael Retzer, who performed an extensive freshwater mussel survey within the drainage, and CTAP.

Threatened and Endangered Species Occurring in the Mackinaw River Watershed (Retzer, 1997, CTAP, 1997)

Plants	
heart-leaved plantain	State Endangered
spreading sedge	State Threatened
tall sunflower	State Endangered
Birds	
Long-eared owl	State Endangered
Short-eared owl	State Endangered
Loggerhead shrike	State Threatened
Brown Creeper	State Threatened

Threatened and Endangered Species Occurring in the Mackinaw River Watershed (Retzer, 1997, CTAP, 1997) (continued)

Amphibians and Reptiles

Kirtland's snake	State Threatened
Illinois chorus frog	State Threatened
Illinois mud turtle	State Endangered
Western hognose snake	State Threatened

Mussels

round pigtoe	State Endangered**
slippershell	State Endangered**
elktoe	State Endangered**
rainbow	State Endangered

**indicates that records exist for these species within the upper Mackinaw River subwatershed.

Birds

Bird species will not be listed in this report because the list is far too long. Many species of birds only summer and nest in the Mackinaw River watershed, and migrate to another location to overwinter. For more information on birds, please reference CTAP, Mackinaw River Area Assessment, Volume 1, 1997.

Mammals

Forty-five mammal species are known to exist in the Mackinaw River Basin (CTAP, 1997). Their occurrence is dependent upon adequate habitat and the population status of these species is unknown. Data was not available as to how many of these species are found within the upper Mackinaw River subwatershed. The following list was obtained from CTAP, 1997.

Mammal Species Known or Likely to Occur in the Mackinaw River Watershed (CTAP, 1997)

Common name	Population status
Virginia opossum	Common
masked shrew	Common
northern short-tailed shrew	Common
least shrew	Common
eastern mole	Common
little brown bat	Common
northern long-eared bat	Common
silver-haired bat	Uncommon
eastern pipistrelle	Common
big brown bat	Common
red bat	Common
hoary bat	Uncommon
evening bat	Uncommon
eastern cottontail rabbit	Common
eastern chipmunk	Common
woodchuck	Common
thirteen-lined ground squirrel	Common
Franklin ground squirrel	Uncommon
gray squirrel	Common
fox squirrel	Common
southern flying squirrel	Common
plains pocket gopher	Common
beaver	Common
western harvest mouse	Common
deer mouse	Common
white-footed mouse	Common
meadow vole	Common
prairie vole	Common
pine vole	Uncommon
muskrat	Common
southern bog lemming	Common
Norway rat (exotic)	Common
house mouse (exotic)	Common
meadow jumping mouse	Uncommon
coyote	Common
red fox	Common
gray fox	Uncommon
raccoon	Common

Mammal Species Known or Likely to Occur in the Mackinaw River Watershed (CTAP, 1997) (continued)

Common name	Population Status
long-tailed weasel	Common
mink	Common
badger	Uncommon
striped skunk	Common
river otter	State Endangered
white-tailed deer	Common

Butterflies and Skippers

Twenty-one species of butterflies and skippers are known to occur in McLean County within the Mackinaw River Watershed. They are the black swallowtail, zebra swallowtail, cabbage butterfly (exotic), clouded sulfur, bronze copper, Dione copper, eastern tailed blue, spring azure, harvester, hackberry butterfly, tawny emperor, viceroy, question mark, hop merchant, silvery checkerspot, pearl crescent, regal fritillary, great spangled fritillary, variegated fritillary, monarch, and dun skipper (CTAP, 1997).

Freshwater Mussels

Freshwater mussel populations were sampled at two locations within the upper Mackinaw River subwatershed. Thirteen different species were found out of 133 individual mussels sampled (Retzer, 1997). Below is a listing of the species and numbers found within the upper Mackinaw River.

Freshwater Mussels Found Within the Upper Mackinaw River Watershed (Retzer, 1997)

Species	Abundance
Alasmidonta viridis	1
Alasmidonta marginata	1
Amblema plicata	20
Andontoides ferussacianus	9
Fusconaia flava	1
Lampsilis cardium	24
Lampsilis siliquoidea	75
Lampsilis teres	1

Freshwater Mussels Found Within the Upper Mackinaw River Watershed (Retzer, 1997) (continued)

Species	Abundance
Pleurobema coccineum	1
Strophitus undulatus	shells only
Toxolasma parvus	shells only
Uniomerus tetralasmus	shells only
Venustaconcha ellipsiformis	shells only

Amphibians and Reptiles

There are 13 amphibian species and 25 reptile species known or likely to occur in the Mackinaw River watershed (CTAP, 1997). A complete listing providing common name and abundance information is provided.

