EXECUTIVE SUMMARY

This is one in a series of River Assessments being prepared by the Michigan Department of Natural Resources, Fisheries Division for Michigan rivers. This report describes the physical and biological characteristics of the Manistique River, details those human activities that have influenced the Manistique River basin, and serves as an information base for future management goals.

River assessments are intended to provide a comprehensive reference for citizens and agency personnel seeking information about a river. The information contained in this assessment is a compilation of not only river related problems but opportunities as well. The relationship between human influence and river status necessitates public awareness and involvement. This river assessment serves as a tool which can be used to assist the management decision process and increase public understanding and foster their involvement in management decisions. This cooperative stewardship by professional managers and the public will benefit the resource, and ultimately, the future generations of people that will live and recreate within the river basin.

This document consists of four parts: an Introduction, a River Assessment, Management Options, and Public Comments (with our Responses). The River Assessment is the nucleus of the report. It provides a description of the Manistique River and its watershed in thirteen sections: Geography, History, Geology, Hydrology, Soils and Land Use, Channel Morphology, Dams and Barriers, Water Quality, Special Jurisdictions, Biological Communities, Fisheries Management, Recreational Use, and Citizen Involvement.

The Management Options section identifies a variety of actions that could be taken to protect, restore, rehabilitate, or better understand the Manistique River. These management options are organized according to the main sections of the river assessment. They are intended to provide a foundation for public discussion, priority setting, and ultimately planning the future of the Manistique River.

The Manistique River basin is located in the east-central portion of the Upper Peninsula of Michigan and drains an area of 1,471 square miles. It lies within five counties: Alger, Delta, Luce, Mackinac, and Schoolcraft. For analysis and descriptive purposes, the Manistique River and its tributaries will be discussed in terms of ecologically similar subwatersheds. These subwatersheds characterize distinct sections of the watershed that share common physical, hydrological, and biological characteristics. These seven subwatersheds are: Mainstem-upper, which extends 31 miles from the headwaters at Locke Lake to the confluence of Boucher Creek; Mainstem-middle, from the confluence of Boucher Creek downstream 23 miles to the confluence of the West Branch Manistique River; Mainstem-mouth, from the confluence of the West Branch Manistique River downstream 21 miles to Lake Michigan; Tributaries-Fox River, this system consists of the East Branch Fox, Little Fox, and the main Fox rivers which collectively flow 68 miles to the mainstem Manistique River; Tributaries-central basin, the central basin consists of numerous drainages from lands in the northern portion of the watershed and collectively include 296 miles of river; Tributaries-upper Indian River, which extends from its origin in Hovey Lake 65 miles downstream to the confluence with Big Murphy Creek; and Tributaries-lower Indian River, beginning at the confluence with Big Murphy Creek and extends 15 miles downstream before entering the mainstem.

The final glacial retreat approximately 10,500 years ago formed the present day Manistique River watershed. Native Americans first inhabited the watershed following the glacial retreat. The Manistique River was an important source of food and materials for Native Americans. The first documented exploration by Europeans began in the early 1600s and fur trade was the first economic enterprise in the region. Timber harvest began in the late 1830s with large scale logging developing by the 1880s. Major logging operations occurred in two sequences known as the pine era and the

hardwood era. During the pine era, red and white pine were cut in winter and driven down rivers during spring thaws. The town of Manistique was an important community to the lumbering industry and was the principle port of destination for wood harvested within the watershed. Railroads were constructed during the hardwood era and were the primary mode of transportation. By the 1930s, logging focused on secondary growth pulpwood timer for paper production and transportation shifted from rail to motorized vehicle roads. Settlement patterns shifted with transportation modes. Concentrations of people lived around mills during the pine era, along railroads during the hardwood era, and then at road intersections.

During the early 1900s failed farming attempts resulted in state and federal ownership of much of the land within the Tributaries-central basin. In 1935 the 96,000 acre Federal Seney Wildlife Refuge was established.

Since 1937 the United States Geological Survey has maintained as many as 14 stream flow gauges within the Manistique River watershed. These gauges provide the necessary information to measure a river's groundwater inflow, flood potential, and its dynamic nature. No gauge sites were located on the Fox River system or in the upper Indian River.

