ST. CLAIR FLATS MANAGEMENT PLAN

QH
541.5
.M3
S7
1980

IVISION OF
ND RESOURCE PROGRAMS
T OF NATURAL RESOURCES

Ayres, Lewis, Norris & May, Inc.
Engineers · Architects · Planners
Ann Arbor, Michigan

At the mouth of the St. Clair River and forming a delta of marsh land which has been known from time immemorial the world over as the St. Clair Flats, the Venice of America, we have the greatest small mouthed bass spawning grounds in the country; also, a natural nesting place for the mallard, canvasback, teal, etc. Situated as it is, only a few minutes ride from Detroit, and forming as it does, one of the finest recreational haunts for the sportsmen in America, this paradise for the sportsmen has been slowly but surely taken away from the people of this State.

"St. Clair Flats Battle is On"
By Lloyd F. Eagan
Detroit Waltonian, March, 1925

ST. CLAIR FLATS MANAGEMENT PLAN

FEBRUARY, 1980

Prepared for the:

Michigan Department of Natural Resources
Division of Land Resource Programs
Coastal Program Unit

Prepared by:

AYRES, LEWIS, NORRIS & MAY, INC.
Engineers – Architects – Planners
3983 Research Park Drive
Ann Arbor, Michigan 48104

Financial assistance for this plan
has been provided through the
COASTAL ZONE MANAGEMENT ACT OF 1972
administered by the
Office of Coastal Zone Management
National Oceanic and Atmospheric Administration
and the
Michigan Department of Natural Resources
Division of Land Resource Programs
Coastal Program Unit

Property of CSC Library

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

HH541.5.M3 S7 1980
9014268

MAR 24 1981

TABLE OF CONTENTS

SECTION		PAGE
	MANAGEMENT PLAN SUMMARY	i-vi
	Findings and Conclusions	ii
	Management Recommendations	iv
	Land Management Plan	iv
	Policy Plan	v
	Acquisition Priorities Plan	vi
I	INTRODUCTION	1-4
	Purpose of the Plan	2
	Planning Process	2
II	HISTORICAL PERSPECTIVE	5-11
III	NATURAL RESOURCE AND CULTURAL RESOURCE FACTORS	12-69
	Natural Resource Factors	
	Water Resources	12
	Water Quantity/Flow Characteristics	12
	Water Quality	14
	Flood Hazard Areas	15
	Physiography	16
	Geologic History	16
	Geomorphology	19
	Soils	20
	Terrestrial and Aquatic Ecosystems	24
	Vegetation	24
	Fish and Wildlife Resources	30
	Unique Habitats; Endangered, Threatened, and Rare Species	41
	Other Functions of the Wetlands	43
	Cultural Resource Factors	
	Land and Water Use	44
	Utilities and Service	48
	Local Economy and Tax Base	52

SECTION		PAGE
III	Existing Regulatory Authority	53
	Land and Water Management	53
	Public Health and Water Quality	65
	Dredge and Fill Activities	67
	Miscellaneous Legislation	68
IV	PHYSIOGRAPHIC AND CULTURAL UNITS	70-82
	Characterization of Physiographic Site Types	70
	Characterization of Cultural Units	81
V	MANAGEMENT PLAN	83-123
	Findings	83
	Alternate Management Scenarios	90
	Evaluation of Management Scenarios	90
	Selection of the Management Scenario	98
	Land Management Plan	100
	Policy Plan	103
	General Policies	103
	Land Management	104
	Public Health and Environmental Protection	108
	Recreational Use	109
	Resource Value of the Flats	111
	Acquisition Priorities Plan	113
	Acquisition Priorities	113
	Acquisition Costs	117
	Acquisition Methods	118
	Acquisition Funding	121
	CONCLUSIONS	124,125
	BIBLIOGRAPHY	
	APPENDICES	

LIST OF FIGURES

Figure 1	The Planning Process
Figure 2	St. Clair Flats Regional Area
Figure 3	State Legislation Dealing Specifically with the St. Clair Flats
Figure 4	Distribution of Inflow from the St. Clair River through Lake St. Clair
Figure 5	Typical Landform Cross-Section, St. Clair Flats Area
Figure 6	The Deltaic Landforms of Dickinson Island,
Figure 7	Typical Soil Profile, St. Clair Flats Delta
Figure 8	Plant Community Displacement Model, Dickinson Island
Figure 9	Areal Extent of Wetlands, by Vegetation Type, Dickinson Island Wetlands, 1949, 1964, and 1975
Figure 10	Fish Species Found in St. Clair Flats
Figure 11	Michigan Non-Salmonoid Sportsfish Catch and Fishing Effort, Lake St. Clair vs. Other Michigan Great Lakes Waters, 1975
Figure 12	Spawning Requirements and Habitat Preferences of the Primary Sportsfish of the Flats
Figure 13	Fish Species Inhabiting Coastal Wetlands which are Tolerant to Siltation, Turbidity, and Pollution
Figure 14	Species Kill Data, 1976-1977, St. Clair Flats, Michigan
Figure 15	Endangered Plants Found in the St. Clair Flats Area
Figure 16	Septic Permits Issued in the Flats, January, 1978 - July, 1979
Figure 17	Legislation Relating to the St. Clair Flats
Figure 18	Summary of Deeded and Leased Parcels, St. Clair Flats, 1977
Figure 19	Original Lease Rental Fees, as Provided for by Act 326
Figure 20	Physiographic Unit Evaluation Matrix
Figure 21	Physiographic Unit Sensitivity and Development Capability
Figure 22	Range of Management Scenarios
Figure 23	Scenario Evaluation Matrix: Summary of Costs
Figure 24	Scenario Evaluation Matrix: Summary of Benefits
Figure 25	Acquisition Methods of Leaseholdings
Figure 26	Land Acquisition Methods for Deeded Properties and Private Claims

LIST OF MAPS

Map 1	Physiographic Units
Map 2	Cultural Units
Map 3	Land Management Plan
Map 4	Acquisition Priorities Plan

Summary

ST. CLAIR FLATS MANAGEMENT PLAN
SUMMARY

The St. Clair Flats, located at the mouth of the St. Clair River, represent the largest deltaic wetland system in the Great Lakes. Due to the extensive wetland habitat, the Flats have received national recognition as a popular spot for hunting, fishing and boating. As a recreational resource, the St. Clair Flats are easily accessible to three-fifths of the State's population.

Unfortunately, the highly valuable wetlands of the Flats have been significantly altered over the years. Prior to 1900, the Flats contained over 13,500 acres of wetlands. Today, less than 4,500 acres of wetlands remain. The remaining wetland acreage represents 88% of the total wetland on the Michigan portion of Lake St. Clair. Residential and commercial development has altered much of the original wetlands. Dredging, filling and bulkheading has destroyed important fish and wildlife habitat and has degraded public recreational opportunities. Court decisions in the early 1900's declared the Flats to be State-owned bottomlands. However, legislative mandates and the lack of regulatory enforcement by State and local governments have allowed the diversion of State-owned bottomlands to private residential and commercial use. The St. Clair Flats Act, Act 326, P.A. of 1913, and subsequent amendments, have provided for the leasing and deeding of State-owned land for private use. Presently, the Flats are a mixture of State-owned lands, State-owned leased lands, and privately-owned deeded properties.

This study has concluded that the Flats are biologically and economically important. Fish and waterfowl production for the entire Lake St. Clair region is dependent on the Flats as the last remaining wetlands on the U.S. side of the Lake. The biological value is directly tied to recreational opportunities such as fishing and hunting for over three million residents in southeastern Michigan. In addition to the biological value, social, economic and recreational values require that the

past management practices be rectified and that new management policies be adopted which recognize the importance of the Flats.

SUMMARY OF FINDINGS AND CONCLUSIONS

A summary of major findings which form the basis of the management plan is presented. The findings highlight the major issues and problems and demonstrate the need for corrective action in the Flats.

Major Findings and Conclusions

- Over 80% of the coastal wetlands on the Michigan side of Lake St. Clair have been destroyed. Of the remaining wetlands, 88% are found in the St. Clair Flats.

- The wetlands of the Flats offers important food, cover and breeding areas for fish and wildlife. The resources of the Flats are believed to support many fish found within the entire Lake St. Clair system. Large numbers of migratory waterfowl are also supported by these same resources.

- Because of the close proximity to the Detroit metropolitan area, and the high productivity of fish and waterfowl, the Flats are an extremely valuable recreation resource for fishing and hunting.

- Special interest legislation has historically authorized the conversion of State-owned public trust bottomlands to private leases and deeds. However, changes in public attitudes and increasing scientific documentation of wetland values, as evidenced by recent enactment of the Goemarve-Anderson Wetland Protection Act, P.A. 203 of 1979, support additional protection of wetlands such as St. Clair Flats.

- Department of Natural Resources has not developed regulations to protect the paramount rights of hunting, fishing and navigation as directed by Act 326, P.A., 1913.

- Lots have been leased or converted to deeds at extremely low prices. This has inadvertently encouraged development and despoiled the resources of the Flats.

- A 1977 survey of the St. Clair Flats area concluded that approximately 50% of leased and deeded parcels remain unoccupied and undeveloped.

- Because of extremely high water table, septic systems do not function properly and pose severe public health hazards to the users of the Flats.

- Many residents utilize direct intakes of water for household use. There exists a potential for contamination of water supplies from the inadequate sanitary systems.

- Most parcels are subject to severe flooding or ice damage. The costs of flood protection are a burden to the residents and the public.

- Sewers, water systems and flood protection structures will require unusually high expenditures because of the unique site conditions of the Flats. The unusual development costs are a burden for private individuals and the public.

- Septic field permits continue to be granted by St. Clair County. While most applications for new permits are denied by the County sanitarian, a County Health Department Appeals Board overturns the denial and issues the permits.

- A State Circuit Court (1974) has ordered Clay Township to refrain from issuing building permits which will threaten or degrade the waters of the State. Building permits are still being issued and the waters of the Flats are jeopardized.

SUMMARY OF MANAGEMENT RECOMMENDATIONS

The summary of findings demonstrates the value and importance of the Flats to the people of the State of Michigan. After preparation and evaluation of five alternative management options for the Flats, an approach was selected which promotes strong resource conservation, strict environmental enforcement, and mixed recreational use.

The Management Plan presents management recommendations divided into three sections: Land Management Plan, Policy Plan, and Acquisition Priorities Plan. A summary of the management recommendations are as follows:

Land Management Plan

- The Land Management Plan designates land use within the Flats according to physiographic units developed in the course of the study. Specific land use recommendations are based upon the sensitivity of the physiographic units to sustain such usage.

- The majority of the Flats are designated as "Conservation" due to productivity for fish and wildlife. These areas are largely located around interior bays, out-islands, Dickinson Island, and a portion of Harsen's Island adjacent to Muscamoot Bay.

- Residential, commercial and boating facilities are recommended to be contained in existing developed areas approved for deeds.

- Wildlife management areas include the managed cropland and waterfowl areas currently operated by the State.

Policy Plan

- The St. Clair Flats Management Plan should be adopted by the Natural Resources Commission to provide policy guidance to the Department of Natural Resources regarding future decisions affecting the Flats.

- Existing regulatory authority should be enforced. Provisions to protect the fish and wildlife resources of the Flats are available under Act 326, PA 1913 and Act 247, PA 1955. In addition Act 245, PA 1929 and Act 368, PA 1978 provide authority to regulate the discharges of sewage waters into the waters of the State. Strict enforcement of the Acts would protect the valuable wetland resources from further alteration and minimize contamination of public waters and its potential health hazards.

- In view of substantially increased awareness of the public values of wetlands, the Legislature should consider an amendment to Act 326 which would allow the termination of undeveloped and unoccupied leased parcels, and the acquisition of leasehold interests.

- The land management plan designates areas as "conservation." These areas have a special environmental significance and no new leases should be issued for these areas. Holders of existing leases should be informed that their leases will not be renewed.

- The conversion of deeds may be permitted in "areas approved for deeds," subject to the protection of the paramount rights of hunting, fishing and navigation. However, the cost of deed conversions should be reflective of the market value of the property.

- The uses and density of the leased or deeded properties must be strictly controlled. Assignment of leased properties resulting in more intensive use should not be permitted. Fractionalization of leased and deeded parcels should also be prohibited.

- Local authority under Clay Township's Zoning Ordinance, building code and floodplain regulations should be enforced. Specifically, site regulations, structural safety and building restrictions must be complied with to insure the safety of the residents.

- State, County and Township officials must work together to formulate a cohesive policy regarding water quality and public health. The township must comply with the Circuit Court order of 1974 which prohibits the issuance of building permits which degrade the waters of the state. The county must enforce the sanitary code and deny sanitary permits which violate septic field requirements.

- Mixed recreational uses should be promoted. Fishing, hunting, boating and wildlife interpretation are recreational opportunities which are well suited for the Flats. However, the activities must be conducted in a manner that promotes the total protection of natural resources.

- The Flats must be viewed as a unique and dynamic biologic and geologic unit. All future management proposals must be evaluated with regard to their impacts on the function of the natural hydrologic regime and ecosystem.

- Dredging, filling and bulkheading destroys fish and wildlife habitat. Such activities should be prohibited in critical areas within the Flats.

Acquisition Priorities Plan

- Acquisition priorities are based upon the importance to fish and wildlife, land use, land value and other considerations.

- Priority attention should be directed toward acquiring the undeveloped leased and deeded parcels.

- Acquisition of leased parcels on Muscamoot Ridge, Muscamoot Bay and various out-island areas are recommended.

- Acquisition priorities for deeded parcels include interior lands along Little and Big Muscamoot Bays and scattered parcels on Dickinson Island.

- Notices should be given to all leaseholders that leases will not be extended beyond the original 99-year period.

- A variety of acquisition methods should be employed and range from fee simple purchase to less common methods such as purchase of development rights and conservation easements.

Introduction

INTRODUCTION

The St. Clair Flats has long been recognized as one of the State's important natural resources. The area supports large numbers of fish and wildlife and has provided popular recreational opportunities to the residents of Southeastern Michigan. Since the late 1800's, settlers and vacationers have been attracted to the excellent fishing, hunting, and boating opportunities. Over the years, recreational pressures and population densities have increased. Unfortunately, the popularity and demand has imposed an excessive burden upon these lands and aquatic resources. Urban development and its accompanying problems of pollution and encroachment into sensitive wildlife areas have despoiled much of the St. Clair Flats. In past years, the Flats was often looked upon as swamp wasteland with little value. Special interest legislation was enacted allowing the diversion of public resources to private use. More recently, the public value of the unique and irreplaceable qualities of the Flats have come to the forefront.

The value of the Flats is even more significant when considered in the context of its geographical proximity to southeastern Michigan. The Flats are within easy access to over 3 million residents within the metropolitan Detroit area. To many of these residents, the recreational opportunities of northern Michigan are not accessible or cannot be afforded. Recreation pressures for boating, fishing, and hunting will undoubtedly increase. Urban development and demand for vacation homesites within a short drive of urban centers will also increase. In short, recreational and residential pressures will continue to encroach upon the Flats. Yet, how much development can the wetlands absorb without adversely impacting the ecosystem? What are the best uses of the Flats, and which areas are most sensitive? Finally, in what manner should these lands be managed?

To answer these and other important questions, the Michigan Department of Natural Resources commissioned Ayres, Lewis, Norris & May, Inc., an independent consulting firm, to document past management actions and recommend a management strategy for the St. Clair Flats.

PURPOSE OF THE PLAN

The purpose of the St. Clair Flats Management Plan is to provide a long-term guide for the future administration and use of the Flats. The Plan is directed at utilizing the public resources in the best interest of all the people of the State of Michigan. The Management Plan is intended to clarify the basic issues and systematically study all natural and man-influenced factors. The Plan will provide a detailed inventory and analysis of natural resource factors, cultural factors, existing legislation, local ordinances and administrative procedures. By establishing a detailed base of information, the effect of future management options can be considered.

A primary purpose of the Plan is to offer management recommendations which are in the best interest of the public and the resources of the Flats. Sensitive wetland areas are identified and conclusions concerning the carrying capacity and future uses are made. An acquisition and implementation plan which establishes priorities for critical lease or deed holdings, is presented. In addition, policy recommendations are made which provide a management framework for the most suitable future uses of the St. Clair Flats.

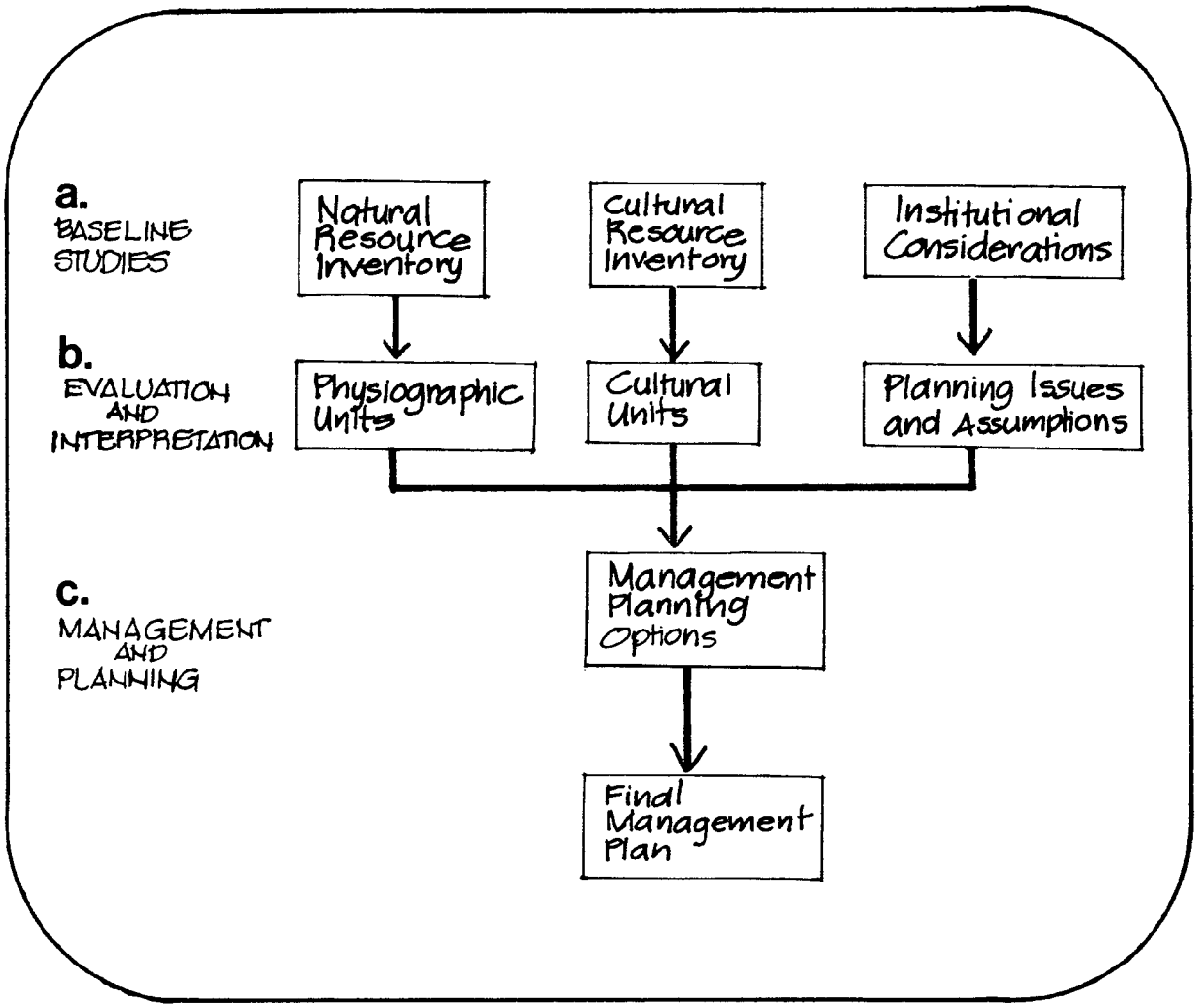
In summary, this Plan is intended to be a policy guide to the Michigan Department of Natural Resources, the administering agency for the Flats. It is based upon a comprehensive understanding of the unique terrestrial and aquatic ecosystem. It is intended that the future uses will not degrade this fragile resource while offering unique recreational opportunities for the people of the State of Michigan.

PLANNING PROCESS

The planning process followed a three step procedure which included: (1) background studies; (2) evaluation and interpretation; and (3) management planning. Detailed planning procedures are summarized in the accompanying diagram (Figure 1).

Figure 1

St. Clair Flats Management Plan
Study Process



Background studies involved extensive data collection. Sources included previously published data, contacts with experts familiar with the Flats, discussions with local officials and citizens. In addition to these sources, detailed conversations with State and Federal agencies also transpired. The Michigan Department of Natural Resources and its various divisions were the primary source of information. Other contacts include the Great Lakes Fishery Laboratory, Soil Conservation Service, Army Corps of Engineers, and interest groups concerned with the Flats.

The second step in the planning process included an evaluation and interpretation of the gathered data. The study area was classified according to physiographic and cultural units. These units were based upon natural resource and cultural characteristics and provide a framework for detailed evaluation. This procedure evaluated the opportunities, constraints, and carrying capacity of these physiographic units. Management implications of the cultural units were also assessed.

The final step in the process involved management planning. Alternative management scenarios were prepared in order to present a range of alternatives for the future use of the Flats. The scenarios were evaluated and a scenario selected which provided a basic framework for the Management Plan. The final step was the development of the Management Plan including a Land Management Plan, Policy Plan and Acquisition Priorities Plan.

Historical Perspective

HISTORICAL PERSPECTIVE

The area known as St. Clair Flats, located at the mouth of the St. Clair River in Clay Township of St. Clair County, represents the largest deltaic wetland system in the Great Lakes. It is a nationally known recreation, waterfowl, and fishing area which is located 25 miles from Detroit, and thus easily accessible to three-fifths of the State's population. Figure 2 illustrates the regional location of the Flats and outlines the land areas of the delta. The delta is cut by four main channels, the North, Sni Bora, Middle, and South Channels, and consists of a variety of large and small islands and marshland. Approximately 8,185 acres of land and 13,509 acres of marsh and water (a total of 21,694 acres) are included in the St. Clair Flats study area.

Because of the excellent hunting and fishing available in the Flats and its close proximity to Detroit, it is an extremely attractive location for summer cabins or permanent homes. In the early years, many people settled there without clear title or deed. This situation, coupled with ambiguous or conflicting policies and legislation has created a complex situation. A review of the early court cases and legislative actions regarding the Flats illustrates the confusion and discrepancies which have occurred in its past management. Through such past confusing management practices, the public resource has been diverted for private use.

When the first ship channel was dredged through the Flats in 1866, the way was cleared for the recreational use of the area. During this period, the State generally classified the Flats as "swamp" or "overflowed" lands, subject to the Federal Swamp Lands Act of 1850. Such lands were placed under State control and could subsequently be sold or disposed of in a variety of ways. In 1899, the Legislature passed Act No. 175 to provide ". . . for the sale, disposition, and control of the unpatented swamp and overflowed lands . . . in the St. Clair Flats . . ." The Act provided for a survey of the area and represented an attempt to dispose of them as marshlands. Those who had previously settled in the Flats became classified as trespassers on State land and ejection proceedings followed. The settlers were involved in numerous lawsuits from 1901 to 1910, which resulted in contradictory rulings.

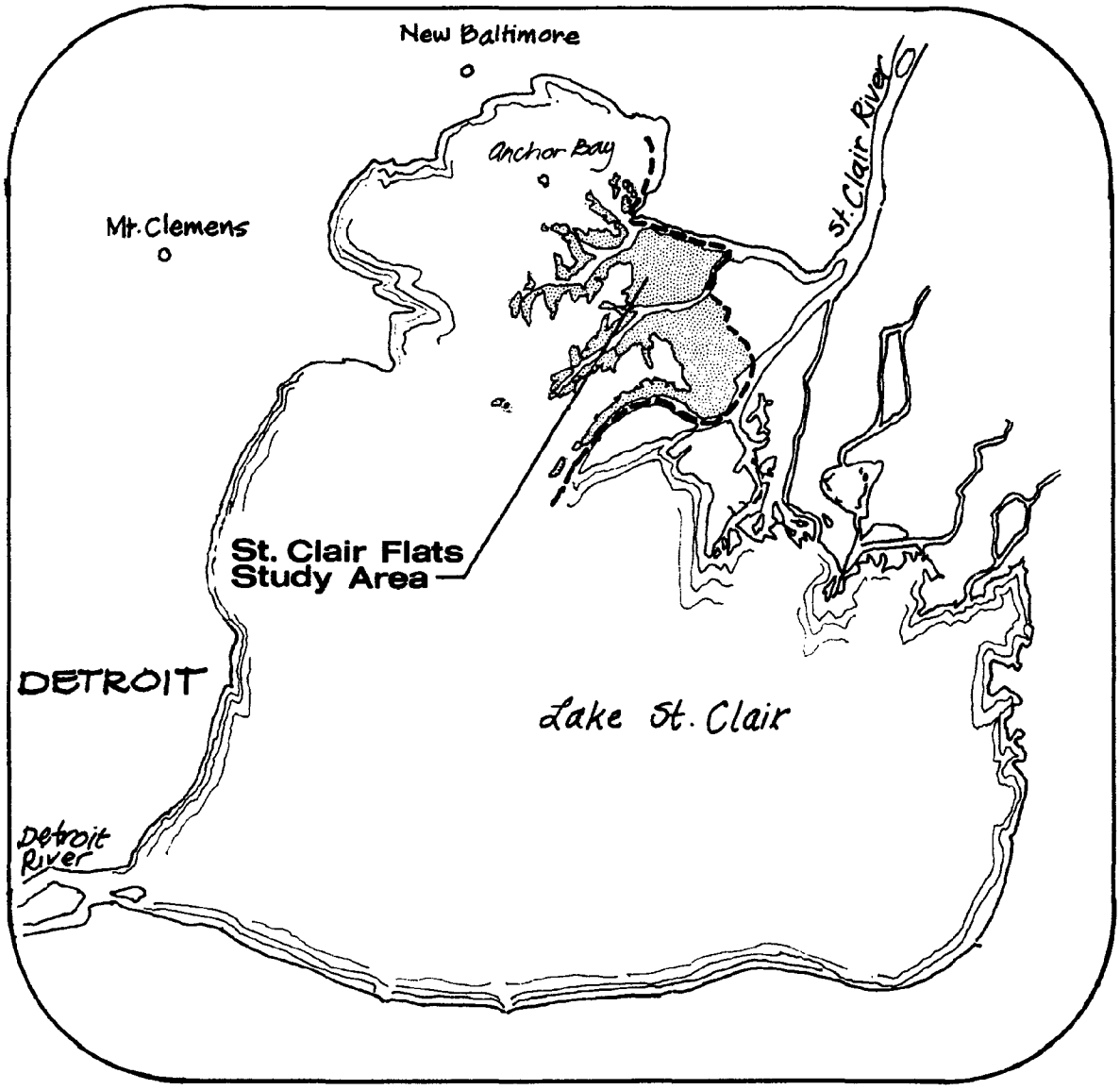


Figure 2

St. Clair Flats Regional Area

The rulings involved claims by the State that "swamplands" were State lands. A few years later the State changed its stance and held that the Flats were not "swamp or overflowed" lands, but were actually part of the bottomlands of Lake St. Clair. The new position was taken because the swamplands were eligible to be claimed by citizens under a land scrip program issued after the Civil War. By declaring the Flats "bottomlands" instead of "swamplands," the lands were retained in the name of the public trust and the public resources could be protected.