Amphibian and Reptile Species Known or Likely to Occur in the Mackinaw River Watershed (CTAP, 1997)

Common name	Abundance
smallmouth salamander	Common
tiger salamander	Uncommon
eastern newt	Uncommon
American toad	Common
Fowler's toad	Common
cricket frog	Common
striped chorus frog	Common
Illinois chorus frog	State Threatened
Cope's gray treefrog	Common
eastern gray treefrog	Common
bullfrog	Common
northern leopard frog	Uncommon
plains leopard frog	Uncommon
snapping turtle	Common
painted turtle	Common
Blanding's turtle	Rare
Illinois mud turtle	State Endangered
map turtle	Uncommon
spiny softshell turtle	Uncommon

Amphibian and Reptile Species Known or Likely to Occur in the Mackinaw River Watershed (CTAP, 1997) (continued)

Common name	Abundance
ornate box turtle	Rare
slender glass lizard	Rare
six-lined racerunner	Rare
eastern hognose snake	Uncommon
western hognose snake	State Threatened
racer	Uncommon
smooth green snake	Uncommon
rat snake	Uncommon
fox snake	Common
bullsnake	Uncommon
milk snake	Uncommon
prairie kingsnake	Common
western ribbon snake	Uncommon
plains garter snake	Common
common garter snake	Common
brown snake	Common
red-bellied snake	Uncommon
Graham's crayfish snake	Uncommon
northern water snake	Common

Socio-Economic/Human Resources

Per capita income is slightly lower in the entire Mackinaw River watershed than it is statewide. In McLean County, the per capita income was $21,000. From 1970 to 1990, the per capita income rose by forty-five percent (CTAP, 1997).

The median household income in 1989 for the entire Mackinaw River area was $36,715, down by approximately four percent since 1979 (CTAP, 1997).

The economy of the Mackinaw River area generates approximately three percent of the state's employment and two percent of its personal income. McLean County accounted for fifty-three percent of the area's employment and forty-seven percent of the personal income. During the period 1969-1993, McLean County fared well in employment growth, with employment up over seventy percent, from 48,743 workers to 84,123 workers (CTAP, 1997). State Farm Insurance, located in Bloomington/Normal was the single largest employer within the Mackinaw River watershed. It is not known if these numbers reflect the economic trends within the upper Mackinaw River subwatershed, however.

Farmer/non-farmer relationships seem positive. Major conflicts between farmers and non-farmers is not apparent within the upper Mackinaw River subwatershed.

Minorities account for approximately six percent of the total population in McLean County (CTAP, 1997). This figure reflects the metropolitan area of Bloomington-Normal, which is not in the upper Mackinaw River subwatershed. For the entire Mackinaw River watershed, minorities account for approximately three percent of the total watershed population (CTAP, 1997). This figure more accurately describes the percentage of minorities in the upper Mackinaw River subwatershed.

Agriculture accounts for thirteen percent of employment in McLean County within the Mackinaw River watershed. This percentage reflects both persons primarily employed in farming, as well as the households earning farm self-employment income. The remaining eighty-seven percent of employment is in agribusiness and nonagricultural fields (1990 US Census; cited in Anderson, 1997). The top five major employers in McLean County are State Farm Insurance, Mitsubishi Motor Manufacturing, Illinois State University, Bromenn Healthcare, and White Consolidated Industry. All are located in the Bloomington-Normal metropolitan area (CTAP, 1997). Within McLean County, there are approximately 3,200 non-farm employers. Approximately 200 employers have fifty or more employees. The remaining 3,000 employers have below fifty employees (CTAP). It is not known if this information reflects the employment demographics for the upper Mackinaw River subwatershed.

The transportation infrastructure of the upper Mackinaw River subwatershed is important, as roadways, airports, waterways, and railways enable businesses and residents to move both goods and people from place to place. Within the upper Mackinaw River subwatershed, 52 miles of major roadways, and 24 miles of active railways exist (Brown, 1998).

The upper Mackinaw River subwatershed is an agricultural area, with ninety-six percent of the land in agricultural production.

Current outreach programs are summarized in the **Component #3: Watershed Activities** section of this report. Please refer to this section for information concerning outreach programs for the upper Mackinaw River subwatershed.

Twenty-two percent of the agricultural producers in the upper Mackinaw River subwatershed have annual farm incomes that are below $25,000 (Illinois Agricultural Statistics, 1996). According to the McLean County FSA, particular

farm cost-share programs are targeted towards limited resource agricultural producers, however sign up is low due to the inability to afford taking acreage out of production, or to come up with landowner match to apply agricultural BMPs to their land.