Geology of the Manistique River watershed is characterized by highly permeable materials along the south-east portion of the watershed, and across the northern and western edges of the watershed. These areas of coarse-textured materials provide high groundwater inflow to the river creating stable water flows and temperatures. The Mainstem-upper and -middle subwatersheds are stable with good groundwater inflow and hydraulic stability. Much of the river within these sections has sufficient power to move sand and adjust the channel (e.g., lateral movement of the river channel), and channel adjustments occur almost annually.

The Mainstem-mouth is the only area within the mainstem having excessive peak flows. These flows are a result of the Manistique Paper Inc. dam. The river area within the influence of the dam is artificially constricted with poor aquatic habitat. In addition, bank armoring to contain abnormal flows has resulted in poor aquatic habit.

The Tributaries-Fox River flows through areas of coarse-textured materials. Groundwater inflow is high and flows are quite stable.

Much of the central watershed, primarily Tributaries-central basin, is an area of lacustrine sand and gravel with medium permeability. Groundwater inflow to river channels is modest and rivers within this area have less stable flows with varying amounts of groundwater inflow. Many factors contribute to the unstable nature of this subwatershed. Surficial geology and soil types hinder groundwater inflow and numerous dams and extensive channelization have further degraded this subwatershed.

The Tributaries-upper Indian River flows through areas of coarse-textured materials. Groundwater inflow is high and flows are quite stable. The Tributaries-lower Indian River includes Indian Lake. Groundwater inflow is modest and surficial geology is primarily materials of medium to low permeability. Run of the river flows are not maintained during summer months below the Indian Lake Dam. The resulting low flows within the affected portion of Indian River reduce available aquatic habitat.

The Tributaries-lower Indian River is quite stable with good groundwater inflow. This river has limited ability to transport sand and alter its channel. Indian Lake Dam negatively influences river low flows. This lake-level control structure further reduces stream flow during periods of low flow.

The Manistique River watershed is predominately sandy soil materials with minimal gravel-cobble deposits. Specifically, three major soil types are found within the watershed. Wet sand – organic soils

are the dominant group and cover 70% of the watershed; coarse sand – sand cover 22%; and loamy sand – loam cover 8%. Coarse sand – sand soils, which provide high inflow are found in headwater areas along the south-east, north, and west edges of the watershed. Loamy sand – loam soils are primarily in the eastern edge and along the mainstem and provide modest inflow. The Tributaries-central basin is dominated by wet sand – organic soils. These wet soils prevent newly fallen precipitation from readily moving through the soil profile and river water temperatures are easily influenced by ambient air temperatures. The Indian River subwatersheds are comprised of 98% sand and less than 2% gravel-cobble. Recognizing the sandy composition of the Manistique River watershed is essential to understanding and properly managing its waters.

Much of the land within the watershed is wetland (57%), and forested upland covers an additional 32.8%. Minimal farming occurs and is limited, mostly, to the Mainstem-upper and Mainstem-middle and generally occurs in areas of loamy soils. Only 1.6% of the watershed is in agricultural use. Poor soils and a short growing season inhibit agriculture. Growing degree-days average 2,201°F days and soils have a frigid temperature regime. Forest and recreational habitats dominate.

Gradient, measured in ft/mi (ft per mi), is an indicator of fish habitat quality. Fish habitat improves as gradient increases to 69.9 ft/mi and declines as gradients exceed 69.9 ft/mi. Gradient within a river system varies with land form and areas of good and poor habitat can occur within a system. Average gradient of the Manistique River is 1.3 ft/mi and is characterized as mostly run habitat with low hydraulic diversity. Tributaries-Fox River has a mean gradient of 4.4 ft/mi and is characterized as having some riffles with modest hydraulic diversity. Approximately 4% of habitat in this subwatershed is rated as excellent. Habitat within the Tributaries-central basin is variable, with most rated good. Mean gradient varies from 3.0 to 9.1 ft/mi. Gradient within the Indian River system varies from 2.8 ft/mi in the lower subwatershed to 3.3 ft/mi in the upper. Most of the habitat found in this subwatershed is rated as good.

