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WEST UPPER MAPLE RIVER WATERSHED

CLINTON & GRATIOT COUNTIES MICHIGAN

FINAL ENVIRONMENTAL IMPACT STATEMENT



PREPARED BY
UNITED STATES DEPARTMENT of
AGRICULTURE

SOIL CONSERVATION SERVICE

East Lansing, Michigan

April, 1975



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WEST UPPER MAPLE RIVER WATERSHED PROJECT

Clinton County
Gratiot County

State of Michigan

FINAL ENVIRONMENTAL IMPACT STATEMENT

Arthur H. Cratty
State Conservationist
Soil Conservation Service

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Gratiot County Soil Conservation District
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Cordray Drainage District
Courthouse
Ithaca, Michigan 48847

Ferdun Creek Drainage District
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April 1975

Prepared By

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USDA ENVIRONMENTAL IMPACT STATEMENT

WEST UPPER MAPLE RIVER WATERSHED

Clinton County
Gratiot County

Michigan

Prepared in Accordance with
Sec. 102 (2) (C) of PL. 91-190

SUMMARY

- I. Final
- II. Soil Conservation Service
- III. Administrative
- IV. Description of Purposes and Action:

The purposes of the project are watershed protection, flood prevention, and improved drainage on agricultural land and public fish and wildlife development in the West Upper Maple River Watershed which is located in Clinton and Gratiot Counties of Michigan. The proposed project action consists of 9.5 miles of levees, 9.2 miles of collection channels, 2 pumping stations, 1.8 miles of channel work, 1.1 miles of channel snagging, conservation land treatment measures, and public fish and wildlife development with recreational facilities.

The 1.8 miles of suction-type channel dredging and 1.1 miles of channel snagging will be done on the Maple River, a perennial stream, previously modified prior to 1903. Channel cover is mixed grass and woody species. Adjacent land use is approximately one-third cropland, one-third wetlands, and one-third woods. Levees will be constructed outside of this flood plain on agricultural cropland. Collection channels and pumping stations will be located outside of the leveed area primarily through agricultural cropland. Collection channels are new channels with intermittent flows. Banks and berms will be seeded to a mixture of grasses and legumes.

V. Summary of Environmental Impacts

- Adequately protect 4,300 acres of crop and pasture land against erosion.
- Reduce gross erosion rate to 2.5 tons per acre.
- Reduce sediment load in channel 40 to 60 percent.
- Reduce surface water runoff in the watershed by 4 to 6 percent.
- Improve agricultural efficiency on 4,300 acres.
- Reduce annual fossil fuel consumption by 6,600 gallons.
- Provide additional wildlife habitat through conservation land treatment.
- Reduce flood damages on 1,740 acres by 90 percent.
- Improve drainage on 4,200 acres of cropland.
- Reduce flooding to terrestrial wildlife cover.
- Reduce residential flood damages by 54 percent.
- Reduce sediment leaving watershed by 52 percent.
- Convert 310 acres of pasture, idle and forest land to crop production.
- Increase grass land by 132 acres, water area by 14 acres, and gravel surfaces by 6 acres from installation of structural measures.
- Decrease forest land by 11 acres and cropland by 141 acres.
- Increase wildlife "edge effect."
- Increase numbers of ground nesting birds and small rodents.
- Create new wildlife cover by building brush piles between the levees.
- Add 993 acres of new public land managed for fish and wildlife.
- Increase erosion and sedimentation during installation of structural measures.
- Increase sedimentation and turbidity on the Maple River during the dredging period.
- Loss of wildlife habitat on structural measures for up to 3 years.
- Increase in mosquitobreeding on 14 acres of new water.
- Destroy fish cover and lower densities of aquatic plants and invertebrates on 8.7 acres of river bottom for up to 15 years.
- Displace wildlife during construction activity (8 months each year for 3 years).
- Increase in noise, air, visual, and solid waste pollution as a result of 34,000 additional recreational visits.
- Loss of local property tax base on 993 acres.
- Loss of nonrenewable fossil fuel (used during the construction period and for the operation of pumping stations).

VI. Alternatives

1. Accelerated land treatment.
2. Channel deepening and widening with the addition of levees in close proximity to the channel banks for the full length of the main stream.
3. Designate the flood plain as a valley preserve.
4. No project action.

VII. Agencies from which Comments have been Received:

Department of the Army
Department of Health, Education and Welfare
Department of the Interior
Department of Transportation
Environmental Protection Agency
Advisory Council on Historic Preservation
Michigan Department of Agriculture
Michigan State University-Department of Fisheries & Wildlife
Mid-Michigan District Health Department
Michigan Department of Natural Resources

VIII. The draft environmental impact statement transmitted to CEQ on December 20, 1974.

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USDA SOIL CONSERVATION SERVICE FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR

The West Upper Maple River Watershed
Clinton County, Gratiot County
State of Michigan

Installation of this project constitutes an administrative action. Federal assistance will be provided under authority of Public Law 83-566, 83rd Congress, 68 Stat. 666, as amended.

SPONSORING LOCAL ORGANIZATIONS

Clinton County Soil Conservation District
Gratiot County Soil Conservation District
Michigan Department of Natural Resources
Maple River Drainage Board
Cordray Drainage District
Ferdun Drainage District

PROJECT PURPOSES AND GOALS

The goals of the sponsoring local organizations are to protect the watershed through conservation land treatment; flood prevention; improved agricultural drainage on existing crop and pasture lands; and public fish and wildlife development, including recreation facilities.

Conservation land treatment measures will help fulfill the sponsors' goals of reducing runoff, erosion, and sediment; improving production efficiency on crop, pasture, and forest land; and improving fish and wildlife habitat for increased recreational and aesthetic enjoyment. Land treatment objectives are to maintain or improve soil productivity by adequately protecting cropland, pasture, forest land, and other land. Following are specific goals: reduce overall surface runoff; reduce gross sheet erosion for the watershed to an allowable rate; reduce sediment leaving the watershed; increase agricultural efficiency on cropland; reduce fossil fuel consumption as a result of minimum tillage; and improve recreational and aesthetic resources in the watershed.

The goals of the sponsors are to reduce flooding along the Maple River, Cordray Drain and Ferdun Creek. It is a goal to protect the 1,740 acres which flood from a 2-year frequency event. It is desired to decrease annual flooding and damage to 4 miles of county roads, 4 bridges, and 11 farmstead residences.

Another goal is to improve drainage on 4,300 acres of cropland and pasture land. This will increase the agricultural efficiency of use of land, labor, and capital by allowing farmers to get into their fields sooner. More intensive use of the land will result, crop yields will increase, and crop quality will improve. The types of crops grown in the problem area require moderately well drained soils and cannot tolerate saturated soil moisture conditions for an extended period of time. To obtain maximum yields these crops must be planted as early as possible in the spring to utilize the full length of the growing season. Expected yields for the various crops will increase by 7.0 tons (per acre) for corn silage, 47 bushel for corn grain, 29 bushel for wheat,

45 bushel for oats, 18 bushel for soybeans, 9 bushel for white beans, 6 tons for sugar beets, 1.7 tons for hay, and 50 cow pasture days for pasture.

The goals for fish and wildlife are to protect and manage plant and animal resources on 1,160 acres of floodplain. This will also provide additional waterfowl habitat. Another goal is to provide recreational opportunities, and public access for visitors to the area.

PLANNED PROJECT

LAND TREATMENT MEASURES

Currently there are 8,800 acres in the watershed which are adequately protected (soil, water and plant resources are adequately protected from deterioration, either naturally or by action of the land uses). Additional areas are partially protected. The land treatment program planned to be installed during the 10-year project period includes practices that will adequately treat an additional 4,200 acres of cropland, 250 acres of forest land, 100 acres of pasture land, and 145 acres of other land. Land adequately treated is used within its capability on which the conservation practices that are essential to its protection and planned improvement have been applied. There will be partial treatment on the remaining acres in the watershed. The acres planned to be treated are realistic goals based on past accomplishments, available technical assistance and cost sharing. Experience from other watersheds in Michigan shows that about 85% of the planned land treatment measures have been applied. Additional measures will also be applied to the land after the installation period as a part of the Soil Conservation Districts ongoing conservation program.

During the 10-year installation period, 47 new conservation plans will be prepared. A conservation plan is the properly recorded decisions of the cooperating landowner or operator on how he plans within practical limits, to use his land in an operating unit within its capability and to treat it according to its needs for maintenance or improvement of the soil, water, and plant resources. Assistance will also be provided through the preparation of forest land management plans for 8 landowners.

Practices to be applied on cropland include conservation cropping systems, crop residue use, critical area planting, grade stabilization structures, grassed waterways, minimum tillage, drainage mains or laterals, drainage field ditches, drains and wildlife upland habitat management. Treatment to be applied on pasture land include grade stabilization structures, grassed waterways, drainage mains and laterals,

*All information and data, except as noted, were collected during watershed planning investigations by the Soil Conservation Service and the Forest Service, U. S. Department of Agriculture. (Numbers in parenthesis refer to references listed in Appendix D.)

pasture and hay land management, pasture and hay land planting, drainage and field ditches, drains and wildlife upland habitat management.

Land treatment for forest land include 30 acres of tree planting and 220 acres of hydrologic cultural operations (improvement of the forest through thinning and other cuttings). Measures to be applied on other land include grassed waterways, ponds, and wildlife upland habitat management. Definitions of land treatment practices are given in Appendix E.

The establishment of the land treatment program is essential to the proper functioning of structural measures by reducing sedimentation from sheet erosion and resulting in the reduction of operation and maintenance costs.

Installed land treatment measures will be maintained by the landowners, operators, and responsible land managers. Technical assistance will be made available to private landowners through the on-going programs of the Clinton and Gratiot County Soil Conservation Districts in cooperation with the Soil Conservation Service and of the Michigan Department of Natural Resources in cooperation with the U. S. Forest Service under cooperative forestry programs.

STRUCTURAL MEASURES

Structural measures planned include approximately 1.8 miles of channel work consisting of suction-type dredging, 1.1 miles of channel snagging, 9.5 miles of levee construction, 9.2 miles of collection channels parallel to the levees, 2 pumping stations, 0.6 miles of clearing of tributary floodways, and public fish and wildlife development with 5 access sites. All stream channels were previously modified in the early 1900's with additional minor clean-out of parts over the years. (The location of these measures are shown on the Project Map in Appendix B).

Included for the total works of improvement are the following construction items and estimated quantities: clearing and grubbing, 12 acres of heavy woods and 112 acres of brush; stream channel and collection channel excavation, 543,200 cubic yards; levee construction, 234,000 cubic yards; surface water inlet structures, 88; tile outlets,

22; daily seeding, 32 acres; seeding and mulching, 115 acres; gravity flow pipe structures with flap gates, 3; collection channel culverts, 8; and 2 pipe structures under Ferdun Creek to the pumping station.

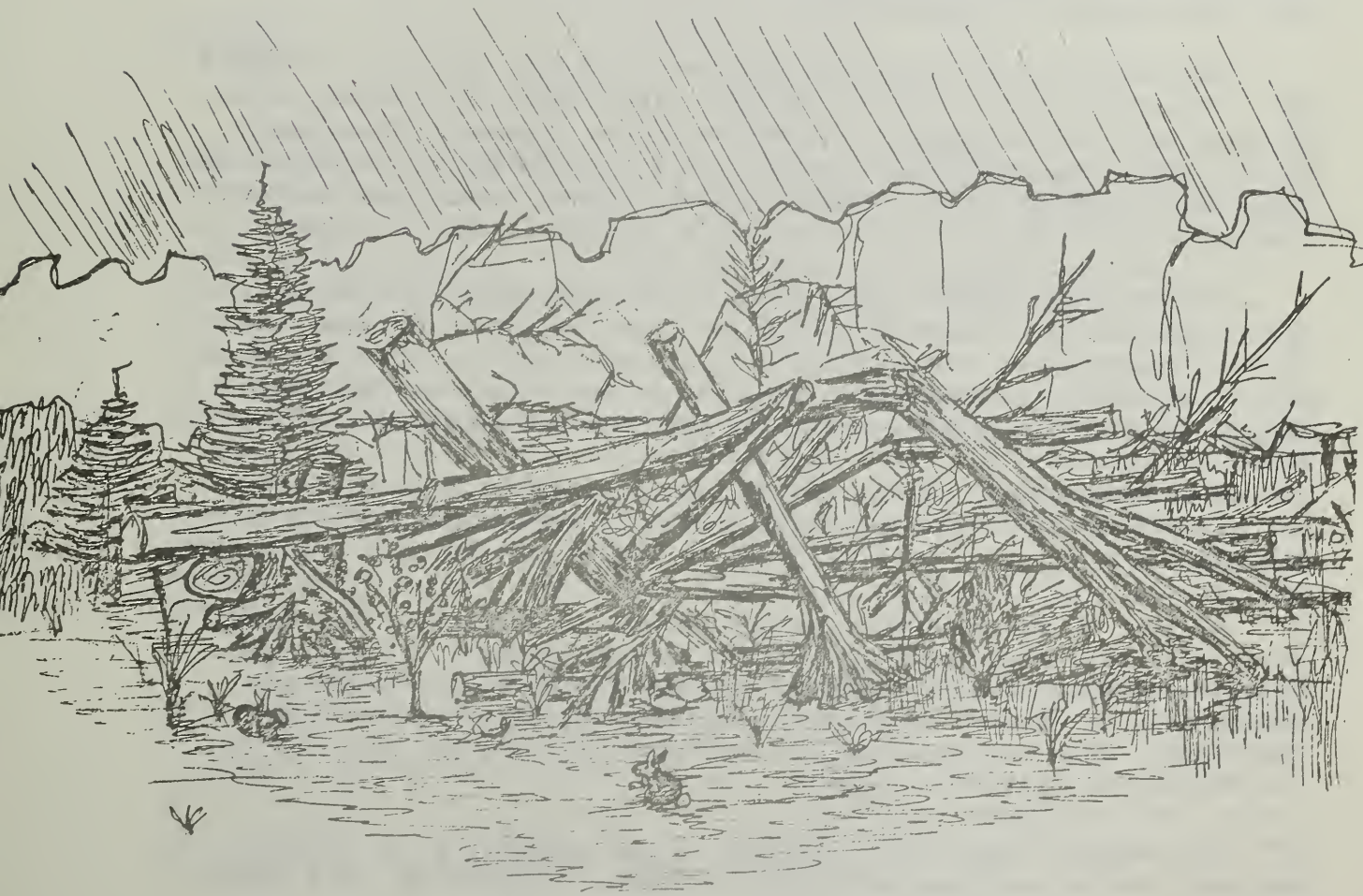
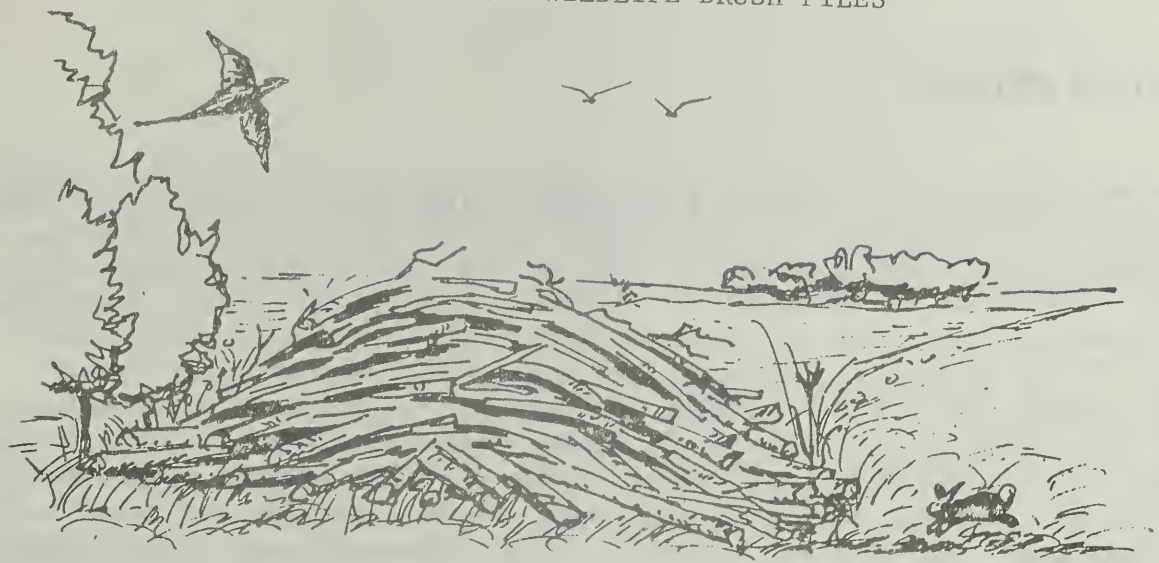
Daily seeding of all excavated channel side slopes will be done for the portion completed that day. All seedings will be applied at the following rate per acre: 10 pounds creeping red fescue, 20 pounds tall fescue, 2 pounds Kentucky bluegrass, 1 pound redtop, 2 pounds Timothy, and 5 pounds birdsfoot trefoil. A permanent seeding and mulching with the same seed mixture will be applied to the levees, berms, spoil banks, borrow areas and other areas exposed including repairing daily seedings after completion of the final shaping operation. All seeded areas will be preserved for erosion control and wildlife use. Trees and brush cleared for the project will be piled between the levees for use by wildlife. (See Figure 1.)

Requirements for safety and health in conformance with the Federal Construction Safety Act of 1969 (PL91-54) will be included in each construction contract. Design and construction of all measures will comply with applicable state laws regarding safety, health, sanitation, and erosion control.

The West Upper Maple River Watershed project has been reviewed with the State Historic Preservation Officer of the Michigan History Division. An archeological survey of the proposed construction area has disclosed the presence of four prehistoric indian sites (1). Three of these sites--Konecny, Camburn, and Fabrus--are not regarded as having any major importance. The Ayen site, however, is important to preserve part of Michigan's cultural history. Letters of notification have been sent to the U. S. Department of Interior, National Park Service and the Michigan Department of State, Division of History. Details have been worked out and approved by the History Division to preserve the materials by relocating construction around the site. If any other artifacts are uncovered during construction, the Michigan Historic Preservation Officer and the U. S. National Park Service will be immediately notified.

There are no properties included in the National or State Register of Historic Places. The project will not result in the transfer, sale, demolition, or alteration of any federally owned properties or eligible National Register properties, nor will it contribute to the preservation and enhancement of non-federally owned districts, sites, buildings, structures, and objects of historical, archeological, architectural, or cultural significance.

FIGURE 1 - WILDLIFE BRUSH PILES



SUCTION DREDGING

The 1.8 miles of suction-type channel dredging will be done on the Maple River, previously modified prior to 1903, starting from a line extending from Crapo Road on upstream to the east watershed boundary line. Deepening is necessary to furnish a gravity outlet for drainage of areas upstream from the pumping station in the adjacent East Upper Maple River Watershed. Work in this reach will substantially reduce the pumping time for the pumping stations in the adjacent watershed during periods of low flow on the Maple River. The use of a suction-type floating dredge will allow shoreline wildlife habitat disturbance to be kept to a minimum along this part of the channel. Existing channel banks will not be excavated. Since the work area will be primarily within the river adjacent vegetation disturbances will be kept to a minimum. Spoil disposal areas will not need to be cleared. Suction-dredged materials will be transported by pipeline to selected disposal areas. Downstream sedimentation will be kept to a minimum by using this method of construction.

The suction-type channel dredging will be done adjacent to Type 3 and 7 wetlands in the flood plains (refer to Figure 4), however, these wetlands will not be drained. A system of low levees using an estimated 1,000 cubic yards of earth will be strategically placed along the Maple River channel in the dredging reach. These levees and low land behind them will act as a sediment basin for the dredged material.

Approximately 20,000 cubic yards of dredged material will be spread out over 145 acres, of which 125 acres is Type 3 or Type 7 wetlands. Deposits are expected to be less than 3 inches deep over 98 percent of the sediment basin area and 3-24 inches deep over less than 2 percent of the area (mainly where the dredge discharge pipe is located). Materials deposited will be a mixture of water silt, clays, and sands. The water returning to the river will be essentially free of sediment, but may contain colloidal particles that will cause turbid water conditions.

As part of the suction dredging project, 2.9 miles of the Maple River will have snags removed from the channel bottom. In addition, those trees which are in danger of falling in the river in the near future will be removed to prevent blockages and creating raw banks which could easily erode. Woody materials will be piled adjacent to the channel for wildlife cover.

Two sediment basins are included in the dredging work to trap sediment during construction and after project completion. The basins are to be located at Blair Road and the downstream end of the dredge

project. They will be 10 feet wide, 700 feet long, and 1.5 feet deeper than the proposed channel bottom elevation at Blair Road and 60 feet wide, 950 feet long, and 4.5 feet deeper at the downstream end. These basins are entirely within the existing channel and thus require no additional channel width.

The dredging operation will not disturb a large oxbow in a forested area on the south side of the Maple River. (See Figure 2.) The oxbow is located about 400 feet downstream from the confluence of the Cordray Drain channel with the Maple River. The oxbow drains into the river at its downstream end only during periods of flood flow from Cordray Drain. During periods of low flow, natural drains and seepage provides water for the oxbow. Existing water levels will be maintained in the oxbow and the area will be saved for use by aquatic and semi-aquatic birds and mammals.

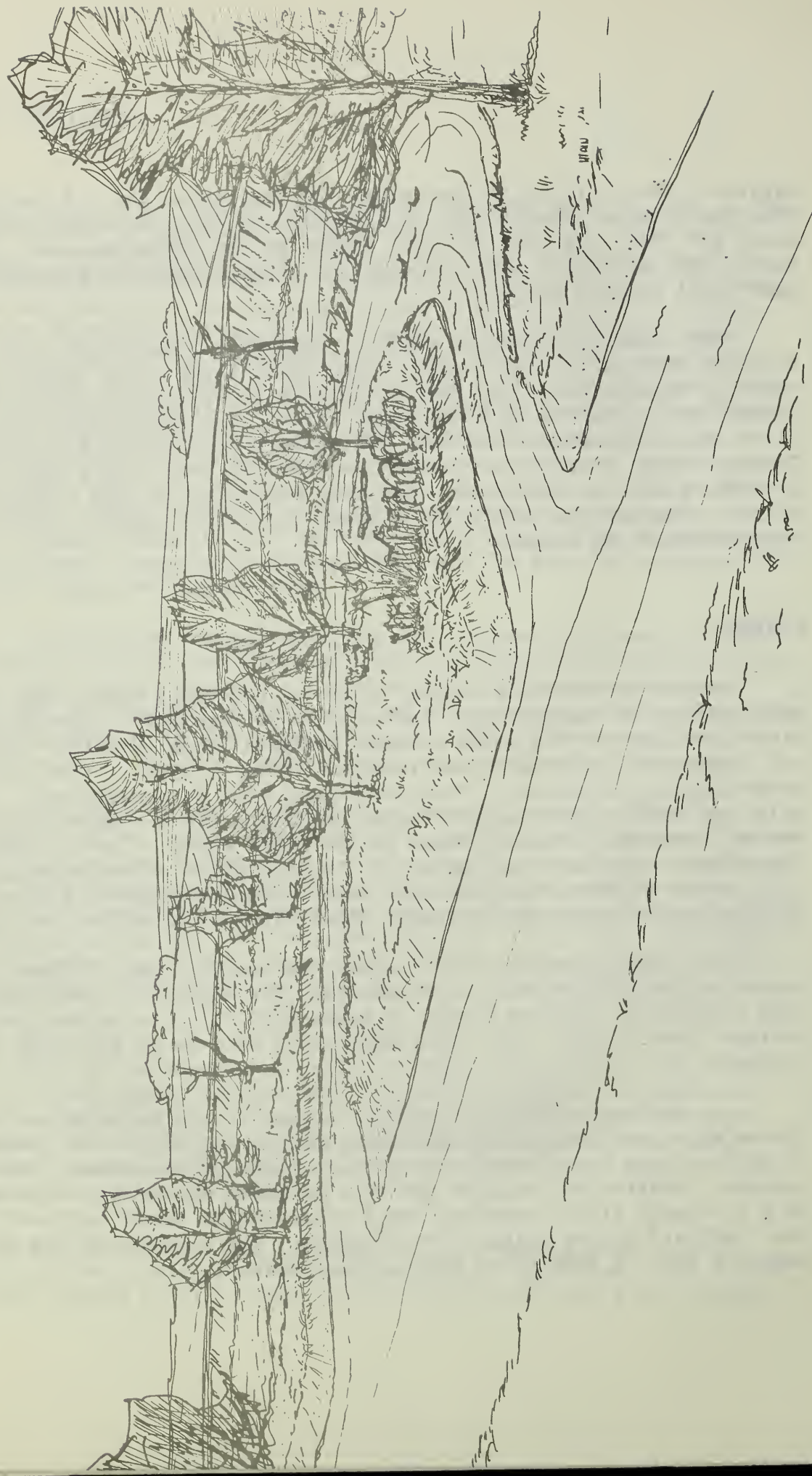
LEVEES

Because of the flat channel slope of the Maple River, the back-water effect is significant. Levees will be required to contain the river flow for the 3.8 miles between the Bear Creek (Gratiot) junction and Highway U.S. 27, the downstream end of the project. (See typical cross section--Figure 3.) Tie-back levees will be constructed - 0.7 miles on Cordray Drain and 0.7 miles on Ferdun Creek - on both sides and will connect with the levees on the Maple River. The tie-back levees will eliminate pumping on 13.1 square miles of drainage area (5.4 square miles on Cordray Drain and 7.7 square miles on Ferdun Creek) by routing the runoff and drainage flows directly into the levee system.

All leveed sections will contain the runoff from a 25-year frequency storm with two feet of freeboard. Top width will be 8 feet, side slopes 3:1, and the height of levee will be up to 10 feet with the average about 6 feet. (A 6 foot high levee will be 42 feet wide at the bottom.)

An overflow or spillway area is needed in the Maple River levee system which will be accomplished by lowering the top of the levee 8 to 12 inches below the planned elevation in selected locations. This will provide a controlled location and will minimize damage to the levees if a frequency storm exceeding the 25-year design should encroach upon the freeboard to the point of overflowing. The location of the control sections will be determined during final design.

FIGURE 2 - PRESERVING THE OXBOW NEAR CONFLUENCE OF CORDRAY DRAIN AND MAPLE RIVER



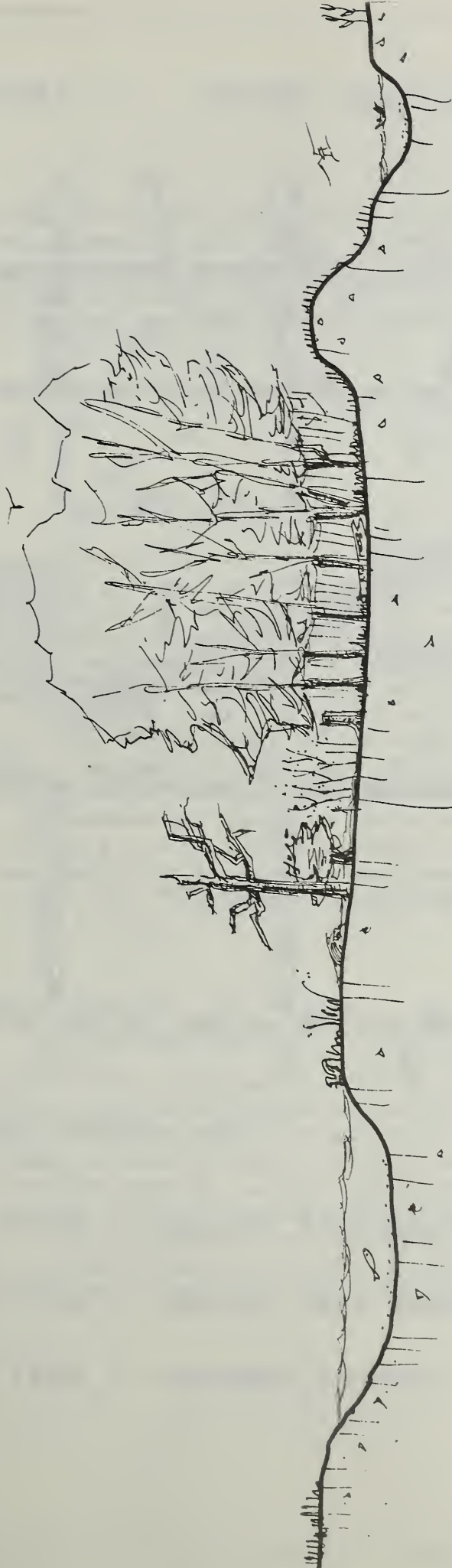


FIGURE 3 - TYPICAL CROSS SECTION OF MAPLE RIVER, FORESTED FLOOD PLAIN, LEVEE AND COLLECTION CHANNEL

All of the fill material for levees will come from the construction of the adjacent collection channels. Levees will be constructed mainly outside of the wooded flood plain. Prime wood-duck habitat will be preserved and undisturbed. The levees will be located on agricultural cropland and will not disturb identified wetlands as shown on Figure 4.