Agricultural organizations exist within the upper Mackinaw River subwatershed, and participation by landowners/operators varies with the organization. McLean and Ford Counties have Soil and Water Conservation District offices where membership is not specifically tracked. Every cooperator who utilizes the services of the county Soil and Water Conservation District is considered a voting "member" of the organization, and is invited to attend the annual meeting where board members are elected. In McLean County, the 1998 annual meeting had an attendance of approximately 148 cooperators and was very successful (Kraft, 1998). The McLean County Farm Bureau is quite active, with over 9,000 members. Of the 9,000 members, approximately 2,200 are agricultural producers (McLean County Farm Bureau, 1998). McLean County also has an active Agriculture club where farm owners/operators, farm managers, and agribusiness owners participate in monthly meetings. In 1998, approximately 110 members regularly attended meetings (Kraft, 1998). These numbers reflect county wide participation, and specific information about membership for residents in the upper Mackinaw River is not known.

There are no conservancy districts within the upper Mackinaw River subwatershed. There are two drainage districts, the Mackinaw Drainage District and a tile district. Specific details about these two drainage districts are contained in the **Drainage** section of this report.

The USDA/NRCS is located in Normal, Illinois, and serves producers in McLean County within the upper Mackinaw River subwatershed. The USDA/NRCS located in Paxton, Illinois serves producers in Ford County within the upper Mackinaw River subwatershed.

Three forms of local government exist within the upper Mackinaw River subwatershed. County boards are elected officials who represent the upper Mackinaw River subwatershed residents at the county level. Ford and McLean Counties each have county boards who meet monthly and make decisions at the county level. The villages of Sibley, Anchor, and Colfax have village boards consisting of elected town residents who serve the needs of the local communities. Ford and McLean Counties have Soil and Water Conservation District boards who oversee the Soil and Water Conservation District staff, and help guide the administration of state and federal cost-share programs for agricultural BMPs.

Membership in environmental organizations within the upper Mackinaw River subwatershed include the McLean County Audubon Society, the Parklands Foundation, The Nature Conservancy, The Mackinaw River Project, cooperators who participate in the Soil and Water Conservation District programs, and other civic organizations who participate in environmental awareness through educational speakers at weekly or monthly meetings. In Sibley, members of the Historical Society spend hours at work days in the Sibley Burr Oak Grove, helping to restore the Burr Oak Grove and establish the 10 acre wetland constructed by The Nature Conservancy at that site.

Media/ Education outlets include small village newspaper/flyers for Sibley and Colfax. The Bloomington Pantagraph is a major newspaper within the upper Mackinaw River subwatershed, providing national, state and local news to Central Illinois. Champaign/Urbana has a newspaper which serves residents in Sibley, and throughout the upper Mackinaw River headwaters.

In 1995 The University of Illinois Department of Urban and Regional Planning conducted a Farm Operator Survey within the Mackinaw River Watershed. Results from this survey provide some indication of land user problems and attitudes towards the watershed, and the waterbody of the Mackinaw River. One-on-one interviews with farmers were conducted, as well as a written survey. Twenty-five farmers were interviewed from each county within the Mackinaw River watershed. Approximately 1,700 written surveys were distributed by mail to farmers throughout the watershed. Responses, received from approximately five percent of farmers in the watershed, were coded, entered into a computer database, and analyzed (Schneider et al., 1995).

One objective of both the surveys and interviews was to identify problems associated with local waterways with which farmers are faced. People whose farms are situated on the Mackinaw River reported high dissatisfaction with flooding. Seventy percent of survey respondents considered this a significant problem (Schneider et al., 1995). Other problems identified by the majority of farmers bordering the Mackinaw river include soil sedimentation, and crop residue and debris deposited on fields during flooding. Farmers had mixed views about the presence of chemicals in the river, with twenty-five percent dissatisfied, thirty-six percent satisfied, and forty percent with no opinion (Schneider et al., 1995).

Farmers who lived away from the Mackinaw River tended to be less concerned with river conditions than were farmers on the river. The majority of farmers on tributaries of the Mackinaw were satisfied with waterway conditions, and thirty percent were dissatisfied (Schneider et al., 1995).