The survey provided for by Act 175, P.A., 1899 was completed in 1902, but by that time the Supreme Court had ruled that the land could not be disposed of in the manner prescribed by that Act. Because lake bottomlands were to be held in the public trust and thus could not be sold, provision was made to grant five-year leases to those occupying the land through the passage of Act 215 of the Public Acts of 1909. Act 215 was a temporary measure designed to alleviate the trespass problem, and it was repealed in 1913 with the passage of Act 326. In 1910, in the State vs. Venice of America Land Company, the Court confirmed that the St. Clair Flats were part of the bottomlands of Lake St. Clair and thus held in title by the State.

Act 326 of the Public Acts of 1913 was passed to provide for leasing, control and taxation of the unpatented overflowed lands and lake bottomlands of the St. Clair Flats owned by the State of Michigan. Act 326 specified that the rights of the lessee were subject to the paramount rights of hunting, fishing and navigation which were, and remain today, retained by the State in the public interest. Section 2(e) authorized the Department of Conservation to make and enforce regulations necessary to protect hunting, fishing and navigation rights. Such regulations have never been developed.

Although paramount right of hunting, fishing, and navigation were retained by the State, much marshland in the Flats has already been diverted for private use.

A Board of Control consisting of the Secretary of State, Auditor General, and Commissioner of the State Lands Office was originally charged with the responsibility of leasing the lands for a ninety-nine year term, divided into periods of fifty and forty-nine years. The Board was empowered to determine rental values, based on the value of the land excluding value of improvements made on the land. Original rental fees were based on an average front footage basis and were set at an extraordinarily low level. More detailed information on lease rates is presented in another section of this report.

Since the passage of Act 326, numerous acts have been adopted amending Act 326 and expanding the rights of private interests in the Flats. Figure 3 summarizes legislation dealing with the Flats. Act 92 of the P.A. 1915 amended Act 326 and provided the lessee with the exclusive rights to remove marl, stone, rock, sand, gravel or earth from the area adjoining, or immediately in front of, their property. Act 92 allowed this right to be exercised 500 feet into Lake St. Clair or 100 feet into the channels of the Flats from the low water mark, subject to the protection of public rights of hunting, fishing and navigation. Act 12, PA 1917 again amended Act 326 and provided for the forfeiture of lease rights by those who do not pay the second half of their lease rental or who are delinquent in payment of their property taxes. It also provided mechanisms for re-leasing parcels.

In 1949, an association of lessees petitioned the Legislature to authorize the conversion of leases to deeds. The lessees felt this was justified to facilitate borrowing money, protect investments in expensive improvements, and provide the "owner satisfaction" associated with a deed. As a result, Act 215 P.A. 1949 was passed. It mandated the conversion of leases to deeds of certain designated parcels along the South Channel, but retained the paramount rights of navigation, hunting and fishing for the public. More detailed information regarding the fees charged for deed conversion are discussed in a later section of this report

Act 215 also granted the Department of Conservation (now the Department of Natural Resources) the authority to dedicate certain unleased surveyed lake bottomlands of the Flats exclusively for public hunting, fishing, and other recreational uses and to determine acquisition priority for areas already leased. This provision resulted in the establishment of the St. Clair Flats Wildlife Area. The acquisition of these parcels has been accomplished as funds have become available. Approximately $64,000 has been spent on acquisition since 1952, however, most of these funds have applied to acquisition of interior wetlands within the managed wildlife area on Harsen's Island.

Six additional legislative acts have been passed since 1949, each providing for

conversion of existing leases to deeds in specified segments of the Flats. They are Act 221, P.A. 1956; Act 43, P.A. 1961; Act 107, P.A. 1961; Act 148, P.A. 1962; Act 153, P.A.1962; and Act 194, P.A. 1963. Act 107, P.A. 1961 provided that lessees could lease or deed one half of a water highway adjacent to their property if it is determined that the highway is no longer needed for navigational ingress or egress to surveyed lots, or for any other public use. In all instances, the paramount rights of navigation, hunting, and fishing have been retained by the State.

Figure 3

State Legislation Dealing Specifically with the St. Clair Flats

Act and Year	Area of Authority
Act 326, P.A. 1913 St. Clair Flats Act	– Provided for leasing control and taxation of Flats' lands subject to the paramount rights of hunting, fishing and navigation
Act 92, P.A. 1915	– Deals with leasee rights with regard to mining and dredging
Act 12, P.A. 1917	– Amends Act 326; deals with forfeiture and re-leasing
Act 215, P.A. 1949	– Provides for conversion of leases to deeds in area along South Channel; dedication of lands for the St. Clair Flats Wildlife Area
Act 221, P.A. 1956 Act 43,P.A. 1961 Act 107, P.A. 1961 Act 148, P.A. 1962 Act 152, P.A. 1962 Act 194, P.A. 1963	– Provides for conversion of leases to deeds in additional portions of the Flats. Including lots approved for deeds in 1949, a total of 652 deeds have been issued

Natural Resource and Cultural Resource Factors

NATURAL RESOURCE FACTORS

This section summarizes the inventory of the natural resource factors of the Flats. The water resources of the area are discussed, followed by a presentation of geologic history, soils, and geomorphology of the area. Finally, the aquatic and terrestrial ecosystems are described. This baseline environmental information will be utilized to characterize the area by physiographic units. These physiographic units will subsequently be evaluated to determine their sensitivity and suitability for various uses.

WATER RESOURCES

Water Quantity/Flow Characteristics

The St. Clair Flats are located at the mouth of the St. Clair River, which connects Lake St. Clair and Lake Huron. The St. Clair River is approximately 40 miles in length, 20 miles of which lie north of the City of Algonac. South of Algonac, the River divides into four distributaries which flow through the St. Clair Flats delta into Lake St. Clair. The greatest quantity of water flows through the western, or American side of the delta. Ninety-five percent of the flow of the St. Clair River is carried by the North, just five percent (Jaworski et al, 1979 p. 76; Rf. ACOE, 1968)

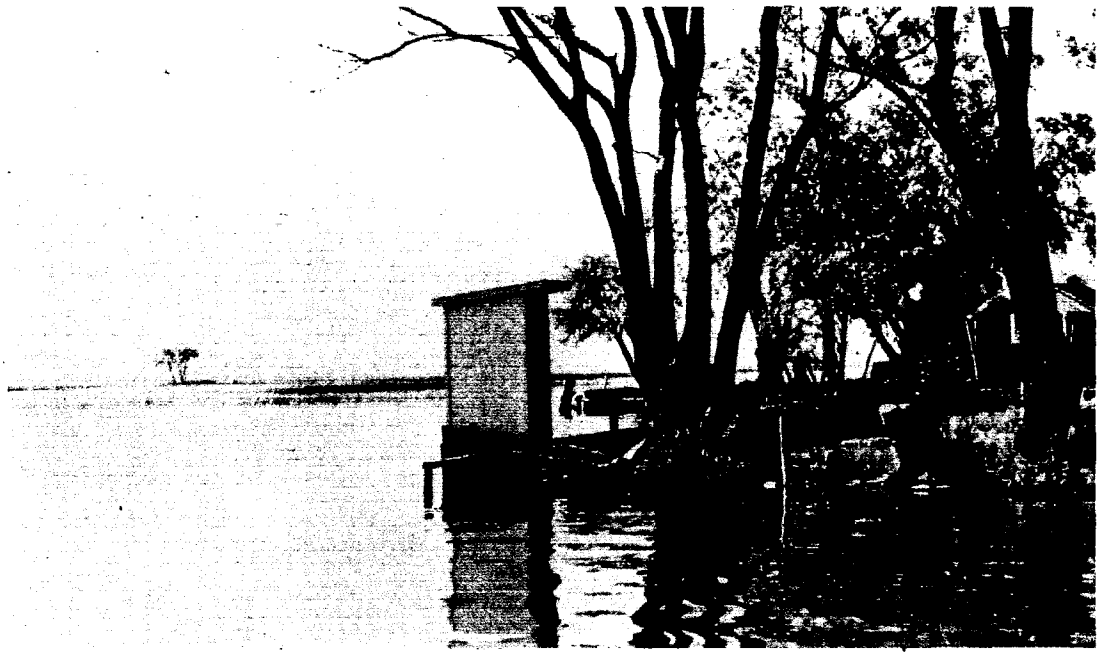
A century ago, the North Channel was the main channel, however in 1962 the St. Clair Cutoff was extended along the South Channel in order to provide a direct route for shipping. Continued maintenance dredging of the South Channel has increased the depth and flow making this channel the principle distributary. The depth of the South Channel is maintained at 35 feet. Inflow into Lake St. Clair from the St. Clair River averages about 187,000 cfs per year. The proportions borne by each channel are summarized below in figure 4.

Figure 4
Distribution of Inflow
From
St. Clair River Through Lake St. Clair

North Channel (Splits into:)	99,200 cfs
North Channel	61,800 cfs
Middle Channel	37,400 cfs
South Channel (Splits into:)	78,500 cfs
Southwest Bend	33,600 cfs
St. Clair Cutoff	37,400 cfs
Bassett Channel	7,500 cfs
Chenal Ecarte (Canadian side)	9,300 cfs

Water Quality

Discharge of sewage into the waters of the St. Clair Flats has undoubtedly degraded water quality. Privies and improperly functioning septic fields are responsible for direct or indirect discharges into these waters. According to a Michigan Department of Public Health Survey conducted in 1973, 75% to 80% of the septic systems of the Flats lie within the groundwater table. It is safe to assume that many of these septic systems are polluting the surface waters.



Unsuitable soils and high water tables place severe constraints on septic system operation. Some residents have opted for the direct disposal method: using privies which discharge directly into surface waters and pose a potentially severe health hazard.

This same survey collected samples of water from six untreated intake lines. Four samples were considered unsafe due to fecal coliform levels, while two had no evidence of contamination. The samples were drawn from an unspecified site on Harsen's Island.

In addition to these samples, the Michigan Department of Natural Resources has maintained an ongoing water quality station inventory (Data is available through the EPA's computerized "STORET" System). The nearest stations to the Flats are all located within the St. Clair River near Algonac and do not accurately reflect conditions within the interior bays, channels and wetlands of the study area. The Great Lakes Fishery Labratory is also unable to supply reliable water quality data on the interior waters of the Flats. Although data on the major channels and St. Clair River is available, the fast flow of the river and upstream influence will not indicate accurate conditions of the immediate area. Chemical sampling was performed by Environmental Control Technology Corporation (under EPA contract) in 1973 at the mouth of the St. Clair River. The samples indicated enriched levels of phosphorous, nitrogen and heavy metals. The environmental impact statement for the Dickinson Island dredge spoil disposal site (ACOE 1974) confirmed concentrations of heavy metals, especially mercury. Based upon these chemical samples, it is likely that sediment found within the wetlands is polluted and passed within the food chain to fish and waterfowls.

In conclusion, field observations and limited sampling indicate that the water quality within the Flats has been degraded. It is apparent that the water is unsafe for consumption and in some areas may be unsafe for body contact. While turbidity and chemical contamination of the wetlands is a concern, the most serious problem is the health hazard which these waters present to the occupants and users of the Flats.

Flood Hazard Areas

The St. Clair Flats is especially sensitive to flooding because of its delta formation

and low-lying elevations. Cyclical fluctuations of lake levels within the Great Lakes are the primary cause of flooding within the Flats. High water levels are also complicated by wind tides and ice jams. Record flooding occurred during the spring of 1973 and 1975, when lake levels rose to approximately four feet above the low water datum. Residents within the Flats suffered extensive property damage, and while water levels have subsided since 1973, property owners face a continual battle against shoreline erosion and bulkhead deterioration.

Because Clay Township is a participant in the National Flood Insurance Program, the Office of Federal Insurance and Hazard Mitigation has published a Flood Insurance Study which delineates the 100-year flood plain. The results of this study indicate that over 90% of the land area within the Flats is susceptible to severe flooding. The Sni, North and Middle Channel areas and most of the South Channel area is within the 100-year floodplain and thus subject to flooding.

Throughout the Flats, approximately a foot and a half of water could inundate the first floor of a home during a 100-year flood (H.U.D. Flood Insurance Study, Clay Township, State Frequency Curve). Based upon typical residential flood damage curves for homes without basements, (U.S. Army Corps of Engineers, 1974) flood damage for the 900 homes within the Flats could be as high as six million dollars. (Appendix C). In addition to flood damage costs, residents are also burdened with necessary improvements to bulkheads and shoreline stabilization structures to protect against flooding, ice damage and shore erosion.

PHYSIOGRAPHY

Geologic History

St. Clair Flats was once covered by an ancient glacial lake system. While the geologic history of the delta is complex and poorly understood, some basic conclusions concerning the geologic significance can be drawn (Jaworski and Raphael, 1973). Periodic glacial scouring and deposition of clay materials formed

the 100 to 140 foot sub-base beneath the delta. A cross-section of the delta, (Figure 5), depicts different land elevations. The land level corresponds to the pre-modern and modern surfaces which were formed during different geologic periods.

Approximately 11,500 to 12,500 years ago, the ancestral St. Clair River flowed southward. This flow was interrupted when outlets through what is now Georgian Bay were established and the level of Lake Huron dropped. Flow through the St. Clair River then ceased. This period of low water occurred between 7,500 and 11,200 years ago and corresponds to the existence of Lake Stanley-Nipissing. A subsequent rise in water level about 6,000 years ago created ancestral Lake Huron, known as Lake Nipissing, which drained southward. Leverett and Taylor believe the pre-modern delta was deposited during the establishment of Lake Nipissing (Leverett and Taylor, 1975).

The older, pre-modern delta has a surface about five feet above the level of Lake St. Clair. It lies at the apex of the delta, and is characterized by coarse, oxidized sand and primarily upland vegetation. It was dissected by long, sinuous channels which have subsequently become inactive, or "relict." The modern delta is located at the present mean lake level and is characterized by finer sediments and species indicative of moister soil conditions.

Lakeward migration of the modern delta continues today. The St. Clair River erodes materials from its banks and bed and transports these materials, along with those eroded by waves acting on the shores of Lake Huron, to Lake St. Clair. Large pebbles are transported within the fast moving channels, while finer sediments may be transported by slower moving crevasse channels, locally known as "highways." The reduced velocity in the highways results in deposition of the sediments almost transversely across the bays. Continued deposition results in filling of the bays, subsequent colonization by emergent vegetation and ultimately in lakeward extension of the delta.

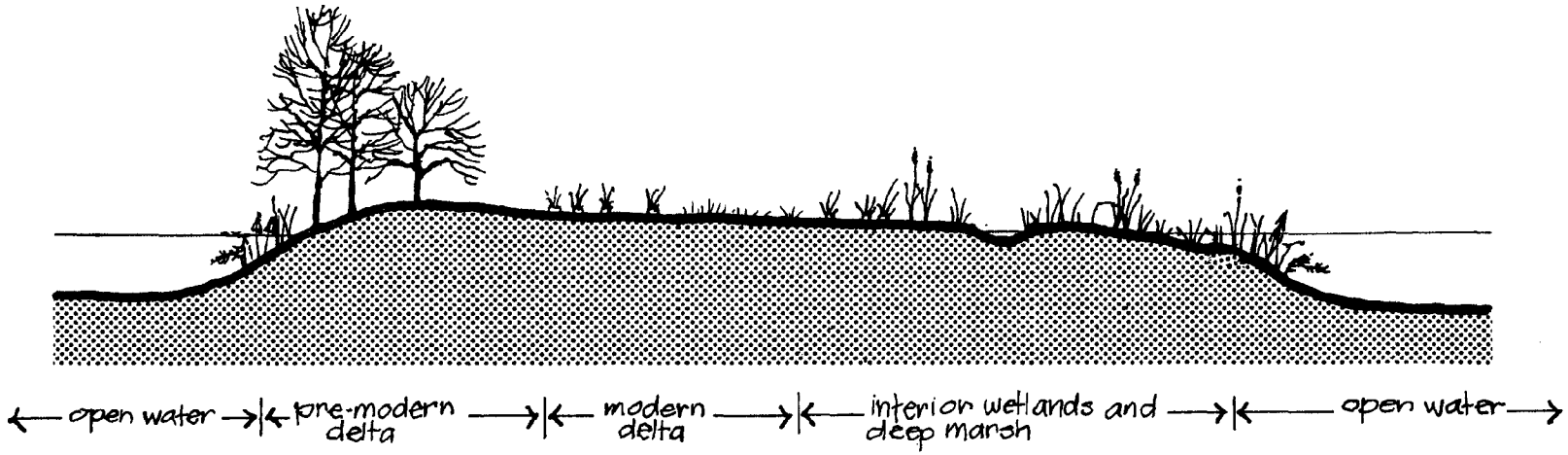
While specific rates of sediment accretion are unavailable, the growth rate of the

Figure 5

Typical Landform Cross-section

St. Clair Flats Area

not to scale



Sources: Adapted by Ayres, Lewis, Norris & May
From Jaworski and Raphael, 1979

delta can be charted by comparing surveys made in 1903, 1952 and 1961. These comparisons reveal that the delta head and delta interior lands are slowly advancing. However, the filling of the bays is a slow process. Crevasse channels are persistent features of the landscape and appear to actively transport sediments to the bays only intermittently. Even ice jams, which divert flow from the main channels through these highways, do not appear to result in much sedimentation of the interior bays. The dominant sediment size is sand which is not easily transported from the deep channels to the back bays.

A number of other factors slow delta formation. First, the annual sediment load carried by the River is small, amounting to approximately 20,000 cubic yards per year (Pezetta, 1975). The sediments are transported primarily as bedload, rather than in suspension, as is evidenced by the clarity of the water. Most of the load is transported directly into Lake St. Clair. Secondly, man's activities disrupt the natural erosive and depositional process. Maintenance dredging by the Army Corps of Engineers removes an average of 80,000 cubic yards of sediments annually. Commercial operators have been granted leases to engage in the removal of sand and gravel from the channels for many years. On a smaller scale, property owners modify shorelines by dredging and filling to protect their homes or provide boat access to their properties. The net effect of these activities has been to retard the growth of the delta. However, the delta remains an extremely dynamic system due to continual erosive and depositional action and fluctuation of Great Lakes water levels.

Geomorphology

The St. Clair Flats Delta is a unique geomorphic system. No other fresh water delta of its size exists within the United States and the area has been a living laboratory for numerous scientific inquiries. Comparisions have been made to the Mississippi River Delta which has a similar bird-foot configuration yet empties into a marine basin (Jaworski and Raphael, 1973).

Figure 6 depicts the geomorphic features of Dickinson Island. As was mentioned previously, the pre-modern delta was formed during an earlier geologic period. It is crossed by inactive or "relict" channels which may periodically become inundated and colonized by marsh vegetation. Formation of the modern delta continues today, as water-borne sediments accumulate in the bays.

Along the interior shorelines of the bays, poorly developed beaches may be found. Other features which resemble beach ridges may be found within the interior marshes. These features may represent previous shorelines which existed as delta formation occurred.

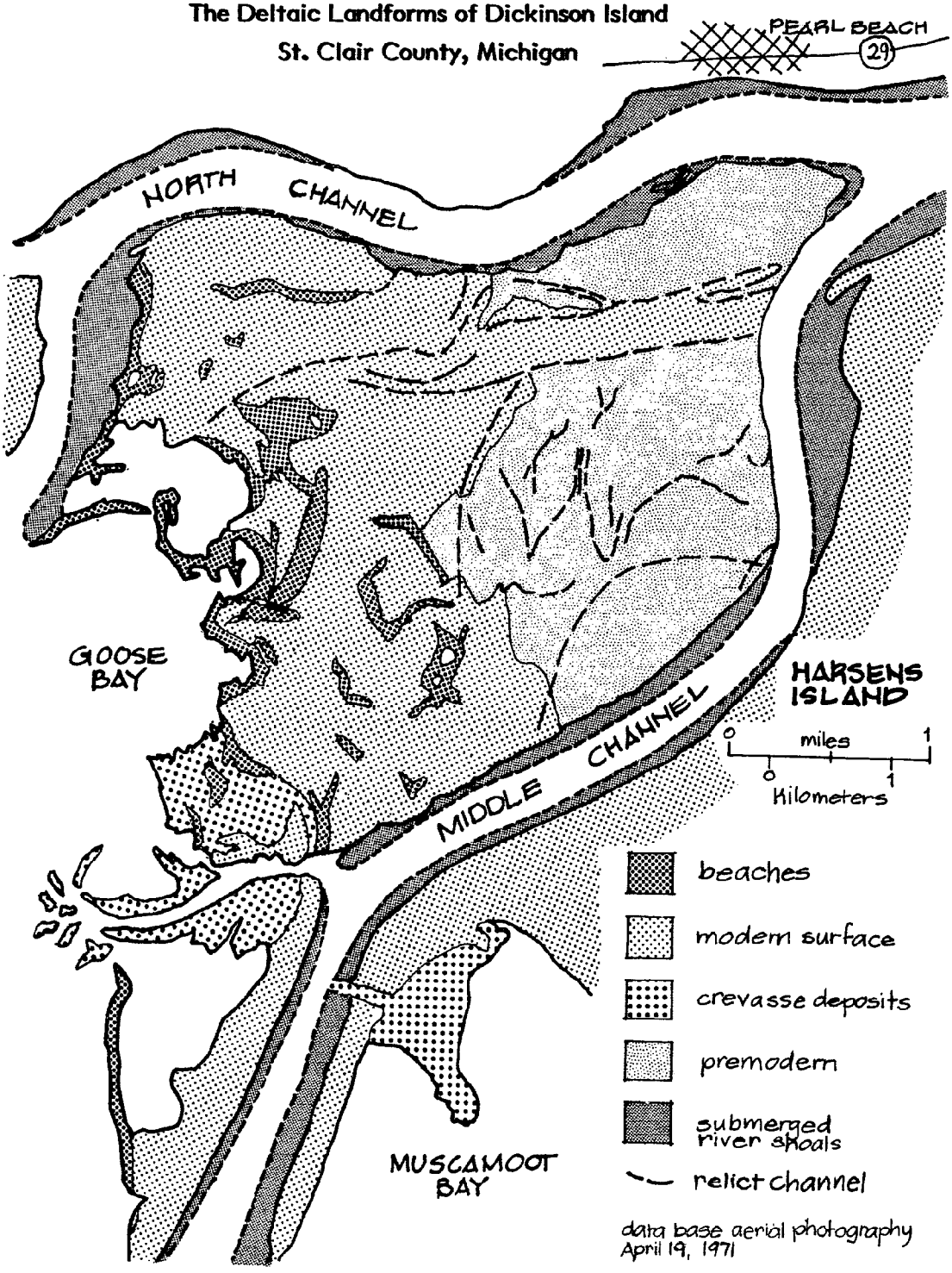
The St. Clair River divides into distributaries as it enters Lake St. Clair. These distributaries, known as the North, Middle and South Channels, average 35 feet in depth and 1,500 feet in width. However, depths of 80 feet and widths of 2,000 feet are not uncommon. The channels exhibit submerged river shoals, along both sides which may be attributed to lateral erosion of fine, sandy deltaic sediments which overlie the lacustrine clays, or to slight base level oscillations (Jaworski and Raphael, 1979). Because lake levels fluctuate only 1.5 to 2 feet annually, natural levees are poorly formed and average a few inches to 1.5 feet in elevation. Lower levees are often breeched during periods of high water and sediments are carried into the interior wetlands.

Soils

The soils of the St. Clair Flats area are classified as fine sandy soils transported from the Lake Huron Basin by the St. Clair River. As the river velocity decreases, water-borne sediment is released and deposited within the delta region. Over the years, sand accretions have created upland delta formations. The Soil Conservation Service has identified two major soil associations in the delta area. These associations are Sanilac very fine sandy loams and Bach very fine sandy loams. Both soils are poorly drained, level and characteristic of marshlands, river

Figure 6

The Deltaic Landforms of Dickinson Island
St. Clair County, Michigan



Source: Jaworski and Raphael, (1979), p. 78.

channels, and dredged lands. A high lime content is common and while certain areas are suitable for agricultural uses, the primary restriction is wetness and high water table. The high water table places severe limitations upon septic disposal fields. Michigan Department of Public Health officials estimate that 75-80 percent of tile fields in the Flats are within groundwater levels. (Michigan Department of Public Health, Field Survey, 1973). The high groundwater table does not allow effective filtration of sewage through the soils and there is little doubt that the soils within the flats are incapable of safely disposing of waste material.

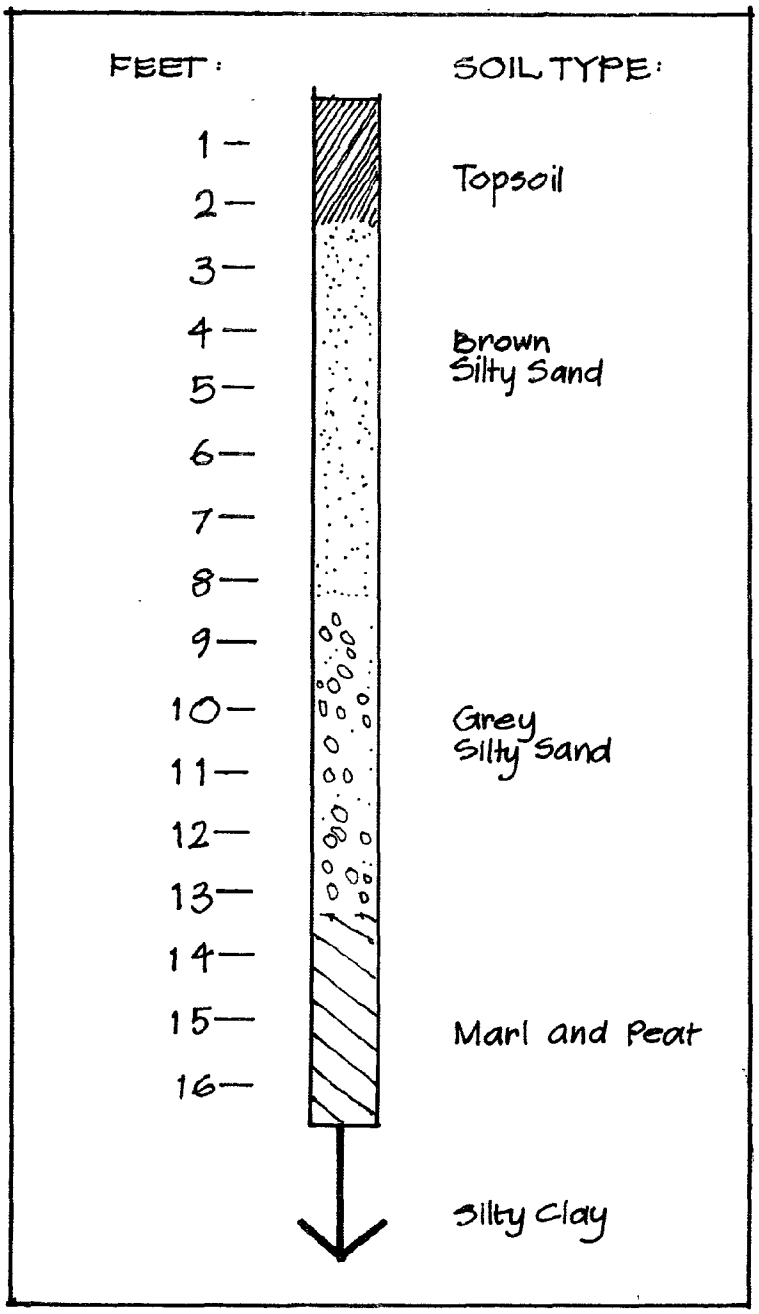
A typical soil boring is illustrated in Figure 7. The top stratum is composed of two feet of organic soils, six feet of silty brown sand, six feet of grey silty sand, and three feet of marl and peat. The bottom layers are composed of wet clays which are found down to bedrock. During spring flood conditions, groundwater is often found within 12 to 24 inches of the surface.