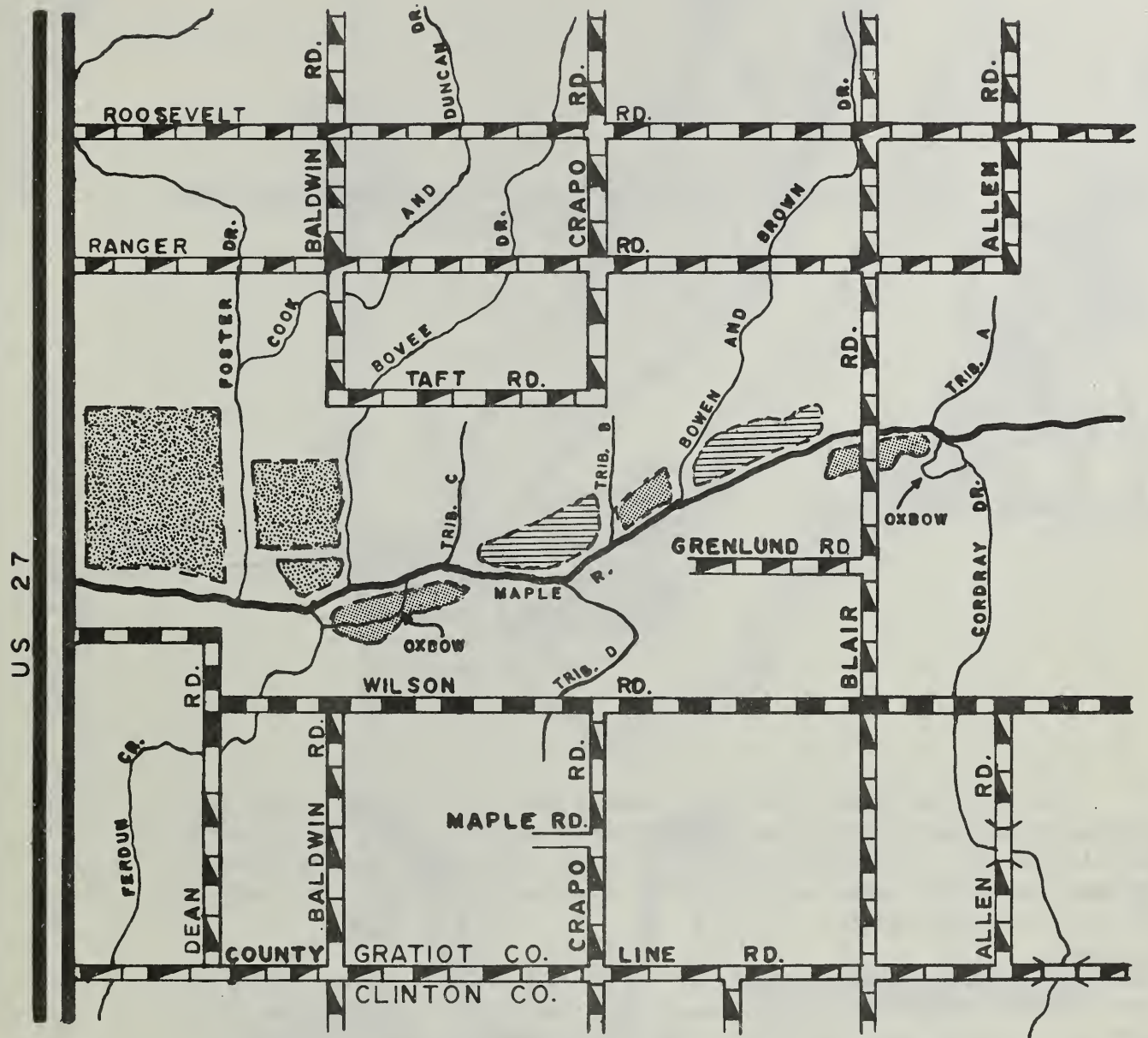
COLLECTION CHANNELS

A collection channel system will be constructed outside each levee to carry the runoff water from a 2-year frequency storm to the pumping stations. Collection channels will have the depth to furnish drainage outlets for adequate drainage for all crops grown in the surrounding area. On all but Ferdun Creek bottom widths will vary from 4 to 30 feet and depths from 5 to 15 feet. Ferdun Creek will have shallow collection channels from 2 to 3 feet deep and 2 to 12 foot bottom widths. Tile mains approximately 2 feet deeper will parallel the collection channels to provide tile drain outlets and control seepage stability in the fine sands found in this section. Collection channel culverts will provide access to levees for maintenance. Figure 5 shows a typical collection channel crossing. The 9.2 miles of collection channels to be constructed outside of the levees are new channels through primarily agricultural cropland.

PUMPING STATIONS

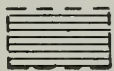
To achieve drainage of the areas protected by the levees, two pumping stations will be installed to remove the surface runoff and sub-surface drainage water. (See Figure 6.) From a hydrologic and economic study it was determined that the most economical pumping rate would be one-half inch in twenty-four hours. At that rate the pumping capacities of the two pumping stations are as follows: Northwest station - 76,000 gallons per minute; and the Southwest station - 44,900 gallons per minute. Total pumping capacity is 120,900 gallons per minute and covers a total drainage above the pumps of approximately 20.0 square miles.

FIGURE 4 — WATER RESOURCE MAP



WETLAND TYPES (29)

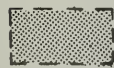
SCALE 1"=3520'



TYPE 3 — INLAND SHALLOW FRESH MARSHES

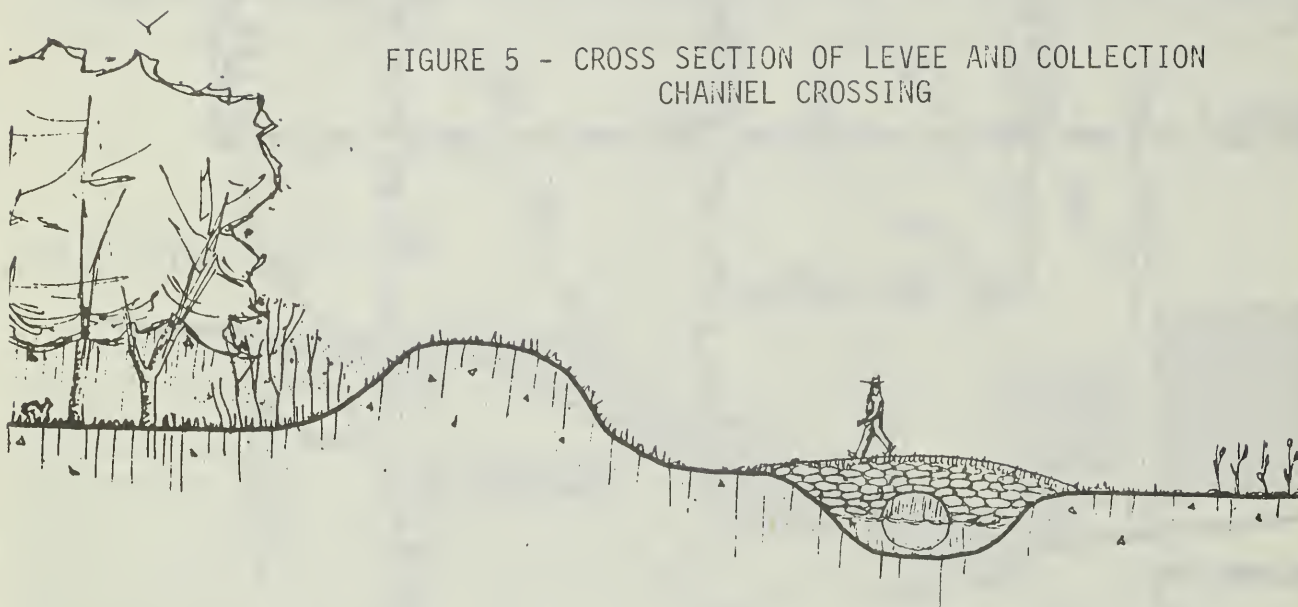


TYPE 4 — INLAND DEEP FRESH MARSHES



TYPE 7 — WOODED SWAMPS

FIGURE 5 - CROSS SECTION OF LEVEE AND COLLECTION CHANNEL CROSSING



Gravity flow pipe structures (See Figure 7) will be installed at pumping stations to allow drainage without pumping when the river is at low flow stage. A third gravity flow pipe structure will be placed through the south levee near US-27 to provide an outlet for a separate 100 acre drainage area.

The pumping stations will be of modern design, unobtrusive concrete block construction and extend to a height of approximately 22 feet above levee top elevation. The stations are located adjacent to wooded areas to minimize visual dominance and powered by electric motors to keep noise levels low and reduce operator costs. Overhead power lines will bring electricity into each pumping station. The Northwest and Southwest pumping stations will require construction of all weather access roads to service the pumps of approximately 1,100 feet and 2,500 feet, respectively.

FIGURE 6 - MAPLE RIVER, LEVEE, PUMPING STATION
AND COLLECTION CHANNEL

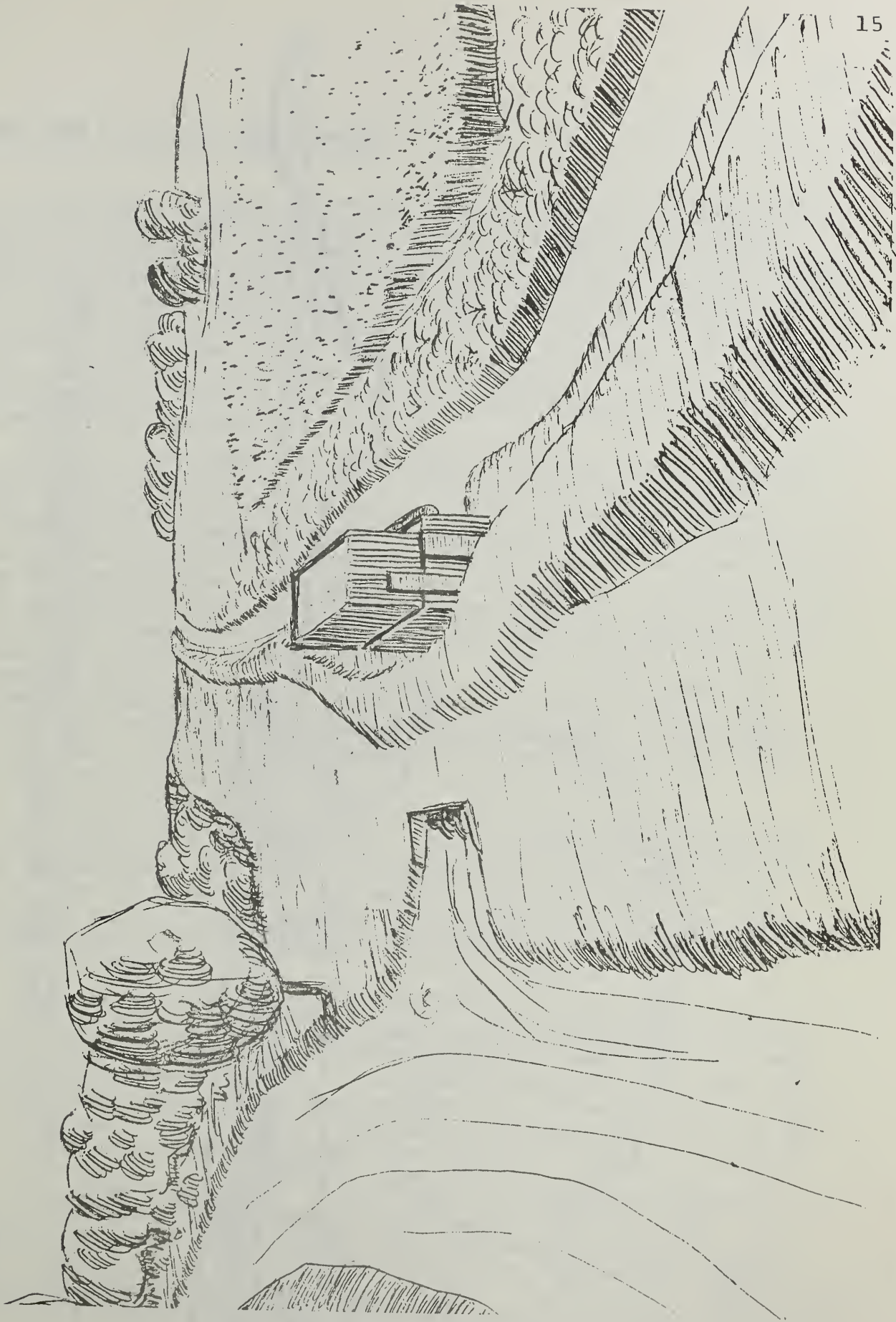




FIGURE 7 - CROSS SECTION OF A LEVEE AND FLAP-GATED PIPE FOR GRAVITY FLOWS WHEN THE MAPLE RIVER IS IN LOW FLOW PERIODS

FISH AND WILDLIFE DEVELOPMENT

Collection channels, levees and the area between the levees which will be used for a public fish and wildlife development involves a total of 1,339 acres. Included in this total is 346 acres of the Maple River State Game Area which is managed by the Michigan Department of Natural Resources. This portion of the game area is located adjacent to the Maple River just east of Highway US-27. Levees will be constructed on both sides of the flood plain along the Maple River having widths between the levees varying from 1,150 feet to 3,100 feet. With this arrangement, most of the trees and natural vegetation along the channel will be preserved.

A total of 180 acres (which includes 14 acres of the present game area) will be committed to levees, collection channels, and channel work. One-hundred sixty-six acres of this area will be purchased by the Maple River Drainage Board for the Maple River Drainage District from various private property owners. Title for the 14 acres will remain with the Michigan Department of Natural Resources. MDNR will provide an easement to the Maple River Drainage Board for construction, operation and maintenance of the levees and collection channels. The levees and collection channels have been located to provide public recreational uses of the game area. This location of the levees and collection channels provide a barrier for one side of a water level control area to facilitate wetland wildlife management. These levees also provide access trails to extensive holding of public lands along the north side of the Maple River.

The public fish and wildlife development between the levees will involve a total of 1,159 acres. This area includes approximately 609 acres of privately owned land to be purchased by the Michigan Department of Natural Resources and cost-shared 50-50 with Public Law 566 funds, 332 acres of the Maple River State Game Area, and approximately 218 acres purchased by the Michigan Department of Natural Resources with other funds.

Major recreational uses of the public fish and wildlife development include fishing; small game, deer and waterfowl hunting; trapping; hiking; canoeing; bird watching and photography. There will be a total of 5 public access sites with sanitary facilities, including those for the physically handicapped. (See Appendix B.) Sanitary facilities will be of the vault type to prevent pollution of the water resources of the area and will meet requirements of local and state health departments.

Two sites will have 20 car and trailer parking sites and boat ramps. One site will have parking for 25 cars and 25 cars with trailers and a boat ramp. One site will have parking for 10 cars and walk in access to the river. There will also be two wildlife observation platforms and one mile of nature trail. One access site already exists and will be improved with sanitary facilit-

ies and an improved access road to Highway 27. This access road will be designed by the Michigan Department of Natural Resources in consultation with the Michigan State Highway Department to assure safe entrance and exit to facility visitors.

Access right-of-ways to pumping stations will be widened and used for public access roads. Access to the area will be from existing county roads as follows: Taft Road on the north side; Blair Road on the east side; and Wilson Road on the south side. Entry to the public access sites will require a total of one mile of gravel roads.

Public fish and wildlife development facilities have been kept to a minimum to preserve the existing ecological community and physical features of the flood plain. In addition to the planned recreational facilities, water resource improvements are planned within the leveed area. (Figure 8.) These will consist of wildlife food plots (on previously farmed cropland), low dikes to allow flooding of these plots, and a water level control structure to manage the water levels in the plots. Provisions for the physically handicapped will be incorporated into the design of all facilities. Of the total 1,339 acres in the planned public fish and wildlife development, 346 acres are now in public ownership as a wetland type 4 (inland deep fresh marsh).

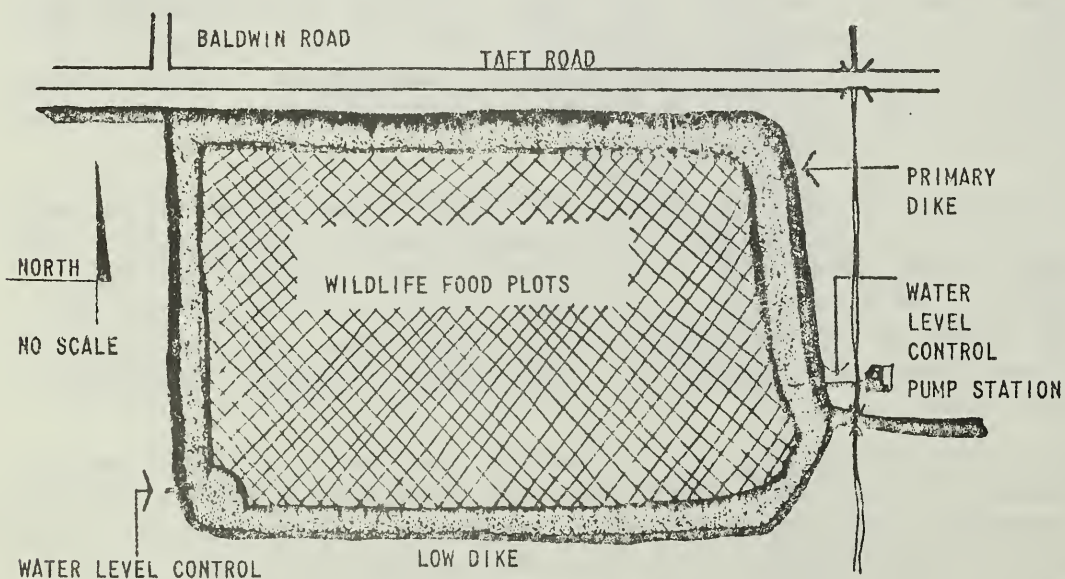


FIGURE 8 - WATER RESOURCE IMPROVEMENT

Present land use of the 993 acres in private ownership to be purchased and committed to structural measures and the public fish and wildlife development consists of the following: water areas, 28 percent; cropland, 23 percent; forest land, 42 percent; and grassland,

7 percent. Most of the cropland is presently in corn and soybeans. The flood plain wildlife habitat and adjacent cropland receive substantial use by upland and wetland species of wildlife. Table 1 shows land use in the proposed fish and wildlife development area.

TABLE 1 - CURRENT LAND USE IN THE PROPOSED
FISH AND WILDLIFE DEVELOPMENT

<u>Land Use</u>	<u>Acres</u>
Idle	204 <u>a/</u>
Woods	507
Crop	247
Water Surface Streams	30
Borrow Pit	<u>5</u>
Private Ownership	993
Original State Game Area	<u>346</u>
	1,339

a/. Includes 40 acres of idle cropland and 164 acres of marsh.

OPERATION AND MAINTENANCE

An establishment period not to exceed three years is provided for the structural work and associated vegetative cover. During this period the Soil Conservation Service may use PL-566 funds to cost share on any repairs or other work resulting from unknown site conditions or latent defects. The cost of repairs will be limited to 10 percent of the original construction cost and shared in the same ratio as in the work plan agreement. Cost of work under this provision will be limited to 10 percent of the contract cost. Type of work includes minor structural measures such as reshaping of the constructed channel and rock toes, and prompt establishment of adequate vegetative cover.

The continued functioning of the multiple-purpose channel work, levees, collection channels, and pumping stations in providing the degree of flood protection for which they were designed and for serving as adequate outlets will require a timely maintenance program. This will require the control of undesirable vegetal growth by mowing and/or spraying; resloping of eroding banks; removing sediment bars from channels; and removing debris from pipes, trash racks, and pumps.

The Maple River Drainage Board will operate and maintain the structural measures on the Maple River, Cordray Drain, Ferdun Creek, and the two pumping stations. The Michigan Department of Natural Resources will operate and maintain the fish and wildlife development area, including the access roads, parking lots, foot trails, foot bridges, sanitary facilities, observation towers and boat ramps.

The following items will be provided for in the maintenance program:

1. A specific maintenance agreement between the Soil Conservation Service and the appropriate sponsoring organization will be executed prior to the issuance of an invitation to bid on construction contracts.
2. A joint inspection will be made annually or after unusually severe floods by representatives of the sponsoring organizations including those in the Drainage District having responsibility for the works of improvement to be installed. Representatives of the Soil Conservation Service will assist with these inspections. A record will be made of all inspections, with one copy for the sponsoring organization and one copy for the Soil Conservation Service.
3. After an initial three-year period of joint inspection, the inspections of the structural works of improvement will be made annually by the sponsors, and a copy of the report prepared by them will be sent to the Soil Conservation Service representative.
4. All costs for labor, equipment and materials for operation and maintenance will be furnished by the appropriate local sponsoring organization.

5. Maintenance rights-of-way to the structural measures will be furnished by local sponsoring organization.
6. Maintenance work on seeded areas by mowing or spraying with environmentally safe chemicals should be done at a time which will allow for completion of the nesting season, preferably after July 15.

Land treatment measures will be operated and maintained by individual landowners or farm operators. This will be accomplished under cooperative agreements with the soil conservation district. Technical assistance will be provided by the Soil Conservation Service and for forestry measures, by the Michigan Department of Natural Resources.

PROJECT COSTS .

Total project installation costs are \$3,711,900. Of this total, PL-566 funds will pay \$2,533,000, and other funds will provide \$1,178,900.

Total construction costs for the project are \$2,156,800. Construction costs distributed to PL-566 funds are \$1,957,100 while other funds will pay \$199,700.

ENVIRONMENTAL SETTING

PHYSICAL RESOURCES

The West Upper Maple River Watershed is located in Clinton and Gratiot Counties in the south central portion of the Lower Peninsula of Michigan. The watershed includes 25,730 acres (40.2 square miles). Population of the watershed is approximately 1,550. This watershed is adjacent to the East Upper Maple River Watershed as shown on the Project Location Map.

Eureka is the only town or village in the watershed. Several towns and cities near the watershed are listed below along with their population and geographic location with respect to the watershed (14, 16).

Ithaca - population 2,749 - 5 miles north
St. Johns - population 6,672 - 10 miles south
Lansing-East Lansing - population 179,086 - 20
miles southwest
Owosso - population 17,179 - 22 miles southeast
Saginaw - population 91,849 - 30 miles northeast
Flint - population 193,317 - 42 miles east

The West Maple River Watershed is located in the Grand River Basin which is the Lake Michigan Subregion of the Great Lakes Water Resource Region. It lies in the Southern Michigan Drift Plain Land Resource Area of the Lake States Fruit, Truck and Dairy Land Resource Region (22).

Water resource problems of the area consist of flooding, impaired drainage, sedimentation, erosion and lack of adequate fish and wildlife development. Floods occur annually along the Upper Maple River and its tributaries during the heavy spring runoff in March and April. These floods are of such duration as to cause delayed planting and disruption

of crop rotations throughout the flood plain. Floods also occur during the growing season nearly every year and damage growing crops. Over the past twenty years, floods have occurred an average of four times per year.

In addition to crop and pasture damage, floodwaters damage farm roads and surface drainage ditches, public roads and bridges, and farmstead residences. Inadequate channel depth and capacity cause impaired drainage on an area of 5,360 acres, including 3,800 acres presently in cropland. The problem areas include the flood plain and adjacent lands which require internal and surface drainage for efficient agricultural use, and are dependent upon the Maple River and its tributaries for drainage outlets.

Sedimentation has occurred in all of the channels in the watershed. This has contributed to loss of capacity within the channels at certain points. Erosion damages within the watershed consist of movement of soil materials from cultivated land, roadside ditches, upland gullies, channels, and other sources. This creates local maintenance and clean-out expenses as well as damage to the land ecosystem itself. These damages and expenses result from local problems of erosion which occur throughout the watershed.

There is a need to protect the valuable fish and wildlife habitat of the Maple River State Game Area. Due to the increasing outdoor recreation demand from nearby urban centers, there is an inadequate number of acres of this type of public fish and wildlife development in the watershed (30). The basic facilities at the existing game area are incapable of satisfying the present recreational demand being exerted on them according to Department of Natural Resources officials.

Soils in the problem areas are predominantly organic muck, clay loam, and sandy loam which are somewhat poorly to very poorly drained. Cropland is largely in SCS Capability Classes II and III (21). See Appendix F for definitions of capability classes.

In the northern part of the problem area, the soils are poorly to somewhat poorly drained, and developed from clay loams, silty clay loams, and clays. Included are the Toledo, Pert, and Lenawee soils. Closely associated are local areas with 18 to 40 inches of loamy sand overlaying the clay loams and clay. In the southern part of the problem area, the soils are poorly to somewhat poorly drained. Included in this area are the Blount, Capac, Parkhill, Sims, and Wasepi soils (25, 26). Specific soils are described in Appendix F.

Water-holding capacity of the soils in the watershed generally ranges from 7.0 to 8.5 inches. Soil infiltration rates are 1.0 to 4.0 inches per hour.

Topography of the watershed is moderately rolling, except an area on the north side of the Maple River in Gratiot County, which is level to gently sloping. Elevations vary between 755 feet above sea level near Eureka to 650 feet above sea level at U. S. Highway No. 27 which is the lower end of the watershed.

The problem area lies directly upon the lake bed of the ancient glacial Lake Saginaw. The valley is oversized and the gradients are very low. Lake bed sediments are mainly silts and clays, with some sandy areas and beach deposits. The problem area is flanked to the west and south by the Owosso and Flint moraines. The system of moraines is rolling to steep with mixed clay till and sandy outwash material. Beneath the glacial drift is the Grand River Formation of Pennsylvanian age (8). The Grand River Formation consists mainly of sandstone and yields profuse amounts of low quality ground water, high in dissolved salts.

Throughout most of this area, wells in bedrock, which are 6 inches or more in diameter, will yield from 100 to 500 gal/min. In some locations, wells may yield less than 100 gal/min or more than 500 gal/min (9). In the eastern half of the watershed, wells in glacial deposits will yield less than 10 gal/min. In the western half of the watershed, wells 6 inches or more in diameter in glacial deposits will yield from 10 to 100 gal/min. An adequate supply of ground water is available for domestic and agricultural needs (9). Depths to ground water in the flood plains range from 0.5 - 10.0 feet, while depths range from 18.5 - 19.5 feet on upland adjacent to the flood plain (3).

There are no known surface or subsurface mineral resources in the area with the possible exception of minor deposits of sand and gravel.

There are no U. S. Weather Bureau Stations in the watershed. The nearest climatological station is located at St. Johns, about 8 miles southwest of the watershed. The length of record for this station is 33 years (7). Pertinent climatic data from this station is shown in Table 2.

TABLE 2 - CLIMATIC DATA

January average temperature	22.8°F
July average temperature	71.2°F
Maximum temperature recorded	102°F
Minimum temperature recorded	-19°F
First killing frost in fall (ave.)	Sept.29
Last killing frost in spring (ave.)	May 12
Length of growing season	140 days
Average annual precipitation	30.2 inches
Maximum annual precipitation (1950)	41.5 inches
Minimum annual precipitation (1958)	20.03 inches
Maximum 24-hour precipitation (Aug.1952)	3.78 inches
Percent of average annual total precipitation received during the six months April through September	62 percent

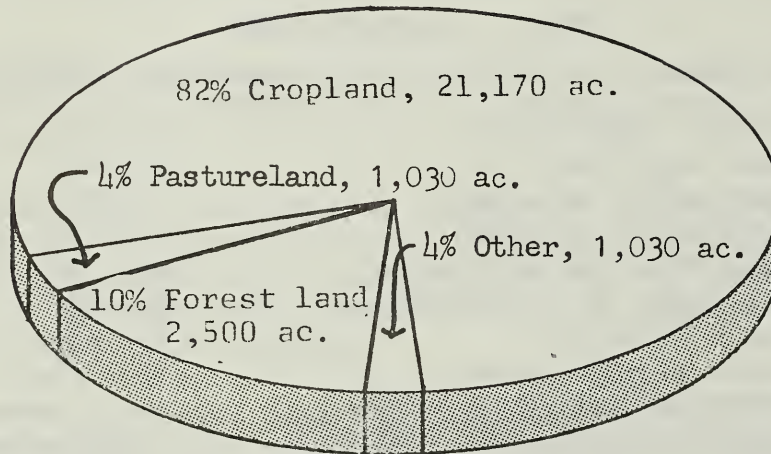
PRESENT LAND USE

Present land use in the watershed is strongly agricultural with approximately 82 percent of the watershed in cropland. (See Figure 9.) Forest land is a distant second. Other land (includes farmsteads, residences, roads, water areas and wildlife areas) and pasture land make up 4 percent each and are the smallest acreages.