When interviewed about the causes of the identified problems of flooding, sedimentation, crop residue and debris deposited on fields during flooding, sixty percent of respondents identified natural river function and weather as causing flooding. Forty-four percent said land loss due to river meandering and bank instability is caused by natural river function or weather. The second most frequently cited cause of all river problems was inadequately maintained levees and drainage ditches. Forty-six percent of the respondents said inadequate levees cause or worsen flooding, and forty-one percent said inadequate levees cause soil sedimentation. Traditional farming practices was the third most frequently mentioned cause of sand and gravel deposits, land loss to rivers, and chemicals in rivers. Urbanization was the fourth most frequently cited factor identified as worsening or causing all of the river problems about which respondents were questioned (Schneider et al., 1995).

Approximately 160 farmsteads exist within the upper Mackinaw River subwatershed. Average farm size is 450 acres (Schneider et al. 1995). Seventy-eight percent of the farmers have been in operation for 10 or more years, and earn over $25,000.00 per year (IL. Ag. Stats, 1992). Thirty-three percent of the operators own their own farms, forty percent operate on ground they own and lease, and twenty-seven percent operate on ground that is leased only (Schneider et al. 1995). Cropland is valued at between $2,800.00 and $3,000.00 per acre, and is typically cash rented at $120.00 to $125.00 per acre (Meyer, 1997).

Information concerning the number of farmers with off-farm employment was not available at the time of this report. However, there has been a two percent decline in farm workers annually in McLean County. A five-year moving average indicates that in McLean County farm earnings declined five percent per year between 1971 and 1991 (CTAP, 1997).

The estimated mean age in the upper Mackinaw River subwatershed, according to the 1990 census, is 37 and over. The median age rose 5.7 years in the combined three-county area of McLean, Woodford and Tazewell Counties between 1970 and 1990. For McLean County, the median age rose 4.2 years during this time frame (CTAP, 1997).

The loss/retention of people in the area is not specifically known for the upper Mackinaw River subwatershed. Information is available on the increase in housing units between 1970 and 1990 for McLean County. Over the twenty year period, McLean County experienced the largest gain in housing units, up twenty-four percent, compared to a thirty percent statewide increase (CTAP, 1997) This increase reflects growth in the Bloomington-Normal metropolitan area, and not necessarily in the rural areas within the upper Mackinaw River watershed.

Information concerning the family farm/corporate farm trends was not available at the time of this report. However, statewide, there has been an increase in farm size, and the number of absentee landlords in Illinois has resulted in a corresponding increase in the number of farm managers. The amount of acreage that each farm manager oversees has grown considerably in the past few years, with most managers now handling 10,000 to 20,000 acres (Gehrt 1995; cited in Schneider et al., 1995).

In 1993, total farm cash receipts for the entire Mackinaw River watershed represented just over one percent of Illinois total farm receipts. McLean County led in the three-county area of the Mackinaw River watershed with $211 million in crop receipts (corn, soybeans, wheat, and other). The Mackinaw River watershed livestock receipts accounted for four percent of the state's total farm receipts in 1993. Livestock has remained relatively stable within the watershed. Woodford County led the watershed area in livestock receipts in 1993, followed by Tazewell and McLean Counties receptively (CTAP, 1997).

Recreational opportunities within the upper Mackinaw River subwatershed are not specifically known. Outdoor recreation has already been discussed in this section of the **Resource Inventory.**

Educational opportunities in McLean County include Heartland Community College, in Bloomington and Illinois State University, in Normal. In 1990 educational trends in McLean County indicate that fifteen percent of persons age 25 and over did not complete high school, fifty-five percent completed high school only, and twenty-nine percent completed four or more years of college (CTAP, 1997). It is not known if these percentages reflect the educational trends in the upper Mackinaw River subwatershed, however.

The relationship between individuals and their watershed is known for the agricultural sector only. These relationships are reflected through the Farm Operator Survey conducted by the University Of Illinois Department of Urban and Regional Planning and have been summarized in this section of the **Resource Inventory**.

Many civic organizations exist within the villages of the upper Mackinaw River subwatershed. Information concerning the types of civic organizations, their membership numbers, and the amount of hours spent volunteering within their communities is not known and will have to be researched within the next two years.

Component #5
Problem Statement

Problem #1

High velocity and volume of water after storm events (caused primarily by altered hydrology) which enters the upper Mackinaw River is resulting in an increase in streambank erosion and sedimentation, and thereby a decline in water quality. Altered hydrology may include channelization, subsurface tiling, and the loss of functional wetlands.

Problem #2

Water quality and wildlife diversity within the upper Mackinaw River subwatershed has decreased due to the loss of wetland areas, a decrease in vegetation in riparian zones, and increased water flows due to urbanization and current agricultural practices within the subwatershed.