The wetland soils and vegetation have a unique and complex relationship within the ecosystem. Vegetation stabilizes soils, prevents erosion and allows sediments to accumulate within the delta. Nutrients are found within top soil layers and are taken up by vegetation. As the vegetative matter dies and decays, nutrients are cycled back into the soil. This process modifies soil pH and adds organic matter to fine-textured silt-laden sands.

Figure 7

Typical Soil Profile

St. Clair Flats
Delta



TERRESTRIAL AND AQUATIC ECOSYSTEMS

Coastal wetlands are extremely dynamic ecosystems which change in form and function in response to the fluctuation of the Great Lakes water levels. The St. Clair Flats is no exception, and is perhaps even more dynamic than most coastal ecosystems due to its unique deltaic geomorphology. The level of Lake St. Clair fluctuates both seasonally and annually and may vary as much as 5 to 6 feet in a 10- to 15-year period. Vegetation, fish and wildlife respond to this dynamic system and are all interdependent upon its functions.

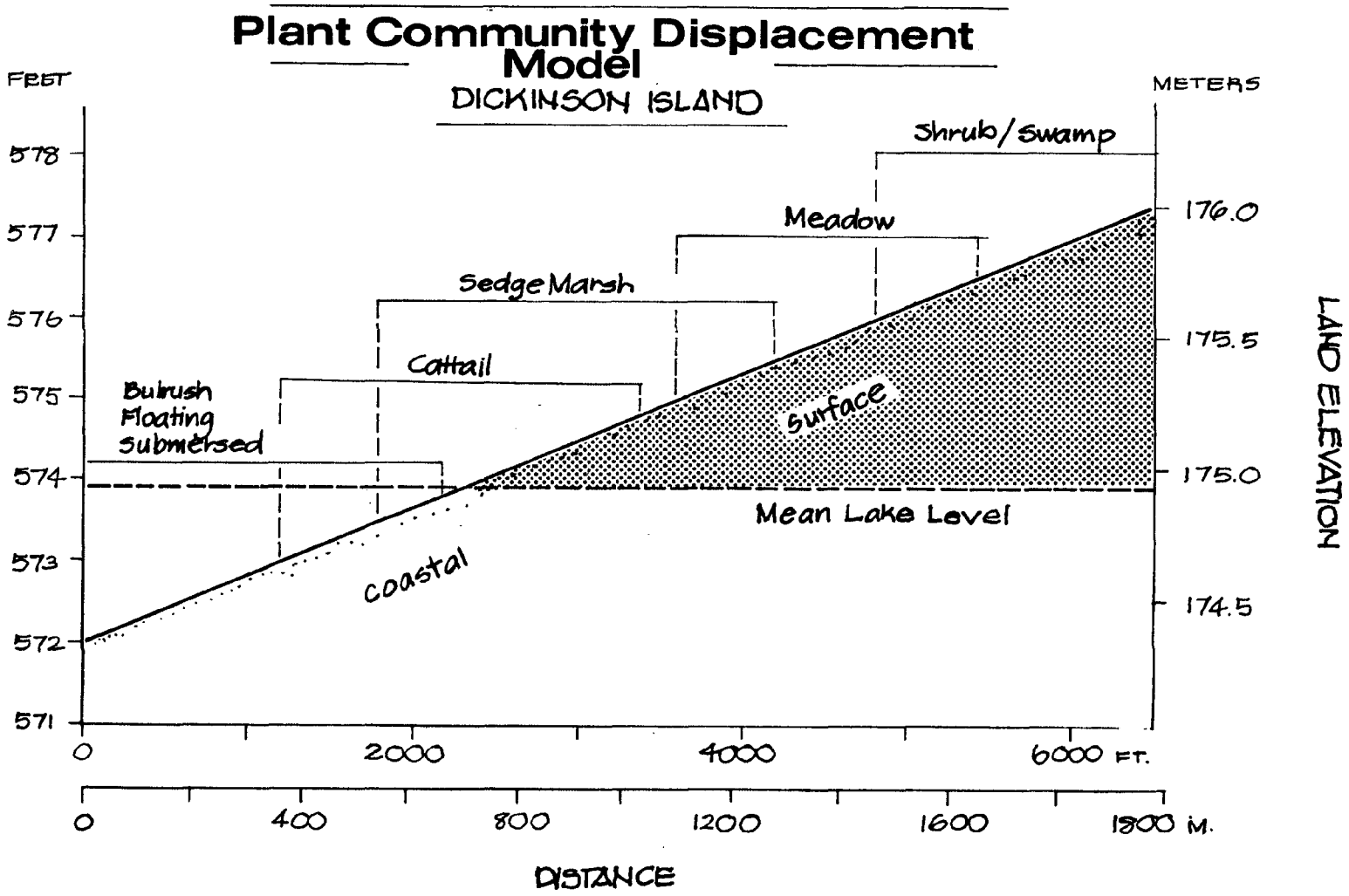
Vegetation

Vegetative communities change in response to the wetness or dryness of a site, and the boundaries of a given plant zone vary in response to these changes in water level. Subsequently, the magnitude of the use of a zone by various wildlife species and the physical function of the wetland vary in response to water level.

Submergent vegetation is found in the deepest areas, and becomes intermixed with hardstem bulrush (Scirpus Sp.), bur-reed (Sparganium Sp.) and pickerel weed (Pontederia cordata) in shallower areas. A cattail zone is found in water 6 to 12 inches in depth. Sedges dominate in the area immediately upland of the cattail zone, followed by dogwood meadow associations in slightly higher areas. Shrubs become established in areas inundated infrequently, while forests may become established on the upland areas which remain dry for long periods of time. Figure 8 depicts the relationship beween vegetation and water level as interpreted for Dickinson Island, (Jaworski and Raphael, 1979).

Vegetation in the Flats is not established in regular patterns due to the unique geomorphology of the area. For example, cattail and bulrush marshes may be found in the interior of Dickinson and Harsen's Islands in old distributary channels. Furthermore, the effects of water stress and invasion of an area by different communities may not become evident for several years after a period of low or high water.

Figure 8



Source: Jaworski and Raphael, (1979), p. 319.

Maps of vegetative changes on Dickinson Island depict how drastically vegetation associations can change over a period of years. Low water levels were experienced in 1964 and high levels in 1975. Levels in 1971 are closely comparable to those of 1979, and are representative of mean water levels. Jaworski and Raphael (1979) have studied the magnitude of these vegetative changes on Dickinson Island (See Figure 9). The sedge and meadow areas appear to change in area and extent for most all of the plant associations.

Wildlife users change with the fluctuation of water level. During periods of low water, the red-winged blackbird, short-billed marsh wren, mallard, blue-winged teal, and the muskrat are more common. Dabbling ducks may feed and breed near the remaining open water areas, while white-tailed deer, cottontail rabbits, and small rodents may also be more dependent on the wetland during low water periods. (Jaworski and Raphael, 1979)

During high water levels, wildlife diversity increases. Macroinvertebrates, amphibians, and reptiles may increase in abundance due to the increased availability of their preferred habitat (submergent vegetation in open water areas). They in turn are consumed by piscivorous birds and some fish species. (Jaworski and Raphael, 1979).

Fresh water ecosystems are among the most productive on earth. The high productivity can be attributed to the extensive growth of macrophytes and the epiphytic algae which colonize submerged substrates. Emergent vegetation, particularly cattails, is the most photosynthetically productive group of macrophytes. Extensive beds of cattail are found in wetlands, and the plant's long narrow leaves provide a large surface area for photosynthetic activity. Emergent vegetation is not consumed directly by most organisms because its high fiber content renders it difficult to digest and slow to decompose. However, seeds are consumed by waterfowl, and the vegetation does provide excellent cover for waterfowl, fish, and other organisms.

Figure 9

Areal Extent of Wetlands, by Vegetation Type
Dickinson Island Wetlands, 1949, 1964, and 1975

1949 Distribution (Low to Average Water Level)

Wetland Type	Acres	Hectares	% of Total
Wooded and Shrubs	252	102	9
Meadow (Grassy)	252	102	9
Sedge Marsh	644	260.5	23
Emergents (Cattail)	1,120	453.5	40
*Submersed-Floating	322	130.5	11.5
Developed Lands	154	62.5	5.5
Open Water	56	23	2
Subtotals	2,800	1,134.0	100.0

1964 Distribution (Low Water)

Wetland Type	Acres	Hectares	% of Total
Wooded and Shrubs	280	113.5	10
Meadow (Grassy)	252	102	9
Sedge Marsh	1,022	414	36.5
Emergents (Cattail)	1,036	419.5	37
*Submersed-Floating	140	56.5	5
Developed Lands	56	22.5	2
Open Water	14	6	0.5
Subtotals	2,800	1,134.0	100.0

1975 Distribution (High Water)

Wetland Type	Acres	Hectares	% of Total
Wooded and Shrubs	280	113.5	10
Meadow (Grassy)	112	45.5	4
Sedge Marsh	364	147.5	13
Emergent (Cattail)	784	317.5	28
*Submersed-Floating	840	340	30
Developed Lands	210	85	7.5
**Open Water	210	85	7.5
Subtotals	2,800	1,134.0	100.0

*Includes scattered colonies of hardstem bulrush and three-square.

**This category may be underestimated because some open water was included in the submersed floating-leaved wetland category.

Source: Jaworski and Raphael, (1979), p.247

The productivity of submergent vegetation is highly variable, depending on local environmental conditions. Both the submergents and floating-leaved plants have a higher nutritive value and are more commonly ingested directly by herbivores or omnivores than is emergent vegetation. Both provide prime habitat for macroinvertebrates. Floating leaved plants are restricted to quiet, protected areas (such as the southeastern corner of Little Muscamoot Bay and Mud Lake) and, as thus, are not as abundant as submerged species. Goose Bay and Big Muscamoot Bay are largely devoid of submergent vegetation due to wave action, the turbidity of the water and the sandy substratum. Growth is limited to scraggly stands of Muskgrass (Chara) which is interspersed with Najas in Goose Bay later in the season. Little Muscamoot, Fisher, and Anchor Bays are more densely colonized by submergents. Little Muscamoot is possibly the most productive. It is colonized by dense stands of Potamogeton, Chara, and Myriophyllum in the central portion, as well as some Elodea and Vallisneria. The southeastern portion is colonized by water lilies (Nymphea), pickerel weed (Pontederia), and pondweed (Potamogeton natans). (Personal communication with Charles Brown, Great Lakes Fishery Lab).

Mud Lake, in the interior of Dickinson Island, is connected to both the Sni Bora Channel and to Fisher Bay. Mud Lake supports floating leaved plants, and Fisher Bay is almost as densely colonized by submergents as Little Muscamoot Bay. Small and largemouth bass are caught in large numbers in this area.

Channel weed (Elodea) is particularly dense in Snook's Highway, Dead Tree Cut, and Big Fisher Highway. Another dense bed can be found at the mouth of the North Channel where vegetation ranges from cattail along the shore to bulrush (Scirpus) in slightly deeper water, and finally to Potamogeton and Myriophyllum in the deeper water. The current is too swift to support dense vegetative growth in the center of the channel. Instead, the growth forms bands 10 to 15 feet wide along either bank. The vegetation provides cover for fish and is often associated with excellent fishing sites.

Submergent and floating leaved vegetation is important habitat for macro-

invertebrates, which are a major food source for fish. Waterfowl also ingest macroinvertebrates, particularly during their breeding season, to help aid egg yolk formation. Myriophyllum and Elodea, in particular, are heavily colonized by mayflies, isopods, amphipods, and chironomids. Submergent vegetation is also a major direct food source for waterfowl. Elodea, Vallisneria, and Potamogeton sp. are particularly important. Food preferences and consumption patterns vary from species to species and in response to season and food availability.

Submergent vegetation is also extensively colonized by epiphytic algae, which take advantage of the large surface area provided by the finely dissected leaves of many species. Epiphytic algae is a more important primary producer in wetland communities than planktonic algae which is more abundant in open water areas. Epiphytic algae remains viable during the winter and is an important food source for aquatic organisms which are active during the winter months.

Wetlands produce more detritus than any other aquatic community in the Great Lakes. Detritus is defined as particulate organic matter which has been lost from any level of the food web. The material consists primarily of dead vegetative materials which are extensively colonized by bacteria and fungi. Detritus serves as the primary base for the food chain in wetlands, and numerous macroinvertebrates rely completely on it as their food source. In turn, macroinvertebrates are an important food source to fish, amphibians, reptiles, birds and mammals. The diversity of macroinvertebrates is high in wetlands due to the variety of habitat available and large amount of detritus found there. Detritus feeds not only organisms residing in the wetlands but is also transported to nearshore areas of open water where it is utilized by organisms not generally associated with wetlands.

The Flats are the largest wetland remaining on the American side of Lake St. Clair and must be recognized for their importance to fish and waterfowl. The extensive wetlands of the St. Clair Flats provide a source of food, as well as cover, nesting, and spawning sites, for organisms which are found throughout Lake St. Clair and surrounding area. The concentration and diversity of aquatic vegetation illustrate the importance and uniqueness of the area.

Fish and Wildlife Resources

The Flats are nationally known for the large number of fish and waterfowl species they support. They also are famous for the fishing and hunting opportunities they offer. The Flats are in close proximity to over three million residents in the southeastern Michigan area and are easily accessible to many recreational users. In 1975, Lake St. Clair accounted for approximately 50% of all non-salmonoid angler days for the entire State. It is evident that the demand for hunting and fishing opportunities near Detroit will continue.

Over the years, many of the wetlands in Lake St. Clair have been degraded or destroyed by man's activities such as dredging, filling and bulkheading. The result has been a progressive loss of habitat and a corresponding decline in fish and wildlife populations. However, the significance of the Flats for fish and wildlife production is now even greater than in the past because most of the wetlands along the western shore of Lake St. Clair have been destroyed.

Economic analyses of the value of an acre of wetland are based on values that are difficult to qualify. However, it has been estimated that the value of sportfishing in lower Harsen's Island is $324.00 per acre of wetland per year, (Jaworski and Raphael, 1978). In comparison, the value of waterfowl hunting is approximately $31.00 per acre of wetland per year. These calculations are based upon annual expenditures by sportsmen and revenues generated by these activities.

Fisheries

Lake St. Clair, the St. Clair River, and the marshes and bays around the delta support a diverse array of fish species which spawn, feed, or utilize the Flats as cover. Some species migrate through the area as the seasons change and as they enter different periods in their life cycle. Others are found in the Flats year round. A list of species may be found in Figure 10.

Figure 10
Fish Species Found in the St. Clair Flats

Sportsfish

– Salmonoids –	– Non-Salmonoids –
Chinook Salmon	Yellow Perch
Coho Salmon	Walleye
Steelhead	Northern Pike
Rainbow Trout	Muskellunge
Brown Trout	Pan Fish (Bluegill, Pumpkinseed, Rock Bass, Green Sunfish)
Splake & Splake Backcross	Black & White Crappie
Atlantic Salmon	Sauger
	Lake Sturgeon*
	Largemouth Bass
	Smallmouth Bass
	White Bass

Forage Species	Underutilized Species
Rainbow Smelt	Channel Catfish
Banded Killifish	Carp
Silver Chub*	Black Bullhead
Brook Silverside	Brown Bullhead
Mottled Sculpin	Yellow Bullhead
Trout Perch	Freshwater Drum (Sheep's Head)
Log Perch	Turbot
Blackchin Shiner	Mooneye*
Golden Shiner	Red Horse*
Lake Emerald Shiner	Lake Whitefish
Spotfin Shiner	Bowfin (Dogfish)
Spottail Shiner	American Eel
Blackstripe Topminnow	Common Sucker
Bluntnose Minnow	Quillback Carpsucker
Least Darter	Hog Sucker
Johnny Darter	Spotted Sucker
Northern Greenside Darter	Grass Pickerel
Brindeled Madtom	Longnose Gar
Tadpole Madtom	Goldfish
Stonecat (Madtom)	Bigmouth Buffalo
Alewife	
Gizzard Shad	

Parasitic Species

Silver Lamprey
Sea Lamprey

*indicates endangered species

Source: Personal communication, Ron Spitler, DNR District Fish Biologist

Lake St. Clair is the most valuable non-salmonoid sports fishery in the Great Lakes. Figure 11 illustrates the non-salmonoid sportfish catch and fishing effort in Lake St. Clair versus other Michigan Great Lakes. In 1975, 48% of the fishing effort and 33% of the Great Lakes fish catch were attributed to Lake St. Clair. More walleye, bass, and centriarchid panfish were taken from Lake St. Clair than from any other Great Lakes water body. More than half of the state's muskellunge are caught there (Jaworski and Raphael, 1978). These figures are particularly impressive in light of the Lake's small size and can be tied to both the extreme productivity of the area and its accessibility to the large population of southeastern Michigan.

There are no ongoing fish management programs in the immediate area. Steelhead and brown trout were stocked in the North Channel adjacent to Decker's Landing in the past, and an experimental walleye rearing program was conducted in the marshes of the Wildlife Area. The walleye evidenced exceptional growth, but recovery of the fish was unsuccessful. (Personal communication Pospichal, DNR Wildlife Division). Steelhead, coho salmon, and chinook salmon have been stocked in other portions of Lake St. Clair and may be caught in the Flats, particularly in the North Channel and St. Clair River at the northern end of the delta.

Commercial fishing has been nonexistent in the United States side of Lake St. Clair and the St. Clair River since the 1930's, except for the temporary fishing for catfish in the 1960's. The only commercial fishery in the Lake is operated by the Walpole Indians of Ontario, who fish for northern pike in the wetlands of Walpole Island.

Lake St. Clair general spawning requirements and habitat preference of the most popular sportfishes can be found in Figure 12. Northern pike and muskellunge spawn in emergent vegetation adjacent to Dickinson Island, (MDNR, EIS, 1975a, p. 11) and probably in Little Muscamoot Bay. Smallmouth and largemouth bass spawn in deep cattail marshes. Smallmouths have been observed on reeds in southeastern Little Muscamoot Bay and both large and smallmouths are found in the Fisher Bay/Mud Lake area. Yellow perch spawn in shallow waters throughout the marsh.

Figure 11

Michigan Non-Salmonoid Sportsfish Catch and Fishing Effort in Lake St. Clair vs. Other Michigan Great Lakes Waters, 1975

Lake	Yellow Perch	Walleye	Bass	Panfish	N. Pike	% of Total
St. Clair	6,803,060	809,030	399,500	1,490,900	114,410	33
All Others	17,856,660	96,560	329,630	1,294,040	168,300	67
TOTAL	24,659,720	905,590	729,130	2,784,940	282,710	100

	Angler Days	Percent of Total
St. Clair	1,996,990	48
Others	2,137,750	52
TOTAL	4,134,740	100

Source: Jamsen, (1976), p.6

Figure 12

Spawning Requirements and Habitat Preferences of the Primary Sportsfish of the Flats

Species	Timing and Location of Spawning	Feeding and Cover	Year Round (Y) Migratory (M)	Fishing Season and Locations in Lake St. Clair
Yellow Perch	April – May; after pike. spawn in shallow water over submerged vegetation and brush	throughout the area, especially channel fringes and marshes	Y	Year Round
Walleye	April; Thames River, Canada; cold, clean, running Clinton & St. Clair Rivers	channels, marsh fringes, open lake	M	Year Round Spring: St. Clair River All season: North Channel
Northern Pike	Late March – April; sedge meadows (shallow marsh)	protected bays, marshes	Y	May 15 – Feb 28
Bass				
Large Mouth Small Mouth	Mid-May – Mid-June; deep cattail marshes	marshes (in reeds and cattails, channel edges, Anchor Bay weed beds	Y	June 16 – Dec 31 Marshes, all season Small Mouth in channels midseason, also
White	Mid-May – Mid-June;	channels	Y	Year Round
Rock	June – July;	marshes, channel edges	Y	Year Round
Muskellunge	Early June; deepest part of Anchor Bay	migrate counter-clockwise around Lake St. Clair; weed beds in lake/channels	Y	June 3 – Dec 15
Panfish				
Bluegill Pumpkinseed Crappie	Late June; after bass. cattail marsh "shoreline"	throughout area (especially channel fringe and marshes)	Y	Year Round
Lake Sturgeon	May; St. Clair River and North Channel, deep "holes"	channels, deep "holes"	Y	Year Round
Salmonoids				
Brown Trout Rainbow Trout Chinook Salmon Coho Salmon Steelhead Splake X Lake Trout	(stocked)	channels – spring and fall migrants steelhead and browns more extended periods	M	April – May (St. Clair River) May (North Channel) Year Round

Spawning grounds during spawning season are particularly sensitive areas. However, it should be emphasized that protection of these areas alone will not insure the continued high production of the species. Fish move to different habitats during different periods of their life cycles and for feeding or cover. Therefore, it is a misconception to believe that protecting one unique habitat type will insure the continued productivity of a species.

Bulkheading with backfill is one of the most destructive practices on fish productivity. Bulkheading destroys the natural gradient of the lake bottom. Most of the Flats is so shallow that small changes in water level may be evident in a ten to fifteen foot area. When bulkheads are constructed and the natural gradient is destroyed, water levels fluctuate a foot or two along a shear bulkhead wall. A portion of the habitat to fish is lost. Research into gabion structures to replace bulkheads has been proposed. Gabions are composed of large rocks and would provide a more gentle transition between the land and water. The resulting habitat would be more favorable to fish than bulkheading.

Dredging is not always harmful to fish. Dredging may provide fish access to interior wetland and provide for the exchange of nutrients. However, the benefits of the dredging have to be carefully weighed against the environmental costs associated with increased turbidity and loss of habitat. Effects of dredging are likely to be less detrimental in open water areas than in marshes if the sediments are unpolluted. Filling is typically more detrimental because it is most often proposed in shallow, marshy areas which are vegetated and utilized extensively by fish and waterfowl. Unfortunately, much of the wetland alteration in the Flats has occurred in these shallow marshy areas which are especially productive for fish and waterfowl.

Figure 13 indicates the tolerance of some common fish species to turbidity siltation and pollution. While the tolerance of species varies, some generalizations can be made. Species which are more tolerant are not considered to be desirable for sport fishing. The diversity of species decreases in response to siltation and chemical

Figure 13
Fish Species Inhabiting Coastal Wetlands Which are Tolerant to Siltation, Turbidity, and Pollution

Species Tolerant to an Increase in Turbidity and Siltation

Gizzard Shad	White Crappie
Bigmouth Buffalofish	Black Crappie
Channel Catfish	Green Sunfish
Brown Bullhead	Sauger
Black Bullhead	Freshwater Drum (Sheepshead)

Species Tolerant to Organic and Inorganic Pollution

Common White Sucker
Carp
Goldfish

Source: Pinsak and Meyer, 1976, as cited by Jaworski and Raphael, (1978).

pollution. Large predators such as northern pike and bass, and forage minnows such as blacknose and golden shiners decline in numbers. Fast growing detritivores increase. This trend has been observed in Lake Erie where less valuable species such as freshwater drum, alewife, gizzard shad, carp and goldfish have become predominant (Great Lakes Basin Commission, 1975a, p. 165).

Waterfowl and Wildlife

Michigan is situated at the intersection of the Atlantic and the Mississippian Flyways. An estimated three million waterfowl migrate annually through the State, including large numbers of dabbling and diving ducks. Canadian geese, snow geese, blue geese, swans and coots are also commonly found.

Lake St. Clair is crossed by the primary migratory corridors utilized by the dabbling and diving ducks and the secondary corridor utilized by Canada geese. The principle migration corridors of whistling swans, canvasback, buffleheads, and the ruddy ducks extend diagonally across the state from the northwest to the southeast with a resting stop in Lake St. Clair. The Lake is characterized by extensive beds of submergent vegetation and relatively calm waters which make it an attractive resting place. It is a nationally recognized concentration area for canvasbacks, redheads, scaups and buffleheads. A recent study (Dawson, 1975) suggested that only a small portion of the submergent macrophytes and invertebrates available to migrant ducks in Anchor Bay is being used. This is probably because of hunting pressure and disturbance by boaters and fishermen which force the main flocks out before they deplete food supplies, (Dawson, 1975).

Studies conducted on Harsen's Island indicate on the average, 72 to 103 nesting pairs of ducks may be found per square mile. Each pair has an average of 7.5 acres of wetland. The number of young which can potentially be produced is .96 per acre, (Martz, undated, and Martz, 1976).

In addition, a large number of redheads and canvasbacks breed on Harsen's Island

along the South Channel in the unfilled marshes between the road and residential properties. (Personal communication, Elden and Pospichal). Mallards also nest there and in other portions of the Flats.

Portions of the St. Clair Flats are managed for waterfowl production. Hunting is prohibited in two open water areas south of Anchor and Goose Bays in an area designated by Presidential proclamation as the St. Clair Wildlife Refuge. This area is protected by the Fish and Wildlife Service. Lower Harsen's Island is managed by the MDNR Wildlife Division for waterfowl production and is known as the St. Clair Flats Wildlife Area. The objectives of the wildlife management program are to:

1) provide food, cover and sometimes needed protection for peak populations of upwards to 150,000 migrating waterfowl;

2) to provide quality hunting opportunities for waterfowl on a fair and equitable basis to the public;

3) to provide viewing and other nonconsumptive uses to the public during migration period; and

4) to provide breeding habitat for the production of 4,000-5,000 waterfowl per year. (MDNR Wildlife Division, St. Clair Flats Wildlife Area Master Plan, 1977-1987)

A twenty-three mile long system of dikes provides total control of water levels in the Wildlife Area. The area is comprised of two marsh units, totalling 1,600 acres, and ten agricultural units, totalling 1,100 acres. In 1977, a total of 850 acres of food crops were planted, including corn, mullet and buckwheat grains.

In addition to the vast number of hunters who use the remaining 20,000 acres of the Flats, the St. Clair Flats Wildlife area is utilized by 6,000-7,000 hunters during the 50-day season, and more seek permits than there are available reservations.

Seventy-three percent of the 1977 kill was comprised of mallards. A substantial number of green-wing teal, black ducks, pintails, and baldpates were also killed (see Figure 14). It is estimated that the area could accommodate up to 12,000 hunters if the management program is expanded. Proposals for future programs include diking and managing portions of Dickinson Island for waterfowl. Dickinson Island is essentially uninhabited and undeveloped at the present time.

In addition to being a waterfowl concentration area, the Flats is extensively utilized by shorebirds, seabirds and marsh wading birds. Shorebirds include several species of sandpipers, lesser yellowlegs, Wilson snipe, dowitcher, killdeer, black-bellied plover and upland plover. These birds concentrate on exposed mudflats which are especially available during low water years. Seabirds include several species of gulls and terns, many of which are present year round. They can be observed on old pilings and other objects emerging from the water. Representative species include herring gull, Bonapart's gull, ring-billed gull, common tern and black tern.

Marsh bird species include egrets, bitterns, rails and herons. Especially significant is a large great blue heron rookery which is located in the southeastern corner of Dickinson Island. In May 1972, 125 occupied nests were counted in two hours of observation. (U.S. ACOE, 1975). Herons and egrets can be observed hunting throughout the Flats during much of the year. In addition, 170 species of upland, non-game, water-oriented and terrestrial birds can be observed throughout the year. Pheasants are managed concurrently with waterfowl.