Dairy, cash crops and general farming are the major types of farm enterprises in the watershed. There have been some shifts in recent years from dairy to cash crop enterprises, particularly in Gratiot County. The major crops are corn, soybeans, and wheat. Some sugar beets and edible dry beans are also grown in the watershed. Industrial employment opportunities are available within 20 miles of the watershed and have contributed to a considerable amount of part-time farming.

Most of the forest land is privately owned and scattered throughout the watershed in small tracts averaging 10 to 15 acres in size and is predominantly hardwood stands with some scattered pine plantations. Total forest land in the watershed amounts to 2,500 acres or 10 percent.

FIGURE 9- LAND USE IN THE WATERSHED



Total Acreage- 25,730

The Michigan Department of Natural Resources manages 346 acres of State-owned game lands adjacent to the Maple River just east of U.S.27. This land is part of the Maple River State Game Area which includes an extensive area west of the watershed boundary. (See Project Map in Appendix B.)

WATER RESOURCES

The Maple River is the major stream in the watershed. It originates about 30 miles upstream from the project area. Along the 3.8-mile-long reach within the project area it receives, near the east border, the Cordray Drain and about 3 miles downstream, the Ferdun Creek. Both tributaries enter from the south. (See Figure 4.)

After leaving the watershed area at U.S. Highway No. 27, the Maple River flows in a westerly direction and discharges into the Grand River and finally into Lake Michigan near Grand Haven. Within the watershed boundary the river averages 100 feet in width, measuring a maximum of about 230 feet and a minimum of 25 feet. The depth varies from 2 to 9 feet.

The natural channel has been modified prior to 1903. Two oxbows are still connected with the channel and provides quiet pool water and habitat for the native biota. (See Figure 4.)

Based on the discharge data at Maple Rapids (15 miles downstream) the typical discharge pattern is shown on Figure 10. The extremes during the 29 years of record are 6,500 cubic feet per second on March 20, 1948 and 4.4 cubic feet per second on August 13, 1965 (9).

Cordray Drain is 14.1 miles long. The lower reaches of Cordray Drain are classified as "previously modified channel." At Wilson Road, about 1 mile upstream from the confluence, with the Maple River the channel is about 20 feet wide and 1 to 4 feet deep. At the lower reaches Cordray Drain is classified as perennial and it appears that the water is stagnant during periods of low flow. Table 3 classifies this drain as well as others in the watershed.

Ferdun Creek is 10.6 miles long. The lower reaches are classified as "previously modified channel." At Wilson Road the creekbed has an average width of 7 feet and a depth ranging from 0.5 to 3 feet. The lower reaches of Ferdun Creek are classified as perennial. During the wet season the flow is estimated to be in the order of 8 cubic feet per second and less than 2 cubic feet per second during the dry season.

Ninety-six percent of all wetlands are located in the flood plain of the Maple River. (See Figure 4.) Two hundred and eighty-four acres of type 4 wetland--inland, deep fresh marshes (34)--are located along the right bank of Maple River between the confluence with Ferdun Creek and U. S. Highway No. 27 (31). This marsh has been diked and the Michigan Department of Natural Resources controls the water level by pumping. The remaining wetlands in the flood plain consist of 140 acres of type 3 - inland shallow fresh marshes, and 490 acres of type 7 - wooded swamps.

The water-filled borrow pits that total about 15 acres are located between Wilson Road and the Maple River. One pit has been used as a dump for domestic solid waste.

FIGURE 10
TYPICAL DISCHARGE PATTERN
MAPLE RIVER AT MAPLE RAPIDS

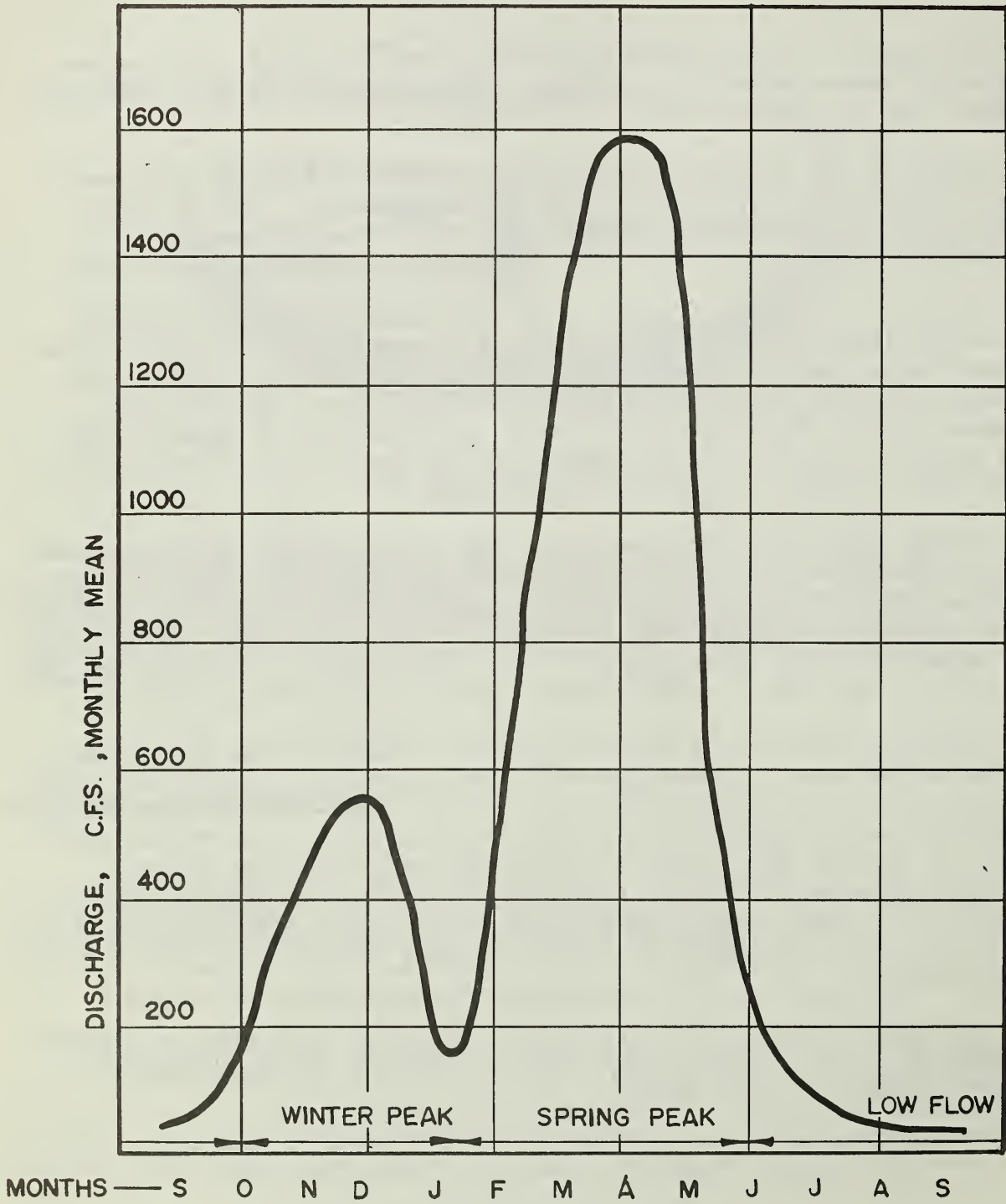


TABLE 3 - TRIBUTARIES TO WEST UPPER MAPLE RIVER (31)

<u>Name</u> (flows north to south)	<u>Miles of Channel</u>	<u>Type of Channel*</u>	<u>Flow Condition*</u>
TRIBUTARY A	1.4	M(100%)	I
BOWEN AND BROWN DRAIN	2.5	M(80%) N(20%)	I
TRIBUTARY B	1.9	M(100%)	I
TRIBUTARY C	.3	M(100%)	E
BOVEE DRAIN	4.4	M(100%)	Pr(I- Upper Reaches)
FOSTER DRAIN	7.1	M(90%) N(10%)	Pr(I- Upper Reaches)
(flows south to north)			
CORDRAY DRAIN	14.1	M(80%) N(20%)	Pr(I- Upper Reaches)
TRIBUTARY D	1.4	M(100%)	I
FERDUN CREEK	10.6	M(80%) N(20%)	Pr(I- Upper Reaches)

*Key

- M - Man-made ditches and/or previously modified channel
N - Natural stream course
Pr- Perennial - flows at all times except during extreme drought
I - Intermittent - continuous flow through some seasons of the year but little or no flow through other seasons
E - Ephemeral - flows only during periods of surface runoff, otherwise dry

Uses for the Maple River established by the Michigan Water Resources Commission (13) are: (a) warmwater fish including bass, pike, walleye, and panfish, (b) partial body contact recreation, (c) public water supply at the point of water intake, (d) agriculture, (e) navigation, and (f) industrial water supply. The river is designated and

protected for these uses according to Commission regulations. The river bottom substrate consists of medium stiff to very stiff brown, sandy to clayey silts and silty clays overlain by silt, sand, occasional boulders, and accumulated detritus (3).

WATER QUALITY

Physical and chemical data on the river water are available from two sampling stations. One station is located 22 miles upstream at Warren Road bridge, the other 15 miles downstream at M-21 bridge in Ionia County. Only general conclusions can be drawn from the six available samples as the sample stations are about 50 miles apart and sample dates cover a timespan from 1967 to 1973. However, these data (shown in Table 4) provide general information on the water quality to reflect present quality conditions.

The foregoing table of sample data shows low to middle turbidity. The relationship between conductivity and total residue follows the expected range (66-79 percent) for that geographic area and the total residue falls just below the tolerable maximum of 500 mg/l (34). The dissolved oxygen (DO) ranges from 70 percent to 100 percent saturation and the 5-day BOD remained below 3 mg/l. Nitrogen (N) levels as nitrites, nitrates, and ammonium are below the standards set by the Michigan Water Resources Commission. Chlorides and phosphate levels show little evidence of pollution from adjacent soil runoffs. Hardness, measured in mg/l of calcium carbonate, is about twice the amount defined as "very hard" (35). The alkalinity of the water is also reflected in the 8 pH value. The above data are based on six samples only, and the analysis, therefore, reflects only general characteristics of the river water, which may vary drastically during one climate cycle.

According to the selected parameters in the literature (6, 13, 31, 33, 35) the water quality is acceptable for wildlife, recreation, partial contact sports, agriculture, and with treatment for municipal industrial usage. Presently the water is being used for agricultural needs and indirectly through wells for domestic supply.

TABLE 4 - MAPLE RIVER WATER QUALITY (10)

DATE:	SAMPLES 22 MILES UP- STREAM FROM WATERSHED		SAMPLES 15 MILES DOWN- STREAM FROM WATERSHED				
	10-4-67	10-14-70	8-30-71	4-17-73	5-15-73	6-7-73	
FLOW	ft ³ /s	7	3	39	*3,000	*2,000	*3,000
WATER TEMPERATURE	°C	20.0	14.0	17.5	7.5	10.0	18.0
TURBIDITY	JTU	--	6.0	17.0	7.0	5.0	43.0
CONDUCTIVITY umhos	25°C	--	700	570	540	540	520
TOTAL RESIDUE	mg/l	499	464	413	358	359	411
pH		8.0	8.1	8.1	7.9	7.8	7.5
DO	mg/l	10.8	7.2	6.8	10.3	8.3	--
BOD5-Day	mg/l	1.4	--	1.3	2.8	1.2	--
ORG N	mg/l	--	--	0.06	0.31	1.30	0.90
TOTAL NO3 N	mg/l	0.45	0.30	0.40	1.20	0.98	1.20
TOTAL NH3 N	mg/l	0.00	0.05	0.06	0.01	0.01	0.08
TOTAL	CaCO ₃ mg/l	300	295	210	195	210	205
TOTAL HARD	CaCO ₃ mg/l	385	390	280	275	295	250
TOTAL PHOSPHATE	mg/l	0.05	0.04	0.13	0.12	0.17	0.21
CHLORIDE	mg/l	8	15	37	24	24	23
FECAL COLI	MPN/100ml	300	--	130	10	30	470

*Flows are estimates based on discharge data at Maple Rapids Station.

The substrate of both Ferdun Creek and Cordray Drain consists of sand, silt, and partially decomposed organic matter, which in the Cordray Drain emits a strong odor. Overhanging trees and some large rocks provide cover for fish.

PLANT AND ANIMAL RESOURCES

Approximately 10 percent (2,500 acres) of the total land area is forest cover and is generally considered to be in good hydrologic condition with a potential for hydrologic improvement. The two major

forest types are northern hardwood and oak-hickory. Maple, oak, hickory, basswood, and ash are the major species present. Some walnut, cherry, hawthorn, and beech can be found. The Dutch elm disease has killed a large number of elm trees throughout the watershed (20). Many of these trees have fallen into the river causing blockages.

Forest fire protection is provided by the Michigan Department of Natural Resources in cooperation with the U. S. Forest Service through the Clarke-McNary Cooperative Forest Fire Control Program.

Numerous weeds, vines, grasses, legumes, and shrubs are also found scattered throughout the watershed. Those plants most likely to occur in the watershed are shown in Table 5.

TABLE 5 - PLANTS FOUND IN THE WATERSHED

Weeds

Chicory
 Daisy Fleabane
 Goldenrod
 Lambsquarter
 Milkweed
 Mullen
 Orange Hawkweed
 Pigweed
 Ragweed
 Smartweed
 Thistle Species
 Wild Carrot

Vines

Bitter Nightshade
 Greenbriar
 Poison Ivy
 Wild Grape

Shrubs

Choiceberry
 Dewberry
 Elderberry
 Gray Dogwood
 Hawthorn
 Juniper
 Pin Cherry
 Red-osier Dogwood
 Rubus Species
 Shrub Willow
 Silky Dogwood
 Sumac Species

Grasses

Bluegrass
 Bromegrass
 Quackgrass
 Reed Canarygrass
 Timothy

Legumes

Alfalfa
 Red Clover
 Sweet Clover
 (white and yellow)
 White Dutch
 Clover

The Maple River is classified by the Michigan Department of Natural Resources as "top quality, warmwater mainstream," (a stream containing good populations of warmwater game fish and large enough to permit fishing with all standard gear (11)). Cobbles, boulders, brush, overhanging trees, and wood debris provide cover for fish. The river contains northern pike, walleye, smallmouth bass, channel catfish, bullhead, sucker, crappie, bluegill and carp. Forage fish that have been observed include minnows, chubs, shiners, and darters. Preliminary information available from the Department of Natural Resources' fish survey (36) is tabulated below for the three survey stations in the watershed.

<u>Station</u>	<u>Game and Panfish</u>		<u>Non-Gamefish</u>	
	<u>Number</u>	<u>Weight</u> (pounds)	<u>Number</u>	<u>Weight</u> (pounds)
Highway 27	151	75	169	457
Upstream 1 mile	155	101	48	82
Blair Road	28	15	16	18

The observed dominant invertebrates are scuds (Amphipodae), water boatmen (Corixidae), in addition to numerous nymphs of the orders Ephemera and Odonata.

Both Ferdun Creek and Cordray Drain have much in common. They are very small and are classified as "second quality warmwater feeder stream" (11). (Too small to permit fishing with all standard gear, too small to support game fish population composed of individuals large enough to provide a satisfactory fishery; value of contribution to main-stream limited by highly fluctuating stream flow, and/or presence of heavy silt load or other pollution.)

The observed macroorganisms are bottom dwellers found usually under lenitic (stillwater) conditions. They include sowbugs (order Amphibota), snails (family Gastropoda), clams (family Sphaeriidae), giant crane fly larvae (order Diptera), mayflies (order Ephemera), damselflies (order Odonata), and some genera of Chironomus and Tubifex.

Some of these species are tolerant to pollution and low oxygen levels and thus may be used with some discretion as indicators for pollution. The odor and the presence of some of the pollution tolerant benthos (bottom dwelling organisms) indicate a condition of pollution in Cordray Drain. This condition seems to be absent in Ferdun Creek.

The Type 3, 4, and 7 wetlands in the flood plain provide excellent habitat for waterfowl, other semi-aquatic birds, mammals and amphibians. The watershed is located on the major waterfowl flyway between Wisconsin and Lake Erie (5). The wetlands are ideal for migrating teal, mallards, and black ducks. Nesting areas are available for black-ducks, mallards, blue-winged teal, and wood ducks. The forty-one miles of tributaries

and drains also provide habitat for semi-aquatic birds and mammals. Other species such as pheasants, doves, crows, songbirds, hawks, cottontail rabbits, fox and gray squirrels, skunks, opossums, raccoons, red fox and white-tailed deer have habitats available among the interspersion of 2,500 acres of forests (84 individual woodlots), 22,200 acres of cropland and pasture land, and 41 miles of tributaries and drains that have grass, brush, and tree cover along the banks. There are few brushy fencerows. Swans use the Michigan Department of Natural Resources marsh and adjacent areas as a resting place during the spring and fall migration.

Wildlife game species in the watershed are shown in Table 6(17). There are no rare endangered species of plants, mammals, birds, amphibians, reptiles, or fish known to exist in the watershed.

ECONOMIC RESOURCES

The watershed is primarily an agricultural area with the exception of Eureka. All of the land is privately owned except for 346 acres of the Maple River State Game Area owned by the Michigan Department of Natural Resources.

Dairy and cash cropping are the major farming enterprises in the watershed. There are 205 farms which average about 125 acres and range in size from 20 to 240 acres.

Eighty-six percent (22,200 acres) of the watershed is in cropland and pasture at the present. The major crops are corn, soybeans, and wheat. Sugar beets and edible dry beans are also grown in this area. Yields for the principal crops grown, for the watershed as a whole, and for the water resource problem areas are shown on Figure 11.

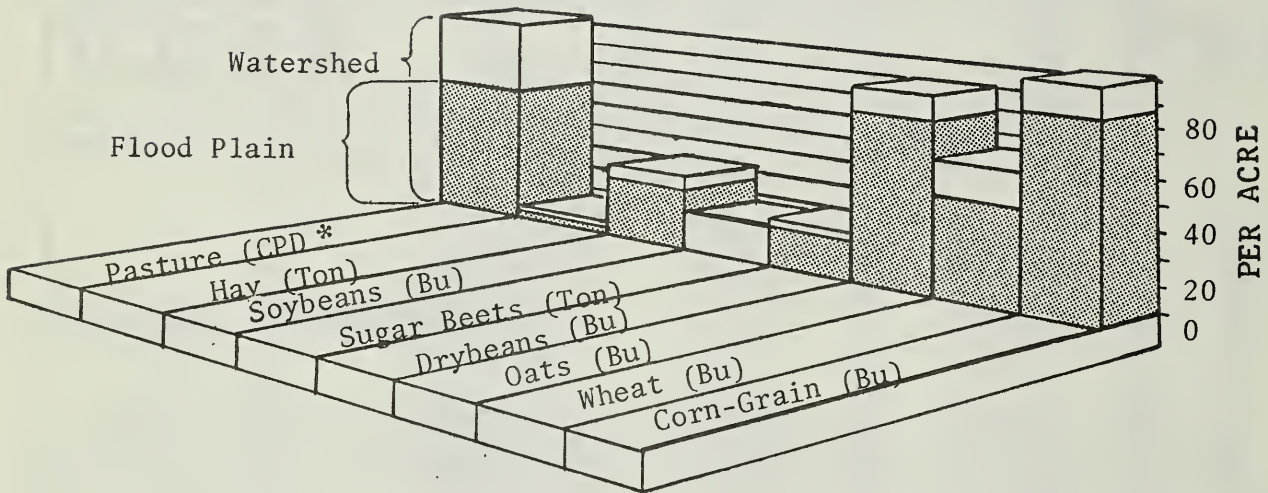
Over 90 percent of the farms in the watershed, including the flood plain, are family farms. The percent of total farms in each economic class (determined according to market value of all farm products sold) is shown on Table 7.

Average market value per farm (1969) of all agricultural products sold was \$11,075 (average for Clinton and Gratiot Counties) and \$10,641 for Michigan. In 1969, 8 percent of all farm operators in these two counties worked 100 to 199 days off the farm and 46 percent worked 200 days or more compared to 8 percent and 45 percent, respectively, for Michigan (29).

TABLE 6 - GAME SPECIES (2, 4, 17)
IN THE WEST UPPER MAPLE RIVER WATERSHED

<u>Species</u>	<u>Relative Abundance</u>	<u>Management Potential</u>	<u>Game Range Zones</u>
Continental Rabbits	Moderate (0-33/100 acres)	Good - rabbits can be encouraged by providing areas of thick, brushy cover.	Thick, brushy cover
Tree Squirrels	Moderate (1/25 acres)	Good - squirrel populations occur in many woodlots and the population is generally under harvested.	Forested areas with oaks
White-tailed Deer	Low - moderate (3-30/sq. mi.)	Medium - huntable populations occur throughout watershed. Highest numbers found in the Maple River Flood Plain. Because conflicts with agriculture and increasing car-deer collisions, it may be necessary to control further increases of deer population.	Any forested areas
Ring-necked Pheasants	Moderate (20-40 hens/sq.mi.) (5-15 roosters/sq.mi.)	Good - the watershed constitutes fair to good pheasant range and the population will increase in the future.	Throughout the watershed
Quail	Low	Limited - Clinton County was opened to Quail hunting in 1966. Because the county is on the northern fringe of the quail's range, the population will fluctuate, depending on the severity of the winter.	Clinton County
Ruffed Grouse	Low, species cyclic.	Limited.	Maple River State Game Area
Waterfowl Wood duck	High (8-12 nesting pairs/mile of river)	Limited - the Maple River State Game Area provides the best waterfowl hunting in the watershed. During the spring migration many of the waterfowl species found in Central North America can be observed on the Maple River and this attracts considerable interest. Natural lakes and marshes attractive to waterfowl are not found throughout the remainder of the watershed.	Maple River and adjacent land
Blue-winged Teal	High		
Mallard	High		
Black duck	Low		
Woodcock	Moderate, mostly flight woodcocks	Limited.	Maple River and adjacent lowland swales
Turkey	Low	Limited - planted in State Game Area in 1966.	Maple River State Game Area
Snowshoe Hare	Very low.	Have been planted in the State Game Area	Maple River State Game Area
Muskrats	High (8/acre of wetland)	Excellent.	Maple River State Game Area

FIGURE 11 - CROP YIELDS



*CPD- Cow Pasture Days

Several sawmills are located in the vicinity of the watershed and provide good markets for sawlogs. The market situation for secondary forest products is generally fair to poor. Given protection and management, the forest stands could be expected to contribute more to the economy of the watershed.

Upland used for agricultural purposes is valued at approximately \$600-\$700 per acre. Flood plain land which is being farmed is valued at about \$400 per acre while flood plain land immediately adjacent to the river is valued at \$300 per acre. Since Eureka is the only village in the watershed, no attempt was made to estimate a value for urban land.

The area is served by a good network of county and township roads. U. S. Highway 27 is the main north-south highway, crossing the watershed near its western boundary. Michigan Highway 57 is the major east-west highway. One Grand Trunk Western Railroad line crosses the watershed just north of M-57.

Statistical data is most readily available by county. Since the watershed lies in both Gratiot and Clinton Counties, Table 8 presents the social characteristics of the watershed in terms of both of these counties.

 TABLE 7 - PERCENT FARMS BY ECONOMIC CLASS (29)

<u>Class</u>	<u>Percent</u>
Class 1 (\$40,000 and over)	5.2
Class 2 (\$20,000 to \$39,000)	10.8
Class 3 (\$10,000 to \$19,000)	14.0
Class 4 (\$5,000 to \$9,999)	15.8
Class 5 (\$2,000 to \$4,999)	16.0
Class 6 (\$50 to \$2,499)	4.4
Part-time (\$50 to \$2,499; operator under 65)	27.6
Part-Retirement (\$50 to \$2,499; operator over 65)	6.2

The population of Clinton County increased 27.7 percent between 1960 and 1970 and is projected to increase by 50.9 percent between 1970 and 1990 (15). Much of this increase is the result of rural migration from Lansing. Many people in this area are employed in Lansing and commute daily. In 1960, 27.8 percent of the population of Clinton County was rural farm, 50.3 percent was rural non-farm, and 21.9 percent was urban. In the same year, 28.9 percent of the population of Gratiot County was rural farm, 29.5 percent rural non-farm, and 41.6 percent urban (19).

Agriculture is the major industry in the watershed. Other employment opportunities are found in retail, wholesale, and other industries in the nearby industrial centers. A sugar beet receiving station is located in the watershed near the junction of US-27 and M-57. The facility is operated by the Michigan Sugar Company and receives sugar beets for rail shipment at company expense to processing plants near Saginaw, Michigan. In the past, farmers had to pay trucking costs to Saginaw, and, therefore, sugar beet production in the watershed was not profitable. This shipping arrangement is expected to stimulate production considerably, and will contribute to more diversified use of cropland in the watershed.

RECREATIONAL RESOURCES

Existing recreational resources in the watershed are fall colors, snowmobile areas, river canoeing, and the multiple use of 346 acres of

TABLE 8 - SOCIAL CHARACTERISTICS (16)*

<u>Factor</u>	<u>UNIT</u>	<u>Gratiot Co.</u>	<u>Clinton Co.</u>	<u>Michigan</u>
<u>Population</u>				
1960	No.	37,012	37,969	7,823,194
1970	No.	39,246	48,492	8,879,862
Change 1960 to 1970	%	6.0	27.7	13.5
Rural 1960	No.	21,615	29,681	2,084,062
Rural 1970	No.	22,606	38,154	2,321,310
Rural change 1960 to 1970	%	4.6	28.5	11.4
Urban 1960	No.	15,397	8,288	5,739,132
Urban 1970	No.	16,640	10,338	6,553,733
Urban change 1960 to 1970	%	8.1	24.7	14.2
1990a/	No.	43,221	73,151	12,226,000
Change 1970 to 1990	%	10.1	50.9	37.7
Density 1970	No./sq.mi.	69.5	84.8	156.2
Net migration 1960 to 1970	No.	-2,804	4,160	27,236
Persons per household <u>d/</u>	No.	3.32	3.55	3.27
<u>Health</u>				
Physicians <u>e/</u>	No.	40	13	11,214
Dentists <u>e/</u>	No.	11	11	4,518
Nurses <u>e/</u>	No.	314	253	68,713
Hospitals <u>f/</u>	No.	1	1	248
Hospital Beds <u>f/</u>	No.	142	83	40,587
Nursing Homes <u>f/</u>	No.	7	3	458
Nursing Home Beds <u>f/</u>	No.	486	117	37,671
<u>Housing</u>				
Total Units <u>d/</u>	No.	11,332	13,605	2,653
<u>Education</u>				
Enrollment <u>d/</u>	No.	12,424	15,912	2,770,179
Persons 25 <u>g/</u> older completing high school				
male	%	51.7	50.2	51.2
female	%	56.3	60.2	54.2
<u>Employment</u>				
Nonworker-worker ratio <u>d/</u>	ratio	1.63	1.58	1.52
Unemployment <u>f/</u>	%	15.0	5.9	8.2
<u>Income</u>				
Per capital personnel income <u>d/</u>	\$	3,117	-	-
Medium family income <u>g/</u>	\$	8,891	11,014	-
\$15,000 and over <u>g/</u>	%	15.9	23.0	-
Below poverty level <u>g/</u>	%	9.0	5.2	-

*All data in the table is from the Michigan Statistical Abstract unless otherwise noted.

a/ Project 80 and 5, "Summary of Phase I Papers," Michigan State University, 1972.

b/ Project 80 and 5, projection for year 2000.

c/ Percent change from 1970 to 2000.

d/ 1970 information.

e/ 1972 information.

f/ 1971 information.

g/ 1969 information.

the Maple River State Game Area. An additional 13,500 acres of State Game Areas are available within ten miles of the watershed. Major recreational uses of the state game areas are as follows in declining order of occurrence: hunting, fishing, berry picking, picnicking, swimming, camping, sight-seeing, mushrooming, boating and target shooting (12).

Greatest utilization of fish and wildlife resources appear to be the hunting of waterfowl, fox and gray squirrels, pheasants, cottontail rabbits, deer and the trapping of muskrat. The aesthetic value of the wildlife in the state game marsh is appreciated by many people who travel U.S. Highway 27, nature clubs, and school groups. Recreational potentials for Gratiot and Clinton Counties are shown in Table 9.

Present water quality does not have any known effect on the use of recreational resources. Water based recreational activities are of the nature and level of participation that would be expected from the type of water resources found in the watershed.

Public access is available to the Maple River State Game Area at three principal sites: directly off US-27, Wilson Road in NE1/4 Sec. 26, and Blair Road bridge. No recreation facilities are provided. Access to other areas in the watershed is obtained by permission from private landowners.

ARCHEOLOGICAL, HISTORICAL, AND UNIQUE SCENIC RESOURCES

Four archeological sites have been identified within the proposed project area (1). These are: 1) the Konecny Site - a seasonal camp site, 2) Camburn Site - seasonal campsite, 3) Fabrus Site - seasonal collection campsite and chipping station, and 4) Ayen Site - base camp or small community. Numerous artifacts have been recovered from these sites by the landowners and the survey team. According to the survey report the Ayen Site

"... seems to have functioned in a different capacity than the other sites. It reflects a substantial occupation by a community with several kinds of technological tasks represented. Whether it was a sedentary village cannot be determined at this time."