Fish habitat quality may also be evaluated by comparing channel cross-section measures with expected measures. Channels that are overly wide result from frequent flood events. Such events may be caused by dams, impoundment draw downs, or from channelization or similar land use practices that rapidly move water from the surrounding landscape into the channel. Dams impound river segments and provide limited storage capacity to moderate flows downstream. Dams also increase river surface area by impounding the river. When precipitation exceeds storage capacity, river flow below the impoundment is amplified due to increased surface area. Similarly, channels that are too narrow may result from channelization, bank armoring, bulkheads, or similar artificial constructs that constrict channel width.

Much of the mainstem has appropriate channel width. The area of exception is below the Paper Mill Dam in Manistique. Here, the river is artificially constrained and forced to remain within boundaries resulting in poor habitat quality.

Most sites within the Tributaries-central basin had appropriate channel widths. However, areas of the Driggs River and Marsh Creek are overly narrow. Both areas have been affected by dredging and channeling. These actions have reduced groundwater recharge and drained adjacent marshlands.

Channel width below Indian Lake Dam on the Indian River was found to be excessively wide. This area is affected by the Indian Lake Dam. During low flow this structure dramatically decreases flow. During high flow Indian Lake provides limited storage capacity and excess water is passed downstream, resulting in excessive channel width.

There are 54 dams located within the watershed. Only one dam has historically served to generate electricity (Paper Mill Dam), the remaining dams serve as water-level control structures, fish barriers, or to create waterfowl habitat. Paper Mill Dam has a hazard rating of 1 (failure of dam would result in

loss of life), Indian Lake Dam has a hazard rating of 2 (failure of dam would result in severe property damage), and the remaining dams have lesser hazard ratings.

Dams exert many influences on river systems and the fish communities within them. By impounding rivers, dams reduce water movement. This changes the system from a riverine to a lake environment. Reducing or halting water movement allows for the sediment load, which was naturally carried by the river current, to fall out and deposit on the streambed. Direct solar radiation and surrounding ambient air temperatures serve to warm water within these lake environments. Warm surface water from impoundments thermally dominates stretches for considerable distance before cooler groundwater can restore water temperatures. In these artificially warmed stretches fish communities are limited to species tolerant of warm water. Naturally occurring coldwater species, such as trout, are less likely to inhabit these areas which have been negatively influenced by dams. Warm water has less physical potential to carry dissolved oxygen than cold water, therefore fish communities within the impoundment waters are often characterized by the presence of fishes that survive in less oxygenated waters. Fish communities found within impounded waters rarely include coldwater species but often include largemouth bass, northern pike, brown bullhead, yellow perch, and white sucker.

Dams prevent downstream passage of woody structure. The natural in-stream deposition of logs, trees, and root-wad materials is halted. Woody material provides important over-head cover for fish, hydraulic diversity, and attachment sites for invertebrates. Biological communities below dams are negatively affected by the lack of woody structure.

Dams act to impede upstream and downstream fish movements. Barriers to fish movements prevent fish from accessing their spawning grounds or from reaching holding pools. Preventing fish, reptiles, amphibians, and insects from free access throughout a river system fragments the river and its biological communities. In the Manistique River system, potamodromous fish seeking to spawn can only migrate up to the Manistique Paper Co., Inc. (MPI) dam, which is located approximately one mile upstream from the river mouth. This same dam acts to prevent sea lamprey from ascending the river during their spawning run and blocks them from 1,400 miles of potential lamprey spawning habitat.

For the most part, the water quality of the Manistique River system is good and relatively undisturbed. The waters originate from surface water run-off or groundwater springs. There are no large industrial or human settlements in the upper watershed, so degradation of the chemical parameters of the water quality is minimal until the river reaches the City of Manistique. Thermal degradation (warming) of the water quality occurs from the various dams within the watershed.

Non-point source sedimentation to the river is one of the biggest affects on water quality in the watershed. Run-off from road building, and wetland ditching and draining has resulted in large inflows of sediment to stream channels. Airborne mercury contamination affects the watershed and is manifested within the fish of the Manistique River system.