Problem #3

High levels of fecal coliform concentrations, caused from untreated sewage discharge into the upper Mackinaw River is resulting in a decline in water quality.

Problem #4

A lack of awareness about the relationship between land use and the condition of the river/stream, and the value of our water resources. This results in a need for additional conservation practices to improve water quality.

Component #6
Goals and Objectives

Goal #1

To reduce the volume and velocity of water which enters the upper Mackinaw River after a storm event, thereby reducing sediment loads and erosion and improving water quality.

Objective #1

A. To reduce and retain where possible, surface and subsurface runoff on 43,000 acres (sixty percent) by promotion of such best management practices as conservation tillage, terraces, water and sediment control basins (WASCOBS), contouring, waterways, filter strips, stormwater detention/retention basins, and wetlands.

B. To establish/restore 3,500 acres (approximately five percent of the subwatershed area) to wetlands and wet prairie.

C. To stabilize fifteen percent (approximately 71 miles) of streambank within the upper Mackinaw River subwatershed.

Goal #2

To reduce the levels of chemical pollutants and fecal coliform levels which occur in the upper Mackinaw River contributing to an improvement in water quality.

Objective #2

A. Promote the use of conservation tillage practices, grass waterways, and filter strips.

B. Provide education and assistance to landowners for improvement of riparian corridors.

C. Provide technical assistance and support for the management of nutrients and human sewage.

Goal #3

To increase the awareness and participation in the application of best management practices by residents, which will improve water quality within the watershed.

Objective #3

A. Provide educational opportunities, technical and financial assistance to residents of the watershed to learn about water resources and management.

Components #7, #8, and #9
Implementation Strategies, Cost Summary, and Measuring Progress

Strategy #1: Agricultural Best Management Practices

Utilize NRCS Whole Farm Planning and available funding to reduce soil loss on sixty percent of this subwatershed. Practices could include:

Type	Quantity	Cost Per Unit	Total Cost
Conservation tillage (ac)	6,000	$10.00	$60,000
Contouring (ac)	10	NA	NA
Terraces (ft)	6,000	$5.00	$30,000
WASCOBS (#)	300	$1,000	$300,000
Structures (#)	30	$4,000	$120,000
Waterways (ac)*	150	$1,300	$195,000
Filterstrips (ac)	2,000	$150.00	$300,000

*Based upon research by the City of Bloomington, The University of Illinois, and Illinois State University on wetland treatment of surface and subsurface runoff from agricultural fields, The Mackinaw River Project would like to demonstrate field tile treatment wetlands in each subwatershed.

Schedule of Completion
5 years. Starting dates will be dependent upon program sign-up dates.

Agency-organizational Roles/Resources
USDA/NRCS/SWCD will provide technical assistance and financial assistance. The Nature Conservancy (TNC)/ The Mackinaw River Project (MRP): outreach and education, promotion of programs.

Environmental Impacts
These practices will reduce soil erosion, reduce volume and velocity of stormwater, and reduce sediment and nutrients. When implemented, these practices will achieve goals #1-3.

Projected Cost
$1,005,000

Total Cost
$1,005,000

Funding Sources
Federal: USDA (EQIP, CRP, CREP). State: Illinois EPA, IDNR (C-2000); Private: TNC/MRP, Pheasants Forever, Monsanto Green Strip Program

Measuring Progress
Progress can be determined by the number of BMPs and acreage enrolled in five years. Stream team (volunteer) water quality monitoring, hydrological data collection, estimation of soil erosion and sedimentation will also be used to measure progress. The number of landowners participating in these programs within the watershed can also indicate progress.

Strategy #2: Wetlands

Identify and promote protection, construction, and/or restoration of suitable wetland areas and promote sidestream storage of water. Establish 3,500 acres (approximately five percent of the total acreage in the upper Mackinaw River subwatershed) of wetlands and adjacent wet prairies.

Schedule of Completion
5 years. Start date: Summer, 1998

Agency-organization Roles/Resources
USDA/NRCS/SWCD: design, technical, and financial assistance; IDNR: financial assistance, seed, trees. TNC/MRP: technical and financial assistance, labor, education and promotion. Illinois EPA: 319 funding. US Fish and Wildlife: funding. Army Corps of Engineers: permits

Environmental Impacts
Wetlands will reduce volume and velocity of water, treat nutrients, and enhance/increase habitat and biological diversity. This will achieve objectives #1-3.

Projected Cost
Land acquisition @ $3,000 per acre, design and construction of wetland @ $1,200 per acre. Earth work: $2.70/cubic yard. Water level control structures installed: $250-2,500 each. Field tile removal @ 500/acre. Seeding: $600/acre.