TABLE 9 - POTENTIALS FOR OUTDOOR RECREATION (2, 4)

<u>Activity</u>	<u>Potential</u>	
	<u>GRATIOT COUNTY</u>	<u>CLINTON COUNTY</u>
Vacation Cabins, Cottages, and Homesites	High	Medium
Vacation Site Camping Grounds	Medium	Medium
Canoe Trips	Medium	Low
Transient Campgrounds	Medium	Medium
Game, Play & Target Areas	High	High
Bicycling	High	High
Picnic Areas	High	Medium
Fishing Waters-Warm	Medium	Medium
Standard & Par 3 Golfing	High	High
Driving Ranges & Miniature Golfing	High	High
Hunting-Small Game	High	High
Hunting-Big Game	Medium	Medium
Hunting-Waterfowl	Medium	Medium
Natural Areas	Medium	Medium
Scenic Areas	Medium	Medium
Historic Areas	Med. Low	Med. Low
Riding Stables	Medium	High
Shooting Preserves	Medium	High
Vacation Farms	Medium	Medium
Water Sports	Medium	Medium
Winter Sports	Low	Low

This project has been reviewed by the State Preservation Officer of the Michigan Department of State, History Division. Other than the four sites mentioned above there are no known archeological, architectural, historic, or unique scenic areas which will be affected by the project. The Maple River State Game Area's water level controlled marsh area does represent a unique scientific area. Here many species of wildlife exist and scientific data is gathered on waterfowl and muskrat harvests. No property is included in the National or State Registers of Historic Places.

SOIL, WATER, AND PLANT MANAGEMENT STATUS

From 1964 to 1969 the acres of land in farms in Clinton County decreased from 309,445 acres to 286,958 acres or 4.6 percent. During the same time period, the acres of land in farms in Gratiot County decreased from 314,505 acres to 301,873 acres or 4.0 percent. In Clinton County, total cropland decreased 6.3 percent and harvested cropland decreased 20.7 percent, while in Gratiot County, total cropland decreased 1.3 percent and harvested cropland decreased by 11.2 percent (29). Total population increased from 1960 to 1970 by 27.7 percent in Clinton County and by 6.0 percent in Gratiot County. During this time period, in Clinton County the percent of the population that is rural increased by 0.7 percent, while the portion that is urban decreased by 2.3 percent. In Gratiot County the portion of the population that is rural decreased by 1.6 percent, while the portion that is urban increased by 1.7 percent (16). These trends indicate that population and land used for rural non-farm housing is increasing rapidly in Clinton County and will continue to exert a prominent land use demand for this purpose in the future.

Because of flooding and impaired drainage, it is often not possible to follow recommended crop rotations and cultural practices in the problem areas. On the average, yields are lower per acre in the problem areas than the watershed as a whole by 12 bushels for corn grain, 14 bushels for wheat, 10 bushels for oats, 3 bushels for dry edible beans, 8 bushels for soybeans, and 1.3 tons for hay.

The soil conservation districts conduct information programs on the benefits of proper land treatment. They encourage landowners and operators to install and maintain land treatment measures for the protection and improvement of the watershed. Of the 205 farms in the watershed, 71 are cooperators with the soil conservation districts and 57 of these have basic conservation plans. Approximately 8,800 acres are considered to be adequately protected against erosion. This includes 36 percent of the cropland, 30 percent of the pasture land, and 50 percent of other land. In addition many other acres are partially protected. Table 10 gives a listing of those practices which have already been installed. While only about 10 percent of the forest land is adequately treated for optimum production, it has adequate fire control and produces very little sediment.

TABLE 10 - LAND TREATMENT MEASURES ALREADY APPLIED

<u>Measures</u>	<u>Unit</u>	<u>Applied As of July 1969</u>
LAND TREATMENT		
Contour Strip Cropping	Acres	13
Field Strip Cropping	Acres	5
Conservation Cropping System	Acres	3,093
Cover & Green Manure	Acres	1,974
Crop Residue Use	Acres	3,264
Ditch Bank Seeding	Feet	4,086
Farm Ponds	No.	3
Grade Stabilization	No.	5
Grassed Water Way	Acres	.7
Land Smoothing	Acres	342
Minimum Tillage	Acres	1,777
Drainage Main or Lateral	Feet	8,456
Plow Planting	Acres	243
Drainage Field Ditch	Feet	1,500
Tile Drain	Feet	583,120
Pumping Plant for Water Control	No.	2
Pasture & Hayland Management	Acres	53
Pasture & Hayland Renovation	Acres	46
Pasture & Hayland Planting	Acres	13
Hedgerow Planting	Feet	3,158
Wildlife Habitat Management	Acres	62
Recreation Access Road	Feet	382
Recreation Area Planting	Acres	15
Recr. Land Grading & Shaping	Acres	13
Tree Planting	Acres	30
Hydrologic Cultural Operations	Acres	50
Fire Control	Acres	2,500

PROJECTS OF OTHER AGENCIES

There is one existing water resource development that will be affected by the structural measures. This is the diked wildlife marsh with pumping station for water level control owned and managed by the Michigan Department of Natural Resources adjacent to the Maple River at Highway 27. The pumping station will be raised to allow its continued use for water level control in the marsh.

WATER AND RELATED LAND RESOURCES PROBLEMS

LAND AND WATER MANAGEMENT

Agricultural land does not produce up to its potential due to inadequate drainage outlets and flooding. Because of these conditions, it is sometimes impossible to follow recommended crop rotations and has prevented many land managers from making the necessary investments in land treatment measures. The adoption of improved management practices, such as commercial fertilizer use, and minimum tillage, is lagging. Few farmers are using adequate amounts of fertilizer due to high potential loss of crops in the flood plain. Management plans and timber stand improvement measures are lacking on forest lands and thus, do not produce up to their potential.

Spring and fall floods and impaired drainage prohibit performing field operations in a timely manner, and the high probability of flooding prohibits land managers from investing in proper cultural practices causing decreased yield and inefficient use of land, labor, and capital. As a result, agricultural land is often put to a less intensive use than its potential capability. Susceptible small grain and navy bean crops have been replaced with soybeans which are more tolerant to excess water and late planting. More farmers are fall plowing in order to speed up field operations after the spring floodwaters recede. The change from small grain to soybeans and fall plowing have increased the sheet erosion rate by three times (10 tons per acre per year) on the cropland of the problem area (18,27). The necessary capital for installation of land treatment measures would be available if adequate protection was insured.

FLOODWATER DAMAGE

Floodwater damage and impaired drainage are the major land and water resource problems of the watershed. There are no towns or villages in the flood plain area. Damages are primarily to agricultural lands. The annual flood hazard has adversely affected land use and crop rotations in the 2,900 acre flood plain. Some areas of former cropland

have reverted to pasture or brush because of an increase in the frequency of flooding since 1955. Corn and soybeans are presently being grown on highly productive soils normally suitable for such water-sensitive crops as navy beans and sugar beets. In addition to crop and pasture damage, floodwaters damage farm roads, surface drainage channels, 4 miles of country roads, 4 bridges, and 11 farmstead residences.

The farms in the damage area average 125 acres in size. Land use in the flood plain including major crops, is shown in Table 11. Cropland makes up 52 percent of the present land use with soybeans being the major crop with a total of 22.4 percent. Woods are the major use in the 48 percent of non-cropland.

TABLE 11 - PRESENT LAND USE IN THE FLOOD PLAIN

<u>Land Use</u>	<u>Present Acres</u>	<u>Present Percent</u>
Cropland		
Corn	286	9.9
Wheat	154	5.3
Oats	62	2.1
Navy Beans	74	2.6
Soybeans	652	22.4
Hay	280	9.7
<hr/>		
Subtotal Cropland	1,508	52.0
<hr/>		
Woods	543	18.8
Pasture	65	2.2
Idle	345	11.9
Other	439	15.1
<hr/>		
TOTAL	2,900	100

Floods occur annually along the Upper Maple River and its tributaries during the heavy spring runoff in March and April. These floods are of such duration as to cause delayed planting and prevent proper distribution of crop rotations throughout the flood plain. Floods also occur during the growing season nearly every year and damage growing crops. Over the past twenty years, floods have occurred an average of four times per year.

One of the largest floods in terms of duration and acres affected occurred in April 1967. Over 2,800 acres of the 2,900 acre flood plain were inundated for a period of up to three weeks. This storm was estimated to be a five-year event. When floods of a greater magnitude occur, floodwaters spill across the watershed boundary into the Shiawassee River Basin. This prevents a large number of additional acres from being flooded by larger storms. In addition, at least two growing season floods affected the flood plain area to a lesser extent during 1967. Total damages for that year were estimated to be \$84,000.

Agricultural land in the flood plain is valued at approximately \$600-700 per acre. Land in the flood plain will for the most part remain in agriculture in the near future. This land will increase in value along with other agricultural land. Increases are not expected to exceed average agricultural land price increases due to the relatively low demand for development property in this area in the near future.

Most of the annual flood damages result from water damage. Very little damage results from land voiding, scouring, and sediment deposition during floods. The estimated average annual floodwater damage to crops and pasture is \$57,500, while other agricultural damage amounts to \$1,900. Residential damage amounts to \$300 and road and bridge damage amounts to \$1,300. Floods do not directly threaten the lives of the people in the watershed, although floods do cause moderate indirect damages. When roads and bridges are made impassible, it has been necessary to reroute school buses, farm vehicles, and other local traffic for several miles. On-farm milk pick-up has been delayed due to road conditions with a resultant loss in milk quality, thus, a loss in farm income to the farm operator.

EROSION DAMAGE

The overall gross erosion rate for the watershed is about 3.0 tons per acre per year. Sheet erosion on the 21,170 acres of cropland occurs at an average rate of 3.5 or 4.0 tons per acre per year. This rate is 0.5 to 1.0 tons per acre above that allowable to maintain long-time productivity levels of the soils. The erosion rate on the 4,560 acres of forest land, pasture, and other land is 0.3 or 0.35 tons per acre per year. Other erosion damages occur locally on streambanks, roadside ditches, and scattered gullies. Damages from these sources are minor in the West Upper Maple Watershed.

SEDIMENT DAMAGE

Most of the sediment entering the channel system of the Maple River is derived from sheet erosion; some, however, is derived from upland gullies, roadsides, gravel works, and streambank cutting. These sources, other than from sheet erosion, constitute a very small percentage of the total sediment yield. Sediment deposited on flood plain areas during periods of overbank flow is generally in small quantities and is usually not the coarse, infertile, and detrimental type. Damages from this source are not large and have been included with floodwater damages.

Sedimentation has occurred in all of the channels in the watershed. This has contributed to loss of capacity within the channels at certain points. The worst blockage of the channel in the watershed has occurred along the Maple River channel in a reach in the vicinity of the confluence of the Maple River with Bear Creek (Gratiot County), downstream to Blair Road. Test borings indicate sediment accumulations to be in excess of four feet deep. This blockage is sufficient to impede flow and interfere with drainage. Damage from sedimentation within channels was not evaluated separately from floodwater damage.

Solids in suspension causes turbid water in tributaries, drains and the mainstream during periods of heavy rain and runoff. The volume of sediment leaving the watershed annually is estimated to be 7,975 tons (23).

DRAINAGE PROBLEMS

Inadequate channel depth and capacity cause impaired drainage on an area of 5,360 acres (the 2,900 acres flooded plus a surrounding area amounting to 2,460 acres). Land use in the area suffering from impaired drainage is shown on Table 12. This indicates that cropland comprises 66 percent of the drainage problem area. Soybeans are the major crop with 28 percent, with corn and hay each having about 12 percent. Woods are the major noncropland use with 12 percent.

TABLE 12 - PRESENT LAND USE IN THE DRAINAGE PROBLEM AREA

<u>Land Use</u>	<u>Present Acres</u>	<u>Present Percent</u>
Cropland		
Corn	674	12.6
Wheat	362	6.8
Oats	145	2.7
Navy Beans	174	3.2
Soybeans	1,532	28.5
Hay	660	12.3
Subtotal Cropland	3,547	66.1
Pasture	121	2.3
Woods	664	12.4
Idle	531	9.9
Other	497	9.3
TOTAL	5,360	100

There are 110 landowners in the problem area. The problem areas include the flood plain and adjacent lands which require internal and surface drainage for efficient agricultural use, and are dependent upon the Maple River and its tributaries for drainage outlets. Damage from impaired drainage occurs primarily in the spring, but also occurs during the growing season and at harvest time.

Because of flooding and impaired drainage, it is often not possible to follow recommended crop rotations and cultural practices, and has prevented many farmers from making necessary investments in land treatment measures. These conditions result in a lower quality product; less intensive land use; reduced yields; and inefficient use of land, labor, and capital. In some areas slow natural drainage also reduces forest productivity for marketable wood products. Access to forest land for harvesting is also inhibited by slow drainage.

The soil in the problem areas are predominantly muck, clay loam and sandy loam which are somewhat poorly to very poorly drained. These soils have moderate to wide crop adaptability and impose severe limitations to crop production if not drained. These soils are highly productive if they are flood-free and adequately drained.

RECREATION PROBLEMS

Although there is pollution evident in the drainage ditches, it does not have any known effect on the use of recreational resources. Sediment deposition has decreased channel capacities, slowed velocity and damaged fish habitat which has led to decreased fishing activity. Canoeing is difficult in several places on the Maple River during low flow because of a shallow channel, sand bars, and wood debris.

Public recreational facilities are confined to the 346 acres of the state game area. There are three access roads, limited parking and no sanitary facilities. The access road directly off US-27 is considered dangerous. The road enters US-27 on a steep grade and visibility is impaired. Other access is acquired by permission from private landowners. Motorists on Highway 27 have impeded traffic flow and caused traffic jams while viewing wildlife in the Michigan Department of Natural Resources marsh. The high demand for waterfowl hunting and trapping in

this marsh has resulted in the issuance of regulatory permits for these activities by the Michigan Department of Natural Resources.

The projected population for Clinton and Gratiot Counties in 1990 is 73,151 and 43,221 respectively. This entire portion of Southern Michigan is expected to have a sustained population growth. These trends indicate a high potential demand for recreation in the area. There is a definite need for a greater variety of recreational facilities. Land resources are available, although development of recreational enterprises has not been good over the years.

PLANT AND ANIMAL PROBLEMS

Flooding and poor drainage of cropland have resulted in fall plowing which eliminates the crop residue food source for wildlife. In addition, small grain crops, which are valuable wildlife food and cover, have been replaced by less valuable soybeans which are tolerant to excess water and late planting. Flooding of wildlife nesting, denning and cover areas occurs during a 5-year flood. More fencerows and larger undisturbed strips of land along drains and tributaries are needed to provide more wildlife cover in areas of extensive cultivation. The watershed and surrounding area have a small total amount of water area and are located in a waterfowl flyway. There is a need for additional water acreage to provide for waterfowl nesting areas and migration resting areas.

Sedimentation has filled in pools and riffles used by fish and has produced a less desirable channel bottom (sand, silt, and organic debris) in all channels for the production of aquatic food species used by fish, aquatic and semi-aquatic birds and mammals.

WATER QUALITY PROBLEMS

The odor and presence of some of the pollution tolerant benthos (6, 33, 35) indicate a condition of pollution exists in Cordray Drain.

One of the water-filled borrow pits has been used as a dump for garbage and refuse. While this has been closed to the dumping of domestic garbage for about two years one-third of the original refuse is still uncovered. The Mid-Michigan District Health Department is working with the township to obtain an acceptable final cover for this exposed refuse.

ECONOMIC AND SOCIAL PROBLEMS

Sixty to seventy percent of the farm operators work 100 or more days off of the farm, and many are part-time farmers holding a full-time job outside of the farm. Many farm operators hold part-time or full-time semi-skilled jobs in the automobile industries, machinery manufacturing, and chemical industries of nearby Lansing, Flint, and Saginaw at a wage rate of \$3.00 to \$4.00 an hour. Some are employed in smaller factories in Alma, Mt. Pleasant, St. Johns, Owosso, and Ashley. Several farm operators work as carpenters in the winter, after their crops are harvested, at wage rates of \$4.00 to \$5.00 an hour. In some cases, the wife also works. There is some need of additional employment opportunities in the area, especially in the winter (12).

Nearly all of the farms in the problem area are family farms using less than 1 1/2 man-years of hired labor. There is some need for community development and improvement, especially at the township level. Public recreation facilities are practically non-existent.

RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

Land, water and air are basic assets to be used and managed wisely to protect, conserve, and enhance their productivity and quality for all Americans. A land-use policy is the expression of society's determination of how its resource, land, is used. A land-use policy refers to the total of all those national, state, and local laws, ordinances, and attitudes affecting the short-term or long-term uses of land, private or public, through such mechanisms as ownership, inheritance, taxation, condemnation, zoning, redevelopment, building regulation, master planning and legislative fiat. The major responsibility for land-use policy (including planning and regulation) rests with local and state governments.

Michigan has no one state land-use law. Numerous laws already on record contain provisions for regulating certain types of lands. There is nothing which ties these laws together nor is the enforcement vested with any one department. Many people feel, however, that there is a need for the state to take the leadership in this field and establish a policy.

While there is no local master plan for the area, the proposed action conforms to current desires to help enhance and preserve prime agricultural, forest, and waterfowl habitat lands.

ENVIRONMENTAL IMPACT

CONSERVATION LAND TREATMENT

Installation of planned land treatment measures will result in an additional 4,695 acres being adequately treated. Many of the remaining acres in the watershed will be partially protected or treated. Conservation cropping systems, crop residue use, minimum tillage, critical area planting, grade stabilization structures, grassed waterways, pasture and hayland management, pasture and hayland planting, forest tree planting and forest hydrologic cultural operations will decrease the average annual watershed erosion rate from 3.1 tons per acre to an estimated 2.5 tons per acre; reduce sediment load in channels 40 to 60 percent; and reduce surface water runoff in the watershed four to six percent.

Drainage practices such as drainage mains or laterals, drainage field ditches, and tile drains will improve agricultural efficiency. Improved drainage will allow farmers to get into their fields earlier in the spring; help prevent harvesting delays; permit the selection of higher yielding full season crop varieties; and permit a more effective weed control program.

Other land treatment measures such as conservation cropping systems, crop residue use, minimum tillage, and pasture and hayland planting and management will also increase agricultural production and efficiency as well as protect the land. These measures will increase net returns to land managers as well as make more efficient use of capital, labor, and other scarce resources. Minimum tillage practices will reduce the number of times a farmer must pass over a field, thereby reducing fossil fuel consumption by an estimated 6,600 gallons annually.

The proposed forest land treatment measures will help maintain and improve the hydrologic condition on 220 acres of forest land. The additional litter and humus produced will improve infiltration and increase water storage capacity in the upland soils. On the edges of

low, poorly drained forest lands, special tree and shrub plantings will reduce soil moisture, improve productivity, increase soil moisture storage capacity, and help protect soil from erosion. Special tree and shrub plantings will provide wildlife food and cover and improve aesthetic quality.

Crop residue use and minimum tillage will provide wildlife food in the form of waste grain and terrestrial invertebrates. Drainage field ditches will produce aquatic plants, forage fishes, aquatic invertebrates and amphibians which, in turn, will be used for food by aquatic furbearers, waterfowl and shorebirds. Wildlife upland habitat management will retain, create, and manage wildlife habitat. Pasture and hayland management will provide wildlife food and cover by reestablishing long-term perennial, biennial or reseeding forage plants.

STRUCTURAL MEASURES

Structural measures will reduce flooding on 1,740 acres and improve drainage on a total area of 4,200 acres of cropland. The average annual acres flooded will be reduced from 4,800 acres without project (the same acres are flooded several times a year) to 1,920 acres with project. When floods occur, damage due to flooding with the project will be less since with improved drainage floodwater will recede more rapidly. Flooding and impaired drainage will occur in the sump areas and collection ditches for 3-5 days during a 5-year frequency flood. This will affect primarily grassland, wet forest land, and pasture. Floodings of wildlife cover outside of the levees, will be reduced.

The present 25-year frequency discharge at the bridge of U. S. Highway 27 is 5,500 cfs. With the project the 25-year frequency discharge will be 6,240 cfs. The increased peak discharge will increase flooding on wet forest land in the Maple River State Game Area. Increased flooding will be of short duration equivalent to a 25-year frequency flood without the project.

Structural measures will reduce flooding and improve drainage for 110 landowners. Most of these landowners are farm operators and depend upon the production of agricultural products as their primary source of income. There will be an estimated 90 percent decrease in average annual flood damage to crops and pasture; and 89 percent decrease in other agricultural damages; 67 percent decrease in residential damages; and a 54 percent decrease in road and bridge damages.

Nonrenewable fossil fuel will be used during the construction period. Erosion and sedimentation will increase during the construction of the levees, collection channels, pumping stations, and recreation facilities. Sedimentation and turbidity will increase on the Maple River during the 1.8 miles of snagging and dredging, and the 1.1 miles of snagging only. Land treatment and structural measures will annually reduce sediment leaving the watershed by 52 percent, from 7,975 tons per year to 3,820 tons per year.

Reduced flooding will permit the restoration of former productivity on 65 acres of former cropland. Changed land use in the whole watershed will result from the conversion of 310 acres of pasture, idle and forest land to crop production.

More intensive land use will result in reduced production cost, increased production, and improved crop quality. Improved drainage will allow farmers to get into their fields earlier in the spring; help prevent harvesting delays; permit the selection of higher yielding full season crop varieties; and permit a more effective weed control program. Consideration of high value, water-sensitive crops, such as navy beans and sugar beets, will become possible.

Future land use in the problem area with and without the project including major crops is shown on Table 13. With the project, acres of wheat, navy beans and sugar beets increase. There is also an additional 1,000 acres of public land.

Future crop yields with project will increase an average of about 65 percent. The range varies from 37 percent or 6 tons per acre for sugar beets to a high of 74 percent or 29 bushels per acre increase for wheat. Figure 12 shows the relationships.

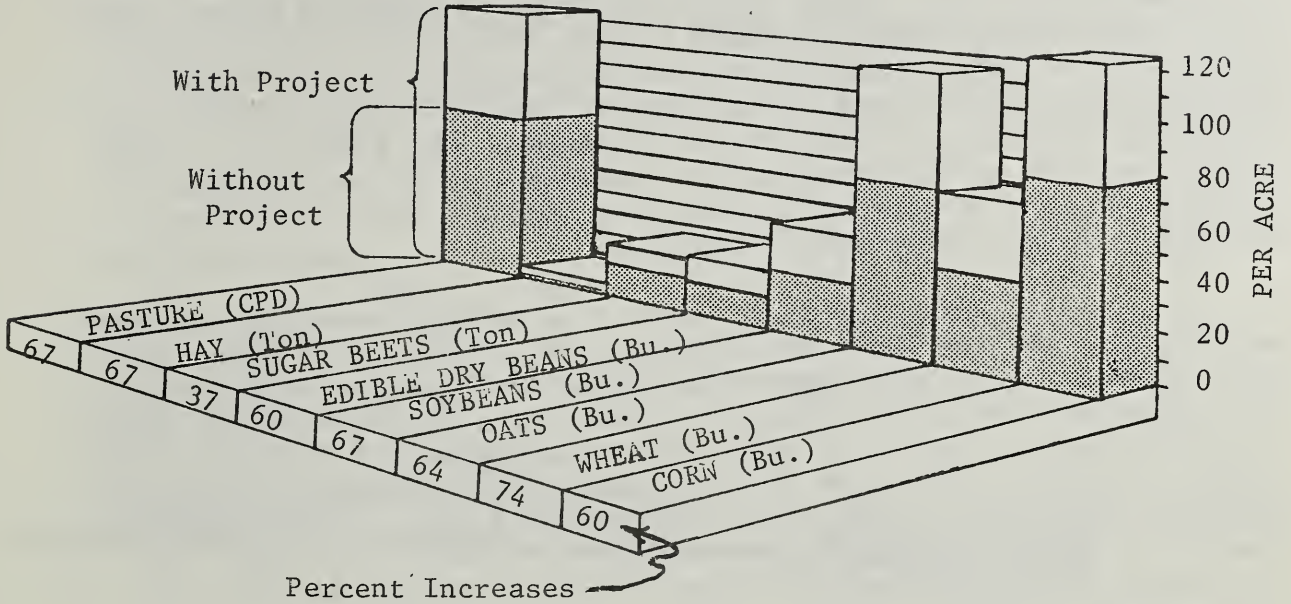
TABLE 13 - FUTURE LAND USE IN THE PROBLEM AREA

Land Use	Future Acres Without Project	Percent Without Project	Future Acres With Project	Percent With Project
Cropland				
Corn	687	12.8	515	9.6
Wheat	470	8.8	686	12.8
Oats	72	1.3	34	.6
Navy Beans	163	3.0	412	7.7
Soybeans	1,694	31.7	1,170	21.9
Hay	470	8.8	309	5.8
Sugar Beets	61	1.1	350	6.5
Subtotal Cropland	3,617	67.5	3,476	64.9
Pasture	94	1.8	27	.5
Woods	643	11.9	125	2.3
Idle	509	9.5	277	5.2
Other	497 <u>a/</u>	9.3	1,455 <u>b/</u>	27.1
TOTAL	5,360	100	5,360	100

a/ Includes 346 acres of state game area, 116 acres for farmsteads and roads, 30 acres for stream water surface, and 5 acres for borrow pits.

b/ Includes 116 acres for farmsteads and roads, and 1,339 acres involved in the Fish and Wildlife Development consisting of 346 acres of original state game area, 49 acres of water areas, 496 acres of woods, 6 acres of roads, and 442 acres of idle, crop and grass land.

FIGURE 12 - FUTURE YIELDS WITH AND WITHOUT PROJECT



An estimated 245 acres will be disturbed or changed with project action. Losses of cropland are 141 acres. Eleven acres of trees and brush will be changed to a gain of 132 acres of grass, 14 acres of gain in water surface and 6 acres gain of gravel roads. Table 14 shows this.

TABLE 14 - TOTAL LAND COVER CHANGES ON ALL DISTURBED ACRES (PERMANENT AND TEMPORARY)

	Before Project	After Project	Permanent Change
Grass	34	166	+132
Tree, brush	41	30	- 11
Crops	170	29	-141
Water	0	14	+ 14
Gravel	0	6	+ 6
TOTAL	245	245	

An estimated 245 acres will be disturbed or changed with project action. Table 14 shows this.

Permanent forest land losses will be 0.4 percent of the total watershed forest land. Most of the 195 acres of cropland between the levees will likely change to grass land or forest land. A few acres will remain in crop production for use by wildlife. An increase in wildlife "edge effect" will occur from the installation of levees and collection channels on 126 acres of cropland. (See Figure 13.) Edge effect is known as the tendency for increased variety and density of wildlife species at community junctions; such as, grass land next to cropland and grass land next to water.

A complete loss of wildlife habitat on berms, levees, and cleared areas will occur for up to three years. The planted cool season perennial grasses on the disturbed areas will provide good food and cover for ground-nesting birds and grazing mammals. Increases in the numbers of ground-nesting birds and small rodents are expected to occur on the newly established 132 acres of grass land. An increase in mosquito breeding will occur in the collection channels and in the wetland between the levees. There will be 310 acres of idle land, brush land and forest land wildlife habitat on 20 farms converted to cropland, a lesser value wildlife habitat. Brush piles between the levees will provide wildlife cover. Several borrow pits between the levees will make small ponds for wildlife use. New public land managed for fish and wildlife will amount to 993 acres.