The lower Manistique River has been identified as an area affected by pollution. During the 1950s a biosurvey of the river documented heavy accumulations of wood fibers, bark, and wood splinters. In the 1960s kerosene, used as a foam depressant in the pulp de-inking process, was routinely released into the river. During the 1970s an oil film on the river, and extensive concentrations of bark and paper fibers were documented. The largest and most publicly known pollution issue within the Manistique River watershed is the presence of polychlorinated biphenyls (PCBs) and heavy metals in he lower 1.5 mile reach of the river. The Michigan Department of Public Health (now known as the Michigan Department of Community Health) issued a no-consumption advisory on common carp within the Manistique River in 1995 due to PCBs. The International Joint Commission, the Great Lakes National Program Office, and the State of Michigan have designated the lower Manistique

River from the Paper Mill Dam in town to the mouth of the harbor at Lake Michigan as one of the 42 Areas of Concern in the Great Lakes.

Several federal and state government agencies have jurisdictional responsibility within the watershed. The United States Fish and Wildlife Service owns and manages the Seney Wildlife Refuge, one of the largest wetland areas in Michigan. Within the Seney Wildlife Refuge, the United States Department of Interior Park Service has designated the Strangmoor Bog as a National Natural Landmark. The Michigan Department of Natural Resources (MDNR) is the primary land owning state government entity. Within the MDNR various aspects of management are administered by Fisheries Division, Wildlife Division, Forest, Mineral and Fire Management Division, and Parks and Recreation Division. The Fox River and its selected tributaries are designated as a Wild-Scenic river by MDNR. The Indian River is a federally designated Wild and Scenic River and is on the state's "proposed" list for Natural River designation.

Since the 1920s, fish surveys within the Manistique River watershed have documented 61 species of fish. Before human settlement there were no physical barriers, such as dams or falls, that prevented movement of fish. Fish distribution and abundance were determined by habitat suitability for each particular species and thermal regime within habitat. Brook trout occupied riverine areas that received cold groundwater inflows, as well as spring fed ponds and thermally stratified lakes connected to these rivers. Coolwater fishes occupied the lower reaches of subwatersheds as well as the connecting lakes that possessed lentic environments. Interior lakes that did not connect with the river system were typically occupied by coolwater fish species.

Pre-settlement fish spawning migrations from Lake Michigan provided for establishment of fish species such as lake sturgeon, lake herring, lake whitefish, round whitefish, lake trout, white sucker, and shorthead redhorse. Great Lake fish spawning runs were blocked in 1919 by the construction of the MPI dam.

Human settlement of the watershed significantly changed the character of the river and the aquatic habitats that many fishes used. No turn of the century quantitative survey data exist to document the population levels of fish species at that time. Modifying factors (such as sedimentation, damming, and loss of woody structure) lessen the biological productivity of the resource.

Ditching and draining of interior wetlands, to foster farming, contributed sediment to the river system and altered groundwater flows. River straightening to facilitate logging, combined with effects of ditching, led to more extreme high and low flows, which further caused streambed scouring and sedimentation.

Currently, 61 species of fish inhabit the Manistique River watershed. The riverine community of fishes has a fairly predictable composition of species. Brook trout generally inhabit upper riverine reaches while brown trout occupy middle and lower riverine reaches. In addition, riverine fish communities typically include: blacknose dace, creek chub, Iowa darter, johnny darter, logperch, and mottled sculpin.

Groundwater inflow is not as strong in the lower portions of the subwatersheds, and fish communities found here are more characteristic of lentic species including northern pike, brown bullhead, largemouth bass, smallmouth bass, pumpkinseed sunfish, and rock bass. Lake dwelling fish species show a similar distribution with lake trout and rainbow trout occupying deeper coldwater lakes, while centrarchids, esocids, and percids inhabit shallow coolwater lakes. No naturally reproducing stocks of lake trout or rainbow trout exist in the inland lakes. Coolwater species typically include: northern pike, muskellunge, walleye, and yellow perch; and warm water species: largemouth bass, smallmouth bass, bluegill, pumpkinseed, and black crappie.

Lake herring, a member of the trout family, are found in the three Manistique Lakes and in Indian Lake. The populations of lake herring in the watershed are self sustaining and fluctuate according to annual year-class spawning success.

Lake sturgeon accessed the Manistique River watershed from Lake Michigan until 1919 when the MPI dam was constructed. Historical data on lake sturgeon distribution is minimal. However, photographic evidence from the logging era during the late 1800s and archeological evidence from Indian campsites have documented lake sturgeon along the Indian River and Manistique River. Lake sturgeon are currently found in Big and South Manistique lakes and in Indian Lake.