Total Cost
$18,900,000

Funding Sources
Federal: USDA (CRP, CREP, WRP). State: Illinois EPA, IDNR (C-2000). Private: TNC/MRP (funding, labor), Pheasants Forever (seed, equipment), Landowners (cost-share, labor, equipment).

Measuring Progress
Progress can be determined by acres constructed or restored, Stream Team (volunteer) monitoring of water quality. The number of landowners participating.

Strategy #3: Wetlands for Communities

Provide assistance to local communities in this subwatershed for the demonstration of constructed wetland treatment of wastewater, including nutrients and human sewage. Quantity: one in a targeted community within the upper Mackinaw River subwatershed.

Schedule of Completion
3 years. Start date: Summer, 1998

Agency-organization Roles/Resources
Illinois EPA (permits). USEPA: financial and technical assistance. TNC/MRP: technical, financial assistance. The Wetlands Initiative(TWI): technical and financial assistance. Local government: land acquisition, financial. Army Corp of Engineers (permits).

Environmental Impacts
This strategy will treat nutrients and human sewage in communities wastewater. This achieves objective #2C.

Projected Cost
An estimated $50,000 to 100,000 will be used for design and construction of the demonstration wetland. This excludes the cost of land acquisition, residential hook-up, etc.

Total Cost
$50,000 to 100,000

Funding Sources
Federal: USEPA. State: Local community, Private: TNC/MRP, TWI.

Measuring Progress

Ambient water quality monitoring, including nutrients, fecal coliform and fecal strep.

Strategy #4: Streambank Stabilization

Stabilize streambanks where needed, encouraging the use of natural materials and native vegetation (buffer strips). Quantity: fifteen percent (71miles) of streambank need stabilization in this subwatershed.

Schedule of Completion
5-7 years. Start date: Summer of 1998.

Agency-organization Roles/Resources
Illinois EPA(319), USDA/NRCS/SWCD: technical and financial assistance, education/promotion. IDNR(C-2000): financial. TNC/MRP: education and promotion, technical, financial. Pheasants Forever: financial.

Environmental Impacts
Reduction of streambank erosion and sedimentation. Increase habitat and biological diversity. This achieves goal #1, objective C.

Projected Cost
Critical area seeding: $190/acre. Vegetative streambank: $20/linear foot.

Total Cost
$7,880,000

Funding Sources
Federal: USDA (CREP, CRP). State: IDNR: (C-2000).
Private: TNC/MRP (funding, labor, equipment), Landowners (labor, equipment, cost-share).

Measuring Progress
Miles of streambank stabilized, Stream Team (volunteer) monitoring of stream and assessment of vegetative cover, landowner participation.

Strategy #5: Biological Diversity

Identify and enhance/restore natural plant areas compatible with soil type and historical use. Historic use refers to Transect notes, centennial photos, and other available historical records. Establish, restore or widen riparian zones where desirable. Within 15 years, target a minimum of ten percent of the subwatershed to be in natural cover (forest, savanna, prairie), with a target of approximately sixty percent of the riparian corridor in native vegetation, including trees along the south and west ditch banks. Ten percent of the upper Mackinaw River subwatershed is approximately 7,200 acres. Sixty percent of the riparian area is approximately 2,300 acres.

Schedule of Completion
15 years. Start date: Summer 1998.

Agency-organization Roles/Resources
USDA/NRCS/SWCD: CRP, WHIP, technical assistance. IDNR: funding (C-2000, Forestry Programs, Wildlife Habitat). TNC/MRP: financial and technical assistance. Pheasants Forever: financial

Environmental Impacts
Reduce volume and velocity of water, enhance and increase habitat and biological diversity, reduce erosion and sedimentation. This will achieve objectives #1-3.

Projected Cost
Technical assistance to identify natural community types: $100,000. Land acquisition/easement costs: variable (based on type and location). Restoration of natural plant communities on 7,200 acres @ $500 per acre = $3,600,000. Restoration of natural plant communities on 2,300 acres of riparian corridor @ $500 per acre = $1,150,000.

Total Cost
$4,850,000

Funding Sources
Federal: USDA (CRP, CREP). State: IDNR (C-2000, Forestry Incentive Program, Partners for Wildlife). Private: TNC/MRP (funding, labor, technical assistance), Pheasants Forever (seed, equipment), Landowners (labor, cost-share, equipment).

Measuring Progress
Number of acres/riparian miles restored, numbers of landowners participating, Stream Teams (volunteer), EcoWatch.