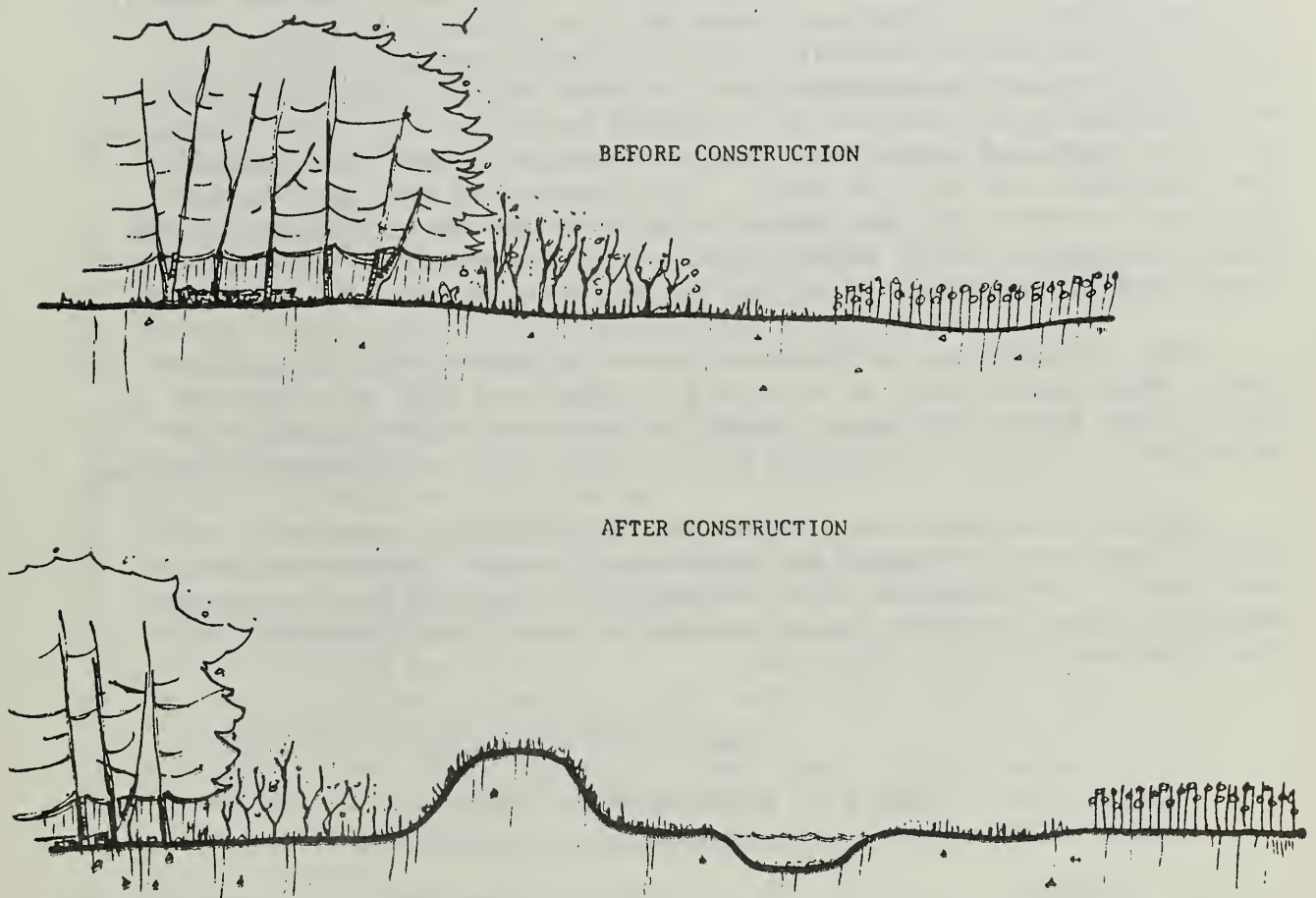
Dredging of 1.8 miles of the Maple River will destroy the fish cover and lower densities of aquatic plants and invertebrates on 8.7 acres of river bottom for up to 15 years. Less than 3 acres will have suction-dredged deposits over three inches deep which may destroy their value as wetlands. Sediment traps and suction-dredged areas may provide additional water depths for fish.

Noise pollution and construction activity will displace wildlife during the construction period (8 months each year for 3 years). An increase in noise, air, visual and solid waste pollution will occur as a result of an increase of 34,010 recreational visits per year.

ECONOMIC AND SOCIAL

Following installation of the project, farm income will increase due to increased production, increased efficiency, improved crop quality, and more intensive land use. The project will also encourage and enable farm operators to use better management techniques. These factors will lessen farm operators' dependence on off the farm employment and will increase the ability of family farms to stay in business. The 993 acres that will be converted to public ownership will constitute a loss to the local property tax base.

FIGURE 13 - EDGE EFFECT OF A TYPICAL LEVEE AND COLLECTION CHANNEL



The greatest amount of use of the Public Fish and Wildlife Development will occur during the hunting seasons (September 15 - December 31). Other high use periods will be the late spring and summer months, especially late May and early June when school children will be taking field trips. The maximum capacity of the access sites is 55 cars and 65 cars and trailers. Daily increases of traffic is expected to be minor and will pose no problem for local roads or services.

There are no known surface or subsurface mineral resources in the area, nor is there any expected impact from the project on any possible future mineral production.

Average annual income in the problem area will be increased by \$181,900 the amount of total annual primary benefits. This increased income will accrue to the local economy in the problem area, thus improving the quality of living. Local secondary benefits will accrue to processors, handlers, and suppliers of goods and services. These are entirely of a local nature and will accrue within the immediate zone of project influences. Since the watershed has a limited capacity to supply goods and services, there will be little multiplier effect within the hydrologic boundary. The increased expenditure for agricultural goods and services within the area will be relatively small, as witnessed by the \$46,500 in secondary benefits. It is also expected that the increased expenditure for consumer goods and services within the watershed area will be small. This means that the major effect on the local economy will be limited mainly to the initial impact of the \$228,400 average annual primary and secondary benefits. Appendix A summarizes the costs and benefits for the project.

With the project, all land between the levees will be owned by the Michigan Department of Natural Resources and will be a part of the Maple River State Game Area. Dredging and removal of snags on 1.8 miles and 1.1 miles of snagging only of the river will improve canoeing.

The Soil Conservation Service and the Michigan Department of Natural Resources conducted an analysis of public fish and wildlife development participation with the project. The analysis showed the expected visit increases per year will be about 34,010. Table 15 lists the various uses expected.

TABLE 15 - RECREATIONAL VISITS

1. Fishing	2,160
2. Deer Hunting - Bow	1,770
3. Deer Hunting - Firearm	1,900
4. Small Game Hunting	2,860
5. Waterfowl Hunting	4,510
6. Trapping	1,810
7. Hiking	6,000
8. Canoeing	2,000
9. Bird watching and photography	2,000
10. Observation towers	<u>9,000</u>
TOTAL VISITS	34,010

FAVORABLE ENVIRONMENTAL EFFECTS

- a) Adequately protect 4,300 acres of cropland, pasture land against erosion.
- b) Reduce average annual watershed erosion rate from 3.1 tons per acre to 2.5 tons per acre.
- c) Reduce sediment load in channels 40 to 60 percent.
- d) Reduce surface water runoff in the watershed by 4 to 6 percent.
- e) Improve efficiency of agricultural operations on 4,300 acres.
- f) Reduce annual fossil fuel consumption by 6,600 gallons.
- g) Provide additional food and cover for wildlife as a result of conservation land treatment.
- h) Reduce flood damages received by 110 landowners on 1,740 acres by 90 percent.
- i) Improve drainage on 4,200 acres.
- j) Reduce flooding to terrestrial wildlife cover outside of levees.
- k) Reduce residential flood damages by 67 percent.
- l) Reduce road and bridge flood damages by 54 percent.
- m) Reduce sediment leaving the watershed from 7,975 tons per year to 3,820 tons per year.
- n) Convert 310 acres of pasture, idle and forest land to crop production, a higher economic value.
- o) A change in use of 11 acres of forest land and 141 acres of cropland to 132 acres of grass land, 14 acres of water area, and 6 acres of gravel road surfaces for a net wildlife habitat increase.
- p) Increase wildlife "edge effect".
- q) Increase numbers of ground nesting birds and small rodents.
- r) Create new wildlife cover by building brush piles between the levees.
- s) Add 933 acres of new public land managed for fish and wildlife.
- t) Increased annual income of \$181,900.

ADVERSE ENVIRONMENTAL EFFECTS

- a) Increase erosion and sedimentation during installation of structural measures.
- b) Increase sedimentation and turbidity on the Maple River during the dredging period.
- c) Convert 310 acres of pasture, idle and forest land to crop production, a lower value wildlife habitat.
- d) A change in use of 11 acres of forest land and 141 acres of cropland to 132 acres of grass land, 14 acres of water area and 6 acres of gravel road surfaces for a net economic loss.
- e) Loss of wildlife habitat on structural measures for up to 3 years.
- f) Increase in mosquito breeding on 14 acres of new water.
- g) Destroy fish cover and lower densities of aquatic plants and invertebrates on 8.7 acres of river bottom for up to 15 years.
- h) Displace wildlife during construction activity (8 months each year for 3 years).
- i) Increase in noise, air, visual, and solid waste pollution as a result of 34,000 additional recreational visits.
- j) Loss of local property tax base on 993 acres.
- k) Loss of nonrenewable fossil fuel used during the construction period.

ALTERNATIVES

In any project there are numerous alternatives and combinations which can be considered. Many of these are engineering variables of the same basic project and are not considered separate alternatives. However, of the others, not all are realistic, and many were considered to a point where they proved to be impossible or unworkable.

There are several structural alternatives which were considered to be almost impractical, but nevertheless were briefly considered. An examination of the watershed for floodwater retarding dam sites was fruitless because of the flat topography. Channel work without levees would require extending work downstream more than 18 miles to the Grand River to obtain adequate outlets. No suction dredging as a variation of the planned project would reduce adverse environmental effects of sedimentation, turbidity, and destruction of fish habitat, but would substantially increase pump operation, maintenance and replacement costs.

Three alternatives in addition to the no project alternative appeared to be the most reasonable and are discussed further. They include accelerated land treatment alone, channel deepening and widening with levees in close proximity, designation of flood plain as a valley preserve, and no project action.

ALTERNATIVE 1- ACCELERATED LAND TREATMENT

One alternative to reduce water and related land resource problems is the installation of conservation land treatment measures. Such measures as conservation cropping systems, pasture and hayland management, tree planting and related conservation practices would be applied. Most of these practices would be applied on upland, since there would be an inadequate drainage outlet on 3,547 acres of cropland in the problem area without the project structural measures.

Accelerated land treatment measures would provide essentially the same reduction in runoff and sheet erosion on the uplands as the planned project, but this would only reduce floodwater damages by three percent and downstream sediment damages by fifty percent. Ninety-seven percent of the floodwater damages would remain. The cost of this alternative is estimated to be \$111,000.

Flooding and impaired drainage would continue on the 5,360 acres owned by 110 landowners. This will result in continued reduced production and efficiency on crop and forest land. Ground nesting, birds and rodents would also continue to suffer. Land use in the problem area would change to more idle cropland, pasture and woods. This would provide more wildlife cover but less food. Many conservation practices which would be applied with this alternative would improve the visual quality of the landscape and improve wildlife habitat. Construction disturbances to fish and wildlife habitat would be eliminated. Additional recreational visits would not be possible and public lands would not be available.

ALTERNATIVE 2- CHANNEL DEEPENING AND WIDENING WITH LEVEES IN CLOSE PROXIMITY

This alternative was developed in the original work plan. In addition to accelerated land treatment structural measures included 5.9 miles of channel work, about 11.8 miles of levees and collection channels and 3 pumping stations. The leveed area would provide 25-year level of protection, while the collection channels would provide drainage outlets and a 5 year level of flood protection. The pumps would remove one-half inch of runoff in 24 hours. Estimated cost of this alternative is in excess of \$3.2 million.

Complete modification of the channel area, as well as additional clearing for the levees, collection channels, and pumping stations would destroy an estimated 194 acres of woods. This alternative would destroy a prime wood duck habitat as well as other fish and wildlife habitat. The straight, constructed channel would affect natural aesthetics, but more cropland would be provided.

Public fish and wildlife development would not be a part of this alternative. Loss of 34,000 annual recreational visits would result. More construction would mean possible higher erosion and sedimentation.

ALTERNATIVE 3- DESIGNATE FLOOD PLAIN AS VALLEY PRESERVE

This non-structural alternative would be to purchase the flood plain as a valley preserve and accelerated land treatment would be essentially as indicated in Alternative 1. Because of the interrelationship of the drainage problem area and the flood plain, if no improvements were made to drainage outlets, the whole problem area would need to be purchased. There are 5,360 acres affected. Of this total 346 acres are under state ownership as the Maple River State Game Area. An additional 1,467 acres of flood plain consisting of pasture, woods and idle cropland would need to be purchased at \$400 per acre for an estimated \$587,000. The remaining 3,547 acres of cropland in the problem area would no longer have a drainage outlet and farming would be uneconomical; therefore this acreage would also have to be purchased at \$600 per acre or a total of \$2.2 million. In addition to this \$2.90 million cost, many of the 110 property owners in this area would need relocation assistance of up to \$25,000 each if Federal or State funds were used for land acquisition. This could total as much as \$2.7 million resulting in a maximum cost of \$5.6 million.

This alternative would eliminate effects of the proposed project on fish and wildlife habitat. There would be an adverse effect on the economy of the area due to a loss of farm income and tax base.

ALTERNATIVE 4- NO PROJECT ACTION

Failure to implement this project would result in a further deterioration of resources, continued damage to improvements including highways, and inhibit economic development of the area. The watershed would remain essentially as described in the "Environmental Setting" section of this report, and would be plagued with problems which led to the initiation of this project. Although Soil Conservation Service's ongoing programs would continue to function and provide technical assistance for the installation of land treatment and resource planning, it would not be at the accelerated rate.

Additional recreational visits to be available with the project will not be available. The net annual monetary benefits foregone by not implementing the project would amount to \$125,150.

SHORT TERM vs. LONG TERM USE OF RESOURCES

Land use in the area is predominantly agriculture. Trends are expected to remain primarily agriculturally oriented. Population trends in the area have shown a slight increase and are expected to continue. The demand for land for residential use in the southern part of the watershed is expected to increase moderately. The demand for residential use in the remaining watershed is not expected to increase markedly until after 1980. The watershed for the most part will stay in agriculture and a state game area. The main purpose of the West Upper Maple project is to improve the efficiency of use and to maintain the productivity of agricultural lands in the watershed. Production efficiency of these lands will be increased for both the present and foreseeable future.

The Grand River Basin Comprehensive Water Resources Planning Study was begun in 1963 to identify short- and long-term needs for national economic development, regional development, environmental enhancement, and the well-being of the people. The objective was to promote wise use of the Basin's water and related land resources. The comprehensive study was made through cooperative efforts of agencies of the Federal government, the State of Michigan and local governments.

The West Upper Maple River Watershed project implements the following recommendations of the Grand River Basin Study:

1. Enhance water quality.
2. Provide flood plain areas for low key recreation.
3. Maintain Michigan Department of Natural Resource's acquisition program of state game lands.
4. Purchase of wetlands in high priority waterfowl production areas.
5. Carry out a ten-year accelerated land treatment program in the basin.
6. Reduce damages from flooding and impaired drainage in the following watersheds: Upper Maple River, Hayworth Creek, Portage River, Stony Creek, Rogue River, Perry Creek, and Libhart Creek.

In the short term, construction activity will cause turbidity, sediment, noise pollution, and degraded aesthetic quality for up to three years. Loss of wildlife cover will occur for up to three years on disturbed areas. Lower densities of aquatic and semi-aquatic species of plants, invertebrates, and vertebrates will occur for up to 15 years on 1.8 miles of channel.

In the long term, terrestrial and aquatic animal and plant productivity of land and water resources will increase by the application of land treatment measures and the management of 827 acres of new state game land. Land treatment and structures will improve water quality. Water and land related recreational activities will increase as a result of an additional 827 acres of new State Game Land.

Flood control, drainage improvement and fish and wetland wildlife development are long-term considerations. Agricultural improvements as a result of the project may make it more difficult to change to other long-term use options but does not preclude these options. Since agriculture and wildlife will be the predominant land use in the future, the project is compatible with projected long-term use of the land. Installation of conservation practices with flood control and drainage improvements will be effective in conserving land and water resources beyond the designated project life.

The West Upper Maple River Watershed is in the Grand River Basin which is in the Lake Michigan Sub-Basin of the Great Lakes Water Resource Region. The following PL-566 projects are also located in the Grand River Basin. (See Table 16.) Their main objective is to protect and enhance (flood control and drainage) existing agricultural land.

TABLE 16 - EXISTING PL-566 PROJECTS IN THE GRAND RIVER BASIN

<u>Project</u>	<u>Acres</u>	<u>Status</u>
Catlin Waters	2,800	Completed
Muskrat Creek	7,650	Completed
Fowlerville Drain	1,500	Undergoing Reformulation
East Upper Maple River	167,730	Under Construction
Rogue River	155,760	Planning
Hayworth Creek	66,810	Planning Suspended

The West Upper Maple River Watershed Project is downstream and adjacent to the East Upper Maple River Watershed Project. These two watersheds total 195,460 acres and are interdependent. Significant cumulative environmental effects will occur upon completion of both projects. Basic land treatment measures will be applied to 32,000 acres of cropland, 750 acres of pasture land, 2,700 acres of forest land, and 1,110 acres of other land to adequately treat and protect these acres. Structural measures planned for both projects include 47.1 miles of multiple-purpose channel work, 1.0 mile of floodway, 18.6 miles of levee construction, 17.0 miles of collection channels, 1.0 mile of snagging, 3.6 miles of suction type dredging, 4 pumping stations, 1 multiple-purpose structure, 1 single-purpose structure, and 7 public access sites. The levees, collection channels and pumping stations were planned and designed together as an interrelated unit to solve the flooding and drainage problems on the 15,360 acre problem area between Bannister and Highway 27. Suction-type dredging on the Maple River in both the East and West portions were designed to reduce required pumping. Effects of channel work and the two flood water retarding structures in the East Upper Maple River Project were considered in the design of the levees. Downstream peak flows will be higher, but they will have no significant environmental effect. The first nine miles downstream from the West Upper Maple Watershed are in the Maple River State Game Area, and the flood plain is managed as Type 4 and 7 wetlands.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Construction of levees, collection channels, pumping stations, access roads, parking lots and public access areas will result in the irretrievable commitment of about 141 acres of cropland and 11 acres of woodland. The project will commit 827 acres of flood plain to wildlife and recreation use.

Labor, fuel and materials needed for the construction, operation, and maintenance of the structural measures will be irretrievably lost.

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY

1. The first part of the experiment is to determine the molar mass of a polymer. This is done by measuring the osmotic pressure of a solution of the polymer in a solvent. The osmotic pressure is measured by a method known as the membrane osmometry. The polymer solution is separated from a pure solvent by a semi-permeable membrane. The osmotic pressure is the pressure that must be applied to the pure solvent to prevent it from flowing through the membrane into the polymer solution.

CONSULTATION AND REVIEW WITH APPROPRIATE AGENCIES AND OTHERS

GENERAL

General consultation and coordination among local, state and federal agencies has been comprehensive during the history of this project development. From 1963-1971, meetings were held with the steering committee, sponsors, interested local landowners, Soil Conservation Service, Forest Service, Michigan Department of Agriculture, Michigan Department of Natural Resources, U. S. Fish and Wildlife Service, Army Corps of Engineers, Bureau of Public Roads, Tri-County Planning Commission, Michigan Water Resources Committee, and the Farmers Home Administration.

As a result of Watershed Memorandum 108 (Guidelines for Planning and Review of Channel Improvement) dated February 1971, additional meetings were held between June 1971 and December 1972 with the steering committee, sponsors, interested local landowners, Soil Conservation Service, U. S. Fish and Wildlife Service and the Michigan Department of Natural Resources to consider changes in the work plan. A written request for historic and archeologic information was made to the National Park Service. An archeological survey of the construction area was made through the State Historic Preservation Officer of the History Division, Michigan Department of State.

A public information meeting was held in Ashley, Michigan on November 6, 1974. The preliminary draft environmental impact statement had been mailed previously to 46 environmental and conservation groups, sponsors, newspapers and concerned citizens. An overview of the project was presented, after which individuals were given an opportunity to comment. Several verbal comments were received and incorporated into this draft statement.

The following is a list of agencies and other sources from which written comments on the draft Environmental Impact Statement were requested and the following lists indicate those who responded and those who did not.

RESPONDED

Department of the Army
Department of Health, Education and Welfare

Department of the Interior
 Department of Transportation
 Environmental Protection Agency
 Advisory Council on Historic Preservation
 Michigan Department of Agriculture
 Michigan State University - Department of Fisheries and Wildlife
 Mid-Michigan District Health Department
 Michigan Department of Natural Resources

NO RESPONSE

Department of Agriculture - Office of Equal Opportunity
 Department of Commerce
 Federal Power Commission
 Great Lakes Basin Commission
 Governor of Michigan
 State Clearinghouse
 Tri-County Regional Planning Commission
 East Central Michigan Planning and Development Regional Commission
 Natural Resources Defense Council
 Friends of the Earth
 Environmental Defense Fund
 National Wildlife Federation
 National Audubon Society
 Environmental Impact Assessment Project
 USDA Agriculture and Stabilization Service - Michigan
 USDA Farmers' Home Administration - Michigan
 Michigan Senate - Agriculture Committee
 Michigan Senate - Conservation Committee
 Michigan House of Representatives - Conservation Committee
 Michigan House of Representatives - Drainage Committee
 Michigan Department of Agriculture - Soil & Water Conservation
 Division
 Michigan Soil Conservation Districts, Inc.
 Michigan State University - College of Agriculture & Natural
 Resources
 University of Michigan - School of Natural Resources
 Cooperative Extension Service
 Clinton County Board of Commissioners
 Gratiot County Board of Commissioners
 Greenbush Township Supervisor
 Washington Township Supervisor

Grand River Watershed Council
 Michigan State Chamber of Commerce
 Michigan League of Women Voters
 Michigan Association of Conservation Ecologists
 Michigan Audubon Society
 Michigan Botanical Club, Inc.
 Michigan Natural Areas Council
 Michigan United Conservation Club
 Sierra Club - Conservation Committee
 The Nature Conservancy - Michigan Chapter
 Trout Unlimited, Michigan Council
 Michigan State Chamber of Commerce
 West Michigan Environmental Action Council
 Michigan Student Environmental Confederation
 Gratiot County Herald
 Lansing State Journal
 Flint Journal
 Consumers Power Company
 Wilber Smith and Associates
 Research Institute of Michigan
 Michigan State University - Resource Development Department
 Michigan Farm Bureau - Legislative Council

DISCUSSION AND DISPOSITION OF EACH COMMENT ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

U. S. DEPARTMENT OF THE ARMY

1. Comment: "Pages 5, 8 and 27 of the Statement indicate that all stream channels scheduled for channel work in the West Upper Maple River Watershed have been previously modified. These channels were modified many years ago, early in the 1900's. It would be constructive to indicate the conditions of those channels at the present. Specifically, do the channels presently contain fish cover and fish? Also, what is the condition of the stream bottom?"

Response: Page 33, Paragraph 1 of the Environmental Impact Statement contains a description of fish cover and species of fish in the area. Preliminary information available from the Department of Natural Resources' fish survey is tabulated below for the three survey stations in the watershed.

U. S. DEPARTMENT OF THE ARMY (continued)

<u>Station</u>	<u>Game and Panfish</u>	
	<u>Number</u>	<u>Weight</u> (pounds)
Highway 27	151	75
Upstream 1 mile	155	101
Blair Road	28	15
	<u>Non-Gamefish</u>	
	<u>Number</u>	<u>Weight</u> (pounds)
Highway 27	169	457
Upstream 1 mile	48	82
Blair Road	16	18

Page 30, Paragraph 1 indicates the condition of the stream bottom. The word sediment has been changed to silt, sand, occasional boulders, and accumulated detritus.

2. Comment: "Are there pools and riffles as in a normal stream or is it more nearly like an open ditch, void of fish hiding and holding places? On Page 33 this topic is addressed but it is not clear if the statements on page 33 apply to the sections of the stream which were previously modified. The present condition of the stream determines the amount of habitat damage done by the proposed channel work."

Response: There are very few riffles in this portion of the Maple River because of the flat channel bottom slopes. Pool areas are limited and scattered, and may move with changes in sedimentation and bed-load movements. Page 33, Paragraph 1 indicates the conditions in the approximately 3 1/3 miles total reach of the Maple River in this project area.

3. Comment: "A second item that needs more attention is the effect of spreading dredged material over marshes and swamps. No discussion of this action is presented in the environmental impact section of the statement. However, the action would have the effects of burying food and destroying ground cover for wildlife."

U. S. DEPARTMENT OF THE ARMY (continued)

Response: Construction plans will limit the area the contractor may place the outlet end of the dredge discharge pipe. Limits for discharge pipe placement will be away from the channel far enough to prevent reentry back into the channel but within a one-hundred feet designated area to minimize wetland disturbances. A sentence has been added to paragraph three, page 58 indicating possible detrimental environmental effects to less than 3 acres of wetlands.

U. S. DEPARTMENT OF THE INTERIOR

1. Comment: "The statement does not discuss adequately anticipated project effects on fish and wildlife resources. The time periods claimed for recovery of fish and wildlife habitat after construction are not qualified in either the text or appendix. Secondary adverse impacts on fish and wildlife are not considered.

The statement focuses instead on the favorable project impacts which are, in most cases, dependent upon the installation of land treatment measures. However, the actual percentage of land treatment measures required to obtain all the beneficial aspects of the project are not quantified."

Response: Several reviews have been made of this EIS by biologists from the Michigan Department of Natural Resources and from Michigan State University. Their comments and suggested changes were incorporated into the draft EIS. They expressed satisfaction with the technical adequacy. The 15 year recovery of fish in the channelized section is a conservative estimate made by the Department of Natural Resources, Fisheries Division and it is assumed they are the most qualified to judge this issue. They feel the recovery actually will be quicker than 15 years because this is not the first time the stream has had channel work done on it and the material which will be removed is mostly silt. Further discussions of wildlife habitat effects are found on pages 57 and 58.

U.S. DEPARTMENT OF THE INTERIOR (continued)

It is true that many favorable project impacts are dependent upon the installation of land treatment measures, which in turn are dependent upon installation of structural measures for flood drainage prevention, wildlife habitat improvements, and increased recreational opportunities.

Page 4, Paragraph 1 indicates "experience from other watersheds in Michigan shows that 85 percent of the planned land treatment measures have been applied." Those most interested in this project have experienced the most damages and thus expressed a desire to install needed land treatment measures. These landowners would be foregoing many expected annual benefits of \$303,900 if measures were not installed and utilized.

2. Comment: "The statement does not mention the existence, potential production, or impact of the proposed project on mineral resources. Even though minerals are not being produced in the project area, we believe the statement is incomplete without at least acknowledging their existence."

Response: EIS has been modified on Pages 24 and 60. There are no known surface or subsurface mineral resources in the area nor is there any expected impact from the project on any future mineral production.

3. Comment: "SUCTION DREDGING, Page 8 -- The third paragraph indicates spoil will be placed on Type 3 or Type 7 wetlands. We question the use of wetlands for spoil areas because of the adverse effects on waterfowl habitat and bottom flora that result. Additional explanation regarding the methods of spoil deposition and containment with maps showing exact locations is necessary to accurately evaluate this impact. The deposition of the dredged material should be coordinated with the U. S. Fish and Wildlife Service and Michigan Department of Natural Resources to assure that all wildlife values are protected."

Response: Preliminary construction plans are available for review in our office. In addition, see response to comment 3 from U. S. Department of the Army.

U. S. DEPARTMENT OF THE INTERIOR (continued)

4. Comment: "An alternative to placing dredge spoil in wetland areas could be to spread it over some of the farmland near the channel. We suggest that this possibility be explored."

Response: It is not feasible to place dredged material outside of the levees because productivity of cropland would be adversely affected, sedimentation damages would result and costs of transporting materials would be excessive.

5. Comment: "FISH AND WILDLIFE DEVELOPMENT, Page 17 -- The second paragraph notes that 14 acres of the Maple River State Game Area are to be acquired by the Michigan Department of Agriculture and, in turn, sold to the Maple River Drainage Board.

The Michigan Department of Natural Resources, under Land and Water Conservation Fund Project No. 26-00361, utilized matching Federal assistance to acquire three parcels of land to expand the State Game Area. Consequently, any utilization of Maple River State Game Area land for non-recreation purposes comes under the purview of Section 6(f) of the Land and Water Conservation Fund Act of 1965, as amended. Section 6(f) requires that (1) approval by the Secretary of the Interior of the conversion of the land to non-outdoor recreation use be obtained and (2) land of at least equal fair market value and reasonably equivalent recreation usefulness and location be provided as replacement land.

The Fund program is administered at the State level in Michigan by Mr. Norman F. Smith, Chief of the Office of Planning Services, Department of Natural Resources, Stevens T. Mason Building, Lansing, Michigan 48926. Your agency should contact Mr. Smith who will be pleased to work with the Department of the Interior's Bureau of Outdoor Recreation in the resolution of the Section 6(f) conflict. The final EIS should include evidence of Department of the Interior approval of the proposed replacement land."

U. S. DEPARTMENT OF THE INTERIOR (continued)

Response: Paragraph 2 on Page 17 has been rewritten to clarify project actions and purposes in this area. Michigan Department of Natural Resources have contacted U. S. Department of the Interior's Bureau of Outdoor Recreation and resolved the Section 6(f) apparent conflict.

6. Comment: "Page 18--The second paragraph indicates there will be recreational facilities and water resources improvements planned within the leveed area. A map showing the exact location of these developments and a figure map showing general design of the water resource improvements would enhance this section."

Response: Public fish and wildlife facilities are located on the second map in Appendix B. A sketch map has been added on Page 18 to show the water resource improvements planned.