A variety of mammals inhabit the Flats including racoons, muskrats, fox squirrels, rabbits, foxes, deer, skunks, opossums, weasels, and a few minks. Muskrats are the most numerous, and the annual hunting take is 5,000-7,000 animals. Racoons are the second most hunted mammal. A small local deer population offers limited hunting opportunity. However illegal kill during the off-season, (year-round), keeps the deer population low. Rabbits and fox squirrels are indirectly managed by the

Figure 14
Species Kill Data 1976-1977
St. Clair Flats, Michigan

1976			1977		
Mallard	5,646	73%	Mallard	5,898	73%
Black	512	7%	Greenwings	612	8%
Baldpate	399	5%	Black	582	7%
Greenwings	382	5%	Pintail	521	6%
Pintail	376	5%	Baldpate	244	3%
Ringneck	117	1.5%	Ringneck	63	
Bluewings	116	1.5%	Bluewings	48	
Gadwall	42		Black x mallard	24	
Wood duck	35		Gadwall	21	
Lesser scaup	31		Hooded merganser	16	
Goldeneye	23		Wood duck	13	
Black x mallard	14	2%	Bufflehead	12	3%
Bufflehead	14		Lesser scaup	11	
Hooded merganser	12		Shoveler	9	
Shoveler	10		Goldeneye	3	
Greater scaup	10		Greater scaup	2	
Common merganser	3		Redhead	2	
Ruddy duck	2		Ruddy duck	1	
Redhead	1				
Pintail x baldpate	1				
Mallard x pintail	1				
Subtotal	7,747			8,082	
Canada goose	62		Canada goose	40	
Snow goose	1		Snow goose	1	
Coot	16		Coot	5	
			Snipe	1	
			Pheasant	33	
Subtotal	79			80	
Total	7,826			8,162	

Sources adapted by Ayres, Lewis, Norris & May, Inc. from:
St. Clair Flats Wildlife Area Master Plan
Department of Natural Resources, (1977)

provisions of cover. Nonagricultural and brushy areas and meadows provide nesting sites and summer food, and the frozen cattail and sedge marshes provide excellent winter cover.

Unique Habitats; Endangered, Threatened, and Rare Species

The value of a wetland can be determined by documenting unique biological and geological characteristics. The geologic and geomorphic uniqueness of the St. Clair Delta has already been described and has resulted in the development of a variety of habitats and species associations.

The normal successional patterns of a wetland are disrupted by fluctuations in water level. However, the unique geomorphology of Dickinson Island including the uplands associated with the pre-modern delta and the interior marshes found in the low former distributary channels make several successional zones present at all water levels. Each zone is characterized by vegetation tolerant of various water depths. The boundaries of these zones may change with fluctuation in water levels, but each persists throughout the course of time (Jaworski and Raphael, 1979). Dickinson Island has a diverse array of habitats and species.

J. T. Curtis (1959) classified Wisconsin prairie vegetation on the basis of soil moisture conditions. Wet prairie environments are unique in Michigan, and seven of ten indicator plant species have been found on Dickinson and Harsen's Islands. Thirty-eight percent of the probably extinct, threatened, or endangered species occupy or have occupied aquatic and wetland habitats (Beaman, 1977). It is likely that more plant species have been lost from wetlands than from any other habitat. Endangered, threatened and rare plants which have been documented in the Flats are presented in Figure 15.

Endangered bird species do not reside year round in the St. Clair Flats. However, the American peregrine falcon, the bald eagle, the osprey and snowy owl are occasionally sited in the Flats. The red-Shouldered hawk (a threatened species),

the rare black crowned night heron, and the American bittern are common visitors. In addition, a great blue heron rookery is located near the southwest corner of Dickinson Island. The endangered lake sturgeon is found in the area and is believed to spawn in the North Channel. Other endangered or threatened fish found in the area include the mooneye, red horse, silver chub and sauger (Harsen's Island, 201 Facilities Plan).

Figure 15
ENDANGERED, THREATENED AND RARE FLORA OF THE ST. CLAIR FLATS

Key: Endangered (E); Threatened (T); Rare (R);

Location	Species
Harsens Island	Panicum liebergii (T)
Harsens Island	Triplasis purpurea (T)
Harsens Island	Asclepias sullivantii, Sullivant's milkweed (T)
Harsens Island	Cirsium hillii, Hill's Thistle (T)
Harsens and Dickinson Islands	Habenaria leucophaea, Prairie Fringed Orchid (T)
Harsens Island	Fimbristylis puberula, (T)
Dickinson Island	Rudbeckia fulgida, var. sullivantii, Sullivant's Coneflower (T)
Harsens Island	Zinzania aquatica, Wild Rice (T)

Source: Wagner et al., 1977; additional sources as cited, as adapted from Jaworski and Raphael, 1978.

Other Functions of the Wetland

Besides providing food and cover for numerous aquatic and terrestrial organisms, coastal wetlands such as the Flats serve other functions which are difficult to quantify. Emergent vegetation in particular helps dissipate current and wave energy, and may in fact help abate shoreline erosion in the delta. No quantified information is available at the present time. Wetlands also serve as effective sediment traps, and nutrients are immobilized by wetland vegetation. While some nutrients are returned to the system upon the death and decay of the plants and are transformed by various microbial processes, the net effect seems to be a reduction in concentration of nutrients in the water.

The hydrology, retention time and nutrient cycling relationships associated with wetlands are difficult to measure and quantify and information on this is generally unavailable. However, wetlands are dynamic, complex ecosystems. In the case of the St. Clair Flats, the uniqueness of the area cannot be attributed to any single species of plant or animal. Rather, its importance can be attributed to the large size of the area and the role it plays in maintaining the viability of the flora and fauna of Lake St. Clair and adjacent ecosystems.

CULTURAL RESOURCE FACTORS

Although the Flats is a unique biologic and geologic resource, it has been utilized and developed by humans for a long period of time. An inventory of cultural resource factors includes land and water uses, zoning ordinances, housing, and utilities. Information on the local economy and tax base are also included to assess the effect of changing policies on the economic well-being of the area. Finally, State and Federal legislative mandates applicable to the Flats are presented. Cultural data must be studied in combination with natural resource factors to obtain an accurate picture of baseline conditions in the area.

LAND AND WATER USE

The entire delta has a history of use by Native Americans. Ojibwa, Potawatomi, and other eastern woodland tribes occupied the area seasonally to utilize the vast food supplies available. European settlement began on Dickinson Island, formerly known as Stromness Island, as early as 1790. The current land use of the St. Clair Flats area is a mixture of open, residential and commercial uses. Lands are primarily open or vacant and the majority of these lands are State-owned and included within the St. Clair Flats Wildlife Area. Residential uses are located throughout Harsen's Island with higher densities of development occurring along the main channels. Densities average three to four units per acre along the waterfront while lower densities are prevalent on the northern and inland portions of the island. Dickinson Island is predominantly uninhabited except for approximately 30 seasonal homes on the east end of the island. The Army Corps of Engineers owns and manages two dredge disposal sites on the north end of the island. The sites are expected to revert to State ownership once filling of the diposal areas is completed.

The smaller, isolated outer islands maintain a mixture of open and residential lands.

North Island, Strawberry Island, McDonald Island, and Bruckner Island support numerous seasonal residences. In addition to these islands, the southwestern portion of the delta contains many other smaller islands and wetland areas.

Hunting, fishing, and water-related recreation have been popular in the area since the early 1900's and population increases within southeastern Michigan have been accompanied by increased recreational demands. Wildlife management programs have responded to these demands and the Flats offers numerous recreational opportunities for sport hunting and fishing and boating.

The productivity of the wetlands and the close proximity to the Detroit metropolitan area has made the Flats one of the prime duck hunting areas in the State. Although duck hunting is prevalent throughout the Flats, hunting data is available for the DNR-managed St. Clair Flats Wildlife Area. For example, during a single hunting day in 1976, 1,099 duck hunting applications were submitted for the 535 daily hunting permits available.

In addition to duck hunting, the Flats is an extremely popular sport fishing area. Fishing activity within the lower Harsen's Island area was estimated at 100,000 angler days for 1975. Recreational demand forecasts for the State indicate that fishing will continue to be one of the more popular outdoor activities. Given the tremendous success rates of fishermen within the Flats, there is every reason to believe that fishing activity will continue at a high rate.

Pleasure boating is another prevalent means of recreation. The many islands and the calm inland bay waters of the Flats provide attractive surface waters for many boaters. Boat registration within a short cruise of the Flats is well over 100,000 and the outlying islands are a convenient destination for boaters from the Detroit Metropolitan area. It is suspected by some MDNR personnel that heavy boat traffic disturbs spawning and nesting habitat and has a detrimental impact upon wildlife resources. Specific data on the exact impacts of boating traffic in unavailable; however, future boating demands will place additional burdens on these

areas and will pose additional problems for fish and wildlife management. Boating activity is particularly heavy on summer weekends and Gull, Firecracker, and Strawberry Islands have been extensively used by pleasure boaters. The over-use of these stop-over islands and the accompanied problems of litter and human wastes have prompted some local authorities to suggest that facilities be constructed to control the abuse of these islands.

Outlying islands, without sanitation or recreational facilities, are intensively used as stopover points during the summer months. Sand Island, shown here, is one of several stopover islands in the Flats.

Residential land use in the St. Clair Flats includes a mixture of types, conditions, and values. Within the study area, there are approximately 900 housing units, the majority of which are seasonally used. A few year-round residents are located on the off-islands, but most are found on Harsen's Island and along the South Channel.

The 1977 DNR field survey of parcels in the Flats included a review of housing conditions on leased parcels. Appriximately 10% of dwellings along the Middle Channel, 20% on the North Channel, and 10% on the Sni Bora were classified as deteriorating. In general, these three channels contained the homes in the poorest condition. Homes along the South Channel and homes with automobile access are generally in better condition than homes on isolated islands.

Transportation of building materials by boat is difficult and remodeling or improvement efforts are restricted. Many home owners with structures on leased lands may also be reluctant to invest large funds on a parcel with a limited lease. Finally, many units are serviced with only limited utilities. Electrical power is not available to all homes and provision of water and available wastewater disposal methods present serious problems. In summary, the homes in good condition have access to roads or utilities and are located on properties that have been deeded by the State.

Deteriorating homes are common in the Flats. Lack of road access makes transport of building materials difficult, and the local condemnation procedure is a slow and lengthy process.

Local township officials are empowered to condemn structures which are in violation of building codes. The condemnation process is a lengthy procedure which involves notification, hearings, committee review and court proceedings which can ultimately impose an ordered lien against the property. Approximately 10 condemnation proceedings have been held within the past two years, resulting in the condemnation of several buildings. However, many other dilapidated, unsafe structures are still standing due to the time and effort required of local authorities to condemn these structures, and because the law makes every effort to protect the property rights of the homeowner.

Utilities and Services

The entire delta is currently without a central wastewater collection system, and disposal is limited to on-site septic fields and direct discharge into surface waters. Unsuitable soils, the high water table, and limited lot sizes render the proper operation of septic systems nearly impossible. Most severe septic problems occur during periods of high water when ground and surface waters inundate the fields and prevent percolation. In addition to inadequate and improperly functioning septic systems, many seasonal residences have privies which discharge effluent directly into Lake St. Clair.

A sanitary survey was conducted in 1973 by the Michigan Department of Public Health to assess development and occupancy on Harsen's Island. Approximately ten percent of the homeowners were interviewed at that time. Sewage was observed ponded on the ground surface in some areas, and an estimated 75-80 percent of the tile systems were in the groundwater table at that time. The remainder of the septic fields were believed to be no more than 12-18 inches above the water table.

In 1974, Judge Halford Streeter of the Circuit Court of St. Clair County issued a ruling that prohibited issuance of building permits or septic permits in Clay Township until a series of conditions was met. These conditions included:

- A sewage treatment facilities plan for Harsen's Island
- Application for federal grants to plan and construct a system

A facilities plan has since been completed for Harsen's Island. The cost of sewer construction of approximately $12,000 per homeowner (over 17 million dollars for the system) are extremely high due to the high water table, soil conditions and scattered development. Less costly alternatives are presently being considered and include nonconventional systems such as composting toilets or cluster septic systems. However a detailed study of these alternatives has not been made and will not likely begin until 1980. It should be noted that the study of alternative systems would only address problems on Harsen's Island and not consider sewage disposal on other islands.

The Streeter Order also prohibited the Township from issuing "further building permits which will cause or threaten to cause any additional degradation of the waters of this state. . . ." The Township has issued approximately six new building permits in the Flats since 1977, in spite of the Streeter Order. At the time of this writing the Water Resources Commission has been notified and a course of action will be forthcoming.

In August of 1979, representatives from the DNR, Michigan Department of Public Health and the St. Clair County Health Department field inspected two septic field sites on Harsen's Island. Soil borings and visual inspection revealed evidence of extremely high water table and very poor land disposal capability. In addition, the size of the lots were insufficient for adequate isolation distances. In one case, the septic field was within 30 feet of open water. Unfortunately, these examples are typical of most septic systems within the study area. It is evident that a potentially serious health hazard exists under these conditions and there is a possibility that a serious disease outbreak could occur.

The St. Clair County Board of Health is responsible for issuing septic system permits and acting on nuisance complaints. Most applications for the construction of new systems in the Flats are denied by the County sanitarian because few areas are suitable. However, the applicant can appeal the decision to an appeals board comprised of three of nine members who rotate in hearing appeals. The appeals

board is composed of one from each of the following groups: three township supervisors, three "professionals," and three Board of Health members. Denials are often overturned. If the denial is upheld, an applicant can appeal again at a later date. The local sanitarian inspects construction of the septic system, yet the inspection does not insure proper operation due to the high water table and minimal lot sizes.

Due to the lack of time and manpower, the County Board of Health does not actively search for violations, but instead acts on complaints of septic system failure. It is their general policy to issue septic permits for replacement or repair of the septic system. Structural repair will eliminate some problems; however the high water table remains as the major limitation. In some cases, the County has required elevated replacement fields so that the drainage field and water table are isolated. In these situations, the tile fields are mounded above the original grade with up to two feet of sandy soil. This helps to isolate effluent from the groundwater but can also cause drainage and seepage to flow into a neighboring system. Even if all problems are not mitigated, improvements are often made. Improvement of an existing system is often the most which can be accomplished for structures which have been permitted.

In the period from January 1, 1978, to July 10, 1979, a total of 35 septic permits were issued in the Flats, including northern Harsen's Island, where most residences are found. Figure 16 summarizes the issuance of septic permits.

Figure 16
Septic Permits Issued in the Flats
January 1978 to July 1979

	Type of Application			
	New	Replacement	Nuisance Abatement	Total
1/1/78-12/31/78	9	9	3	21
1/1/79-7/10/79	4	10	-	14

The study area is presently without a central water supply system. Potable water is transported to the islands in containers due to concerns over possible contamination of water. Many households use water obtained from intakes which extend into the Channels or from shallow wells. The shallow wells yield low quantities of water and lack protection from surface water contamination. Deeper wells penetrate an aquifer with a high brine content. Construction of a waterline to Harsen's Island to provide island residents with a reliable source of safe drinking water was recently begun. Water will be available at a centralized location, at the north end of Harsen's Island, and residents can fill containers for household use. Problems will remain with use of contaminated containers and continued use of more convenient wells and intake.

Electric power and telephone service is supplied to all the major islands within the St. Clair Flats. A few of the smaller, remote islands also have power and utility easements for electrical transmission over State lands. The remote off-islands near the Sni Bora Channel and isolated islands near Goose Bay are without electrical service.

Most homes within the study area are without furnaces or home heating equipment. Those homes that are winterized are dependent upon bottled gas or fuel oil which is transported to the island by ferry. The seasonal vacation homes rely upon electric heat or firewood during cold weather periods.

In summary, provision of utilities is limited within the Flats. The island configuration, high water table and remote setting restricts normal services. While most residents do not mind the electrical and heating limitations, a more serious problem involves water supply and wastewater disposal. Contamination of surface waters seriously endangers public health and contributes to water quality degradation.

Local Economy and Tax Base

Job producing activities within the study area are not significant due to the non-industrial uses of the islands. The majority of year-round residents on Harsen's Island commute to the mainland for employment. These uses are largely dependent upon the recreational and boating industries and service the needs of both the residents and non-residents of the islands. Commercial uses are located upon deeded parcels within the study area and are listed below:

Bars and Restaurants	Marinas
Brown's	B & E
Four B's	Minnick's
Four Winds	Snyder's
Idle Hour	St. Clair Flats Marina

Payments in lieu of taxes by the State on State-owned lands contribute a small share to the local tax base. More importantly, these lands provide the major recreational attraction to the area. Federal lands include the Army Corps of Engineers dredge disposal sites on Dickinson Island and the U.S. Coast Guard Station on the South Channel.

The major portions of the tax base is contributed by residential properties. State Equalized Valuation (SEV) for the study area is approximately 10 percent of the entire SEV for Clay Township. The majority is assessed to deeded parcels that are found along the South and Middle Channels. State-leased properties within the Flats contribute only 1.5 percent to the total Township SEV.

EXISTING REGULATORY AUTHORITY

Local, State and Federal regulatory authority establishes the procedures and rules applicable to various activities. This authority provides the framework within which the implementation of the management plan must be structured. Significant legislation and regulatory authority pertinent to the Flats is summarized in Figure 17 and described below.

Land and Water Management

A variety of federal, state, and local laws apply to the land use and water management of the St. Clair Flats. The most important of these laws are concerned with administration of the Flats by the State and local land use regulations by the Township.

State Programs Specific to the Flats

The St. Clair Flats Act P.A. 326 of 1913 is currently jointly administered by the MDNR Lands Division and Division of Land Resource Programs. The Lands Division accepts, records, and acknowledges all applications for the transfer, leasing, or deeding of eligible parcels in the St. Clair Flats, and sends copies of the applications and other pertinent information to the Division of Land Resource Programs. The Lands Division handles appraisals to determine the value of leased lots on applications for deeds.

The Division of Land Resource Programs, upon receiving copies of an application from the Lands Division for a lease, deed conversion, change in use, or fractionalization of a lot solicits comments from other Divisions and the Department of Public Health. Upon receiving comments, Land Resource Programs decide whether the application should be approved or denied. If necessary, special conditions are included in the final agreement to protect the parcel or restrict its use.

Figure 17

Legislation Relating to the St. Clair Flats

	Federal	State	Local
LAND & WATER MANAGEMENT	Coastal Zone Management Act, 1972 (16 USC 1452) National Flood Insurance Act of 1974 Flood Disaster Protection Act	Soil Erosion & Sedimentation (Act 347, P.A. 1970) Shorelands Protection & Mgmt., Flood Risk Areas (Act 245, P.A. 1970) Great Lakes Submerged Lands (Act 247, P.A. 1955, as amended)	Clay Township Building Codes & Zoning Ordinance
DREDGE & FILL	River and Harbor Act (1899) - Section 10 Federal Water Pollution Control Act (1972) PL 92-500 - Section 404 Fish and Wildlife Coordination Act (1934, + amendments)	Great Lakes Submerged Lands (Act 247, P.A. 1955, as amended)	
WATER QUALITY-PUBLIC HEALTH	Federal Water Pollution Control Act PL 92-500 (1972) - Section 201 Municipal Wastewater Treatment Works NPDES Permits (administered by MDNR, Water Quality Division)	Public Health Code, (Act 368, P.A. 1978) Water Resources Commission Act, Act 245, P.A. 1929, (amended by Act 118, P.A. 1972) The Privies & Water Closet Act (Act 136, P.A. 1881) The Outhouses Act (Act 273, P.A. 1939) St. Clair Flats Act (Act 326, P.A. 1913)	St. Clair County Board of Health and local appeals board, County Sanitary Code and Regulations
MISCELLANEOUS LEGISLATION	Federal Refuse Act National Solid Waste Act Endangered Species Act (PL 93-205) National Environmental Policy Act of 1969 (42 USC 4321-4327) Estuary Protection Act (16 USC 1244; 82 Stat 627)	Solid Waste Management Act, (Act 641, P.A. 1978 Endangered Species (Act 203, P.A. 1974) Michigan Environmental Protection Act (Act 127, P.A. 1970)	

Although authorized by Act 326, regulations which evaluates the impact of parcel conveyance and use on the public rights of hunting, fishing and navigation have never been developed. Nevertheless, recommendations of the Land Resource Programs Staff are based on consideration of the purpose and legality of the application, impacts on the public interest and public trust, impacts on the environment, and compliance with existing land use plans, coastal zone management plans and other related policies and programs. If the decision is contested in Court,the Division of Land Resource Programs must address all questions about their decision regarding the application.

Upon becoming involved in the management of the Flats in 1977, the Division of Land Resource Programs conducted a study and field inventory to collect current information regarding the disposition of lots in the Flats. Figure 18 provides a summary of information obtained from this study. Through fractionalization of parcels, the 1,868 lots contained in the original 1902 survey have been increased to 2,172 lots. Of these lots, 953 lots are state owned, not under lease or deed. There are 567 lots leased and 652 deeded.

Low fees charged for leases and deed conversions have been a major inducement for the large number of lots which have been deeded and leased. These low fees have been a result of both the mandates of the legislation as well as past administrative policies of the Department of Natural Resources. In addition, the fractionalization of leased parcels have been permitted by the Department compounding the existing public health and sanitation problems.

As discussed previously, Act 326 established base rental fees. The original rental fees were based on average front footage in accordance with the following schedule:

Figure 18

Summary of Deeded and Leased Parcels

St. Clair Flats, 1977

Segment	Total Parcels	Number of State Owned Parcels	Area Approved for Deeds				Area Approved for Leases		
			Deeded Parcels	Leased Parcels in Area Approved for Deeds					
				Total Leases	Full Lots	Frac. Parcels	Total Leases	Full Lots	Frac. Parcels
South Channel	687	137	466	84	42	42	0	0	0
Muscamoot Bay	44	30	---	0	0	0	14	14	0
Middle Channel	497	127	100	45	19	26	225	116	109
Goose Bay	53	53	---	0	0	0	0	0	0
Sni Bora	531	323	36	12	11	1	160	79	81
Anchor Bay	48	48	---	0	0	0	0	0	0
North Channel	312	235	50	5	1	4	22	10	12
TOTALS	2172	953	652	146	73	73	421	219	202

Total State-Owned Parcels	953
Total State-Owned Leased Parcels	567
Total Deeded Parcels	652

Source: Adapted by Ayres, Lewis, Norris & May, Inc from:
Department of Natural Resources
Survey of the St. Clair Flats (1977)

Figure 19
Original Lease Rental Fees, as provided by Act 326

Section	Main Channel Frontage	Interior Channel Frontage
South Channel	75 cents per foot	50 cents per foot
North Channel	40 cents per foot	20 cents per foot
All Other Channels (including Middle and Sni Bora)	20 cents per foot	20 cents per foot

The original rental fees reflected a rate far below market values and actually encouraged development of valuable wetland habitat. For example, an average lot might have 200 feet of frontage and be 500 feet in depth (approximately 2.3 acres). The lease averaged $75.00 for the first 50 years, or about $1.50 per year plus taxes. This is equivalent to a rental of $32.60 per acre for 50 years or less than 70 cents per acre per year. Legislation stipulated that rental for the second term could not exceed twice the charge assessed during the first term of the lease. Those who applied for a lease prior to this legislation under Act 175, P.A. 1899 or Act 215, P.A. 1909 did not have to reapply.

Act 215, PA 1949 provided for the conversion of leases to deeds for certain parcels along the South Channel. On September 8, 1949, the Conservation Commission approved a policy for arriving at the consideration for a deed. The policy stated:

1) Land values only will be considered and not the improvements such as dredging, leveling off, sheet piling, docks, buildings, and other improvements.

2) In arriving at the land value, consideration will be given to the fact that the State will retain the paramount right of navigation, hunting, and fishing.

3) When the applicant is a lessee, the appraisal value of the land will be reduced to allow credit for the unexpired term of the lease for which rental has been paid. The present appraisal value less this credit will be the consideration for the deed.

The Commission further elaborated on this policy. First, relating to Item 1 above, the original appraisals made for leases were considered to serve as a guide for establishing land values without improvements. However, because the original legislation provided that the rental fee for the second term of the lease should not exceed twice the original fee, it seemed reasonable to consider twice the original rental fee as a fair appraisal of present land value exclusive of any man-made improvements. Therefore, appraisals were to be calculated at twice the average or $1.50 per front foot for property fronting on the South Channel, and $1.00 per front foot for property fronting on canals in the rear of the South Channel.

In accordance with Item 3 above, appraised values were to be adjusted to give credit for the unexpired lease term. An exception was to made if a lease was issued in recent years at a rental appraisal considerably more than the average appraisal mentioned above. In those instances, credit due the lessee could have reduced the appraisal to a nominal amount. To counteract this possibility, a minimum appraisal of $25 was adopted.

On July 12, 1963, the Conservation Commission directed the Department to revise the 1949 formula for converting a lease to a deed to more accurately reflect current market values of property in the Flats. In determining market value, the value of structural improvements was not to be considered. Further, credit was to be given for the unexpired term of the lease. Although the Lands Division of the Department revised the 1949 formula and conversion fees were increased, the revised formula allowed conversion at fees still substantially below market values. The revised formula established the following front-foot conversion rates:

Middle Channel	$2.00
Sni Bora Channel	1.50

South Channel	3.00
Interior Channel	2.00
Interior Lands not on Water	1.00

This formula has been used since 1963 and accounts for the incredibly low prices for deed conversions. For example, the fees charged for deed conversion on the South Channel have been $3.00 a waterfront foot while current market prices have averaged between $80.00 and $100.00 a waterfront foot. In April 1973, the minimum deed consideration was raised from $25.00 to $100.00, yet this minimum hardly reflects the true market value of property in the Flats. Since the 1963 formula went into effect, over 400 deeds have been issued. The extremely low prices of the past have contributed to increased development, lot splitting and profit taking resulting in the alteration of valuable wetlands and State-owned bottomlands.

Other State Programs

Other State regulatory programs are significant to land management in the Flats. Three statutes administered by the Department of Natural Resources; the Great Lakes Submerged Lands Act, the Shorelands Protection and Management Act and the Soil Erosion and Sedimentation Control Act are applicable to the Flats.

The Great Lakes Submerged Lands Act (Act 247, P.A. 1955, as amended) was originally passed to clear title to unpatented Great Lakes' bottomlands filled prior to 1955 and to regulate filling of these bottomlands. The Act has been amended to regulate construction activities on both patented and unpatented bottomlands, convey marina leases, and allow the State to enter into agreements for the use of State-owned bottomlands.

The definition of the Flats as swamps or bottomland was clouded for some time

and there was confusion as to whether Act 247 applied to the Flats. On August 19, 1977, the Attorney General opinioned that the Flats is subject to the mandates of Act 247 and permits are required for any future activities involving the alterations or modifications of the bottomlands of the Flats.

One of the basic objectives of the Shorelands Protection and Management Act (Act 245, P.A. 1970) is to protect new construction from flood damage and flood hazard. Implementation of the law is to be accomplished by local zoning ordinances or regulations which have received MDNR approval, or in the absence of such ordinances, directly by the DNR through site plan permits. The Flood Insurance Study conducted for the National Flood Insurance Program was completed for Clay Township in 1978 and the Township is scheduled for designation as a flood hazard area under Act 245 in 1980. Upon designation, DNR will review Clay Township's Flood Damage Prevention Ordinance for conformance with the provisions of Act 245. This act also provides for the designation of environmentally sensitive areas. However, such environmental areas are to be situated within 1,000 feet landward of the ordinary high water mark (OHWM) established in Section 2 of Act 247, P.A. 1955, as amended. While portions of the St. Clair Flats lie below the OHWM, other areas are above the OHWM and thus eligible for designation as environmentally sensitive areas.