Lake sturgeon and lake herring are the only fish species state listed as threatened. Other fishes of the watershed include: white sucker, brown bullhead, burbot, and various minnow species. Many of these fishes are an important food for piscivorous birds and other wildlife.

Aquatic invertebrate evaluations conducted on the Fox, East Branch Fox, and Driggs rivers indicated that habitat deficiencies, primarily lack of woody structure, limit macroinvertebrate potential. These systems have good groundwater inflows and stable flow regimes which should foster macroinvertebrate diversity and abundance. Aquatic invertebrate survey data are minimal or lacking throughout the remainder of the watershed.

Eighteen species of freshwater mussels occur within the watershed. No records exist of historic commercial harvest of mussels in the watershed. Zebra mussels have not been found within the watershed above the Paper Mill Dam.

Seven species of snakes and one lizard, the five lined skink, are found within the watershed. Four species of turtles have been recorded; two, the wood turtle and the Blanding's turtle are listed as being of "Special Concern" by the Michigan Natural Features Inventory. Wood and Blanding's turtles are not protected under state endangered species legislation, but are protected under the Director's Order on Regulations on the Take of Reptiles and Amphibians. The land snail (*Vertigo paradoxa* and *Vertigo hubrichti)* is the only family of mollusks/gastropods to occur in the watershed that is ranked as a state species of special concern.

Ten species of frogs and toads and seven species of salamanders, are found within the watershed. None are listed as endangered, threatened, or of special concern by the Michigan Natural Features Inventory.

The Michigan Wildlife Habitat Database documents 194 species of birds that inhabit or use the Manistique River watershed. Twelve species of birds are listed as state threatened, four species are listed as endangered, and seventeen species are listed as special concern species.

The Michigan Wildlife Habitat Database documents 49 species of mammals that inhabit the Manistique River watershed. One species, gray wolf, is considered both state threatened and federal threatened. Moose is the only mammal listed as species of special concern.

Sea Lamprey are present below the Paper Mill Dam during spawning periods. Historically this dam effectively blocked sea lamprey from ascending the Manistique River. Structural leaks in the face of the dam have recently allowed for limited passing of lamprey through the structure and upstream into the River's mainstem reaches.

Fisheries management is primarily the responsibility of Michigan Department of Natural Resources (MDNR). Additional fisheries programs were developed in the latter half of the 1900s by the United States Forest Service, Hiawatha National Forest and the United States Fish and Wildlife Service, Seney Wildlife Refuge. Much of MDNR fisheries management over the years has focused on lake

management duties such as fish stocking, habitat restoration, and establishing a balanced predator/prey relationship within inland lakes and streams.

Beginning in the 1980s, fish management began to employ a holistic ecosystem approach. Management direction gave more emphasis to issues such as watershed dynamics, connectivity of rivers, forage and non-game fishes, reptiles and amphibians, and a departure from managing for single species lakes. More attention was given to appropriate system functionality and a lessening of biological manipulation to enhance sport fisheries. The annual number of lakes chemically treated to eradicate fish species has declined. Walleye, tiger muskellunge, and trout stockings were discontinued in waters with poor angler catch rates and/or less than desirable habitat.

Future management will continue to focus on restoring connectivity of the river system and removal of barriers such as the Paper Mill Dam. Appropriate habitat manipulation practices will continue to play an important role in restoration and stabilization projects. Land use practices within the watershed are an essential component to successful management. Properly constructed and maintained road crossings are essential for preserving aquatic habitat.

The abundance of publicly owned land in the Manistique River watershed allows for many types of recreation opportunities. Recreation activities here are typical of those found in any forest-stream-lake landmass and include: hunting, fishing, fur trapping, berry and mushroom picking, swimming, camping, snowmobiling, ORV trail riding, canoeing, boating, cross-country skiing, hiking, bike riding, sight seeing, bird and wildlife viewing, and numerous other activities. The free access to state and federal land enables recreation seekers to pursue their venture in all parts of the watershed, except where special regulations are in effect.

The future of the Manistique River watershed depends not only on the actions of federal and state agencies, but also on the involvement of citizen groups. Cooperative efforts between these groups have resulted in numerous habitat improvement and watershed management projects. Continued involvement of these groups is essential to maintaining and enhancing the Manistique River watershed.