Strategy #6: Stormwater Control

Enhance participation of rural landowners and local municipalities (developers, businesses, civic organizations) in programs to control runoff, bank erosion, pollution, and soil loss. These will include installation of farm ponds, terraces, grade control structures, retention/detention basins, constructed wetlands, stormwater/erosion control ordinances, and Urban BMPs.

Schedule of Completion
15 years. Start date: Summer of 1999.

Agency-organization Roles/Resources
Illinois EPA-319 (funding and technical assistance, NRCS/SWCD (technical assistance, funding), Local government (funding, planning), Army Corps of Engineers (permits), TNC/MRP (education/promotion, financial and technical assistance).

Environmental Impacts
Reduce volume and velocity of water. Objective #1 will be achieved by this strategy.

Projected Cost
Rural - Farm ponds: Earth work $2.60/cubic yard, overflow pipe 80/ft. Seeding $190/acre Total Costs = $192,000 (Price estimate for 16 farmsteads to install ponds (ten percent of the farmsteads in the upper Mackinaw River subwatershed). Constructed field tile outlet wetlands @ $1,200/acre, Tile outlet control structure @ $2,500 each, Critical seeding @ $600/acre. Total Costs = $ 295,000 (Price estimate for constructed field tile outlet wetlands on each acre of waterway established).Other rural water retention/detention BMP's are included in costs projected for Strategy #1.
Urban - Urban retention/detention basins @ $500,000.

Total Cost
$987,000

Funding Sources
Federal: USDA(EQIP), Illinois EPA (319). State and Local government.
Private: Landowners (cost-share), Developers, TNC/MRP.

Measuring Progress
Soil erosion reduction estimates, sedimentation reduction estimates, peak flooding levels (Stream Teams).

Strategy #7: Nutrient Management

Provide and promote nutrient management for livestock producers and work with local agricultural producers and chemical dealers to reduce over application of fertilizers and pesticides. Provide soil testing on 50% of the total acreage in row crop production for five years (approximately 36,000 acres). This strategy will be accomplished through the provision of information (newsletters, mailings, conferences, workshops), and the development of agricultural nutrient and pesticide management plans based upon realistic productivity goals.

Quantity: One conference/workshop per year, three newsletters, mailings dependent on programs (to be implemented watershed wide; mailing list will be for entire Mackinaw River watershed). For soil testing quantity, see information above.

Schedule of Completion
Start date: November, 1998. Ongoing for 5 years.

Agency-organization Roles/Resources
Illinois EPA (319), USDA/NRCS/SWCD: workshops, funding;
Agricultural businesses: (Monsanto, DuPont) funding, mailing;
TNC/MRP: newsletters, conferences/workshops.

Environmental Impacts
Reduction of nutrient loading, improvement in water quality. This will achieve Objective #2C and #3.

Projected Cost
Soil testing on 36,000 acres @ $5.25/acre (GPS), For newsletters, mailings, and workshop/conference cost, refer to strategy #8.

Total Cost
$189,000/year

Funding Sources
Federal: USDA (EQIP for workshops/conference). State: Illinois EPA (319). Private: Local Agricultural Businesses, Farm Bureau, TNC/MRP (for newsletters and mailings), Landowners.

Measuring Progress
Reduced application of nutrients and pesticides, number of landowner participation, attendance at conferences/workshops.

Strategy #8: Education

Develop a network of educational activities through which information about the watershed and available programs can be disseminated. This would include conferences, newsletters, mailings, a resource handbook, Stream Teams (organization and training), and coordination of workshops, watershed tours, and development of educational materials. (*Note: In order for this to be cost-effective, this strategy needs to be watershed, not sub-watershed wide)

Schedule of Completion
Start date: Summer 1998. Ongoing for 5 years.

Agency-organization Roles/Resources
USDA/SWCD: conferences, workshops, mailings, resource handbook. TNC/MRP: conferences, workshops, newsletters (3), resource handbook, watershed tours, Stream teams. IDNR: EcoWatch, C-2000, educational materials. Farm Bureaus: meeting facilities, watershed tours.

Environmental Impacts
Increased awareness and participation in conservation practices. This achieves Objective #3.

Projected Cost
Newsletter: $3,000 per year; mailings: $1000 per year ; Conference/Workshops: $8,000 per year; Resource handbook: $60,000. Stream Teams: $5,500 per team.