The Soil Erosion and Sedimentation Control Act, Act 347 P.A., 1972, provides for the prevention of soil erosion and control of waters of the state by the regulation of any activity which disturbs one or more acres of land or occurs within 500 feet of a watercourse. The principle regulatory tool is a state-approved construction permit program developed and implemented by a local or county enforcement agency. Certain designated "authorized public agencies" are exempt from the permit requirements. This statute applies only infrequently to construction activities in the Flats because it regulates man-made changes in natural cover or topography of the land (Section 2(7)). The most disruptive activities in the Flats involve creation of new land by bulkheading and filling.

Local Programs

The Clay Township Zoning Ordinance covers Harsen's, Dickinson, and the outlying islands of the Flats. All of Dickinson Island and most of Harsen's Island is zoned single-family residential. Limited areas on Harsen's Island are zoned commercial and one area on the north end of the island is zoned for mobile home parks.

There has been considerable question regarding the relationship between local zoning and State-owned, leased lands in the St. Clair Flats. Legal research on this question was sought from Diana V. Pratt, Attorney-at-Law, from Ann Arbor.

Pratt reports that the question of whether publicly-owned land is subject to local zoning has been extensively reviewed by the Courts of the nation. Michigan Courts, until very recently have wrestled with the individual fact situations presented, but have not followed a coherent and consistent rule. That situation was corrected by the Supreme Court in Dearden vs. Detroit, 403 Mich 257 (1978). After a review of the case law, the Court held:

> The common thread running through these cases, although not clearly stated in some is an attempt to determine the intent of the Legislature when deciding whether a governmental unit is subject to a municipal zoning ordinance. We hold today that the legislative intent, where it can be discerned, is the test for determining whether a governmental unit is immune from the provisions of local zoning ordinances.

The Court applied the test in the Dearden case, finding that the Legislature specifically established the jurisdiction of the Department of Corrections.

> Subject to constitutional powers vested in the executive and judicial department of the state, the department shall have exclusive jurisdiction over the following: . . . (c) penal institutions . . .

The Court found on this basis that the Legislature intended the Department of Corrections to be immune from local zoning. Other case law, although not applying the test, has provided guidance in ascertaining legislative intent.

The issues in regard to St. Clair Flats can be resolved by ascertaining the legislative intent. The St. Clair Flats Act does not state whether the State lands in question will be subject to local zoning. The Township Rural Zoning Act addresses only conflicts with conflicting ordinances and not with statutes. The provisions of the leases themselves are not helpful. The Clay Township Zoning Ordinance, however, provides a means for resolution of potential conflict.

> Whenever any provision of this Ordinance imposes more stringent requirements, regulations, restrictions or limitations than are imposed or required by the provisions of any other law or ordinance, then the provisions of this Ordinance shall govern. Whenever the provisions of any other law or ordinance impose more stringent requirements than are imposed or required by this Ordinance, then the provisions of such ordinance shall govern.

The Ordinance further states:

> In the interpretation and application, the provisions of this Ordinance shall be held to be minimum requirements adopted for the promotion of the public health, morals, safety, comfort, convenience, or general welfare. It is not intended by this Ordinance to repeal, abbrogate, annul, or in any way to impair or interfere with any existing provision of law or ordinance, or with any rules, regulations or permits previously adopted or issued or which shall be adopted or issued pursuant to the law relating to the use of buildings or premises; provided, however, that where this Ordinance imposes a greater restriction than is required by existing ordinance or by rules, regulations or permits; the provisions of this Ordinance shall control.

The Zoning Enabling Act, as interpreted by Dearden, supra, is intended to permit local government regulation of land use. Because there is no statutory provision to the contrary, the zoning ordinance provides a means for resolving land use conflicts. If the DNR by rule or by the terms of a lease or deed issued after the enactment of the Zoning Ordinance, July 27, 1967, imposes a more stringent restriction on use of the land in question, that rule, deed or lease provision will

control. Otherwise, the provisions of the zoning ordinance apply. If, however, a rule or the terms of a deed or lease became effective prior to the enactment of the Zoning Ordinance, under Detroit vs. City of Wixom, the DNR, the owner, or the lessee may have a vested interest in that use. The zoning ordinance has a provision dealing with vested rights:

> Nothing in the Ordinance shall be interpreted or construed to give rise to any permanent vested rights in the continuation of any particular use, district, zoning classification or any permissible activities therein; and, they are hereby declared to be subject to subsequent amendment, change, or modification as may be necessary to the preservation or protection of public health, safety and welfare.

If an existing use is not permitted in the Ordinance, it may continue but as a non-conforming use.

Where the State retains ownership of the land and has not and will not lease or deed it away, the State will likewise be bound by the more stringent requirements, either of the Zoning Ordinance or its own rules. Where the State use is controlled by a statute other than the St. Clair Flats Act, the legislative intent will control. The private user will not be able to claim immunity from zoning except in the very restricted case, where the use is specifically exempted from zoning by statute.

In regard to the sale of unleased lands, Section 2c, specifically states:

> Any of the lands described in Section 2a, not now or subsequently under lease may, in the discretion of the Department of Conservation, be sold and deeded in the same manner, in consideration of the payment of a sum to be determined by the Department of Conservation by using the method provided by Section 9 of Act No. 326 of Public Acts of 1913: Provided, that should the applicant seek to use said lands for other than residential purposes, that pending the enactment of zoning ordinance by the Township of Clay of the County of St. Clair, such other use shall comply with the usual requirements of the Department of Conservation in such regard.

All uses of these lands other than for residential purposes must comply with the zoning ordinance if it exists at the time of the sale, unless the purchaser complies with DNR requirements. Where there is a conflict between the DNR requirements and the zoning ordinance, the more stringent standards apply whether the origin of the standard is with the DNR or the Township.

No distinction need be drawn between leased lands and leased lands that can be deeded. The St. Clair Flats Act in Section 2a provides:

> The deeds shall contain the same provisions as to use and occupancy as now set forth in all leases heretofore granted under Act No. 326 of Public Acts of 1913, as amended.

Under Dearden, supra, the use of the land, whether by the owner or lessee, is controlling. Where there is no statutory exemption of private use of these lands under lease, the lease and subsequent deed is subject to the zoning ordinance.

The final question concerns uses of the property instituted prior to the enactment of the zoning ordinance. If the use complies with the ordinance, it may continue so long as the ordinance is not changed to disallow the use. Where the use does not conform to the Ordinance, it may continue but only as a nonconforming use. The Clay Township Zoning Ordinance makes provision for nonconforming uses. Here again, if DNR requirements are more stringent, they will control.

In summary, eligibility for immunity from local zoning provisions is determined by use of the land and the user, and not by the owner of the land. State and local governments are only exempted from the local zoning when the Legislature has intended that the particular uses are exempt. Private users will have to comply with local zoning except in the rare instances, where the particular use has been exempted by the Legislature. Land uses that are not in conformity with the provisions of local zoning at the time the ordinance becomes effective are treated as nonfonforming uses and must comply with the applicable sections of the local zoning ordinance.

As a participant in the National Flood Insurance Program, Clay Township has adopted a Flood Damage Prevention Ordinance. The ordinance requires that sanitary sewage systems minimize or eliminate infiltration of flood waters into the sewage disposal system. In addition the ordinance requires that new construction be elevated above the base flood elevation. New building permits within the Flats must be scrutinized by the local officials prior to the granting of a building permit. Strict enforcement of the ordinance would deter or significantly alter some development in the Flats. However, use of the variance provisions of the ordinance have allowed construction to continue.

This structure may be in compliance with the local Flood Damage Prevention Ordinance. However, problems associated with shore erosion and lack of an adequate sewage disposal system remain.

Federal Programs

The Coastal Zone Management Act, (PL 92-582) of 1972, provided for assistance and encouragement to coastal states to develop and implement rational programs for managing their coastal zones. Michigan's coastal zone management plan received federal approval in 1978 and is now in the implementation phase. The St. Clair Flats is included within the designated coastal zone area. A federal consistency provision in the Act requires all federal actions to be consistent with the State program to the "maximum extent practicable." Included are all federally conducted and supported activities such as the issuance of federal licenses or permits and federal financial assistance programs. An exception may be made to the federal consistency requirement if the proposed federal activity or program is found to be in the overriding national interest.

The federal consistency requirements are significant to the management of the Flats. Federal activities such as the location and management of dredge disposal sites in the Flats must be consistent with State objectives. The issuance of Section 10 and Section 404 dredge and fill permits must also conform to State plans for the area.

Public Health and Water Quality

The Water Quality Division of the DNR administers both the Federal National Pollution Discharge Elimination System for point source discharges into surface waters and the state permit program for discharges into the groundwater. These permitting programs have limited applicability to the Flats since they deal primarily with nonresidential dischargers and municipal wastewater plants with discharges over 10,000 gallons per day. The primary water quality problem in the Flats is the discharge of sewage from "privies" or improperly functioning septic fields. The most pertinent legislation regarding this problem is the Water Resources Commission Act 245, P.A., 1929.

Under Act 245, direct or indirect discharge of human wastes into waters of the State are illegal. Section 6(b) of Act 245, P.A. 1929 states:

> "The discharge of any raw sewage of human origin, directly or indirectly into any waters of the state shall be considered prima facie evidence of a violation of this section by the municipality in which the discharge originated . . ."

Act 245 clearly regulates discharge activities. It also establishes water quality standards. The administrative rules of the Act (Rule 62) state that the waters of the State shall not contain more than 200 fecal coliforms per 100 milliliters for total body contact recreation. Available water quality samples do not provide evidence of a violation of these standards; however, it is believed that if samples are taken near suspected problem areas, the samples would reveal excessive fecal coliform limits. In order to verify suspected violations, updated and extensive water quality sampling is strongly recommended.

In addition to Act 245, two other acts concerning water quality apply to the Flats. The Privies and Water Closets Act, Act 136, P.A. 1881 and The Outhouse Act, Act 273, P.A. 1939. Act 136 empowers state or local officials to adopt sanitary regulations. Act 273 outlines minimum standards and regulations. Some "privies" are still in use within the Flats and are in direct violation of Act 273 P.A. 1939 and Act 245, P.A. 1929.

Finally the State has authority within the Public Health Code Act 368, P.A. 1978, to intercede in situations of "imminent danger" to public health. Section 2251(3) of the Act states:

> "If the director determines that conditions anywhere in this state constitute a menace to the public health, the director may take full charge of the administration of state and local health laws, rules, regulations and ordinances applicable thereto.

Imminent danger is defined as: "a condition or practice which could reasonably be expected to cause death, disease or serious physical harm . . ." To date, the State Department of Public Health has not interceded in the Flats to mitigate existing public health problems.

On the local level, the County acts as the enforcement agency for public health. The St. Clair County Health Department has adopted Sewage Disposal Regulations which specify design requirements for septic fields. Isolation distances are outlined within the regulations and require:

- 2-1/2 feet between the invert of tile field and top of the high water mark

- 25 feet separation between tile field and open water

The 1973 Michigan Department of Public Health sanitary survey for Harsen's Island estimated that the high water table was no more than 12 to 18 inches below grade for well over 50% of the systems surveyed. It can therefore be concluded that an isolation distance of 2-1/2 feet is impossible to maintain for all septic systems in the study area. State guidelines require as much as 4 feet isolation between tile field and groundwater and 100 feet between tile field and open water. In summary the County regulations are lenient and reflect a sympathetic attitude towards local residents and their soil conditions.

Dredge and Fill Activities

Section 10 of the River and Harbor Act of 1899 was passed by Congress to prohibit unauthorized obstruction or alteration of any navigable water used for past or present interstate commerce, up to the administratively determined "head of navigation" (Federal Register,42, No. 138, 329.10). Permits are required from the Army Corps of Engineers for the alteration or obstruction of any of these waters. The purpose of this Act is to facilitate navigation. The four main channels of the Flats are included in this definition of "navigable waters" and are subject to the corresponding rules and regulations.

The Army Corps of Engineers also regulates by permit the discharge of dredged or

fill materials into navigable waters under the mandates of Section 404 of the Federal Water Pollution Control Act Amendments of 1972, (P.L. 92-500). Included are all waters previously designated under Section 10 plus those waters between the "head of navigation" and headwaters of a stream. Through court rulings the jurisdictional authority of this Act has been expanded to include wetlands. Under the Fish and Wildlife Coordination Act and related memos, the U.S. Department of Interior, Fish and Wildlife Service, and the U.S. Environmental Protection Agency review all permit applications regarding impact on the fish and wildlife resources and environmental integrity of the area.

On the State level, the Great Lakes Submerged Lands Act, P.A. 247 of 1955 is the major piece of legislation controlling dredge and fill activity in the Flats today. This intent of Act 247 has been previously discussed in the section entitled Other State Programs.

Miscellaneous Legislation

The National Environmental Protection Act, (1969), provided that environmental impact studies (EIS) would be required for all federally supported or funded projects. The Army Corp of Engineers prepared an EIS for the diked dredge disposal area which was subsequently constructed on Dickinson Island. A related state act, the Michigan Environmental Protection Act, (Act 127 of P.A. 1970), also exists. This Act enables any public and/or private party to take any other party to Court if it is believed that pollution, destruction or impairment of natural resources is taking place or is likely to take place.

Under the authority of the Endangered Species Act of 1973,(P.L. 93-205), an endangered species program was organized in Michigan. Michigan Public Act No. 203, The Endangered Species Act of 1974, was subsequently passed. The first State list was presented to the Natural Resources Commission in February, 1976. As determined by Beaman (1977), 38% of the probably extinct, threatened or endangered species occupy or have occupied aquatic or wetland habitats. It is

believed that more plant species have been lost from wetlands than any other habitat. While there are no endangered birds which reside in the Flats, they may pass through the area. Included are the American peregrine falcon, the bald eagle, and the osprey. As discussed in a previous section of this report, several species of plants and animals which have been classified as "threatened" or "rare" do reside in the Flats. These legislative mandates are important to insure these species and habitat critical to them are protected.

Physiographic and Cultural Units

PHYSIOGRAPHIC AND CULTURAL UNITS

The baseline natural resource and cultural data presented in Part III of this report has been organized into physiographic and cultural units. These units organize the data in an understandable and concise form and serve as the basis for the development of management scenarios and the management plan.

CHARACTERIZATIONS OF PHYSIOGRAPHIC SITE TYPES

The St. Clair Flats is a unique and valuable area attributable to the ecological relationships and complex interactions of the area as a whole. While particularly sensitive areas such as the great blue heron rookery and the general location of fish spawning grounds can be identified, all areas have a significant role in the propagation of fish and wildlife. Of particular importance are the transition areas between permanent water and upland. Wildlife and fish require different habitats during various stages of their lives, and loss of a particular type of habitat area may threaten the species. Preservation of a nesting or spawning ground alone will not insure the continued viability of a particular species.

The importance of the Flats ecosystem must also be viewed in relation to the rest of Lake St. Clair. The urbanization of the western shore and corresponding loss of wetlands has placed a heavier burden on the Flats for provision of fish and waterfowl habitat. The Flats serves as both a direct and an indirect source of food and fish stocks for the rest of the Lake.

The St. Clair delta is an extremely dynamic ecosystem. The boundaries of vegetation communities and corresponding wildlife use change in response to fluctuations in lake levels. Lake levels fluctuate seasonally and annually, and may vary as much as 5 or 6 feet over a 11- to 14-year cycle. Changes in vegetation may become evident several years after extremely high or low water levels as plants die off or invade an area. The dynamic nature of the ecosystem complicates the process of mapping the area, for a map depicts only a static condition.

Despite the practical difficulties, the Flats were categorized into physiographic units illustrated by Map 1. These units divide the Flats into units of a comprehensible size with unique characteristics, and present a basis for the development of management strategies. The area has been broken down into six physiographic units:

Unit 1 – Open Water
Unit 2 – Deep Marsh
Unit 3 – Transition Area
Unit 4 – Meadow Area
Unit 5 – Upland Hardwood
Unit 6 – Man-Altered Areas

Physiographic units are based primarily on water depth and vegetation type. Substantial interchange exists between Units 2, 3 and 4 depending on lake levels. Two primary sources of information were used to define and map the physiographic units. The first study involved interpretation of high altitude LANDSAT photography of the Flats by John G. Lyon. (Lyon, 1979). The primary purpose of Lyon's study was to examine the capability of computer classification of LANDSAT digital data to provide information on coastal land use and vegetation. The Michigan Land Cover/ Use Classification System, (MLCUCS) was used to categorize and map land use and vegetation. Black and white imagery and field observation were used to verify the results.

The work of Eugene Jaworski and C. Nicholas Raphael, professors of geology and geography at Eastern Michigan University was also used. Jaworski and Raphael have conducted a number of studies over the years using black and white aerial imagery and field observations to map vegetative changes which have occured in response to lake level changes. Rather than use a standard classification system like MLCUCS, Jaworski and Raphael developed their own classification system.

Each study has its own inherent features. Lyon's results are more detailed and

Map 1

Physiographic Units

St. Clair Flats Management Plan

DIVISION OF LAND RESOURCE PROGRAMS
DEPARTMENT OF NATURAL RESOURCES

Ayres, Lewis, Norris & May, Inc.
engineers scientists planners

maps are presented at a smaller scale. However, the LANDSAT imagery used by Lyon was photographed in 1974, during high water levels, and represents only one point in time. Jaworski and Raphael have had extensive previous field experience with the Flats. They used low altitude photography, the interpretation of which is a more established technology. However, Jaworski's and Raphael's map of the entire Flats was based upon 1971 aerial photos when water levels were low. Their additional studies focused only on Dickinson Island and involved photos for 1949 (average to low water levels), 1964 (low and falling waters levels) and 1975 (high water levels). Further information on Lyon's and Jaworski and Raphael's work is provided in Appendix B.

To develop physiographic units for this report, it was necessary to reconcile the differences between the previously discussed studies. Low altitude infrared photography taken in 1978, provided by the Department of Natural Resources, U.S.G.S. topographic maps, navigation charts, interviews with knowledgeable persons and professional judgement were used to categorize the physiographic units.

The six physiographic units are described as follows:

Unit I – Open Water

This unit includes permanently wet interior lakes, waters of Lake St. Clair, river channels, and water highways which are two or more feet deep. Within the study area, water depths rarely exceed six feet except in the main channels. The waters of this zone may be colonized by floating-leaved or deep water emergent plants in protected or quiet areas, (Mud Lake; southeast corner of Little Muscamoot Bay). Other areas which are somewhat deeper may be heavily colonized by a diverse array of submergent vegetation (Little Muscamoot Bay; Fisher Bay; portions of Anchor Bay; some channel edges --- particularly the mouth of the North Channel, Big Fisher Highway, Snook's Highway and Dead Man's Cut); or may be virtually devoid of vegetation except

for a few scraggly specimens of Chara, (Muscamoot Bay and Goose Bay). Submergent vegetation is colonized by epiphytic algae, which provides food and cover for macroinvertebrates. Macroinvertebrates are in turn consumed by fish and waterfowl. Waterfowl also directly consume various species of submergent vegetation. Thus, these areas are particularly important to fish and waterfowl and also subject to human disturbance due to boating, waterskiing, or pollutional stress. Pollution problems will be particularly evident in shallow areas and areas which have a low flushing rate.

Unit 2 – Deep Marsh

These areas are wet during much of the year and are colonized by cattails, bulrushes, and various associated species depending on water levels. Water depth varies from ground level to two feet deep.

Bulrushes (Scirpus sp.) are more tolerant of deep water than are cattails and may be found to a depth of three feet. They are dominant in high water years and in deep waters interspersed with submergent vegetation. Cattails are dominant in shallow areas (6 to 8 inches between the roots and water surface) or during low water years. They cannot survive prolonged periods of flooding. Cattails present in 4 to 6 inches of water without influorescenses are probably actively invading the area. Sedges may be interspersed on the dry, landward side. Unit 2 might also be termed the emergent marsh unit.

Unit 2 areas are located adjacent to landforms, in open water areas which are underlain by shallow bar formations or in relict distributary channels in the interior of Dickinson and Harsen's Islands. The interior marshes are particularly significant because they provide deep water adjacent to shallow marshes and are more protected than outlying areas. They add to the diversity of habitats available to fish and waterfowl (Personal communication, Pospichal and Elden, MDNR). Their role in sediment transport through the delta is poorly understood but believed to be very significant (Personal communication, Jaworski).

Unit 2 is important in terms of primary productivity and serves as an important source of detritus for the aquatic food chain. Outlying areas are major fish spawning grounds and important for waterfowl cover. Interior marshes serve as brooding and nesting grounds for mallards, blue and green wing teal, woodducks, pintails and various other bird species. Carp have also been noted spawning there (Personal communication, Elden, MDNR).

Unit 3 – Transition Area

This unit might also be termed "shallow marsh" or "sedge zone," depending on water levels. During wet years, rushes and cattail advance into this area. Sedges are tolerant of varying water levels, but will generally dominate in drier years. Bur-reed and bluejoint grass may also be found. This unit also includes forested wetlands, such as willow-buttonbush associations, and standing dead trees, shrubs, or stumps indicative of lower water conditions in previous years. Unit 3 is the broadest category. Its importance to wildlife and fish is closely tied to the water level. Wet areas may be utilized for spawning by some fish, such as northern pike, or for waterfowl nesting cover. Drier areas are important habitat for some waterfowl, and also upland birds and mammals. The relative proportion of wet and dry areas and corresponding wildlife users varies with water level.

Generally, Units 2 and 3 are most likely to be dredged or filled. Most surveyed lots fall within these units and they are shallow enough that a minimal amount of fill will raise the land above water level.

Unit 4 – Open Meadow

These areas are typically dry and are underlain by Sanilac soils. They typify early stages of succession, as they are generally colonized by grasses or shrubs. The MLCUCS terms these areas "rangelands." Unit 4 areas on Dickinson Island, (as well as portions of Unit 3 during dry years and Unit 5 during wet

years), may contain plant species indicative of wet prairie environments which are rare in Michigan. Many endangered or threatened plant species have been identified in these areas.

Unit 5 – Upland Hardwoods

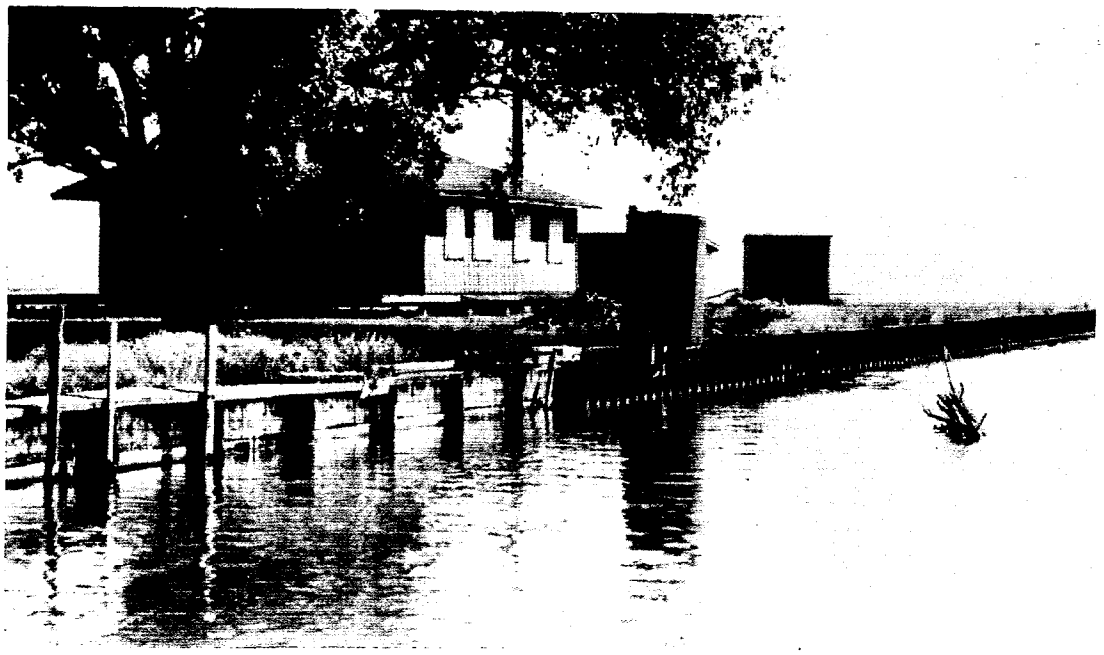
These areas are permanently dry and are underlain by Sanilac soils. They are covered with deciduous forest associations, including oaks, silver maple, American elm, shagbark hickory, eastern cottonwood, and trembling aspen. The presence of these upland species indicates these areas have been dry for some time and are more stable than the other units. Unit 5 would be less sensitive than the other units to development pressures but still has soils unsuitable for septic systems.

Unit 6 – Man-Altered Areas

Included in this unit are residential and commercial developments, the diked dredge disposal site currently in operation on Dickinson Island, and the St. Clair Flats Wildlife Area on Harsen's Island. All have been extensively modified by man. Most of the residential and commercial areas are on sites which have been dredged or filled. These areas are not devoid of wildlife. Canvasbacks, mallards, and redheads nest in remaining open water areas along the heavily urbanized South Channel. Other birds may be observed feeding throughout the area. The dredge disposal site supports dense and diverse vegetative growth and numerous waterfowl and shorebirds were observed in the area in June 1979. There had been no recent dredge disposal activity at that time. The wildlife area is managed primarily for waterfowl, and also supports some upland birds, mammals, and fish.

The physiographic units are evaluated to determine their relative sensitivities to various types of development. Recreation, commercial and residential uses will have different impacts on different units. The degree of impact will vary

according to the intensity of development and the relative sensitivity of the unit. By evaluating and analyzing these units, critical areas can be identified and recommendations made concerning the most suitable uses.



This property is one which would be included in Unit 6 – Man-Altered Area. Marshland has been bulkheaded and filled, and lack of adequate sewage disposal system is evident.

The units are evaluated on a qualitative basis. It is difficult to assign specific rankings of sensitivity or numerical ratings because all the units are sensitive. The units are involved within a dynamic, interdependent ecosystem, and therefore, specific evaluation is impossible without considering the larger overall process. However, a qualitative evaluation of the physiographic can be made based upon the following factors:

- significant value
- functional roles

- sensitivity to disturbance
- development capability

The significant values of the physiographic units are illustrated in a matrix presented as Figure 20. Cultural values such as development suitability, recreational use and visual aesthetics are evaluated. Natural values that are evaluated include vegetative diversity, unique species, waterfowl and fish.

Figure 21 complete the qualitative evaluation of the physiographic units. Illustrated in Figure 21 are the functions, sensitivity to disturbance and development capability of each physiographic unit.

Based upon the matrix and evaluation chart, it is apparent that the entire St. Clair Flats is an extremely fragile and sensitive ecosystem. All physiographic units are valuable for fish and wildlife production. The units are sensitive to human interference especially by dredging, filling and bulkheading within wet areas where biological activity is especially productive. While the drier meadow and hardwood areas are less sensitive to disturbance, they support unique plant species and provide important wildlife habitat.

In summary, the development capability for these physiographic units is severely limited. Residential and commerical uses impose severe impacts upon the units and the fragile ecosystem is incapable of supporting these uses. Limited development uses such as wildlife areas and interpretive areas are less demanding and may be permitted within Units 3 or 4. More intensive uses should be limited, although some suitable sites are found within the drier upland areas of Units 5 and 6.