7. Comment: "CONSERVATION LAND TREATMENT, Page 53--The installation of conservation land treatment measures is dependent on the individual landowner and thus may or may not be accomplished. This fact should be stressed. This section also should state that proper project functioning and project benefits claimed are dependent, to a great extent, on the installation of these accelerated land treatment measures."

Response: This has been covered in the response to comment 1.

8. Comment: "STRUCTURAL MEASURES, Page 58--The second paragraph indicates that wildlife habitat will be lost for up to three years. In three years, some wildlife habitat will indeed return; however, the number and diversity of species inhabiting the area will be less than the pre-project years. This is not sufficient time for the habitat of some species to recover and much of the present riparian habitat will be permanently lost. This section should state that a habitat change will occur and should discuss the impact of this change on wildlife species in the project area."

U. S. DEPARTMENT OF THE INTERIOR (continued)

Response: As indicated on Page 57 much of the construction activity will take place on cropland which does not provide year-round cover. Permanent wildlife habitat is mainly in the adjacent wooded areas. Michigan Department of Natural Resource biologists acknowledge that wildlife species may change from terrestrial to more aquatic species because of the protected public wetlands acquired through project action. The project area will be able to sustain higher and more varied wildlife populations with project completion which includes habitat management and improvement.

Purchase of the area between the levees will increase the acreage of publicly owned land by three times. Construction of the levees with a grass cover will increase the amount of habitat available and overall, this land all will be managed by DNR and therefore should be able to support higher numbers of wildlife. DNR biologists indicate that much of the present riparian habitat will be permanently protected.

9. Comment: "The third paragraph states that, "Dredging of 1.8 miles of the Maple River will destroy the fish cover and lower densities of aquatic plants and invertebrates on 8.7 acres of river bottom for up to 15 years." This sentence gives the impression that the river will be restored to its present condition for fish, invertebrates, and aquatic plants in 15 years. We know of no instance where a channelized stream has recovered in so short a period. Studies of streams which were channelized many years ago indicate fish populations well below a comparable natural stream and comparable unchannelized reaches of the same river. Channel maintenance activities also may prevent recovery of stream ecosystems and should be discussed."

Response: The response to USDI comment 1 covers some of this point. In addition, sediment traps are planned to minimize disturbances and adverse environmental effects during construction as well as to protect structural measures after construction has been completed. It is expected that

U. S. DEPARTMENT OF THE INTERIOR (continued)

primary maintenance activities on the Maple River will be limited to periodic cleaning of sediment traps only.

10. Comment: "Page 58, fourth paragraph--The discussion of displaced wildlife implies that for eight months out of the year wildlife will leave the project area, then return for four months (probably in the winter) and will repeat this cycle for three years. The wildlife found in the future construction zone are present because habitat is available to sustain them during some part of their life cycles. Construction activities will destroy this habitat, and the return of wildlife to the construction area will be limited to those for which adequate habitat has reestablished, assuming these individuals can survive displacement. Usually the adjacent habitat is at its carrying capacity and will not be able to absorb any displaced animals, causing a net reduction of wildlife populations due to increased competition for food and cover."

Response: There will be some temporary reduction in wildlife in the construction zone during actual operations. However, this loss will be more than made up in a very few years because of improved wildlife habitat resulting from management in the fish and wildlife development.

11. Comment: "Page 60, third paragraph--This paragraph indicates there is an expected increase of about 34,010 visits per year as a result of fish and wildlife developments. To give this figure more meaning, we suggest that the expected increase in visits per year on the same area without the project should be stated. We also suggest that the duration of this anticipated annual increase be indicated and that the expected impact of the above recreationists on local roads and services be discussed."

Response: EIS indicates existing facilities are being used to their limit now (Page 48). It is expected there would be very little if any increased visits in the future without the project. Page 59 of the EIS has been modified to indicate no adverse impact to local roads and services as a

U. S. DEPARTMENT OF THE INTERIOR (continued)

result of the additional recreational visits to the area. Permits obtained from the County Road Commissions or the State Highway Department will indicate the need for driveway culverts or deacceleration lanes.

12. Comment: "FAVORABLE ENVIRONMENTAL IMPACTS, Page 61--It should be pointed out that the favorable impacts listed in items a, b, c, d, e, f, g, i, m, and u will occur only if an accelerated land treatment program is implemented voluntarily by landowners."

Response: It is agreed that land treatment measures are applied voluntarily by landowners and they must be installed to realize full project benefits. EIS Page 4, Paragraph 2 defines "A conservation plan is the properly recorded decisions of the cooperating landowner or operator on how he plans within practical limits, to use his land in an operating unit within its capability and to treat it according to its needs for maintenance or improvement of the soil, water, and plant resources." The Clinton and Gratiot Soil Conservation Districts sign the Watershed Work Plan Agreement indicating they will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan and will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

13. Comment: "ADVERSE ENVIRONMENTAL EFFECTS, Page 62--We suggest that items e, g, and h be changed to reflect our comments on the ENVIRONMENTAL IMPACT section above."

Response: We disagree with this comment. Our reasons are discussed in the responses to previous comments.

ENVIRONMENTAL PROTECTION AGENCY

1. Comment: "As part of the project, it is proposed to suction dredge 1.8 miles of the Maple River. The EIS should provide a more detailed discussion concerning the impacts and advantages and disadvantages of using a suction dredge. If there are other types of dredges that could be used to accomplish the dredging, they should be discussed."

Response: EIS Page 8 has been modified to more accurately describe proposed action. Impacts have been described in more detail on Page 58 and Alternative 2, Page 64 discusses the conventional method of dredging. Briefly, this method would use on-land drag-lines, bulldozers and other earth-moving equipment. This would result in the change of vegetation from woodland to grass cover up to 100 feet wide along one bank of the stream and an increase in downstream flow turbidity during construction.

2. Comment: "Wetland areas adjacent to the portion of the river could be adversely affected by increased drainage, thus lowering the amount of water available for wetland production. Effects on the water table should also be discussed."

Response: Wetland areas in the West Upper Maple River are shown on Figure 4, Page 13 of the EIS. These are all located within the leveed area and are being protected by project actions. Suction dredging is designed to provide gravity outlets for upstream tributaries to reduced pumping during low flow stages of the Maple River. This construction will remove 1 to 3 feet of sedimentation deposits but will not drain adjacent wetlands. Suction dredging will lower low-flow water conditions about one foot at Blair Road and result in an insignificant lowering of the water table in the immediate vicinity of the channel. This lowering will not affect wetland production because of imperviousness of soils.

ENVIRONMENTAL PROTECTION AGENCY (continued)

3. Comment: "While doing channel work, consideration should be given to varying the channel width in conjunction with the channel slope to develop pool and riffle areas to aid fish and wildlife and still maintain hydraulic capacity."

Response: This stretch of the Maple River is extremely flat. Slopes are less than 3/4 of 1 foot per mile. Velocities are low. Pool and riffle areas can not be effectively developed because of backwater conditions and low water velocities in the river. In addition it was recommended that a suction-type dredge be used to minimize disturbances of wildlife habitat existing along the banks of the river. Width of the dredged channel will be the same or less than the existing channel.

4. Comment: "The disposal method proposed in the EIS needs further clarification. The disposal of 20,000 cubic yards of material in wetland areas could have adverse effects on these areas. Furthermore, the disposal of dredged material in wetland areas is contrary to EPA policy and we recommend alternative disposal sites be found. The method of disposal for the remaining 523,000 cubic yards material should be discussed. A sediment analysis should be made to determine whether or not the material is polluted and may need to be contained."

Response: This is discussed in the response to comment 3, U. S. Department of the Army. In addition, depositing suction-dredged materials in the manner indicated in the EIS on Page 8, Paragraph 3, has been discussed with biologists and wildlife specialists from the Michigan Department of Natural Resources. Material excavated for the collection channel (523,000 cubic yards) will be used to build the levee as discussed on Page 12, Paragraph 1 of the EIS. This material is from natural soils which have not been subjected to sedimentation deposits.

Prior to suction dredging on the Maple River detailed sampling and sediment analyses will be made to determine if the material is polluted. Consultation with the Michigan Department of Natural Resources and EPA guidelines will be made to determine if special precautions

ENVIRONMENTAL PROTECTION AGENCY (continued)

are needed in handling dredged materials. Analyses of materials will be forwarded to EPA for review.

5. Comment: "The clearing and dredging of the channel will increase the velocity of flow and probably increase the sediment carrying capacity of the stream. Increased sediment loads tend to reduce light penetration, periodically blanket fish spawning areas, periodically suffocate aquatic insect larvae used by fish for food, create shoaling and instabilities in the channel and cause problems with sedimentation in the unimproved channel sections downstream. The EIS should discuss sediment loads in the Maple River before and after the project implementation. We assume your agency will comply with the program for Soil Erosion and Sedimentation Control as required by the State of Michigan's Sedimentation Control Act 347 of 1972."

Response: Purpose of suction dredging as shown on EIS, Page 8 is to furnish a gravity outlet for upstream low flows. Velocities for low flows will increase from existing values of about 0.4 feet per second to 0.6 feet per second when this work is completed. Channel bankfull flow velocities will increase about 0.3 feet per second to an average of 1.4 feet per second with project. Erosion and sedimentation will not increase.

Two sediment basins plus land treatment measures will reduce sediment leaving the watershed from 7,975 tons per year to 3,820 tons per year as shown on Page 55.

Michigan's Sedimentation Control Act will be complied with during and after construction to control erosion and sedimentation. EIS Page 5 and 6 list measures such as surface water inlet structures, tile outlets, and seeding and mulching which will minimize erosion and sedimentation during construction.

ENVIRONMENTAL PROTECTION AGENCY (continued)

6. Comment: "The EIS should include a comparative analysis of costs, impacts and benefits for each alternative. For convenience, this information could be presented in tabular form."

Response: Additional discussions have been added to the Alternatives section on pages 63-66 to more clearly identify potential impacts.

7. Comment: "The EIS indicated sanitary facilities would be provided at the recreational areas within the project. The design capacity of the vault type facilities and the ultimate disposal of the wastes should be discussed.

Since increased amounts of solid wastes will be generated as a result of the project, the EIS should define the type, volume collection and ultimate disposal method and site."

Response: EIS Page 17 has been modified to indicate that sanitary vaults are designed for 6 months use. Waste will be pumped into tank trucks and will be disposed at one of the areas' municipal sewage disposal plants. An estimated 100 cubic yards of solid wastes will be generated by public recreational visits per year, and will be picked up at least twice monthly and disposed of at a local sanitary land fill.

8. Comment: "Further discussion should be included in the EIS on the location of the borrow pits where fill will be obtained for levee construction and the subsequent use of these pits."

Response: All of the fill for the levees will come from the construction of the adjacent collection channels. EIS, Page 12 has been modified to show this.

9. Comment: "Water quality data provided in the EIS should be taken within the project limits. This information could be used as a baseline for an objective appraisal of the projects future impacts. In the Water Quality Section, it was stated that the low levels of chlorides and

ENVIRONMENTAL PROTECTION AGENCY (continued)

sulphates were evidence of little pollution as a result of surface runoff. An analysis of sulphate levels should be provided in this section."

Response: EIS narrative on Page 30 was incorrect when referring to sulphate. This has been changed to phosphate which is also shown in Table 4, Page 31. It is agreed that water quality data within the project area would be desirable. Since general water quality information was available only above and below the watershed project, and this indicates acceptable water quality for planned uses, it was determined that additional information was not necessary.

10. Comment: "Since an EIS is to be prepared for the East Upper Maple Watershed, consideration should be given to a combined Final EIS or an updated Draft EIS to allow for the assessment of the total impacts."

Response: EIS for this West Upper Maple River project was well underway through the review process before the decision was made to revise the East Upper Maple EIS. It was considered that combining the two projects at this time would confuse reviewers.

ADVISORY COUNCIL ON HISTORIC PRESERVATION

1. Comment: "In the case of lands not under the control or jurisdiction of the Federal Government, a statement should be made as to whether or not the proposed undertaking will contribute to the preservation and enhancement of non-federally owned districts, sites, buildings, structures, and objects of historical, archeological, or cultural significance."

Response: EIS has been modified on Page 6, Paragraph 5, to add a phrase indicating that the project will not contribute to the preservation and enhancement of non-federally owned sites of significance other than noted in Paragraph 4, Page 6.

ADVISORY COUNCIL ON HISTORIC PRESERVATION (continued)

2. Comment: "While an archeological survey has been completed, there is no evidence of an assessment of National Register eligibility having been made for the sites, nor of a determination of the project's effect on these sites. Both of these actions are required for compliance with E.O. 11593, and are outlined in Section 800.4(a) of the Advisory Council's "Procedures for the Protection of Historic and Cultural Properties."

Response: Page 6, Paragraph 4 of the EIS details notification procedures taken. State Historic Officer has indicated that they are seriously considering nominating a site for inclusion in the National Register.

3. Comment: "The Advisory Council further suggests that the environmental statement contain a copy of the State Historic Preservation Officer's comments concerning the effects of the undertaking upon these resources."

Response: Letter on file from the State Historic Preservation Officer states that the project has been reviewed and no conflicts exist.

MICHIGAN STATE UNIVERSITY
DEPARTMENT OF FISHERIES AND WILDLIFE

1. Comment: "Where the EIS deals with effects on fish and fisheries, it should be written by fishery biologists. We suspect it was not. Lacking identification of such biologists and descriptions of their qualifications, the fish and fishery aspects of the EIS cannot be accepted as an adequate consideration of the situation."

Response: All information concerning fish and fisheries as well as other wildlife information was prepared by our staff biologists in consultation with Michigan Department of Natural Resources' biologists and other experts in the field. They provided input, reviewed written material and are satisfied with the technical adequacy of this information.

MICHIGAN STATE UNIVERSITY
DEPARTMENT OF FISHERIES AND WILDLIFE (continued)

2. Comment: "The suction dredging might be expected to improve channel depth for fish."
- Response: Sentence has been added to Page 58, Paragraph 3 to indicate that sediment traps and suction-dredged areas may provide additional water depths for fish.
3. Comment: "What are the measures to prevent flood waters from washing dredged sediments back into the river?"
- Response: Construction specification will locate suction-dredged deposits away from the river. Small mounds where sediment has accumulated which do not revegetate themselves will be seeded. Flood-flows in the flood plain will not have velocity high enough to destroy or move stabilized sediment mounds.
4. Comment: "Under "Plant and Animal Resources" it is mentioned on Page 33 that MDNR was making a fish population survey at the time the EIS was being written. The MDNR survey has now been completed. It should be fully included in the EIS as an appendix--and Page 33 should be reworked accordingly."
- Response: EIS, Page 33, Paragraph 1 has been modified to show survey data. The report is still a draft. When completed it will become a part of our reference material rather than be included as an appendix to the EIS.
5. Comment: "The wildlife considerations in this project are good, but could be improved by two changes. First, alternative sites for the placement of the 20,000 cubic yards of dredged material should be chosen in place of the 125 acres of Type 3 and 7 wetlands. Could not this dredged material be placed outside of the levees?"
- Response: Point discharge areas for suction-dredged material have been selected in consultation with biologists from the Michigan Department of Natural Resources to be the least damaging to wetland areas and high quality forests. It

MICHIGAN STATE UNIVERSITY
DEPARTMENT OF FISHERIES AND WILDLIFE (continued)

is not feasible to place dredged material outside of the levees because productivity of cropland would be adversely affected, sedimentation damages would result, and costs of transporting materials would be excessive. In addition, see response to U. S. Department of the Army, Comment 3.

6. Comment: "Second, the removal of dead and dying trees inside the levees will destroy valuable woodduck nest sites. If absolutely necessary, such removal should be confined only to those dead and dying trees on the immediate edge of the river. In addition, where felled trees will be in wetlands, they should be allowed to remain where they are felled, instead of being piled, to create loafing and resting sites for waterfowl."

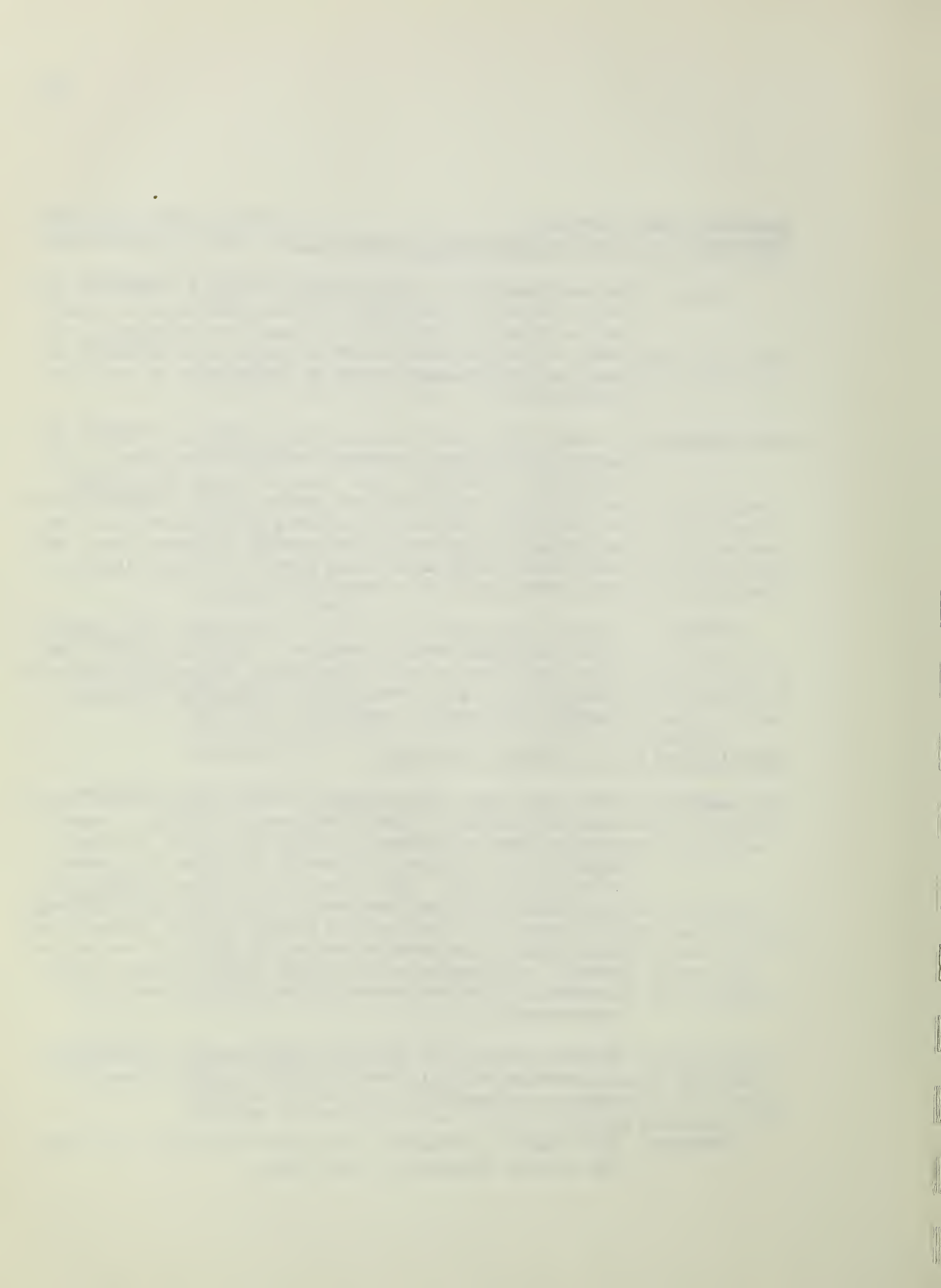
Response: EIS has been modified on Page 8, Paragraph 4 to clarify that only those trees in danger of falling in the river in the near future will be removed. We believe selective piling will be more beneficial to wildlife for cover, loafing, and resting sites.

MID-MICHIGAN DISTRICT HEALTH DEPARTMENT

1. Comment: "This department has reviewed the West Maple River Watershed Environmental Impact Statement. We wish to make comment about a statement on Page 50 of the Statement concerning the dumping of domestic garbage in a water filled borrow pit. This dump site has been closed for a period of at least two years to the dumping of garbage and refuse. Our observation indicates only boulders and large stumps are being deposited at the north end of the parcel. Approximately one-third of the original refuse (consisting of tin cans and other metal products) is yet uncovered.

We are scheduled to work with the township in obtaining an acceptable final cover for this exposed refuse in the near future."

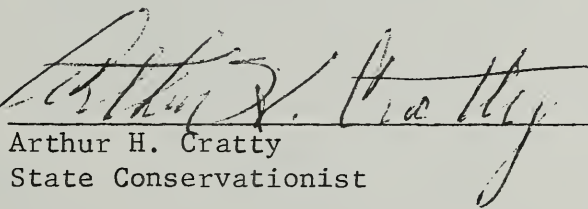
Response: EIS, Page 50, Paragraph 1 has been modified to indicate the current situation in this area.



LIST OF APPENDICES

- APPENDIX A** - Comparison of Benefits and Costs for Structural Measures.
- APPENDIX B** - Project Map.
- APPENDIX C** - Letters of Comment Received on the Draft Environmental Impact Statement.
- APPENDIX D** - Selected References.
- APPENDIX E** - Definitions of Land Treatment Practices.
- APPENDIX F** - Description of Soils and Capability Classes.

APPROVED BY



Arthur H. Cratty
State Conservationist

DATE

4/23/75

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APPENDICES

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service - Forest Service

With Assistance By

Clinton County Soil Conservation District
Gratiot County Soil Conservation District
Maple River Drainage Board
Cordray Drainage District
Ferdun Drainage District
Michigan Department of Natural Resources

Prepared By

Prepared under Authority of the
Watershed Protection and Flood Prevention Act
(P.L. 566, 83rd Cong., 68 Stat. 66, as amended)

February, 1975

SUPPLEMENTAL WATERSHED WORK PLAN NO. 1
West Upper Maple River Watershed
Clinton, and Gratiot Counties, Michigan

APPENDIX A

COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

West Upper Maple River Watershed, Michigan

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS ^{1/}							Benefit Cost Ratio
	Flood Damage Reduction	More In- tensive Land Use	Agr. Changed Land Use	Drain- age	Fish and Wildlife Develop- ment	Second- ary	Total	
Channel work, levees, collection channels, and pumping stations ^{3/}	81,700	66,200	10,700	75,200		70,100	303,900	1.8:1
Fish and Wildlife Development Recrea- tion Facilities, and Water Resource Development					44,600	5,000	49,600	1.3:1
Project Administration							19,100	
GRAND TOTAL	81,700	^{4/} 66,200	10,700	75,200	44,600	75,100	353,500	1.6:1

^{1/} Price Base - Adjusted Normalized










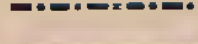
^{2/} Includes project installation costs amortized for 50 years plus the annual cost of operation and maintenance.

^{3/} Includes Maple River channel, levees, collection channels and pumping stations.

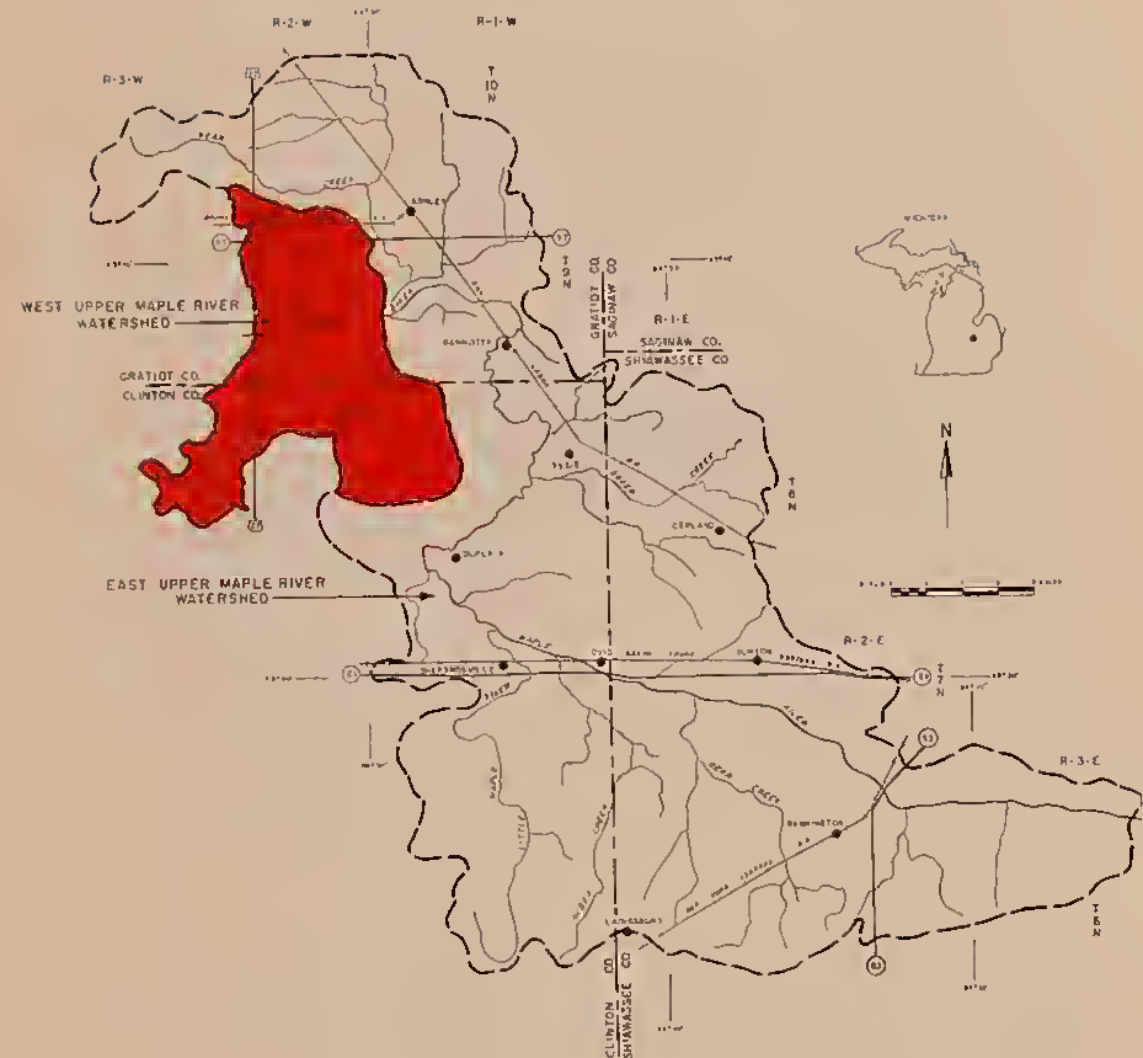
^{4/} In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$1,700 annually.

December, 1974

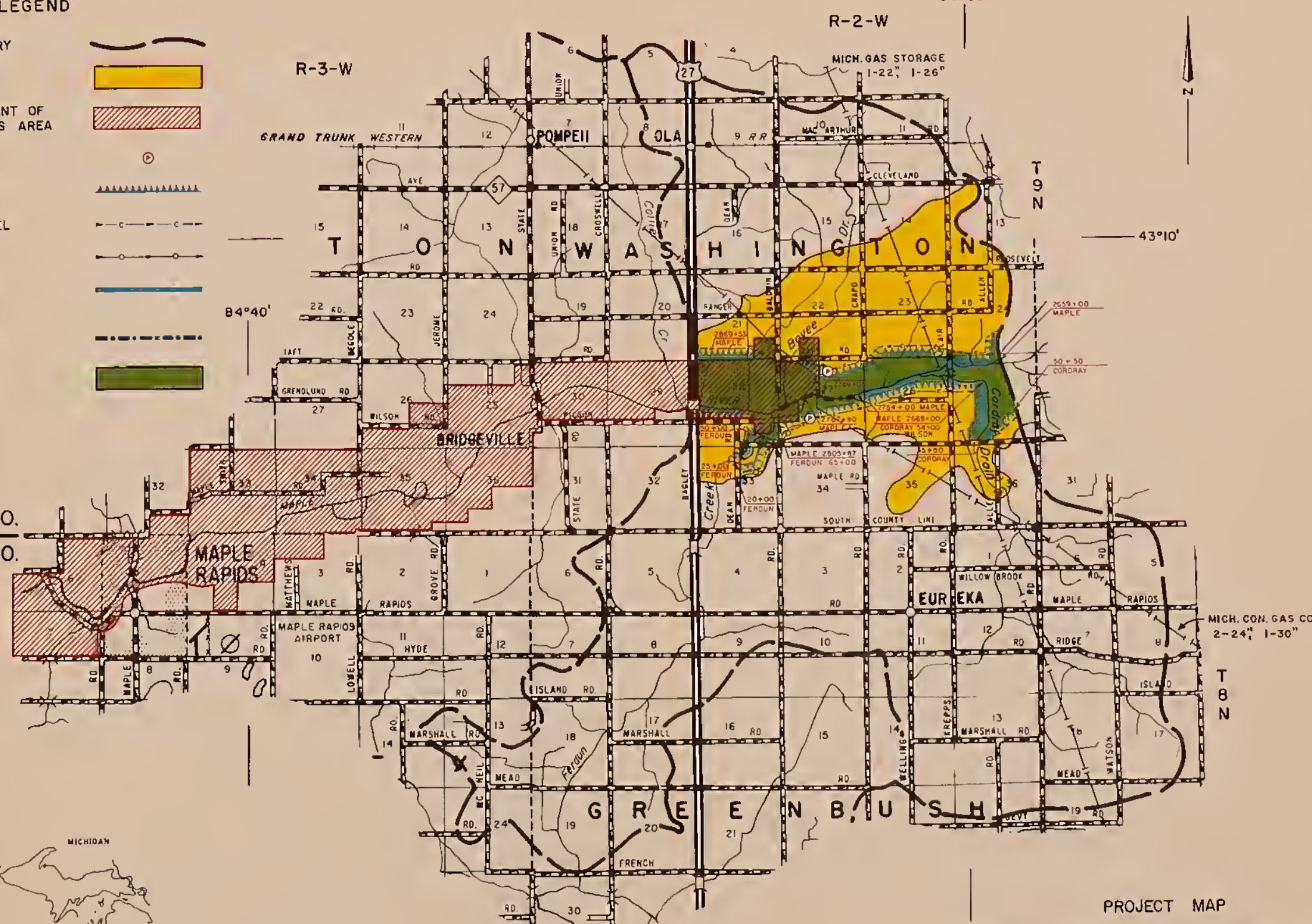
LEGEND

- WATERSHED BOUNDARY 
- BENEFITED AREA 
- MICHIGAN DEPARTMENT OF NATURAL RESOURCES AREA 
- PUMP SITE 
- LEVEE 
- COLLECTION CHANNEL 
- TILE MAIN 
- CHANNEL WORK - SUCTION OREGING 
- CHANNEL SNAGGING 
- FISH AND WILDLIFE DEVELOPMENT AREA 

PROJECT LOCATION MAP
UPPER MAPLE RIVER WATERSHED



GRATIOT CO.
CLINTON CO.