Total Cost
$120,000/5 years for the entire watershed. Total cost/5 years per subwatershed = $13,000

Funding Sources
Federal: USDA/NRCS (EQIP), USEPA. State: Illinois EPA, IDNR/C-2000, EcoWatch (training). Private: TNC/MRP, Schools, Farm Bureau.

Measuring Progress
Stakeholder surveys, number of volunteers, participation in conferences/workshops

Total Cost Summary for Implementation Strategies
Upper Mackinaw River Subwatershed

Strategy #1: Agricultural Best Management Practices	$1,005,000
Strategy #2: Wetlands (Includes Land Acquisition Costs)	$18,900,000
Strategy #3: Wetlands for Communities	$100,000
Strategy #4: Streambank Stabilization	$7,880,000
Strategy #5: Biological Diversity	$4,850,000
Strategy #6: Stormwater Control	$987,000
Strategy #7: Nutrient Management	$945,000
Strategy #8: Education	$13,000
Total Cost	**$34,680,000**

References

Bohnhoff, K., USDA/NRCS District Conservationist for McLean County. 1998. Personal Interview. Normal, IL.

Brown, K. 1998. Upper Mackinaw River Watershed Maps and Land Use Data. Illinois State Water Survey, Champaign, IL.

Brown, M., S. Hartzold, K. Bohnhoff, C. Myers, J. Schuler. 1997. Mackinaw River Basin Inventory and Evaluation of Erosion and Sedimentation and an Assessment of the Conservation Treatment Needs. United States Department of Agriculture Natural Resources Conservation Service. Champaign, IL.

Dirks, H. 1994. A Comprehensive Plan for the Development of the Community of McLean County. McLean County Regional Planning Commission. Bloomington, IL.

Dulka, A., Illinois Environmental Protection Agency. 1998. Personal Interview. Springfield, IL.

Gough, S. 1994. Geomorphic Reconnaissance and Draft Management Strategy for the Mackinaw River Ecosystem Illinois. DRAFT. The Nature Conservancy, Illinois Field Office. Peoria, IL.

Gough, S. 1997. Stream Classification and Assessment: A Report to The Nature Conservancy and the Illinois Department of Natural Resources. Steve Gough & Associates. Champaign, IL.

Illinois Department of Natural Resources. 1997. Mackinaw River Area Assessment, Volume I and II. Springfield, IL.

Illinois Environmental Protection Agency. 1994-1995. Illinois Water Quality Report, Volume I and II. Springfield, IL.

Illinois Environmental Protection Agency. 1997. Targeted Watershed Approach; A Data Driven Prioritization. Springfield, IL.

Kraft, J., Resource Conservationist, McLean County Soil and Water Conservation District. 1998. Personal Interview. Normal, IL.

McLean County Soil and Water Conservation District. 1996. 1996 BSWC Transect Survey Data. United States Department of Agriculture Natural Resource Conservation Service. Normal, IL.

Meiner, L., McLean County Drainage Commissioner. 1996. Personal Interview. Colfax, IL.

Meyer, D., McLean County Farm Bureau Manager. 1996. Personal Interview. Normal, IL.

National Flood Insurance Program. 1985. Baltimore, Maryland.

Retzer, M. 1997. Aquatic Classifications and Conservation of Aquatic Communities in the Mackinaw River, Illinois. The Nature Conservancy, Illinois Field Office. Peoria, IL.

Retzer, M. 1997. Assessment of the Water Quality, Fish, and Mussel Communities in the Mackinaw River, Illinois. The Nature Conservancy, Illinois Field Office. Peoria, IL.

Retzer, M. 1996. Mackinaw River Drainage Site Conservation Plan. DRAFT. Unpubl. The Nature Conservancy, Illinois Field Office. Peoria, IL.

Schneider, D., R. Farrell, D. Fathke, J. Kowalski, T. Mahr. 1995. Point Source Pollution in the Mackinaw River Watershed. (Report to The Nature Conservancy). Department of Urban and Regional Planning, University of Illinois. Urbana, IL.

Schuler, J., USDA/NRCS District Conservationist for Woodford County. 1998. Personal Interview. Eureka, IL.

Short, M. 1987. An Intensive Survey of the Mackinaw River Basin 1987. State of

Illinois Illinois Environmental Protection Agency Division of Water Pollution Control Planning Section. Springfield, IL.

Short, M. B., T. G. Kelly, J. E. Hefley, and W. H. Ettinger. 1996. An Intensive Survey of the Mackinaw River Basin 1994. State of Illinois Environmental Protection Agency Division of Water Pollution Control Planning Section. Springfield, IL.

United States Department of Agriculture. 1996. Illinois Agricultural Statistics. Bull. 96-1.