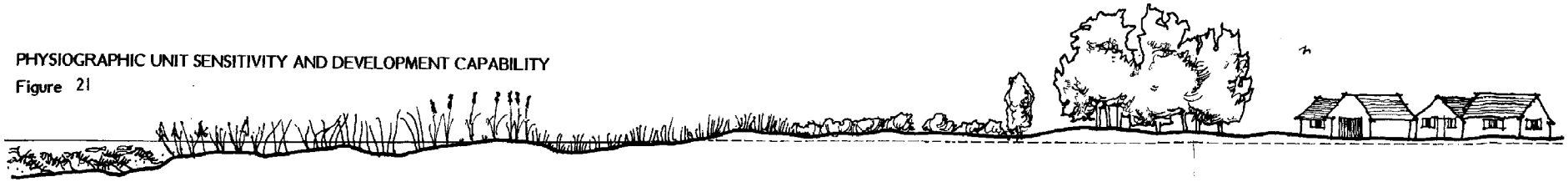
Figure 20
PHYSIOGRAPHIC UNIT EVALUATION MATRIX

● Significant Value
◒ Moderate Value
⊖ Limited Value

		Unit 1/Open Water						Unit 2/Deep Marsh		Unit 3/Transition Area	Unit 4/Meadow Area	Unit 5/Upland Hardwood	Unit 6/Man-Altered		
		1						2		3	4	5	6		
		Goose Bay	Little Muscamoot	Big Muscamoot	Fisher Bay	Water Highway	Main Channel	Outlying Areas	Interior Distributary				Dredge Disposal	Wildlife Management	Urbanized
CULTURAL	Suitable for Development	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	◒	◒	⊖	⊖	◒
	Recreational														
	– Fishing	●	●	●	●	◒	◒	◒	◒	◒	⊖	⊖	⊖	⊖	◒
	– Hunting	●	●	●	●	⊖	⊖	●	●	●	◒	⊖	⊖	●	⊖
	– Water Sports	●	●	●	●	⊖	⊖	●	⊖	⊖	⊖	⊖	⊖	⊖	⊖
	Visual Aesthetics	◒	◒	◒	◒	⊖	⊖	◒	◒	◒	◒	●	⊖	⊖	⊖
NATURAL	Diverse Vegetation	⊖	●	⊖	●	⊖	⊖	●	●	●	◒	◒	⊖	⊖	⊖
	Unique Species														
	– Vegetation	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	◒	●	⊖	⊖	⊖	⊖
	– Fish & Wildlife	⊖	⊖	⊖	⊖	⊖	○	◒	⊖	⊖	◒	⊖	⊖	⊖	⊖
	Waterfowl														
	– Nesting/Rookery	⊖	⊖	⊖	⊖	⊖	⊖	◒	◒	●	●	⊖	◒	●	◒
	– Habitat/Feeding	●	●	●	●	◒	◒	●	●	●	◒	⊖	◒	●	◒
	Fish														
	– Habitat/Feeding	●	●	●	●	●	●	●	◒	◒	⊖	⊖	⊖	⊖	⊖
	– Spawning	●	●	●	●	●	●	●	◒	◒	⊖	⊖	⊖	⊖	⊖

PHYSIOGRAPHIC UNIT SENSITIVITY AND DEVELOPMENT CAPABILITY

Figure 21



1. OPEN WATER

Function

Dense and diverse array of submergent vegetation serves as habitat for a variety of fish species and spawning grounds for some. Diving and dabbling ducks also feed on submergent vegetation in this area.

Sensitivity to Disturbance

Boating activity will place pressures upon fish and wildlife. Critical times are during spawning and nesting periods in the spring and during spring and fall migration. Submergent vegetation is sensitive to the effects of dredging, filling, and bottom disturbance.

Development Capability

The areas are incapable of supporting development.

2. DEEP MARSH

Function

Emergent marsh vegetation provides habitat for large populations of fish and wildlife. The area is important for fish spawning, waterfowl food sources, and the production of detritus which is vital to the aquatic food chain.

Sensitivity to Disturbance

Dredging and filling activity will have a long term impact upon deep marsh vegetation. Bulkheading will permanently destroy valuable emergents, and revegetation to its original state is unlikely.

Development Capability

High water levels, flood hazards, and unique wildlife habitat make these areas incapable of supporting development. Outlying areas are susceptible to ice and wave action.

3. TRANSITION AREA

Function

The area is tied closely to fluctuations in water levels. During wet years, the shallows are used by fish; in dry years, waterfowl, birds, and mammals make use of the area. Waterborne sediment is trapped within pockets of vegetation, and the land forming process commonly occurs.

Sensitivity to Disturbance

In the past, these areas have been the most susceptible to development and alteration. Disturbance of root rizones, loss of vegetation, and water turbidity will have long term impacts upon habitat. Urbanization places stress and interference upon wildlife behavior.

Development Capability

Recurring high water levels, flood hazards, and valuable wildlife habitat make these areas incapable of supporting residential development. Limited recreation with non-intensive uses may be permitted.

4. OPEN MEADOW

Function

The area is usually dry and supports grasses, shrubs, and wet prairie plant species. Mammals, such as deer and raccoon are typically found, as well as herons, egrets and large birds. This habitat type is rare in Michigan.

Sensitivity to Disturbance

Development could permanently destroy unique plant species and habitat for wildlife.

Development Capability

Drier conditions could support some recreation uses; however, the valuable habitat and high water table place severe limitations upon residential uses and moderate limitations upon some recreational uses.

5. UPLAND HARDWOODS

Function

These highest land areas are permanently dry and support a variety of bird and mammal species.

Sensitivity to Disturbance

Destruction of mature hardwoods would cause long term loss of valuable woodland habitat.

Development Capability

Seasonally high water table places severe limitations upon residential septic field use. However, limited recreation can be supported.

6. MAN-ALTERED AREAS

Function

These areas serve residential, commercial, wildlife management, and dredge disposal functions. All have had some impact on baseline environmental conditions.

Sensitivity to Disturbance

Immediate use areas have been severely impacted. While the wildlife management and dredge disposal areas have undergone alterations, the residential and commercial areas are extensively altered. Much bulkheading has occurred here. Remaining marsh and open water areas adjacent to these sites are critical.

Development Capability

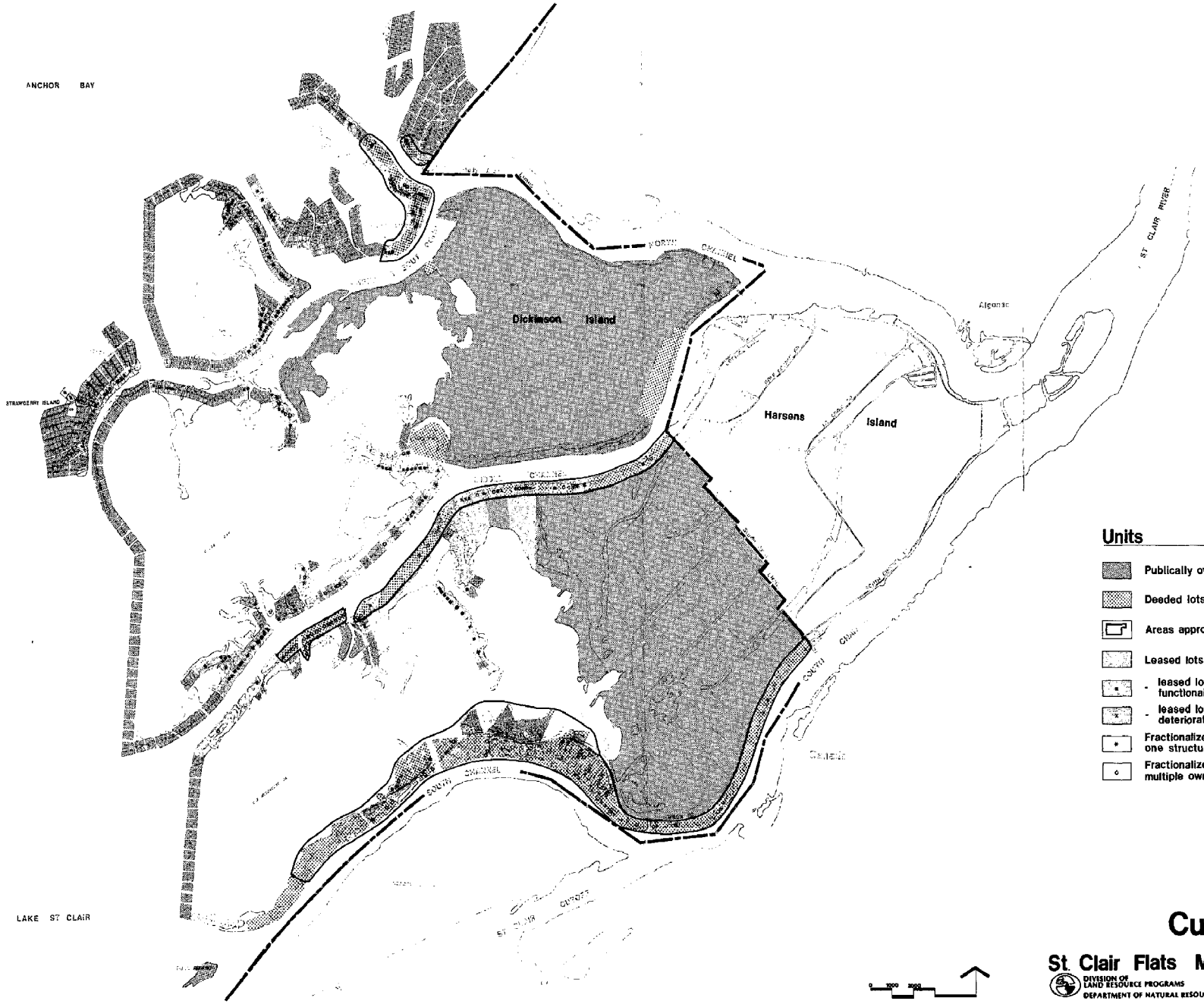
High water tables, flood hazards, and soils unsuited for septic systems characterize these developed areas. Residential and commercial uses are most severely impacted. Increasing densities of development will only compound problems. Limited site specific development with non-intensive uses may be permitted.

CHARACTERIZATION OF CULTURAL UNITS

The cultural units, illustrated by Map 2, serve the primary purpose of presenting the existing land ownership and development patterns in the Flats. The lands in the Flats are either owned by private individuals, by the State, or leased by the State. Not all parcels within the areas approved for deeds are deeded. Some are leased, while the State retains full title to others.

Included in the map is information on the condition and number of structures on leased properties. This information was derived from a 1977 field inventory conducted by the Division of Land Resource Programs of the leased lots. Some lots are unoccupied, while others have structures which range from deteriorating to good condition. The type and condition of development on a parcel is indicative of the property owner's interest in the land and relative value of the properties. It may also be indicative of the degree of disruption of the natural environment in the area. This information will be pertinent when determining acquisition priorities.

Fractionalization of platted lots is a major problem in the Flats. Fractional lots with more than one structure indicate areas of dense development. The tiny lots found on these parcels intensify problems of septic disposal in an area which already has severe limitations on the suitability of soils for septic systems. Septic systems have been installed on lots much too small for adequate septic systems even in locations with suitable soils. On both densely developed and other fractionalized parcels, multiple ownership complicates the process of determining property lines. Consolidation of ownership and acquisition is also complicated. Methods of controlling lot-splitting are discussed in the implementation portion of this report.



Map 2

Cultural Units

St. Clair Flats Management Plan

DIVISION OF LAND RESOURCE PROGRAMS
DEPARTMENT OF NATURAL RESOURCES

Ayres, Lewis, Norris & May, Inc.
engineers architects planners

Management Plan

MANAGEMENT PLAN

The Management Plan is presented in five components: Findings and Conclusions, Alternative Management Scenarios, Land Management Plan, Policy Plan, and Acquisition Priorities Plan. The Findings and Conclusions and Management Strategies serve as the foundation for the development of the Land Management, Policy and Acquisition Priorities Plans.

FINDINGS

A great deal of information has been presented in the preceding chapters. The presentation of findings and conclusions will illustrate the need for prompt action and prudent management of the Flats. The findings and conclusions are divided into the following categories:

Land Management

- Since the early 1900's, the St. Clair Flats has been subject to special interest legislation allowing for the private use of State-owned bottomlands. The St. Clair Flats Act 326 was passed in 1913 to allow for the leasing, control and taxation of parcels within the Flats. Leases were allowed in two terms, 50 years and 49 years. Act 215, PA 1949, authorized the conversion of leases to deeds in certain areas. The extent of deeded areas was subsequently expanded by legislative action on six different occasions.

- Provisions in Act 326 that the rights of leaseholders are subject to the paramount public rights of navigation, hunting and fishing have been largely unenforced until recent years.

- Section 2(e) of Act 326 authorized the Department of Natural Resources to make and enforce regulations for the preservation and use of the

paramount right of navigation, hunting and fishing in the Flats. Such regulations have never been developed.

- The passage of Act 326 provided 1,868 lots available for lease. The fractionalization of parcels have increased the total number of lots to 2,172. There are currently 567 state-owned leased parcels, 652 deeded parcels, and 953 state-owned parcels in the Flats.

- Lots have been leased at extremely low charges. Lease amounts for the first fifty years were leased on an average front foot value schedule. For example, a lot with 100 feet of frontage on the South Channel, the most valuable area, would lease for $75.00 total, or $1.50 per year. The statute specified that the rental could not exceed double the original rental fee during the second 49 year term of the lease.

- In 1963, the Natural Resources Commission directed the Department to revise the 1949 deed conversion formula to more accurately reflect market values. Although the Lands Division revised the formula and fees were increased, deed conversions have still been substantially below market values. For example, the fees charged for deed conversions on the South Channel have been $3.00 a waterfront foot while current market prices have averaged between $80.00 and $100.00 a waterfront foot.

- A 1977 survey conducted by the Department of Natural Resources concluded that approximately 50% of leased and deeded parcels remain unoccupied.

- There are approximately 900 housing units in the Flats, the majority of which are seasonally used. Most year-round residents live on Harsen's Island. The 1977 survey indicated that 10% of the dwellings on the Middle Channel, 20% on the North Channel, and 10% on the Sni Bora are in a state of deterioration. Homes along the South Channel are generally in better condition.

- A central wastewater disposal system does not exist and the costs of providing one are prohibitive. Residences use on-site waste disposal, although some outdoor privies and direct discharges do exist. Because of the extremely high water conditions and poorly drained soils throughout the Flats, septic systems do not function properly, posing public health problems or water quality violations.

- Potable water is unavailable except from a central distribution point on Harsens Island. Residents either haul water from this distribution point or the mainland, or have direct intakes from the nearest channel. Septic system failures and direct discharges of sanitary wastes have the potential to contaminate direct water intakes.

- Clay Township participates in the National Flood Insurance Program. The Flood Insurance Study conducted by the Department of Housing and Urban Development identifies the entire Flats as a flood hazard area. The Flood Damage Prevention Ordinances adopted by Clay Township requires new residential structures to be elevated above the 100-year flood level.

- Most parcels require shoreline bulkheading to protect against flooding, erosion and ice-damage. Dredging and filling and shoreline bulkheading has destroyed valuable fish and wildlife habitat.

- The costs of development in the Flats are a financial burden to both private individuals and the public. Private dollars are spent on replacement of failing septic systems,transportation of potable water, extraordinary construction methods and material to overcome site conditions, and shoreline structures to protect against flooding, ice damage and erosion. Public dollars subsidize private development through lease fees and deed conversion fees well below market values. Should central sewers and water be required, public expenditures could be substantial.

Public Health and Environmental Protection

- County septic disposal requirements call for two and a half feet of isolation between the tile field and groundwater table. A 1973 Michigan Department of Public Health Sanitary Survey of Harsens Island shows that the water table was no more than 12 to 18 inches below grade for over 50% of the systems surveyed. Similar conditions exist in the rest of the Flats.

- Despite prohibitive site conditions, septic permits continue to be issued by local health officials. Since January 1, 1978, over 35 septic permits, including 13 for new systems, have been issued. It is the policy of local sanitarians to issue permits for replacement systems. Most applications for new systems are denied by the sanitarian, only to be overturned by an appeals board.

- A number of outdoor privies, direct sewage discharges and failing septic systems are still in operation in the Flats. Due to manpower shortages, local sanitarians do not search for violations but instead act on complaints.

- The Water Resources Commission has the authority to regulate the direct or indirect discharge of human wastes under Section 6(b) of Act 245, PA 1929. The Administrative Rules associated with Act 245 establishes water quality standards which cannot be exceeded.

- The Department of Public Health is empowered under the Public Health Code, Act 368, PA 1978, to intercede in situations of "imminent danger" to public health. Section 2251(3) of the Act allows the Director to take full charge of the administration of state and local health laws, rules, regulations and ordinances.

- Clay Township's Flood Damage Prevention Ordinance requires that sanitary sewage systems be constructed to minimize or eliminate infiltration of floodwaters into the system.

Resource Value of the Flats

- Over 80% of the coastal wetlands on the Michigan side of Lake St. Clair have been destroyed. Of the remaining wetlands, 88% are found in the St. Clair Flats. The value of the Flats in terms of biological importance cannot be overstated.

- The Flats are a unique geologic phenomena as one of the largest freshwater deltaic formations in the United States.

- Large areas of contiguous wetlands such as the Flats are rare and extremely important for natural fish and wildlife production. The wetlands provide food, cover and shelter for many fish and wildlife species and also act to trap sediment and nutrients and dissipate wave energy.

- The Flats are extremely productive in terms of fisheries resources. Thirty-three percent of the total Michigan non-salmonoid Great Lakes sport catch are caught in Lake St. Clair. Pike, bass, walleye, perch, muskellunge, sturgeon and other species all spawn within the Flats. Because remaining wetlands on Lake St. Clair are limited, there is no doubt that the Flats support large numbers of fish found throughout Lake St. Clair.

- The Flats support large numbers of waterfowl. During one fall migration, over 27,000 ducks, geese and shorebirds were observed in one day. Aquatic vegetation, calm waters and undisturbed wetlands provide ideal habitat for many waterfowl species.

The Flats are valuable because they support a diverse array of fish and waterfowl species. Over two hundred fish, water fowl species are common to the Flats which makes this area one of the richest and diverse habitat areas in the State.

Recreational Use of the Flats

The St. Clair Flats offer excellent opportunities for fishing, hunting, boating and non-consumptive recreational use. Its location near the Detroit Metropolitan area make it accessible to millions of people.

In terms of sport fishing, the value of the Flats is extremely important. Fishing success is very high and has attracted anglers from all over Southeastern Michigan. Fishing activity within the Harsen's Island area was estimated at 100,000 angler days in 1975 and there is every reason to believe that demand will continue.

Due to natural habitat and the provision of a state managed wildlife area, the Flats attract large numbers of waterfowl and ducks. The state managed wildlife area provides for 6,000-7,000 hunters over the 50-day hunting period. Hunting in the remaining areas of the Flats is even more popular. Duck hunting demand will continue to be popular due to the existence of natural habitat, the success of management programs, and the proximity to the Detroit Metropolitan area.

Nonconsumptive recreation such as bird watching is also very popular. There is a diversity of wildlife species offered in the Flats.

Boating is very popular within the Flats. The islands, channels and bays provide attractive resources for pleasure boating, water skiing and fishing. Well over 100,000 pleasure boats are registered along the eastern shores of Lake St. Clair making the Lake and the Flats one of the most

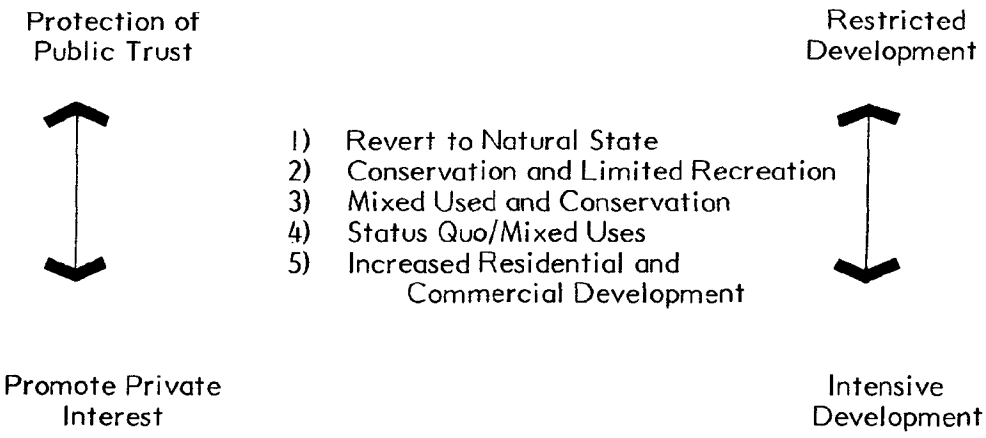
intensively used areas in the state. Intensive boating has had an adverse effect in some areas of the Flats through disturbance of spawning areas, increased turbidity and litter.

ALTERNATIVE MANAGEMENT SCENARIOS

The findings and conclusions presented in the previous section could yield a variety of problem-solving approaches. In order to give full consideration to the myriad of viewpoints, a range of five management scenarios were developed. Management scenarios are planning options which characterize possible courses of action regarding future use and development.

Figure 22 illustrates the range of management options represented by the scenarios. Scenarios one through five range from protection of the public trust to promotion of private interest and present varying development intensities from restricted development to intensive development.

Figure 22
Range of Management Scenarios



Evaluation of Management Scenarios

The evaluation of the management scenarios leads to the selection of a management scenario which identifies the most appropriate courses of action to be taken in the future management of the St. Clair Flats.

The alternative management scenarios are evaluated to determine their relative environmental, economic and social costs and benefits. Figures 23 and 24 are matrices which graphically illustrate the relative environmental, economic and social merits of each scenario.

The characteristics of each scenario are detailed in the following discussion. An evaluation concerning the relative merits or deficiencies is also provided.

Scenario No. 1: Revert Lands to the Natural State

This scenario offers the greatest environmental benefits. All new development would be prohibited and existing development would be removed from designated areas. Residential leases would not be renewed and private land holdings would be acquired. Public access would be restricted. By restricting public use and development, the scenario promotes the total protection of ecologically sensitive lands and pristine wildlife habitat.

The cost of implementation of this scenario could be extremely high. Compensation would have to be granted to homeowners who would have to be relocated. Specific dollar amounts for compensation to property owners is difficult to accurately estimate. However, based upon State Equalized Valuation averages and recent sales averages, acquisition costs for the deeded and leased lots could exceed twenty five million (Appendix C). Acquisition costs may be partially offset when compared to development costs for an intensive development scenario. Sewer and water development, potential flood damage, public health concerns and degradation of wetland habitat are all considerations which could be avoided with the non-development alternative.

In terms of social costs and benefits, the scenario presents few direct benefits for public use. Fishing, boating and hunting would be severely limited, conflicting with the public's right to fishing and navigation on the Great Lakes. In addition, the scenario would necessitate the insulation of the Flats from outside pressures,

Figure 23

SCENARIO EVALAUTION MATRIX

Summary of Costs

Significant Costs ⊖
Moderate Costs ◒
Limited Costs ●

		SCENARIOS				
		Revert to Natural State **1**	Conservation & Limited Recreation **2**	Mixed Uses and Conservation **3**	Status Quo/ Mixed Use **4**	Increased Residential Commercial Use **5**
ENVIRONMENTAL COSTS	Degradation of Water Quality	●	●	●	⊖	⊖
	Loss of Fish Habitat	●	●	◒	⊖	⊖
	Loss of Wildlife Habitat	●	●	◒	⊖	⊖
	Interference with Hydrologic Functions	●	●	●	⊖	⊖
	Degradation of Wetland Values	●	●	●	⊖	⊖
	Loss Terrestrial & Aquatic Vegetation	●	●	◒	⊖	⊖
	Degradation of Geologic Uniqueness	●	●	●	⊖	⊖
ECONOMIC COSTS	Flood Drainage & Disaster Relief	●	●	◒	⊖	⊖
	Shoreline Damage	●	●	◒	⊖	⊖
	Ice Damage	●	⊖	◒	⊖	⊖
	Sewage Collection & Treatment	●	●	◒	⊖	⊖
	Water Supply	●	●	◒	⊖	⊖
	Replacement of Natural Fish Production	●	●	◒	⊖	⊖
	Replacement of Natural Wildlife Production	●	●	◒	⊖	⊖
	Land Acquisition	⊖	⊖	◒	●	●
	Governmental Management & Administration	⊖	⊖	◒	●	●
SOCIAL COSTS	Residential Displacement	⊖	⊖	◒	●	●
	Public Health	●	●	◒	⊖	⊖
	Loss of Fishing Opportunities	⊖	◒	◒	⊖	⊖
	Loss of Hunting Opportunities	⊖	◒	◒	⊖	⊖
	Loss of Boating Opportunities	⊖	⊖	●	⊖	⊖
	Loss of Non-Consumptive Recreation Opportunities	⊖	●	◒	⊖	⊖
	Loss of Unique Resources	●	●	◒	⊖	⊖

Figure 24

SCENARIO EVALAUTION MATRIX

Summary of Benefits

Significant Benefits ⊖
Moderate Benefits ◓
Limited Benefits ●

		SCENARIOS				
		1 Revert to Natural State	2 Conservation & Limited Recreation	3 Mixed Uses and Conservation	4 Status Quo/ Mixed Use	5 Increased Residential Commercial Use
ENVIRONMENTAL BENEFITS	Improvement of Water Quality	⊖	⊖	⊖	●	●
	Protection of Fish Habitat	⊖	⊖	◓	●	●
	Protection of Wildlife Habitat	⊖	⊖	◓	●	●
	Maintenance of Hydrologic Functions	⊖	⊖	⊖	●	●
	Preservation of Wetland Values	⊖	⊖	⊖	●	●
	Protection of Terrestrial & Aquatic Vegetation	⊖	⊖	◓	●	●
	Preservation of Geologic Uniqueness	⊖	⊖	⊖	●	●
ECONOMIC BENEFITS	Reduced Flood Drainage & Disaster Relief	⊖	⊖	◓	●	●
	Reduced Shoreline Damage	⊖	⊖	◓	●	●
	Reduced Ice Damage	⊖	⊖	◓	●	●
	Reduced Costs of Sewage Collection & Treatment	⊖	⊖	◓	●	●
	Reduced Costs of Water Supply	⊖	⊖	◓	●	●
	Preservation of Natural Fish Production	⊖	⊖	◓	●	●
	Preservation of Natural Wildlife Production	⊖	⊖	◓	●	●
	Reduced Land Acquisition Costs	●	●	◓	⊖	⊖
	Local Economic Activity & Tax Revenues	●	●	◓	⊖	⊖
SOCIAL BENEFITS	Improved Public Health	⊖	⊖	⊖	●	●
	Preservation of Fishing Opportunities	●	◓	⊖	●	●
	Preservation of Hunting Opportunities	●	◓	⊖	●	●
	Preservation of Boating Opportunities	●	◓	⊖	●	●
	Preservation of Non-Consumptive Recreation Opportunities	●	◓	⊖	●	●
	Preservation of Unique Resources	⊖	⊖	◓	●	●

including pollution, recreational and commercial boating, fishing and hunting. This would be more difficult to insure, and severely limit the accessibility of the Flats to all human use. Indirectly, environmental problems may be displaced, as the recreational demands are met elsewhere, possibly at more distant locations. The feasibility of implementing this scenario is very low because of its unacceptability to most interest groups, the intensity of use of surrounding areas, and the density of population in close proximity to the Flats. In addition, acquisition and land management costs make this scenario unrealistic and objectionable.