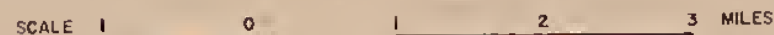
PROJECT MAP

WEST UPPER MAPLE RIVER WATERSHED

GRATIOT AND CLINTON COUNTIES, MICHIGAN



SCALE 1 / 90,293











SOURCE:
S.C.S. DRAWING 5,R-23,437 AND
INFORMATION FROM FIELD
TECHNICIANS. POLYCONIC PROJECTION

DEVELOPMENT MAP WEST UPPER MAPLE RIVER WATERSHED GRATIOT AND CLINTON COUNTIES, MICHIGAN

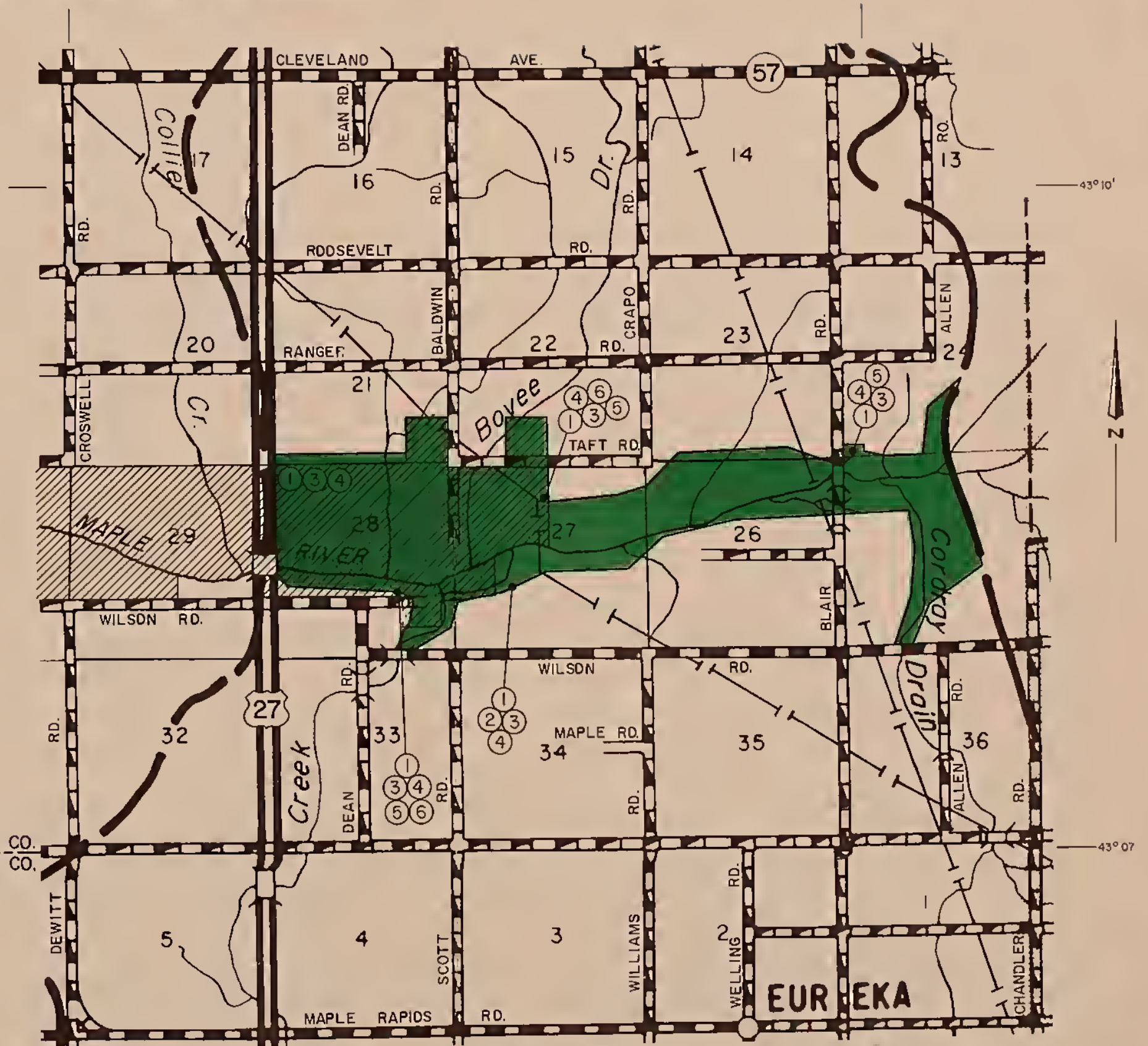
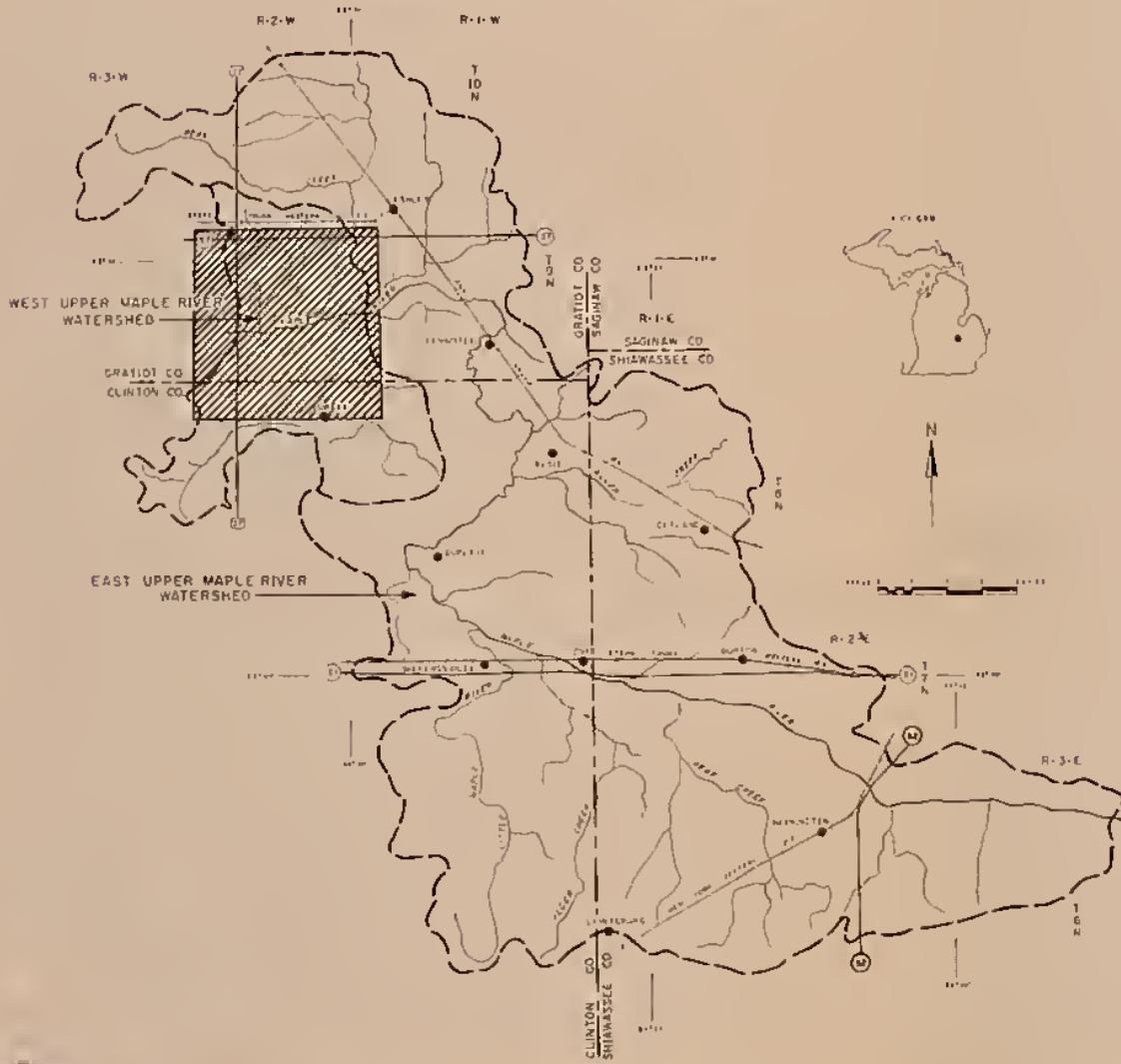
APPENDIX B

LEGEND

- MICHIGAN DEPARTMENT OF NATURAL RESOURCES AREA 
- FISH AND WILDLIFE DEVELOPMENT AREA 
- PUBLIC ACCESS ROAD 
- NATURE TRAIL 
- PUBLIC ACCESS 
- TOILET FACILITIES 
- LANDING FOR SMALL BOATS 
- OBSERVATION PLATFORM 

- ①
- ②
- ③
- ④
- ⑤
- ⑥

PROJECT LOCATION MAP
UPPER MAPLE RIVER WATERSHED



SCALE 0 1/2 1 2 MILES
SCALE 1/42,240

SOURCE :
SCS DRAWING 5-P-25,743 AND INFORMATION
FROM FIELD TECHNICIANS.
POLYCONIC PROJECTION



DEPARTMENT OF THE ARMY
DETROIT DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1027
DETROIT, MICHIGAN 48231

APPENDIX C

IN REPLY REFER TO
NCEED-ER

14 January 1975

Mr. Arthur H. Cratty
State Conservationist
Soil Conservation Service
Room 101, 1405 South Harrison Road
East Lansing, Michigan 48823

Dear Mr. Cratty:

Thank you for the opportunity to review "West Upper Maple River Watershed Draft Environmental Impact Statement."

It is encouraging to note that portions of the recommendations of the Grand River Basin Comprehensive Water Resources Study are becoming reality. The proposed plan for the West Upper Maple River Watershed meets the objectives of the Comprehensive Basin Plan in a number of significant areas. Those are identified on pages 67 and 68 of the Draft Environmental Impact Statement.

Pages 5,8 and 27 of the Statement indicate that all stream channels scheduled for channel work in the West Upper Maple River Watershed have been previously modified. These channels were modified many years ago, early in the 1900's. It would be constructive to indicate the conditions of those channels at the present. Specifically, do the channels presently contain fish cover and fish? Also what is the condition of the stream bottom? Are there pools and riffles as in a normal stream or is it more nearly like an open ditch, void of fish hiding and holding places? On page 33 this topic is addressed but it is not clear if the statements on page 33 apply to the sections of the stream which were previously modified. The present condition of the stream determines the amount of habitat damage done by the proposed channel work.

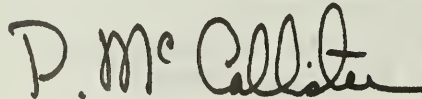
A second item that needs more attention is the effect of spreading dredged material over marshes and swamps. No discussion of this action is presented in the environmental impact section of the statement. However, the action would have the effects of burying food and destroying ground cover for wildlife.

NCEED-ER
Mr. Arthur H. Cratty

14 January 1975

Productivity and species composition may be altered. Gas exchange between soils and air may also be obstructed. These comments are submitted with the hope that they will assist you in preparing the Final Environmental Impact Statement.

Sincerely yours,

A handwritten signature in cursive script that reads "P. McCallister". The signature is written in dark ink and is positioned above the typed name.

P. McCALLISTER
Chief, Engineering Division



DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

REGION V

300 SOUTH WACKER DRIVE
CHICAGO, ILLINOIS 60606

OFFICE OF
THE REGIONAL DIRECTOR

February 25, 1975

Mr. Arthur H. Cratty
State Conservationist
Department of Agriculture
Soil Conservation Service
1405 South Harrison Road, Room 101
East Lansing, Michigan 48823

RE: Draft Environmental Impact Statement
West Upper Maple River Watershed
Clinton and Gratiot Counties, Michigan

Dear Mr. Cratty:

We have reviewed the Draft Environmental Impact Statement for the above project. To our knowledge, and based upon the information provided, this project will not impact to any significant degree on the health, education or welfare of the population.

Sincerely yours,

Robert A. Ford
Regional Environmental Officer

cc: Charles Custard, OEA
Warren Muir, CEQ



United States Department of the Interior

OFFICE OF THE SECRETARY

NORTH CENTRAL REGION
230 S. DEARBORN STREET, 32nd FLOOR
CHICAGO, ILLINOIS 60604

February 24, 1975

(ER-74/1560)

Mr. Arthur H. Cratty
State Conservationist
Soil Conservation Service
Room 101, 1405 South Harrison Rd.
East Lansing, Michigan 48823

Dear Mr. Cratty:

Thank you for your letter of December 20, 1974, requesting our views and comments on a draft environmental statement for the West Upper Maple River Watershed, Clinton and Gratiot Counties, Michigan. Our comments follow:

General:

The statement does not discuss adequately anticipated project effects on fish and wildlife resources. The time periods claimed for recovery of fish and wildlife habitat after construction are not qualified in either the text or appendix. Secondary adverse impacts on fish and wildlife are not considered.

The statement focuses instead on the favorable project impacts which are, in most cases, dependent upon the installation of land treatment measures. However, the actual percentage of land treatment measures required to obtain all the beneficial aspects of the project are not quantified.

The statement does not mention the existence, potential production, or impact of the proposed project on mineral resources. Even though minerals are not being produced in the project area, we believe the statement is incomplete without at least acknowledging their existence.

Specific:

PLANNED PROJECT

SUCTION DREDGING, page 8 - The third paragraph indicates spoil will be placed on Type 3 or Type 7 wetlands. We question the use of wetlands for spoil areas because of the adverse effects on waterfowl habitat and bottom flora that result. Additional explanation regarding the methods of spoil deposition and



containment with maps showing exact locations is necessary to accurately evaluate this impact. The deposition of the dredged material should be coordinated with the U.S. Fish and Wildlife Service and Michigan Department of Natural Resources to assure that all wildlife values are protected.

An alternative to placing dredge spoil in wetland areas could be to spread it over some of the farmland near the channel. We suggest that this possibility be explored.

FISH AND WILDLIFE DEVELOPMENT, page 17 - The second paragraph notes that 14 acres of the Maple River State Game Area are to be acquired by the Michigan Department of Agriculture and, in turn, sold to the Maple River Drainage Board.

The Michigan Department of Natural Resources, under Land and Water Conservation Fund Project No. 26 - 00361, utilized matching Federal assistance to acquire three parcels of land to expand the State game area. Consequently, any utilization of Maple River State Game Area land for non-recreation purposes comes under the purview of Section 6(f) of the Land and Water Conservation Fund Act of 1965, as amended. Section 6(f) requires that (1) approval by the Secretary of the Interior of the conversion of the land to non-outdoor recreation use be obtained and (2) land of at least equal fair market value and reasonably equivalent recreation usefulness and location be provided as replacement land.

The Fund program is administered at the State level in Michigan by Mr. Norman F. Smith, Chief of the Office of Planning Services, Department of Natural Resources, Stevens T. Mason Building, Lansing, Michigan 48926. Your agency should contact Mr. Smith who will be pleased to work with the Department of the Interior's Bureau of Outdoor Recreation in the resolution of the Section 6(f) conflict. The final EIS should include evidence of Department of the Interior approval of the proposed replacement land.

Page 18 - The second paragraph indicates there will be recreational facilities and water resource improvements planned within the leveed area. A map showing the exact location of these developments and a figure map showing general design of the water resource improvements would enhance this section.

ENVIRONMENTAL IMPACT

CONSERVATION LAND TREATMENT, page 53 - The installation of conservation land treatment measures is dependent on the individual landowner and thus may or may not be accomplished. This fact should be stressed. This section also should state that proper project functioning and project benefits claimed are dependent, to a great extent, on the installation of these accelerated land treatment measures.

STRUCTURAL MEASURES, page 58 - The second paragraph indicates that wildlife habitat will be lost for up to three years. In three years, some wildlife habitat will indeed return; however, the number and diversity of species inhabiting the area will be less than the pre-project years. This is not sufficient time for the habitat of some species to recover and much of the present riparian habitat will be permanently lost. This section should state that a habitat change will occur and should discuss the impact of this change on wildlife species in the project area.

The third paragraph states that, "Dredging of 1.8 miles of the Maple River will destroy the fish cover and lower densities of aquatic plants and invertebrates on 8.7 acres of river bottom for up to 15 years." This sentence gives the impression that the river will be restored to its present condition for fish, invertebrates, and aquatic plants in 15 years. We know of no instance where a channelized stream has recovered in so short a period. Studies of streams which were channelized many years ago indicate fish populations well below a comparable natural stream and comparable unchannelized reaches of the same river. Channel maintenance activities also may prevent recovery of stream ecosystems and should be discussed.

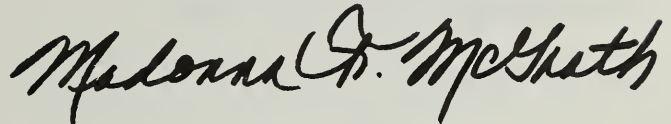
Page 58, fourth paragraph - The discussion of displaced wildlife implies that for eight months out of the year wildlife will leave the project area, then return for four months (probably in the winter) and will repeat this cycle for three years. The wildlife found in the future construction zone are present because habitat is available to sustain them during some part of their life cycles. Construction activities will destroy this habitat, and the return of wildlife to the construction area will be limited to those for which adequate habitat has reestablished, assuming these individuals can survive displacement. Usually the adjacent habitat is at its carrying capacity and will not be able to absorb any displaced animals, causing a net reduction of wildlife populations due to increased competition for food and cover.

Page 60, third paragraph - This paragraph indicates there is an expected increase of about 34,010 visits per year as a result of fish and wildlife developments. To give this figure more meaning, we suggest that the expected increase in visits per year on the same area without the project should be stated. We also suggest that the duration of this anticipated annual increase be indicated and that the expected impact of the above recreationists on local roads and services be discussed.

FAVORABLE ENVIRONMENTAL IMPACTS, page 61 - It should be pointed out that the favorable impacts listed in items a, b, c, d, e, f, g, i, m, and u will occur only if an accelerated land treatment program is implemented voluntarily by landowners.

ADVERSE ENVIRONMENTAL EFFECTS, page 62 - We suggest that items e, g, and h be changed to reflect our comments on the ENVIRONMENTAL IMPACT section above.

Sincerely yours,

A handwritten signature in black ink that reads "Madonna F. McGrath". The signature is written in a cursive, flowing style.

Madonna F. McGrath
Acting Special Assistant
to the Secretary



DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
400 SEVENTH STREET SW.
WASHINGTON, D.C. 20590
PHONE: (202) 426-2262

14 FEB 1975

Mr. Arthur H. Cratty
State Conservationist
Soil Conservation Service
1405 South Harrison Road
East Lansing, Michigan 48823

Dear Mr. Cratty:

This is in response to your letter of 20 December 1974 addressed to Commandant, U. S. Coast Guard concerning a draft environmental impact statement for West Upper Maple Watershed, Clinton and Gratiot Counties, Michigan.

The Department of Transportation has reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

The opportunity to review this draft statement is appreciated.

Sincerely,

W. E. Caldwell

W. E. CALDWELL
Captain, U.S. Coast Guard
Deputy Chief, Office of Marine
Environment and Systems
By direction of the Commandant



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN STREET
CHICAGO, ILLINOIS 60604

Mr. Arthur H. Cratty
State Conservationist
United States Department of Agriculture
Soil Conservation Service
Room 101
1405 South Harrison Road
East Lansing, Michigan 48823

FEB 25 1975

Dear Mr. Cratty:

We have completed our review of the Draft Environmental Impact Statement (EIS) for the West Upper Maple River Watershed Clinton and Gratiot Counties, Michigan which was sent to us on December 20, 1974. We have classified our comments as Category ER-2. Specifically, we have environmental reservations concerning the impacts upon the wetlands in the project area and we believe additional information should be provided on the effects of the channelization, dredging and disposal of excavated material.

The date and classification of our comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on other Federal agencies' projects. The following comments are for your consideration in preparing the Final EIS.

As part of the project, it is proposed to suction dredge 1.8 miles of the Maple River. The EIS should provide a more detailed discussion concerning the impacts and advantages and disadvantages of using a suction dredge. If there are other types of dredges that could be used to accomplish the dredging, they should be discussed. Wetland areas adjacent to the portion of the river could be adversely affected by increased drainage, thus lowering the amount of water available for wetland production. Effects on the water table should also be discussed. While doing channel work, consideration should be given to varying the channel width in conjunction with the channel slope to develop pool and riffle areas to aid fish and wildlife and still maintain hydraulic capacity.

The disposal method proposed in the EIS needs further clarification. The disposal of 20,000 cubic yards of material in wetland areas could have adverse effects on these areas. Furthermore, the disposal of dredged material in wetland areas is contrary to EPA policy and we

recommend alternative disposal sites be found. The method of disposal for the remaining 523,000 cubic yards material should be discussed. A sediment analysis should be made to determine whether or not the material is polluted and may need to be contained.

The clearing and dredging of the channel will increase the velocity of flow and probably increase the sediment carrying capacity of the stream. Increased sediment loads tend to reduce light penetration, periodically blanket fish spawning areas, periodically suffocate aquatic insect larvae used by fish for food, create shoaling and instabilities in the channel and cause problems with sedimentation in the unimproved channel sections downstream. The EIS should discuss sediment loads in the Maple River before and after the project implementation. We assume your agency will comply with the program for Soil Erosion and Sedimentation Control as required by the State of Michigan's Sedimentation Control Act 347 of 1972.

The EIS should include a comparative analysis of costs, impacts and benefits for each alternative. For convenience, this information could be presented in tabular form .

The EIS indicated sanitary facilities would be provided at the recreational areas within the project. The design capacity of the vault type facilities and the ultimate disposal of the wastes should be discussed.

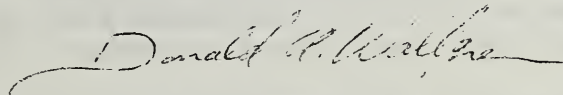
Since increased amounts of solid wastes will be generated as a result of the project, the EIS should define the type, volume collection and ultimate disposal method and site. Further discussion should be included in the EIS on the location of the borrow pits where fill will be obtained for levee construction and the subsequent use of these pits.

Water quality data provided in the EIS should be taken within the project limits. This information could be used as a baseline for an objective appraisal of the projects future impacts. In the Water Quality Section, it was stated that the low levels of chlorides and sulphates were evidence of little pollution as a result of surface runoff. An analysis of sulphate levels should be provided in this section.

Since an EIS is to be prepared for the East Upper Maple Watershed, consideration should be given to a combined Final EIS or an updated Draft EIS to allow for the assessment of the total impacts.

We appreciate the opportunity to review this Draft EIS. When the Final EIS or Updated Draft EIS is filed with the Council on Environmental Quality, please forward 4 copies to us. If you have any questions concerning our comments feel free to contact us.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Donald A. Wallgren". The signature is written in dark ink and is positioned above the typed name.

Donald A. Wallgren
Chief,
Federal Activities Branch

**Advisory Council
On Historic Preservation**

1522 K Street N.W. Suite 400
Washington D.C. 20005

February 14, 1975

Mr. Arthur H. Cratty
State Conservationist
Soil Conservation Service
U. S. Department of Agriculture
Room 101, 1405 S. Harrison Road
East Lansing, Michigan 48823

Dear Mr. Cratty:

This is in response to your request of December 20, 1974, received February 6, 1975, for comments on the environmental statement for the West Upper Maple River Watershed, Clinton and Gratiot Counties, Michigan.

Pursuant to its responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969, the Advisory Council on Historic Preservation has determined that while you have discussed the historical, architectural, and archeological aspects related to the undertaking, the Advisory Council needs additional information to adequately evaluate the effects on these cultural resources. Please furnish additional data indicating:

Compliance with Executive Order 11593 "Protection and Enhancement of the Cultural Environment" of May 13, 1971.

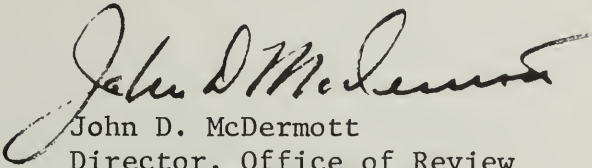
In the case of lands not under the control or jurisdiction of the Federal Government, a statement should be made as to whether or not the proposed undertaking will contribute to the preservation and enhancement of non-federally owned districts, sites, buildings, structures, and objects of historical, archeological, architectural, or cultural significance.

While an archeological survey has been completed, there is no evidence of an assessment of National Register eligibility having been made for the sites, nor of a determination of the project's effect on these sites. Both of these actions are required for compliance with E.O. 11593, and are outlined in Section 800.4(a) of the Advisory Council's "Procedures for the Protection of Historic and Cultural Properties."

The Advisory Council further suggests that the environmental statement contain a copy of the State Historic Preservation Officer's comments concerning the effects of the undertaking upon these resources.

Should you have any questions, or require additional assistance, please contact Stephen Cochran of the Advisory Council staff at 202/254-3380.

Sincerely yours,

A handwritten signature in black ink, appearing to read "John D. McDermott". The signature is written in a cursive style with a large initial "J".

John D. McDermott
Director, Office of Review
and Compliance



AGRICULTURE
COMMISSION

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Chairman

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WILLIAM G. MILLIKEN, Governor

DEPARTMENT OF AGRICULTURE

LEWIS CASS BUILDING, LANSING MICHIGAN 48913

B. DALE BALL, Director

January 3, 1975

Mr. Arthur Cratty
State Conservationist
U.S. Soil Conservation Service
1405 South Harrison Road
East Lansing, Michigan 48823

Dear Mr. Cratty:

The Draft Environmental Impact Statement for the Upper Maple River Watershed Project, submitted to this department for review, provides a satisfactory analysis of the project's potential effects on the environment. We have therefore no comments of consequence to offer.

We recommend that your staff proceed with preparation of the final impact statement in accordance with the National Environmental Policy Act of 1970.

Sincerely,

A handwritten signature in black ink that reads "B. Dale Ball".

B. Dale Ball, Director

January 15, 1975

Mr. Arthur H. Cratty
State Director
USDA Soil Conservation Service
1405 S. Harrison Road
East Lansing, Michigan 48823

Dear Sir:

Faculty of our Department have received via the Michigan Association of Conservation Ecologists (MACE) your December 24, 1974, request for comments on your office's "WEST UPPER MAPLE RIVER WATERSHED DRAFT REVISED ENVIRONMENTAL IMPACT STATEMENT" dated December, 1974.

We submit for the EIS our comments, speaking as the Michigan State University Department of Fisheries and Wildlife, and will forward them also to MACE President, Mr. Michael D. Moore of Roscommon, for his consideration and possible use in responding to you. Our Department would appreciate directly receiving future SCS project work plans and requests for comments on EIS's.

Fisheries Comments (R.J. White)

- (1) Where the EIS deals with effects on fish and fisheries, it should be written by fishery biologists. We suspect it was not. Lacking identification of such biologists and description of their qualifications, the fish and fishery aspects of the EIS cannot be accepted as an adequate consideration of the situation.
- (2) The suction dredging might be expected to improve channel depth for fish.
- (3) What are the measures to prevent flood waters from washing dredged sediments back into the river?
- (4) Under "Plant and Animal Resources" it is mentioned on p. 33 that MDNR was making a fish population survey at the time the EIS was being written. The MDNR survey has now been completed. It should be fully included in the EIS as an appendix -- and p. 33 should be reworked accordingly.