Scenario No. 2: Conservation and Limited Recreation

This alternative is ecologically sensitive yet is less restrictive and would allow certain recreational uses. Nonconsumptive recreational activities such as birdwatching, hiking, and interpretive centers would be promoted, particularly on Dickinson Island. This would insure that the environmental integrity and uniqueness of the area would be retained for the appreciation of present and future generation. Development would be restricted to those facilities needed to support very limited recreational use.

Boating would be prohibited in the highly productive Little Muscamoot and Goose Bays during migration, spawning, and breeding seasons. Fishing would be permitted during noncritical periods in outlying areas. Hunting might be permitted on the wildlife refuge, but the number of permits available would be cut back and hunting in open water areas prohibited. As a general policy, the Dickinson Island area and bays would be the most restricted so that the ecological balance can remain as uninterrupted as possible. It would be utilized only for limited recreational uses.

This scenario would result in the eventual mitigation of pressures from recreational boating, littering, and water pollution from sewage effluent. Residential leases would not be renewed, and action would be initiated to remove residential development in specially designated areas.

This scenario will offer environmental benefits. Unique resources would be protected and environmental constraints would be addressed within limited recreational use. Economic benefits to the local community are limited and State administrative costs are significant. While acquisition of designated lands would cost considerably less than that required for Scenario I, land acquisition costs would still be extremely high. Land development costs for sewers, water lines and flood protection improvements would be minimized because development would be restricted. The social benefits derived from fishing and fish production would remain high as well as the value for boating and water activities. The Flats would continue to provide social benefits from recreational opportunities for southeastern Michigan. However, residents would be displaced and uses would be curtailed.

In short, this alternative offers environmental and recreational benefits. However, the non-consumptive uses promoted in this scenario are expensive, and accessibility to the more pristine interpretive areas is presently limited. More intense recreational use can be permitted without detrimental impacts to the environment. Limited recreational uses, high acquisition costs, and the negative impacts on residential users makes this scenario an unlikely alternative for future action.

Scenario No. 3: Mixed Uses and Conservation

This scenario is characterized by mixed recreational uses on public lands, including hunting, fishing, boating and nonconsumptive uses. Wildlife management activities and habitat protection measures would be permitted. However, such management activities would have to be conducted in a prudent manner which examines the long range implications of both fish and waterfowl habitat alteration and production. In addition to fish and wildlife management, the interpretive value of the Flats would be promoted. Recreational boating would be permited, although the intensity of use might be curtailed during spawning or breeding seasons in particularly sensitive areas. Residential use of the area would be permitted to remain in noncritical areas, but further development would be carefully regulated. Mixed recreational uses, restricted residential and some commercial activity are permissible if these

uses are controlled. The scenario relies heavily on State and local controls and coordination to insure maximum benefits to the environment and various interest groups.

This scenario would offer the most desirable economic and environmental benefits for the Flats. Local and State objectives are met and residential and commercial uses can be accommodated. A phased acquisition of deeded and leased holdings would be necessary to preserve sensitive areas. An estimated figure of ten million dollars for acquisition is based upon average property values within various areas of the Flats. This figure accounts for the acquisition of approximately 180 leased lots with homes and 180 deeded lots with homes at current market prices. These homes are in selected areas within the study area and occupy sites which are important for the future protection or restoration of resources. In addition to these properties, approximately 120 vacant leased lots and 91 vacant deeded lots would also be acquired (Appendix C). These direct costs appear to be high but when considered in light of expenditures required for flood protection, and sewer and waterline development, the costs of acquisition are placed in perspective. In addition, the value of the Flats' wetlands for sport fishing has been placed at $374 per acre (Jaworski and Raphael, 1978) or over five million dollars. Scenario 3 would protect most of the productive fish habitat areas and maintain sport fishing success for anglers in southeastern Michigan.

In conclusion, the Scenario Evaluation Matrix indicates that moderate benefits and moderate costs are associated with Scenario 3. Relative to Scenarios 1 and 2 this is a more desirable mix of costs and benefits.

Scenario No. 4: Status Quo

This scenario promotes the continuance of the status quo situation of mixed uses within the Flats. Residential and commercial development will gradually intensify, and more leases will be converted to deeds. This will increase the likelihood of water quality problems and result in degradation or loss of wetland habitat.

Mixed recreational uses of hunting, fishing and recreational boating will also continue and possibly increase in response to the demands of various interest groups. Presently, there is no move to provide nonconsumptive recreational opportunities or to recognize the uniqueness of the Flats as a unit and to preserve it intact. This will continue to be ignored and the potential for nonconsumptive use would continue to be largely untapped.

A scenario which would continue existing conditions is unacceptable for it does not address issues concerning water quality, parcel fractionalization, and environmental degradation. No overall consistent policy for the Flats exists in the scenario. Rather, each interest group strives to meet its own needs which may conflict with those of others, and the environment receives few, if any benefits. Residential and commercial users, as well as the local economy, receive some benefits, as do hunters and fishermen. However, the overall impacts on the productivity of the ecosystem are not considered due to the individual concerns of these various interest groups. Overall development costs will continue to be high. Continued development will mean more expenditures for flood protection, dredge and fill operations and sewage disposal. It is conceivable that the State would be expected to correct environmental damages suffered during expanded development. Short term social benefits would result from the increase of recreation opportunities; however, the long term impacts of intensive uses would eventually degrade the overall attractiveness of the Flats.

In short, this scenario does not effectively address existing problems and is not an acceptable course of action for the Flats.

Scenario No. 5: Increased Residential and Commercial Development

This scenario represents the pro-development extreme. More state-owned lands would be leased, leases would be converted to deeds, and development would intensify. The trade off would necessarily come with a reduction of recreational opportunities and degradation of the natural environment, unless adequate provision

was made for water and septic systems. However, recent trends indicate a growing demand for vacation homes, especially with waterfront locations. Legislative provisions provide for the conveyance of Flats' lands at a very low price, and the area is located in close proximity to 60% of the State's population. Thus, the attractiveness of Flats real estate is likely to remain for some time. This scenario would attempt to satisfy development interests within the Flats and provide additional residential and commercial uses.

This scenario is inconsistent with both State and local objectives and existing environmental legislation. The local economy would benefit from increased development, but benefits which would accrue to residential and commercial users would eventually level off and decline. The costs of flood protection and sewer and water service would be extremely high. The Harsen's Island Facilities Plan estimates that construction of a sewage collection system and aerated storage lagoon would exceed 17 million dollars. Increased development would incur environmental costs and the impacts of urbanization would detract from the amenities which attract people to the area. Resource productivity and unique habitats and species would be threatened, and the environmental integrity of the area degraded. Legislation protecting the environment will impose constraints on development in this area. For instance, it is unlikely that the dredge and fill permits necessary to reclaim additional lands will be issued in many instances.

In summary, the environmental, economic and social costs far outweigh the benefits and Scenario 5 is an unacceptable management option.

Selection of the Management Scenario

The management scenarios previously presented offer five alternative plans to guide future use of the Flats. The most favorable scenario is that which best addresses the majority of the environmental, economic and social concerns. In terms of environmental benefits, the most beneficial scenarios are number one and two. The scenarios protect water quality, habitat, values and functions of the

wetlands. Moderate or significant benefits are noted for Scenario 3. While this scenario would incur some environmental degradation it would implement management measures designed to protect the resources of the Flats. Economic benefits (in terms of reduced public costs) also favor the limited-development scenarios. The public will not be burdened with excessive expenditures for flood protection or sewage treatment, or water supply systems. Scenario 3 would provide moderate economic benefits and offer a more realistic program for land acquisition than the nondevelopment scenarios. Social benefits and costs are mixed between the five scenarios. While recreational opportunities are restricted by Scenarios 1 and 2, the quality of recreation would eventually be degraded by Scenarios 4 and 5 through uncontrolled development. Scenario 3 offers a suitable recreational alternative and offers the greatest overall social benefits.

When examined together, Scenario 3, Mixed Uses and Conservation offer the most desirable mix of benefits for the Flats. The scenario is feasible, realistic and implementable and will provide a basis for development of the management plan.

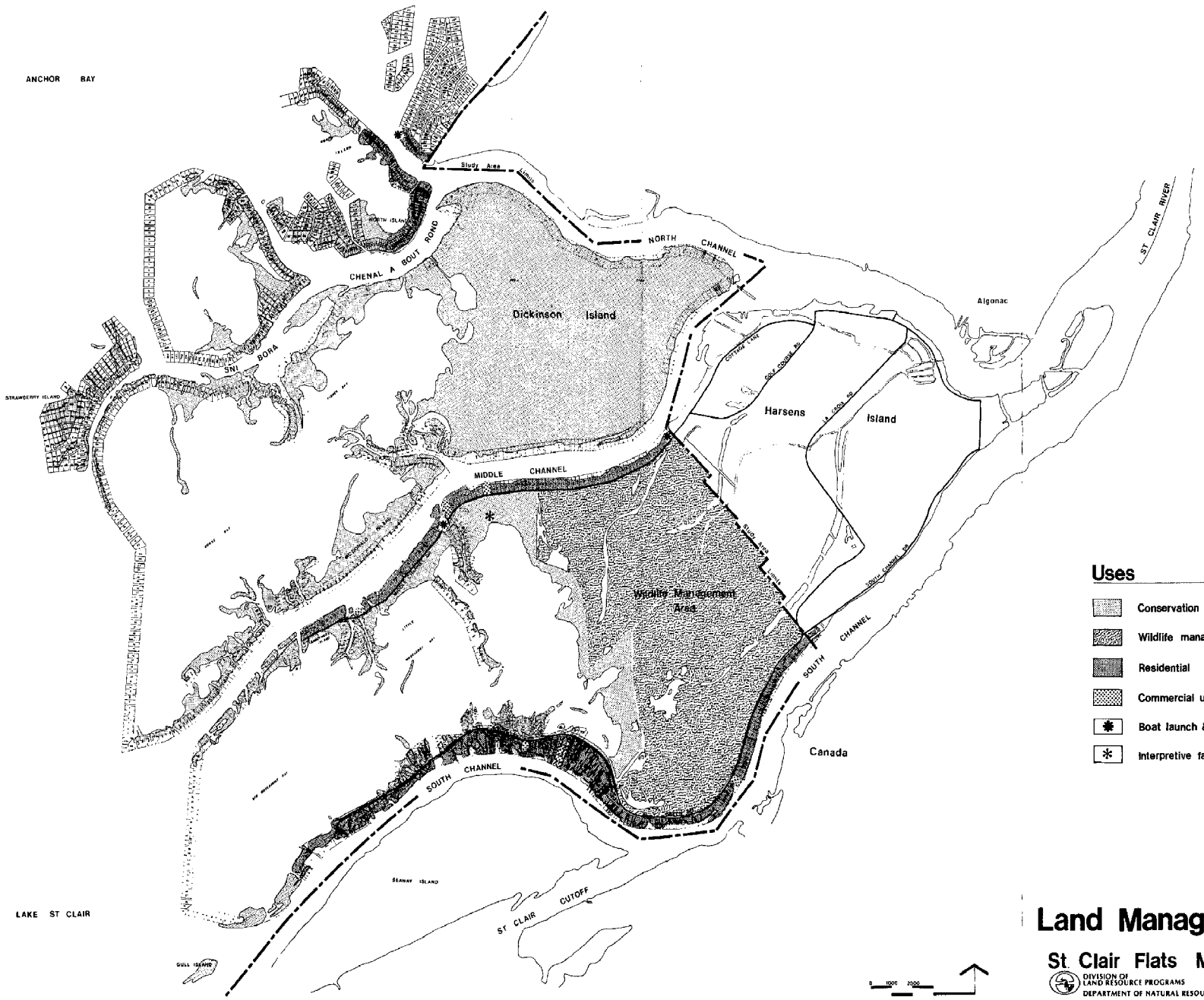
LAND MANAGEMENT PLAN

The Land Management Plan for St. Clair Flats is illustrated in Map 3. Physiographic and Cultural Units and the framework established by Scenario 3, Mixed Uses and Conservation, serve as the basis for allocating the various land uses. Most of the proposed uses are currently found within the Flats, but it is the reapportionment of these uses which is the important aspect of the Plan. Specific uses and facilities include:

Conservation
Wildlife Management
Residential
Commercial
Boating Facilities
Interpretive Facilities

Conservation areas largely include Physiographic Unit 2 – Deep Marsh; Unit 3 – Transition Area; and a small portion of Unit 6 – Man-Altered. These areas are largely located around interior bays, out-islands, Dickinson, and a portion of Harsen's Island adjacent to Muscamoot Bay. The sensitivity of these areas as fish and wildlife habitat is fully discussed in previous sections. Much of the Conservation Area is publicly owned, but significant portions remain privately owned or available for lease. Continued residential and commercial use in this area is not recommended. The large tracts of public and productive wetlands are well suited for continued recreational benefits. Fishing, duck hunting, boating, trapping and nature interpretation are activities which are acceptable to the overall objectives. However, it is important that these activities must not subject adverse pressures to the productive waterfowl and fish habitats.

Residential, commercial and boating facilities are recommended to remain in existing developed, man-altered areas. These areas are located along the South



Map 3

Land Management Plan

St. Clair Flats Management Plan

DIVISION OF LAND RESOURCE PROGRAMS
DEPARTMENT OF NATURAL RESOURCES

Ayres, Lewis, Norris & May, Inc
engineers architects planners

Middle, and North Channels in areas which have been altered and are not as ecologically sensitive. Expansion beyond these areas is not recommended, especially into conservation areas.

Wildlife management areas include the diked, intensively-managed croplands and waterfowl areas currently operated by the State. Future expansion of these areas should be evaluated against potential impacts on fish habitat and the aquatic and terrestrial ecosystems.

POLICY PLAN

The Policy Plan addresses the significant issues concerning the St. Clair Flats and provides direction for implementation of the Land Management Plan. Policy recommendations are organized according to the pertinent issues of residential and commercial development, recreation, resource protection, and jurisdictional authority.

General Policies

1) **The St. Clair Flats Management Plan should be adopted by the Natural Resource Commission to provide direction and guidance to the Department of Natural Resources in the development of policy regarding the St. Clair Flats.**

   The Management Plan calls for a program of land management, environmental enforcement and land acquisition. Implementation of the Plan will require the active support of all elements of the Department of Natural Resources.

2) **Implementation of the St. Clair Management Plan will require increased cooperation and coordination between the various divisions of the Department of Natural Resources.**

   The St. Clair Flats Task Force, with the Land Resource Programs Division as the lead division, should remain established to provide direction and recommendations to the Natural Resources Commission regarding the implementation of the Plan. The Task Force should be expanded to include all divisions affected by the recommendations of the Plan.

3) **Implementation of the Management Plan will require the full employment of existing regulatory authority available to agencies of the State of Michigan.**

Existing regulatory authority available under the Water Resources Commission Act, Act 245, PA 1929; Public Health Code Act, Act 368, PA 1978; Great Lakes Submerged Lands Act, Act 247, PA 1955, as amended; and the St. Clair Flats Act, Act 326 PA 1913, should be fully enforced in the St. Clair Flats to provide for implementation of the Management Plan. Application of these regulations are more fully explained in the ensuing specific recommendations.

4) **The adoption and implementation of the Acquisition Priorities Plan will provide long-term assurance that valuable areas of the Flats are protected from urban encroachment.**

The Acquisition Priorities Plan is more fully described in the next section of the Management Plan.

5) **A permanent staff position should be added to the Division of Land Resource Programs to specifically deal with matters pertaining to the St. Clair Flats.**

The implementation of the St. Clair Flats Management Plan and the and monitoring of routine activities affecting the Flats are significant enough activities to warrant the creation of a full time permanent staff position. This position would serve as staff to the St. Clair Flats Committee, liason between the Division of Land Resource Programs and Lands Division, Monitor Department activities affecting the Flats, and direct the implementation of the Management Plan.

Land Management

1) **The St. Clair Flats Act, Act 326, PA 1913, authorizes the Department of Natural Resources to make and enforce such regulations necessary for the preservation and use of the paramount right of navigation, hunting, and fishing in the St. Clair Flats.**

To implement the Land Management Plan, regulations and policies governing the issuance of leases and deeds subject to public navigation, hunting and fishing rights should be adopted. A specific format, such as Administrative Rules, Commission Policies or Department Procedure, should be explored by staff. Specific provisions of such regulations should include:

a) **In areas designated as "Conservation" in the Land Management Plan no new leases should be issued. Existing leases should not be extended beyond their expiration date.**

Conservation areas include largely Physiographic Unit 2 Deep Marsh and Physiographic Unit 3 - Transition Area. The importance of these areas as fish and wildlife habitat has been discussed in previous sections. Continued urban encroachment on Conservation areas could impair public hunting and fishing rights. Holders of existing leases should be informed that their leases will not be renewed beyond the expiration date. Those who wish to sell the remaining equity in their leases should be so permitted.

b) **Areas designated as "Residential" in the Land Management Plan are confined to existing areas approved for deeds. New leases which affect the public trust should not be permitted. The conversion of leases to deeds should be thoroughly reviewed for the protection of the public trust.**

Section 402 of the St. Clair Flats Act states that the Department may lease lands at its discretion. Such leases are subject to the paramount rights of public hunting, fishing and navigation. Further,

the Department may deny the conversion of leases to deeds if the rights of hunting, fishing and navigation are impaired. The denial of leases and deeds is especially supportable on lots which are wholly or partially submerged. The changing public attitudes and scientific documentation regarding the value of wetlands justifies the responsible protection of these areas.

c) The conversion of leases to deeds should be reflective of the market value of the property.

The cost of acquiring deeds has not been reflective of the true market value of the property. The schedule utilized set deed costs so low that development has been encouraged.

The Lands Division has devised a new methodology for determining the value of deeds which calculates the State's equity in the paramount public rights of hunting, fishing and navigation. The methodology results in increased fees for deed conversion. This schedule appears to be a fair and equitable method of determining the true costs of deeds and should be fully implemented by the Department of Natural Resources.

d) More intensive uses of leased properties should not be permitted.

Proposed changes in the use of leased properties should be reviewed by the Division of Land Resource Programs. Requests which propose a more intensive use of the property should be denied. An example of a more intensive use would be the conversion of a cottage to a commercial use.

e) Assignment of leased properties resulting in more intensive use should not be permitted.

The assignment of leased properties should also be reviewed by the Division of Land Resource Programs. More intensive uses should not

be permitted in the assignment process. Before approval of the assignment is granted, a clause which prohibits bulkheading, filling, or more intensive use of the property should be included in the lease agreement. Similar clauses should be considered to address site specific conditions on lots, especially within the Conservation Area.

f) **Fractionalization of leased and deeded parcels should not be permitted.**

Control of fractionalization of leased parcels can be achieved by denying requests for change in use which propose lot-splitting. Fractionalization of parcels results in a more intensive use of land.

2) **The Legislature should consider amending the St. Clair Flats Act, Act 326, P.A. 1913, to allow the termination of leases on undeveloped and unoccupied parcels and the acquisition of leasehold interests.**

The 1977 survey of the Flats conducted by the Department of Natural Resources indicated that 50% of the leased and deeded parcels remain unoccupied and undeveloped. Due to the increased public awareness of wetland values, the Department should be given the authority to terminate leases on undeveloped and unoccupied parcels and to acquire the remaining leasehold interest.

3) **Building codes should be fully enforced including the issuance of violations, condemnation of deteriorating or uninhabitable structures, and the ultimate removal of condemned structures where violations have not been rectified.**

The Department of Natural Resources has an interesst in structures on leased lots and should provide technical assistance to Clay Township to help conduct an extensive and updated inventory of structural conditions. Notice of violations of the building code and condemnation proceedings against uninhabitable structures should follow. The information obtained in the inventory could also be utilized by the DNR to further refine acquisition priorities. Information of this type could be used to estimate the market value and potential cost of acquiring a parcel.

4) **Clay Township is a participant in the National Flood Insurance Program. All development activities should be in compliance with the National Flood Insurance Program flood plain management regulations. Public awareness of flood hazards and flood insurance availability should be promoted.**

As a participant in the National Flood Insurance Program, Clay Township has adopted a Flood Damage Prevention Ordinance regulating the elevation and construction of structures in a flood hazard area. Inasmuch as the entire St. Clair Flats is identified as a flood hazard area by the U.S. Department of Housing and Urban Development, the Ordinance should be actively enforced. Further, the Department of Housing and Urban Development is obligated to ensure compliance with the National Flood Insurance Program by participating local units of governments.

Public Health and Environmental Protection

1) **Existing regulatory authority under the Water Resources Commission Act, Act 245, PA 1929, and the Public Health Code Act, Act 368, PA 1978 should be fully applied to the St. Clair Flats to mitigate water pollution and public health problems associated with inadequate wastewater disposal.**

The Department of Natural Resources, Department of Public Health, Clay Township and St. Clair County Board of Health should work together to formulate a cohesive policy regarding water quality, public health and acceptable methods of waste disposal. Specific attention should be devoted to:

- Judge Halford Streeter's order of October 15, 1974 prohibiting the issuance of building permits.

- Reversal of the County sanitarian's decisions to deny septic permits by the County Board of Health Appeals Board.

- Measures to mitigate water quality and public health violations due to failing or nonexistent septic systems.

2) **Dredging, filling and bulkheading destroy fish and wildlife habitat. Such activities should be prohibited in critical areas.**

The Great Lakes Submerged Lands Act, Act 247, P.A. 1955, regulates dredge and fill activities on the bottomlands of the Great Lakes as well as in the Flats. Act 247 specifies that the use of bottomlands shall not be permitted if the public use thereof for hunting, fishing, swimming, pleasure boating or navigation is substantially affected or if the public trust is impaired.

Dredge and fill activities particularly threaten deep and shallow marsh areas (Physiographic Units 2 and 3). Dredging and filling disrupts vegetation and results in the loss of fish and wildlife habitat contributing to the decline in productivity. Because the entire western shoreline of Lake St. Clair has been bulkheaded, the Flats are increasingly important for fish and wildlife production for all of Lake St. Clair. Dredging and filling should be prohibited in all remaining marshlands of the Flats.

Recreational Use

1) **Mixed recreational use of the Flats should be promoted to serve a variety of interest groups.**

Concurrent management to promote a variety of uses is desirable and feasible. Fishing, hunting, boating, and nonconsumptive uses are advocated. The wildlife habitat and unique waterway systems of the Flats are ideally suited for these activities. More intensive recreational uses such as playfields, camping, and extensive picnicking are not recommended because of the fragility of the ecosystem.

The proposals of various recreational interests to expand utilization of the area should be evaluated to assess the impact on other recreational uses. For example, alteration of the natural hydrologic regime and fish habitat to provide for waterfowl habitat should be evaluated to assess the long term impacts on the total aquatic ecosystem.

2) **State or locally operated boating facilities are not recommended on out-islands.**

Sanitary wastes and litter are problems associated with these facilities. The problems are most intense during peak summer weekends. Because adequate control and sanitary treatment cannot be ensured, these facilities would be likely to result in further water quality problems and adverse impacts to wildlife habitat. State funds should not be made available to construct such facilities.

3) **Interpretive and nonconsumptive uses should be expanded and promoted.**

Activities such as birdwatching and nature education are nonconsumptive and if properly managed can be well suited to the fragile marsh habitat. A rustic nature center, trail system, and boardwalk would expand the recreational opportunities of the Flats. The facilities could be located on Harsen's Island near Little Muscamoot Bay providing an excellent viewing of wildlife.

4) **All recreational activity must be conducted in a manner that promotes total protection of the unique biologic and geologic resources of the Flats.**

While recreation benefits should be maximized, recreation pressures must be within the carrying capacity of these sensitive lands. Waterfowl and fish production should be carefully monitored for signs of stress or disturbance from recreational activity.

The interior shorelands of Little Muscamoot and Fisher Bays are productive habitat areas for fish and waterfowl. Boating and related water-oriented activities can be disruptive to waterfowl staging areas and fish spawning areas. If signs of stress are reported by field officers, areas should be posted as restricted to motorcraft during these sensitive periods.

Resource Value of the Flats

1) **The Flats must be viewed as a unique and dynamic biologic and geologic unit. All future management proposals must be evaluated with regard to their impacts on the function of the natural hydrologic regime and ecosystem.**

The previously described physiographic units may vary somewhat in their sensitivity to development pressures but all play an important role in maintaining the productivity of the area. Physiographic unit mapping and evaluation provides a valuable tool in evaluating the impact of future proposals. Therefore, all proposed uses must be viewed both in the context of their acceptability to all interest groups and their impact on the rest of the ecosystem. Fish and wildlife utilize different areas in different seasons and during various stages of their life cycles. Thus, the protection of a spawning ground alone will not insure the protection of a species.

2) **Dickinson Island is the largest area which remains largely in its natural state. It should be preserved intact and undisturbed.**

Dickinson Island remains largely undeveloped and its plant communities are directly related to water level fluctuation. It also supports endangered and threatened flora and fauna and has flora characteristic of a wet prarie habitat, which is rare in Michigan.

Dickinson Island is mostly state-owned. The federally-owned dredge disposal site on the northern edge is expected to revert to state ownership once it is filled and sealed. Every effort should be made to consolidate ownership by acquiring the privately-owned lands along the main channels and scattered lots in the interior of the island. Acquisition of the out-islands which border Goose and Fisher Bays will also help preserve the system.

Intensive recreational use should be prohibited in this area. State or federal funds should not be made available to construct boat marinas, diking systems, or other facilities which promote the intensive use of Dickinson Island. Diking and cropping for wildlife management activities would destroy the natural hydrologic regime and unique association of a variety of habitats.

3) **Fish and wildlife studies must continue to monitor conditions within the Flats.**

It is recommended that the DNR Fish and Wildlife Division and the USDI Fish and Wildlife Service establish an interagency agreement to coordinate studies within the Flats and establish a cooperative, ongoing program of data collection and analysis. Both agencies have ongoing research programs in the Flats. A coordinated research program can be instrumental in long range monitoring of fish and wildlife conditions.

ACQUISITION PRIORITIES PLAN

The State has lost a great deal of valuable land to private development interests resulting in the loss of fish and wildlife habitat and degradation of the environment. Act 215, PA 1949, provided for the dedication of the State Wildlife area in the Flats. Since 1949, the Wildlife Division of the Department of Natural Resources has been acquiring land for the wildlife area utilizing a variety of funding sources. Currently, acquisition funds available to the Wildlife Division amounts to approximately $13,000, an amount insufficient to acquire much property. The previous section outlines a range of policy recommendations to assist in the protection of the resource base. However, protection policies must be supplemented with an acquisition program that provides long term assurance that the Flats will be held in the public trust.

Acquisition Priorities

Priorities for the future acquisition of leased and deeded parcels were developed based largely upon the importance of the area to fish and wildlife habitat, aesthetics, and environmental protection. It is felt that leased properties, particularly undeveloped parcels, will ultimately be easier and less costly to acquire because the State retains an interest in leased properties. Many undeveloped parcels remain in their natural condition and are an important contribution to fish and wildlife habitat. Therefore, the acquisition of undeveloped leased parcels is the highest priority. Occupied parcels are likely to be more expensive because the State will have to buy the lease or deed holders equity in improvements and interest in the land.

Map 4 illustrates acquisition priorities. All properties recommended for acquisition lie within the area designated as Conservation in the Land Management Plan, Most properties are within outlying areas or adjacent to interior bays, inaccessible by roads, and occupied only seasonally. Deeded properties are not

generally recommended for acquisition except for those undeveloped parcels which lie adjacent to critical interior bays. Private claims on Dickinson Island have been recommended for acquisition to ensure this area is preserved intact.