Wildlife Comments (G.R. Dudderar)

The wildlife considerations in this project are good, but could be improved by two changes. First, alternative sites for the placement of the 20,000 cubic yards of dredged material should be chosen in place of the 125 acres of Type 3 and 7 wetlands. Could not this dredged material be placed outside of the levees?

Mr. Arthur H. Cratty

January 15, 1975

Page 2

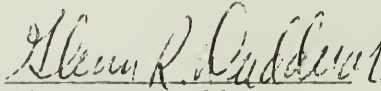
Second, the removal of dead and dying trees inside the levees will destroy valuable woodduck nest sites. If absolutely necessary, such removal should be confined only to those dead and dying trees on the immediate edge of the river. In addition, where felled trees will be in wetlands, they should be allowed to remain where they are felled, instead of being piled, to create loafing and resting sites for waterfowl.

Sincerely,



R.J. White

Assistant Professor



Glenn R. Dudderar

Extension Specialist



N.R. Kevern

Chairman

RJW/GRD/NRK/dgp

cc: Michael D. Moore, President, Michigan Association of Conservation Ecologists

MID-MICHIGAN DISTRICT HEALTH DEPARTMENT



CLINTON
BRANCH OFFICE
ST. JOHNS, MICH. 48879
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GRATIOT
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MONTCALM
BRANCH OFFICE
STANTON, MICH. 48888
831-5770

February 21, 1975

Arthur Cratty
State Conservationist
Room 101
1405 South Harrison Road
East Lansing, Michigan 48823

Re: Draft Environmental
Impact Statement
West Upper Maple River
Watershed

Dear Mr. Cratty:

This department has reviewed the West Maple River Watershed Environmental Impact Statement. We wish to make comment about a statement on page 50 of the Statement concerning the dumping of domestic garbage in a water filled borrow pit. This dump site has been closed for a period of at least two years to the dumping of garbage and refuse. Our observation indicates only boulders and large stumps are being deposited at the north end of the parcel. Approximately one third of the original refuse (consisting of tin cans and other metal products) is yet uncovered.

We are scheduled to work with the township in obtaining an acceptable final cover for this exposed refuse in the near future.

This department also plans to initiate a more extensive surface water sampling program of which the Cordray Drain mentioned on page 49 will undoubtedly be included in sampling.

Please feel free to contact this department for any further information.

Sincerely yours,

Joseph Latoff
Acting Director

Dennis McDonough, Sanitarian

DMc:ig



NATURAL RESOURCES COMMISSION

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CHARLES G. YOUNGLOVE

WILLIAM G. MILLIKEN, Governor

DEPARTMENT OF NATURAL RESOURCES

STEVENS T. MASON BUILDING, LANSING, MICHIGAN 48926
HOWARD A. TANNER, Director

April 9, 1975

Mr. Arthur H. Cratty
Station Conservationist
Soil Conservation Service
1405 S. Harrison Road
East Lansing, Michigan 48823

Dear Mr. *Cratty*:

We have reviewed the Draft Environmental Impact Statement for the West Upper Maple River Watershed Plan and find the statement adequate. Our previous contacts in the planning stages of the project were helpful in resolving our concerns.

We continue to support the project and look forward to its implementation.

Sincerely,

A handwritten signature in dark ink, appearing to read "Dave".

David H. Jenkins
Acting Director



APPENDIX D- SELECTED REFERENCES

1. Chartkoff, Joseph L., and others, "Archaeological Resources of the West Upper Maple River Watershed Development Area," a report to the USDA Soil Conservation Service, East Lansing: Michigan State University, Department of Anthropology, November 1, 1974.
2. Clinton County Soil Conservation District, *An Appraisal of Potentials for Outdoor Recreational Development*, 1967.
3. Dames and Moore, Environmental Consultants, *Report of Geologic Investigation, Upper Maple River Watershed, Gratiot, Clinton, Shiawassee Counties*, Park Ridge, Job Number 2172-009-07, September 1973.
4. Gratiot County Soil Conservation District, *An Appraisal of Potentials for Outdoor Recreational Development*, 1967.
5. Great Lakes Basin Commission, Wildlife Work Group, *Great Lakes Basin Framework Study, Appendix 17, Wildlife*, Draft No. 1, Lebanon: Bureau of Sport Fisheries and Wildlife, U. S. Department of Interior, 1971.
6. J. E. Zajic, *Water Pollution*, Volume 1, New York City: Marcel Decker, Inc., 1971.
7. Michigan Department of Agriculture, Michigan Weather Service and U. S. Department of Commerce, NOAA National Weather Service, *Climate of Michigan by Stations*, 2d. rev. ed., East Lansing: Michigan Weather Service, 1971.
8. Michigan Department of Conservation, Geological Survey Division, *Map of Surface Geology*, Publication 49, 1955.
9. Michigan Department of Conservation, Water Resources Commission, *Water Resources of the Lower Lake Michigan Drainage Basin*, Lansing: Water Resources Commission, 1968.
10. Michigan Department of Natural Resources, Comprehensive Studies, *Background Water Quality*, Storet Retrieval, October 1973.

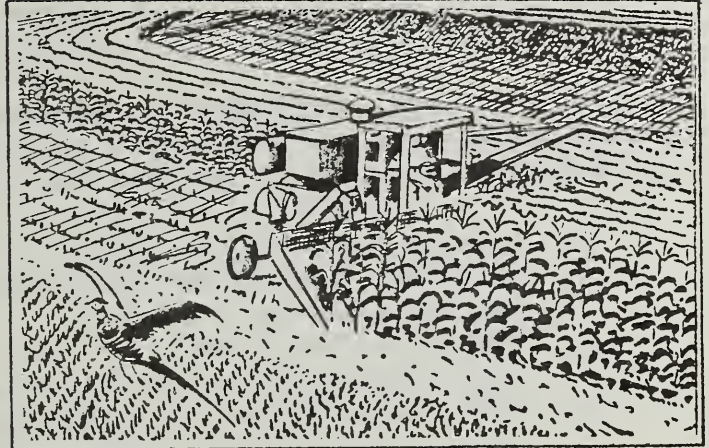
11. Michigan Department of Natural Resources, Fish Division, *Stream Classification Maps*, Lansing: Michigan Department of Natural Resources, 1967.
12. Michigan Department of Natural Resources, Planning Services, *Michigan Recreation Plan*, 1971.
13. Michigan Department of Natural Resources, Water Resources Commission, *Water Quality Standards, Part 4 of General Rules*, 1973.
14. Michigan State Highway Commission, *Michigan Official Highway Map*, Grand Rapids: Michigan Lithographing Co., 1971.
15. Michigan State University, Agricultural Experiment Station and Cooperative Extension Service, *Project 80 and 5*, "The Economic, Social, Political and Technological Climate for Rural Michigan in 1985" (Summary of Phase I Papers), 1972.
16. Michigan State University, Graduate School of Business Administration, Division of Research, *Michigan Statistical Abstract*, 9th ed., 1972.
17. Robert Benson, Wildlife Biologist, Michigan Department of Natural Resources, Personal Letter, March, 1973.
18. U. S. Department of Agriculture, Agricultural Research Service, *Agriculture Handbook No. 282*, "Predicting Rainfall-Erosion Losses from Cropland East of the Rocky Mountains," 1965.
19. U. S. Department of Agriculture, Economic Research Service in cooperation with the Michigan Agricultural Experiment Station/Michigan State University, *Statistical Supplement to Agricultural Economic Report 108*, "An Economic Survey of the Northern Lake States Region", 1969.
20. U. S. Department of Agriculture, Forest Service, *Forest Service Report, West Upper Maple River Watershed*, unpublished, May, 1968.
21. U. S. Department of Agriculture, Soil Conservation Service, *Agriculture Handbook No. 210*, "Land-Capability Classification", September 1961.

22. U. S. Department of Agriculture, Soil Conservation Service, *Atlas of River Basins of the United States*, 2d. ed. Washington: Government Printing Office, 1970.
23. U. S. Department of Agriculture, Soil Conservation Service, *Engineering Memo-SD-15*, "Procedure for Estimating the Sediment Storage Requirements of Storage Reservoirs," Huron: SCS, 1966.
24. U. S. Department of Agriculture, Soil Conservation Service, *Procedure for Computing Sheet and Rill Erosion on Project Areas*, Technical Release No. 51, 1972.
25. U. S. Department of Agriculture, Soil Conservation Service and the Michigan Agricultural Experiment Station, *Soil Survey of Clinton County, Michigan*, unpublished.
26. U. S. Department of Agriculture, Soil Conservation Service and the Michigan Agricultural Experiment Station, *Soil Survey of Gratiot County, Michigan*, unpublished.
27. U. S. Department of Agriculture, Soil Conservation Service, *Technical Guide*, "Maximum Crop Management Factor Values", 1963.
28. U. S. Department of Agriculture, Soil Conservation Service, *Technical Guide*, "Soil Erodibility "K" Values and Soil Loss Tolerance "T" Value", 1964.
29. U. S. Department of Commerce, Bureau of the Census, *Census of Agriculture*, 1969, Volume I, Area Reports, Part 13. Michigan Section 2. County Data, 1972.
30. U. S. Department of the Interior, Bureau of Outdoor Recreation, *Outdoor Recreation in the Grand River Basin - Michigan*, Volume VII, Appendix J, U. S. Army Corps of Engineers, Ann Arbor, Michigan, April, 1970, 165 pp.
31. U. S. Department of Interior, Federal Water Pollution Control Administration, *Report of the Committee on Water Quality Criteria*, April 1968.
32. U. S. Department of the Interior, Geological Survey, *St. Johns North Quadrangle, Michigan*, Washington: U. S. Geological Survey, 1965.

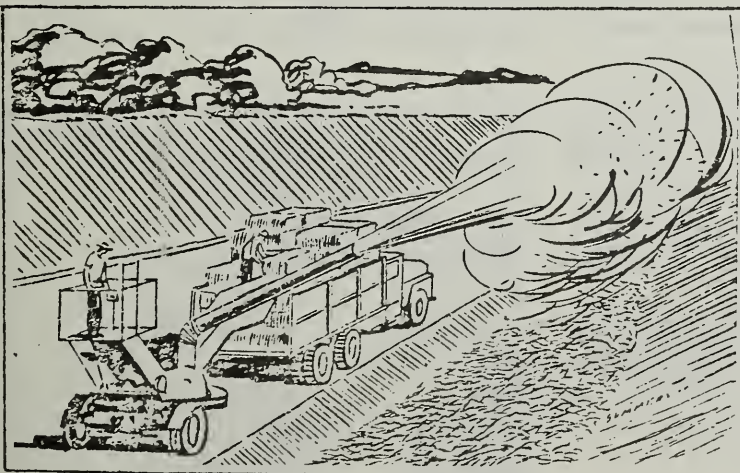
33. U. S. Department of the Interior, Federal Water Pollution Control Administration, *Water Quality Studies Manual*, October 1969.
34. U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife, *Wetlands of the United States*, Circular 39, Washington: U. S. Government Printing Office, 1956.
35. Wayne E. Pettyjohn, *Water Quality in a Stressed Environment*, Minneapolis: Burgess Publishing Co.
36. Lincoln, Russell S. *Inventory of the Fisheries Resources of the Upper Maple River Watershed*, Michigan Department of Natural Resources, Lansing, Michigan, Preliminary Draft, November 1974.

APPENDIX E- DEFINITIONS OF LAND TREATMENT PRACTICES

Conservation Cropping System - Growing crops in combination with needed cultural and management measures. Cropping systems include rotations that contain grasses and legumes as well as rotations in which the desired benefits are achieved without the use of such crops. The purpose is to improve or maintain good physical condition of the soil; protect the soil during periods when erosion usually occurs; help control weeds, insects, and diseases; and meet the need and desire of farmers for an economic return. It is applicable on all cropland and on certain recreation and wildlife land.



Critical Area Planting - Planting vegetation such as trees, shrubs, vines, grasses, or legumes on critical areas. (Does not include tree planting mainly for wood products). The purpose is to stabilize the soil; reduce damage from sediment and runoff to downstream areas; improve wildlife habitat; and enhance natural beauty. It is applicable on sediment-producing, highly erodible or severely eroded areas, such as dams, dikes, mine spoil, levees, cuts, fills, surface-mined areas, and denuded or gullied areas where vegetation is difficult to establish with usual seeding or planting methods.



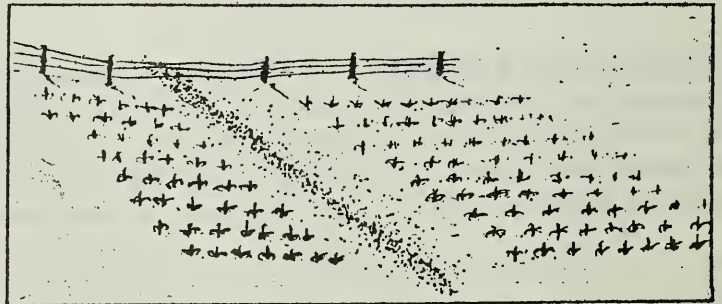
Crop Residue Use - Using plant residues to protect cultivated fields during critical erosion periods. The purpose is to conserve moisture; increase infiltration; reduce soil loss; and improve soil tilth. It is applicable on land where adequate crop residues are produced.

Drain - A conduit, such as tile, pipe, or tubing, installed beneath the ground surface and which collects and/or conveys drainage water. A drain may serve one or more of the following purposes:

1. Improve agricultural production by lowering the water table.
2. Intercept and prevent water movement into a wet area.
3. Relieve artesian pressures.
4. Remove surface runoff.
5. Facilitate leaching of saline and alkali soils.
6. Serve as an outlet for other drains.
7. Provide ground water regulation and control for sub-irrigated areas.

Drains are used in areas having a high water table where benefits of lowering or controlling groundwater or surface runoff justify the installation of such a system.

Drainage Field Ditch - A graded ditch for collecting excess water within a field. This does not include Drainage Main or Lateral, or Grassed Waterway or Outlet. Applicable sites are flat or nearly flat lands that:

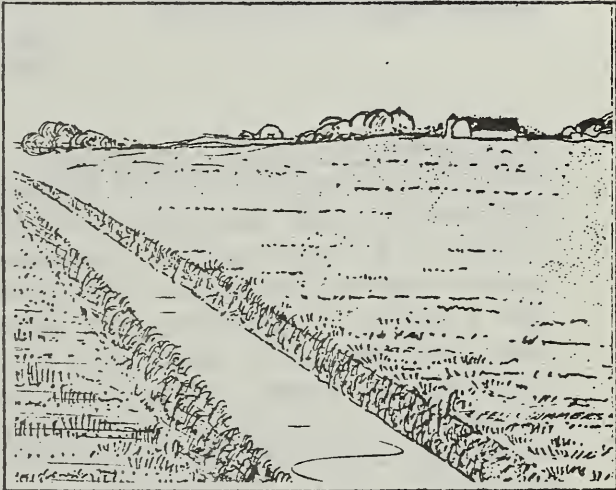


1. Have soils of low permeability or shallowness over barriers, such as rock or clay, which hold or prevent ready percolation of water to a deep stratum.
2. Have surface depressions or barriers which trap rainfall.
3. Have insufficient land slope for ready movement of runoff across the surface.
4. Receive excess runoff or seepage from uplands.
5. Require removal of excess irrigation water.
6. Require control of the groundwater table.
7. Have adequate outlets available for disposal of drainage water by gravity flow or pumping.

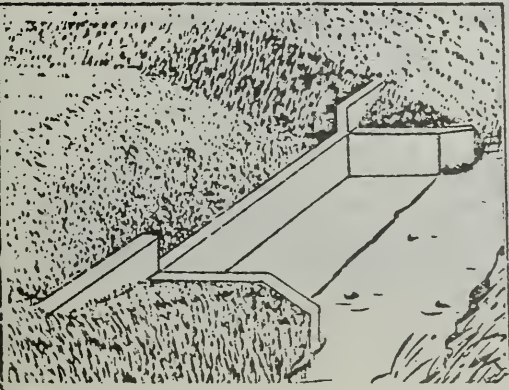
Drainage field ditches are installed to:

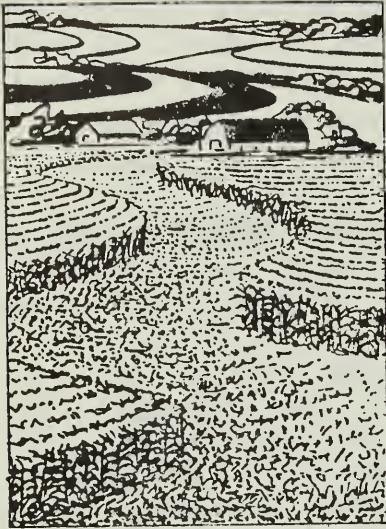
1. Drain surface depressions.
2. Collect or intercept excess surface water such as sheet flow from natural and graded land surfaces or channel flow from furrows for removal to an outlet.
3. Collect or intercept excess subsurface water for removal to an outlet.

Drainage Main or Lateral - An open drainage ditch constructed to a designated size and grade. Does not include Drainage Field Ditch. The purpose of mains and laterals is to dispose of excess surface or subsurface water, intercept groundwater, or to control groundwater levels; to provide for leaching of saline or alkali soils; or a combination of these objectives.



Grade Stabilization Structure - A structure to stabilize the grade or to control head cutting in natural or artificial channels. (Does not include straight pipe overflow structures used in drainage and irrigation systems for structures for water control). Grade stabilization structures are installed to stabilize the grade in natural or artificial channels, prevent the formation or advance of gullies, and reduce environmental and pollution hazards. These structures apply where the concentration and flow velocity of water are such that structures are required to stabilize the grade in channels or to control gully erosion. Special attention will be given to maintaining or improving habitat for fish and wildlife, where applicable.

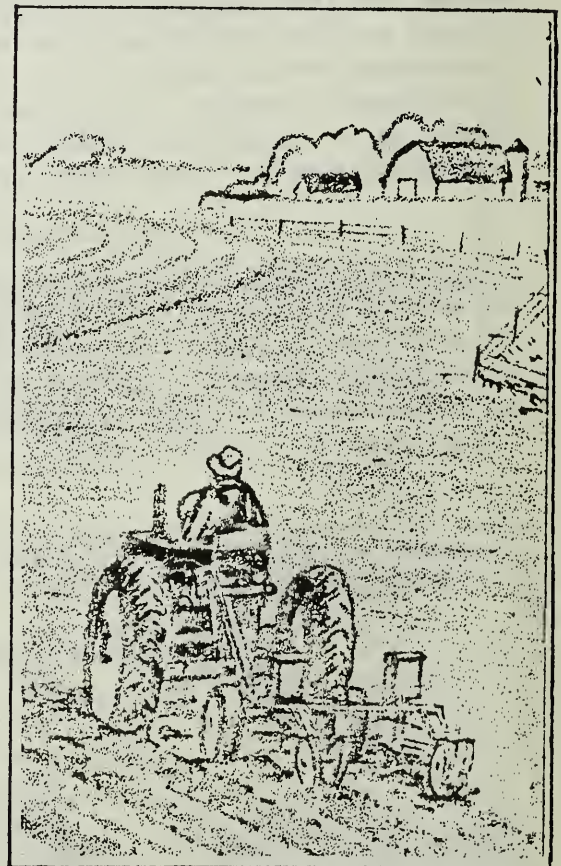




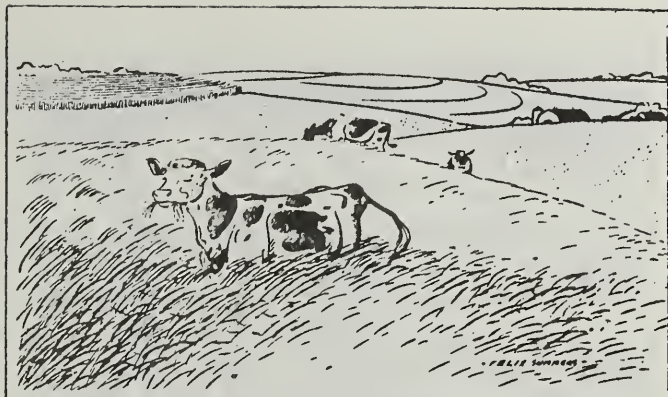
Grassed Waterway or Outlet - A natural or constructed waterway or outlet shaped or graded and established in vegetation suitable to safely dispose runoff from a field, diversion, terrace, or other structure. The purpose is to prevent excessive soil loss and formation of gullies. It is applicable where concentrated runoff must be disposed of at safe velocities.

Hydrologic Cultural Operations - These operations improve forest hydrologic conditions through increased development of litter and humus and maintenance of adequate vegetative cover. These objectives are reached by favoring the establishment and development of desirable species and maintaining stand and stocking conditions favorable to rapid growth and production of maximum amounts of litter and humus. Hydrologic cultural operations include thinnings, weeding, release, salvage and harvest cuts.

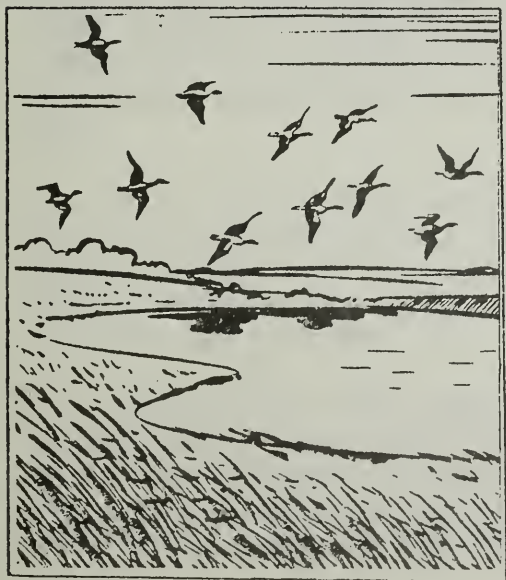
Minimum Tillage - Limiting the number of cultural operations to those that are properly timed and essential to produce a crop and prevent soil damage. The purpose is to retard deterioration of soil structure; reduce soil compaction and formation of tillage pans; and to improve soil aeration, permeability, and tilth. It is applicable on all cropland and on certain recreation and wildlife land.



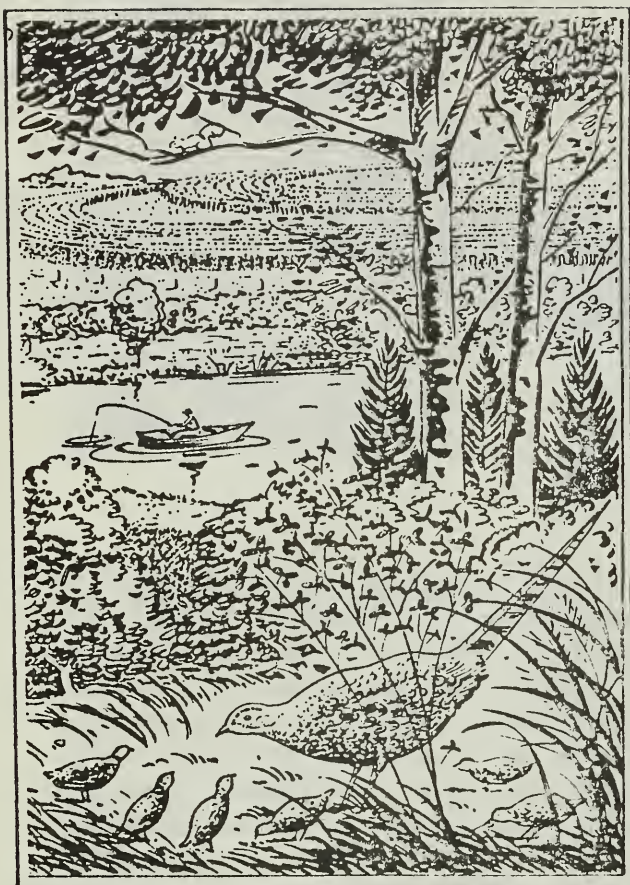
Pasture and Hayland Management - Proper treatment and use of pastureland or hayland. The purpose is to prolong life of desirable forage species; to maintain or improve the quality and quantity of forage; and to protect the soil, and reduce water loss. It is applicable on all pastureland or hayland.



Pasture and Hayland Planting - Establishing and re-establishing long-term stands of adapted species of perennial, biennial, or reseeding forage plants. The purposes are to reduce erosion, to produce high quality forage, and to adjust land use. It is applicable on existing pasture and hayland or on land that is converted from other uses.



Pond - A water impoundment made by constructing a dam or embankment, or by excavating a pit or "dugout." Ponds are constructed to provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses.



Tree Planting - Planting tree seedlings or cuttings. The purposes are to establish or reinforce a stand of trees to conserve soil and moisture; beautify an area; protect a watershed; or produce wood crops. It is applicable in open fields, in understocked woodland, beneath less desirable tree species, or on other areas suitable for producing wood crops; where erosion control or watershed protection is needed; where greater natural beauty is wanted; or where a combination of these is desired.

Wildlife Upland Habitat Management - Retaining, creating, or managing wildlife habitat other than wetland. The purpose is to keep, make, or improve habitat for desired kinds of wildlife. It is applicable on sites (other than wetland) that are suitable for the kinds of wildlife food or cover plants that are needed.

APPENDIX F- DESCRIPTIONS OF SOILS AND CAPABILITY CLASSES

Soils in the Blount series are somewhat poorly drained soils that formed in calcareous clay loam or silty clay loam till. These soils occur in level to gently sloping or gently undulating areas on till plains and moraines. The native vegetation was hardwood forest consisting largely of maple, elm, hickory, and some oak.

Soils in the Capac series are somewhat poorly drained soils that formed in calcareous loam, silt loam, or light clay loam till. These soils are on the level to gently sloping parts of till plains and low moraines. The native vegetation was mainly hardwood forest that consisted chiefly of elm, ash, soft maple, oak, hickory, and basswood.

Soils in the Toledo series are very poorly drained soils that formed in calcareous clay till. These soils are on the level or nearly level areas and depressions of till plains and lake plains. The native vegetation was swamp white oak, bur oak, pin oak, elm, hickory, ash, basswood, and soft maple.

Soils in the Parkhill series are poorly drained and very poorly drained soils that developed in calcareous loam, silt loam, or light clay loam till. These soils are in level or nearly level areas and depressions on till plains and moraines. The native vegetation was deciduous forest consisting mainly of elm, soft maple, basswood, and ash.

Soils in the Pert series are somewhat poorly drained soils that formed in calcareous clay loam or silty clay loam till. These soils are on nearly level or gently sloping areas of till plains. The native vegetation was hardwood forest consisting largely of maple, elm, hickory, and some oak.

Soils in the Sims and Lenawee series are poorly drained and very poorly drained soils that formed in calcareous clay loam till. These soils are on level or nearly level areas and depressions of till plains. The native vegetation was deciduous forest consisting mainly of elm, soft maple, basswood, and ash.

a/ Soil Surveys, Gratiot and Clinton Counties.

Soils in the Wasepi series consists of somewhat poorly drained soils that formed in sandy loam and loamy sand outwash material that is from 24 to 40 inches thick over neutral or calcareous loose sand and gravel. These soils occur on level to gently sloping outwash plains, valley trains, lake plains, and deltas. The native vegetation was principally deciduous forest consisting largely of elm, ash, swamp white oak, soft maple, and hickory.

Soil Capability Classes

Soils in class II require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when the soils are cultivated. The limitations are few and the practices are easy to apply. The soils may be used for cultivated crops, pasture, range, woodland, or wildlife food and cover.

Limitations of soils in class II may include singly or in combination the effects of (1) gentle slopes, (2) moderate susceptibility to wind or water erosion or moderate adverse effects of past erosion, (3) less than ideal soil depth, (4) somewhat unfavorable soil structure and workability, (5) slight to moderate salinity or sodium easily corrected but likely to recur, (6) occasional damaging overflow, (7) wetness correctable by drainage but existing permanently as a moderate limitation, and (8) slight climatic limitations on soil use and management.

Soils in class III have more restrictions than those in class II and when used for cultivated crops the conservation practices are usually more difficult to apply and to maintain. They may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover.

Limitations of soils in class III restrict the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or some combination of these limitations. The limitations may result from the effects of one or more of the following: (1) Moderately steep slopes; (2) high susceptibility to water or wind erosion or severe adverse effects of past erosion; (3) frequent overflow accompanied by some crop damage; (4) very slow permeability of the subsoil; (5)

wetness or some continuing waterlogging after drainage; (6) shallow depths to bedrock, hardpan, fragipan, or claypan that limit the rooting zone and the water storage; (7) low moisture-holding capacity; (8) low fertility not easily corrected; (9) moderate salinity or sodium; or (10) moderate climatic limitations (20).