Year-round residences on the South Channel and deeded parcels along the Middle Channel on Harsen's Island are not recommended for acquisition. These areas are accessible by road and represent significant owner investments. Deeded property along the North Channel is also not included. This area is easily accessible by boat and lies near the mainland.

Acquisition priorities as depicted in Map 4 are described as follows:

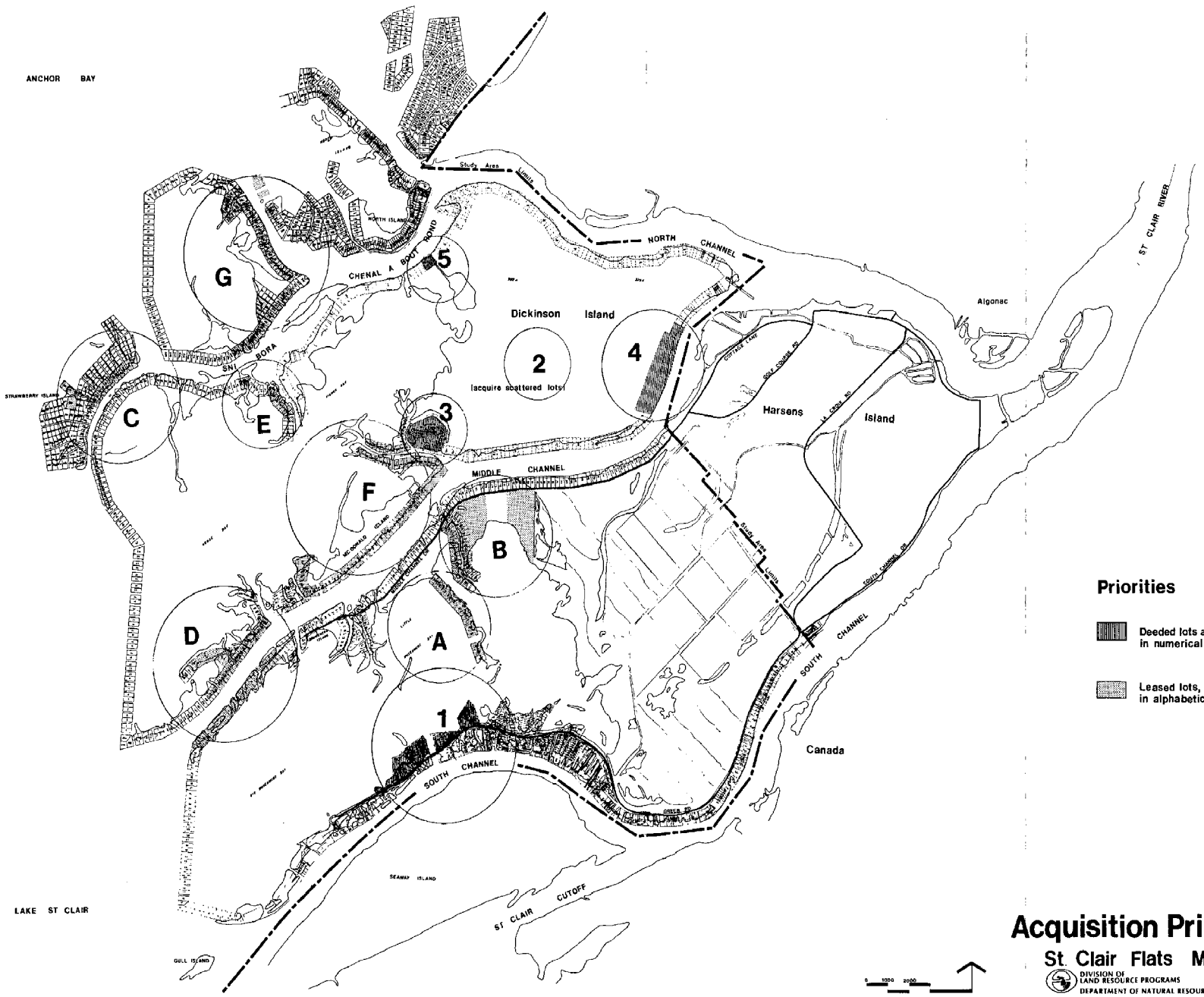
Acquisition Priorities of Leased Properties

A. Muscamoot Ridge

Muscamoot Ridge separates the highly productive Little Muscamoot Bay from Big Muscamoot Bay. Field inspection of the site shows houses which appear to be in the middle of the bay. They are especially subject to flooding because they lie so low in the water. Muscamoot Ridge is an old beach ridge which is important for fish production. This factor in combination with its close proximity to the highly productive Little Muscamoot Bay makes it a high acquisition priority.

B. Northern Edge of Little Muscamoot Bay

Acquisition of this portion of Harsen's Island would consolidate State ownership adjacent to the wildlife area and help protect the interior bay. This area has also been recommended as a site for an interpretive facility. Because most of the property in this area is undeveloped, it should be easier and less expensive to acquire than more densely developed areas.



Map 4

Acquisition Priorities Plan

St. Clair Flats Management Plan

DIVISION OF LAND RESOURCE PROGRAMS
DEPARTMENT OF NATURAL RESOURCES

Ayres, Lewis, Norris & May, Inc
engineers architects planners

C. Strawberry Island

This area lies farther out than any other portion of the Flats. It is highly subject to flooding and ice and wave damage because of its vulnerable location. Acquisition here will be primarily of occupied parcels, but the area is not as densely developed as other areas so total acquisition costs should be lower.

D. Outlying Lands Along the Middle Channel

This area lies far out along the Middle Channel and is one which qualifies as a critical out-island. It will be expensive to acquire completely because it is densley developed, particularly along the northern side of the Channel. The southern side is occupied primarily by an old and established boat club, which would have a lower acquisition priority than the seasonally occupied residential properties in the area. These lands are not accessible by roads.

E. Southern Side of Sni Bora Channel

Acquisition of this area would consolidate State ownership of Dickinson Island. The area is not accessible by roads and is an outlying area which borders an interior bay.

F. McDonald Island

This area is accessible only by boat, and lies adjacent to Goose Bay. It has received lower acquisition priority because it is quite densely developed, particularly along Big Fisher Highway where many fractionalized parcels are located. An immediate goal is to prevent any further development in this area, which could be assured by acquisition of the undeveloped parcels. Eventual acquisition of this area would ensure protection of the ecological resources in and around Dickinson Island.

G. Leased Properties Along the Northern Side of Chenal A Bout Rond and Sni Bora Channel

This area has the lowest acquisition priority of all leased areas because it is removed from the critical interior bays. Several deteriorating or uninhabitable structures which should be condemned and removed, are located there. Deteriorating properties and unoccupied parcels should be acquired first due to lower acquisition costs and to prevent further development in the area.

Acquisition Priorities for Deeded Properties

1. Harsen's Island – Interior Lands Lying Along Little and Big Muscamoot Bays

This area has received high priority in the acquisition programs outlined by the Wildlife Division since 1949. Most of the lands have been acquired as funds have become available. Acquisition of the deeded (and a few leased) parcels on the north side of Green Road should continue to consolidate State ownership and protect lands along the critical interior bays. It may be expensive because some deeded parcels are occupied by year-round residents. However, its location adjacent of critical interior bays makes it a high priority acquisition area.

2. Acquisition of Interior Lands of Dickinson Island

The uniqueness of Dickinson Island as well as the importance of preserving the island as a unit, has been referred to throughout the report. There are approximately 125 deeded parcels in the interior of the island. Some of these parcels have been fractionalized, so there are about 200 property owners involved. These parcels are undeveloped and should be acquired. It will be necessary to unravel the legal descriptions and locate the properties and their owners before acquisition can be accomplished. Any parcels lying in or adjacent to interior marshes in former distributary channels are most critical.

3, 4 & 5. Privately Owned Lands Along the Edges of Dickinson Island

These areas are developed, though they are occupied by seasonal residences. Area 4 is the most densely developed and largest of these three areas, so it will be most expensive to acquire. Acquisition of these three areas is important to insure that the unique Dickinson Island habitat is protected and retained in its natural state.

Acquisition Costs

Acquisition costs for the priority land areas are approximately ten million dollars. This figure includes acquisition for the following lots and structures:

Priorities A through G	
180 leased lots with homes (average value of $22,000)	$ 3,960,000
120 vacant leased lots (average value of $1,000)	120,000
Priorities 1 through 5	
180 deeded lots with homes (average value of $29,000)	$ 5,222,000
91 vacant deeded lots (average value of $8,000)	728,000
Total Acquisition Costs	$10,030,000

The figures are based upon average lot and home values for properties within the Flats. A detailed cost breakdown for each of the leased priority areas or deeded priority areas is impossible to determine without an individualized assessment of each lot and structure.

Acquisition Methods

Figure 25 presents the various methods available to the State of reacquiring leased lands. The most direct method would be not to extend leases beyond their 99-year term in the year 2013. The knowledge that leases will not be renewed will be likely to provide property owners with a disincentive to maintain their property, and thereby contribute to further dilapidation of structures in the area.

Figure 25
Acquisition Methods for Leaseholdings

Method	Implications
Forfeiture for failure to pay taxes	Act 12, P.A. , 1917 amends Act 327, P.A. 1913 to provide the legal mechanisms
Prohibit extension of lease beyond 99-year term	This policy may require State funds to compensate leaseholder for loss of structure
Terminate or acquire lease prior to expiration of full term	Method would be particularly useful for unoccupied parcels but may require new legislation.

Another method is reversion to the State of leased lands on which taxes have not been paid. This method requires the smallest commitment of State funds and effort. However, forfeiture of leases for nonpayment of taxes does not occur frequently enough to contribute significantly to State holdings in the Flats.

A final method is to terminate or acquire leases prior to expiration of the full term of the lease. This option would be particularly effective in acquiring unoccupied and undeveloped parcels in critical areas, but may require new legislation and funds appropriated for this purpose.

Figure 26 illustrates methods for the purchase of deeded parcels and private claims. The most direct method is negotiated fee simple acquisition. However, acquisition through fee simple purchase may require substantial funding. Although the state has issued leases and deeds at a low price, these parcels have enjoyed a fairly high market value. Even unimproved parcels have sold at a high price because of lot-splitting and development potential.

A less attractive alternative of acquisition to a negotiated fee simple purchase is condemnation. However, condemnation and subsequent settlements are likely to be time consuming, expensive and not as politically acceptable as other available methods.

In some cases, deed holders may be willing to donate their lands fee simple to the State or a private conservation organization. Donation is particularly attractive to landowners seeking a charitable deduction on their Federal income tax. Organizations such as the Michigan Nature Association and the Nature Conservancy have expressed a willingness to assist the State in developing such a land donation program in the Flats.

An alternative to fee simple acquisition is the purchase of a less than fee interest in the land known as a conservation easement. Conservation easements are negative in nature in that they stipulate what may not be done with either all or a portion of the property, such as bulkheading, excavating, or building. Easements have some advantages in that they are less costly than a fee simple purchase, and the property would remain on the tax rolls. If the easement is donated, the property owner can enjoy a tax deduction. The difficulty with easements lies in policing the condition of the easements.

Another method of less than fee acquisition is the purchase of development rights of undeveloped parcels. Development rights can be figuratively separated from other rights associated with property ownership. Purchase of development rights is less expensive than fee simple purchase. However, there is little incentive for a property owner to hold title to land that cannot be developed.

Figure 26
Land Acquisition Methods for
Deeded Properties and Private Claims

Method	Implications
Negotiated Fee Simple Purchase	Limited acquisition funds are available. Fair Market Value is very high.
Condemnation	State must pay just compensation to landowner. Process may involve extensive litigation and expensive payments.
Donation of Land Holdings	Donor may write off gift as charitable donation on Federal income tax.
State Purchase of Conservation Easements	This alternative may be considered for protection of critical shoreline areas. It would insure protection until State funds become available to purchase entire parcel.
Purchase of Development Rights	The option would be less costly than fee simple purchase, permit limited recreational use by owners and protect critical resources.
Purchase Property and Lease Back	This method would purchase a deeded property and lease back to landholder. Method would ensure greater control by State.
Property Exchange	Properties located in critical areas would be exchanged for property in less critical area.

Another acquisition method is the negotiation of purchase and leaseback agreements. The State would purchase fee simple title to the land and subsequently lease it back to the previous owner with certain use restrictions. This method might be an attractive interim measure in developed areas which might eventually be reclaimed by the State. Existing property owners would be permitted to remain with short-term leases until such time as they are required to vacate the property.

Land exchange is one final method of acquiring land in critical areas. A property owner (or leaseholder) might be willing to exchange property in a critical area for property in a less critical area. This exchange would consolidate the existing pattern of scattered development. Its applicability would be closely tied to the magnitude and nature of improvements made upon the property and might be more attractive to a property owner who has not made substantial investment in his property.

Acquisition Funding

In recent years, a great deal of public and private effort has been devoted to the acquisition of St. John's Marsh, located adjacent to the Flats on the mainland. The St. John's Marsh has been a primary focus for the expenditure of funds and represents an important step for wetland preservation in heavily populated southeastern Michigan. However, it is hoped that efforts will extend to preserve the equally valuable St. Clair Flats Area.

It is clear that, if the multi-use potential of the St. Clair Flats is to be realized, broader funding participation must be sought from other divisions of the Department of Natural Resources, as well as Federal sources. To date, the Wildlife Division has been the only division of the Department of Natural Resources actively seeking to acquire land in the Flats due to the legislative mandate establishing the St. Clair Flats Wildlife Area in 1949. The Wildlife Division's priorities have been the consolidation of their holdings on Dickinson Island and the upland portions of Harsen's Island (outside of the study area limits). However, with only $13,336 remaining in acquisition funds, the prospect is dim for substantial acquisition.

Several State programs exist for land acquisition activities. The Michigan Land Trust Fund or Kammer Fund is derived from mineral exploration leases. A citizen's board recommends funding appropriations to the Legislature. Funds are used to match Federal Pittman-Robinson and Dingell-Johnson funds discussed later in this section.

The Governor's Urban Recreation Program was appropriated $10 million by the Legislature in 1978. Approximately $1 million was made available for land acquisition in St. John's Marsh.

Early Federal legislative mandates and appropriations provided funds for draining or filling wetlands to reclaim agricultural lands and to control flooding. In later years, legislation was passed which provided funds for wetland protection and acquisition because of their importance for fish and waterfowl production. The major acts included the Pittman-Robinson Act and Dingell-Johnson Funds. The funds allocated by these acts remain the major sources available for wetland acquisition today.

The Pittman-Robinson Act derives its authority from the Federal Aid in Wildlife Restoration Act of 1937. These funds are available for land acquisition, development, research, and coordination necessary to restore or manage wildlife populations and to provide for the public use of the resource. Although funds are not utilized only for wetland acquisition, much wetland acreage has been acquired under this program.

Dingell-Johnson Funds became available through provisions of the Federal Aid in Sport Fish Restoration Act of 1950. The provision of funds and coordination between State and Federal authorities, as well as stipulations for use of funds, are similar to the Pittman-Robinson program except that they are earmarked for enhancement of the sports fishery.

These sources of funds are used jointly and are matched by State appropriations or private donations. They are used by the Wildlife Division in its acquisition program. Recently, a large portion has been devoted to the acquisition of the St. John's Marsh.

Funds have been available to State and local governments through the Land and Water Conservation Fund (LWCF). Under this program, Federal matching funds are granted to State and local governments for land acquisition for recreational and preservation purposes. LWCF monies have not been utilized for acquisition in the Flats because of the predominance of fishing and hunting programs. The LWCF program places greater priority on urbanized areas with a mix of recreational uses.

CONCLUSIONS

The St. Clair Flats remain as a vestige of the natural heritage of Michigan and the Great Lakes. Besides its intrinsic value as the largest deltaic wetlands system in the Great Lakes, the Flats represent 88% of the remaining wetlands on the Michigan side of Lake St. Clair. Located within easy accessibility of three-fifths of the State's population, the Flats are an irreplaceable public resource providing fishing, hunting, boating and other recreational opportunities to hundreds of thousands of people.

Through legislative action and regulatory inaction, much of the Flats has been degraded and destroyed. Residential and commercial development has been built in areas not capable of supporting such development. Over 90% of the land area within the Flats is subject to severe flooding. The high water table prevents individual septic systems from functioning. Further, the discharge of septic effluent into area waters poses a threat to public health. Many of the Flats' residents utilize the direct intake of water for household use. The dredging, filling and bulkheading which have accompanied urban development have resulted in the degradation of wetlands and fish and wildlife habitat.

Although a great deal of damage has already been done during this century to the St. Clair Flats, the opportunity still exists to rectify the abuses of the past. However, maintenance of the status quo will surely result in the eventual loss to the citizens of Michigan of this unique and highly valuable area. Failure to protect the Flats would further deprive current and future generations of the rapidly diminishing opportunities for hunting, fishing, boating and recreation sought in the Flats by so many from past generations.

The St. Clair Flats Management Plan is designed to protect and reclaim the public's interest in the St. Clair Flats. Through a program of revised land management policies, enforcement of environmental regulations, and acquisition of critical

lands, the Flats can be preserved as a public recreational, environmental and economic resource. The full implementation of the Management Plan will require the active leadership of the Department of Natural Resources and the cooperation of local, State and Federal agencies and private organizations. Considering the value of such an irreplaceable resource, an effective management program of the St. Clair Flats is essential.

Bibliography

BIBLIOGRAPHY

Clark, John, The Sanibel Report: Formulation of a Comprehensive Plan Based on Natural Systems, The Conservation Foundation, 1976.

Clark, John, Coastal Ecosystems: Ecological Considerations for Management of the Coastal Zone, The Conservation Foundation, 1974.

ClayTownship, Clay Township, St. Clair County, Future Land Use Plan, Clay Township, St. Clair County, Michigan, 1970.

ClayTownship, Ordinance No. 25, Zoning Ordinance, Clay Township, St. Clair County, Michigan, 1967.

ClayTownship Planning Commission, Clay Township, Concepts for Growth, Clay Township, St. Clair County, Michigan, 197?.

Cole, Leon J., "The Delta of the St. Clair River," Geological Survey of Michigan, Volume IX, Part I, 1903.

Curtis, J. T., The Vegetation of Wisconsin, University of Wisconsin Press, 1959.

Dawson, Steven A., "Waterfowl Food Production and Utilization in Anchor Bay, Lake St. Clair," Unpublished Master's Thesis, University of Michigan, Ann Arbor, Michigan, 1975.

Federal Water Quality Administration, Investigation of Mercury in the St. Clair River - Lake Erie Systems, Federal Water Quality Administration, Great Lakes Regional Office, Lake Huron Basin Office, Lake Erie Basin Office, National Field Investigations Center, 1970.

Hubbell, Roth and Clark, Inc., Harsens Island Segment of the Clay Township, Ira Township and the City of Algonac, St. Clair County, Michigan Facilities Plan, C26-2646, 1977.

Jamsen, Gale C., "Michigan's 1975 Sport Fishery," Surveys and Statistics Service Report No. 156, Surveys and Statistics Division, Department of Natural Resources, Lansing, Michigan, 1976.

Jaworski, Eugene and Raphael, C. Nicholas, Fish, Wildlife and Recreational Values of Michigan's Coastal Wetlands, Wetlands Value Study, Phase I, U.S. Fish and Wildlife Service, Region III, Twin Cities, MN, 1978b.

Jaworski, Eugene, Raphael, C. Nicholas, et al., Impact of Great Lakes Water Level Fluctuations on Coastal Wetlands, Final Report, Contract No. 14-0001-7163, for the Office of Water Resources and Technology, U.S. Dept. of Interior, 1979.

Jaworski, Eugene, and Raphael, C. Nicholas, "Modification of Coastal Wetlands in Southeastern Michigan and Management Alternatives," The Michigan Academician, Vol. 8(3), 1976.

Jaworski, Eugene, and Raphael, C. Nicholas, "A Morphological Comparison of the St. Clair and Mississippi River Deltas," Proceedings of the Association of American Geographers, Vol. 5, 1973.

Larson, J. S., Models for Assessment of Freshwater Wetlands, Water Resources Research Center, University of Massachusetts, Amherst, Mass., 1976.

Leverett, Frank and Taylor, F.B., The Pleistocene of Indiana and Michigan and the History of the Great Lakes, U.S. Geological Survey, Vol. 52, Washington, D.C., 1975.

Lyon, John G., "Analyses of Coastal Wetland Characteristics: The St. Clair Flats, Michigan," Unpublished Master's Thesis, University of Michigan, 1979.

McHarg, Ian L., Design with Nature, The Conservation Foundation, 1967.

Michigan Dept. of Natural Resources, Division of Land Resource Programs, Michigan Land Cover/Use Classification System, Lansing, Michigan, 1975.

Michigan Dept. of Natural Resources, Wildlife Division, St. Clair Flats Wildlife Area Master Plan, 1977-1987, 197?.

Michigan Dept. of Natural Resources, Wildlife Division, State of Michigan, Environmental Assessment: Purchase and Management of St. Johns Marsh Wildlife Area, Lansing, Michigan, 1977.

Pezetta, J.M., "The St. Clair River Delta," unpublished Ph.D. Dissertation, University of Michigan, Ann Arbor, Michigan, 1968.

Pieters, A.J., "The Plants of Lake St. Clair," Bulletin of the Michigan Fish Commission, No. 2, 1894.

Raphael, C. Nicholas and Jaworski, Eugene, "Geomorphic and Biological Values of the St. Clair Delta," Michigan Academician, in press.

Roller, Norman, E.G., Changes in the Wetlands and Land-Use Patterns of St. John's Marsh, St. Clair County, Michigan, ERIM Report 193400-11-T, Environmental Research Institute of Michigan, 1976.

Tilton, Donald L., Kadlec, Robert H., and Schwegler, Benedict R., The Ecology and Values of Michigan's Coastal Wetlands, Wetlands Value Study, Phase II, U.S. Fish and Wildlife Service, Region III, Twin Cities, MN., 1978.

U.S. Army Corps of Engineers, Detroit District Office, Final Environment Statement, Proposed Diked Disposal Area on Dickinson Island, St. Clair County, Michigan, 1974.

U.S. Army Corps of Engineers, Detroit District Office, Maintenance Dredging of the Federal Navigation Channels in the St. Clair River, Michigan, Final Environmental Statement, 1976.

U.S. Army Corps of Engineers, St. Paul District, Typical Residential Flood Damage Curves for Homes Without Basements, October, 1974.

U.S. Dept. of Agriculture, Soil Conservation Service, Soil Survey of St. Clair County, Michigan, U.S. Government Printing Office, Washington, D.C., 1974.

U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Township of Clay, Michigan, St. Clair County, 1977.

U.S. Dept. of the Interior, Fish and Wildlife Service, National Estuary Study, Volume 4, USDI-FWS, Bureau of Sport Fisheries and Wildlife and Bureau of Commercial Fisheries, 1970.

Wagner, W.H., et al., "Endangered, Threatened and Rare Vascular Plants in Michigan, The Michigan Botanist, Vol. 16, 1977, (reprint), prepared for the Dept. of Natural Resources.

Williamson, Brooks B., "The Wetlands of Dickinson Island, St. Clair County, Michigan, and its Response to Water Level Fluctuations," unpublished M.S. Thesis, Eastern Michigan University, 1979.

Appendices

APPENDIX A

List of Those Contacted
During the Course of This Study

I. Local Officials

Clay Township

- Ed Spenick - (former) Clay Township Supervisor
- William Lowes - (former) Clay Township Building Inspector
- Marty Zimmer - (former) Clay Township Tax Assessor
- Joe Hoisington - Clay Township (and St. Clair County) Planner

St. Clair County Board of Health

- John Tironi - Director of Environmental Health
- Norm Grinnel - Clay Township Sanitarian

II. State Officials

Michigan Department of Public Health

- Ric Falardeau, P.E.

Michigan Department of Natural Resources

- Division of Land Resource Programs
  - Karl Hosford, Chief
  - Mo Nielsen - Submerged Lands Unit
  - Roger Hack - Submerged Lands Unit
  - Chris Shafer - Coastal Program Unit
  - Dave Warner - Coastal Program Unit

Lands Division

Jane Bower - Supervisor, Leasing

David Freed - Leasing

Bill Schmidt - Land Appraiser

Wildlife Division

Ed Mikula - Land Acquisition and Management

Leo Pospichal - Wetlands Planner

Dr. Sylvia Taylor - Endangered Species Coordinator

Thomas Nederveld - Wildlife Biologist, Southern Land Management

Dick Elden - Wildlife Biologist, Pontiac District Office

Fisheries Division

Henry Vondett - St. Clair Flats Committee

Ron Spitler - Fisheries Biologist, Pontiac District Office

Environmental Enforcement Division

Don Inman, Wildlife Biologist

Gary Gettel

Virginia Pierce

Water Quality Division

John Wuycheck - St. Clair Flats Committee

Warren Slocum - Grant Review Section

Water Management Division

Wallace A. Wilson - St. Clair Flats Committee,
Supervisor, Flood Plain Management

Daniel Morgan - Flood Insurance Studies

Conservation Officers - St. Clair Flats Area

Gary Hoover

Don Hall

Attorney General's Office

Russel Prins, Assistant Attorney General

III. Federal Government

U.S. Army Corps of Engineers

Dr. Mary Ann Cooper - Environmental Branch

Brooks B. Williamson - Environmental Branch

Gary Mannesto - Regulatory Functions

William McClarnon - Engineering Division (Winter Navigation)

U.S. Department of the Interior - Fish and Wildlife Service

East Lansing Area Office

Bill Owens

Great Lakes Fishery Laboratory

Thomas Edsall

Bruce Manny

Charles Brown

Michael T. Werner

and other members of the research team

Shiawassee NWR

Bob Johnson, Refuge Manager

IV. Other Groups Contacted

John Lyon

School of Natural Resources

University of Michigan

Ann Arbor, Michigan

Doug Joergens
Environmental Control Technology Corporation (ENCOTEC)
Ann Arbor, Michigan

Dr. Eugene Jaworski, and Dr. C. Nicholas Raphael
Dept. of Geology and Geography
Eastern Michigan University
Ypsilanti, Michigan

Dr. Paul Thompson, Plant Ecologist
Cranbrook Institute of Science

Lake St. Clair Advisory Committee
Ray Trombley, Director
Mt. Clemens, Michigan

The Nature Conservancy
Michael L. Green, State Director
Lansing, Michigan

Michigan United Conservation Clubs
John Whitmore, Regional Vice President
Farmington Hills, Michigan

Ducks Unlimited
Barbara Whitmore

ERIM (Environmental Research Institute of Michigan)
Norman Roller, Earth Resources Remote Sensing Application
Ann Arbor, Michigan

Diana V. Pratt
Attorney-at-Law
Ann Arbor, Michigan

APPENDIX B

Relationship of Physiographic Units to MLCUCS and Jaworski and Raphael's Vegetative Zones

The MLCUCS system uses a four digit system to categorize land cover. Each digit corresponds to a progressively more detailed classification. For example:

Level I (one digit)	1	Urban and Built up
Level II (two digits)	11	Residential
Level III (three digits)	111	Multi-family, medium to high-rise
Level IV (four digits)	1111	High density
	1112	Medium density
	1113	Low density

Level III and IV classifications have not been developed for all classes. When no detailed information is available, a zero is used in the four digit code. MLCUSC classifications which correspond to the physiographic units are presented in Figure A.

Jaworski and Raphael used vegetative type and water depth to develop their categorization system. Species of vegetation which correspond to their categories are presented in Figure B.

Figure A

RELATIONSHIP BETWEEN PHYSIOGRAPHIC UNITS, MLCUCS DESIGNATION, AND JAWORSKI AND RAPHAEL'S CATEGORIZATIONS

Physiographic Unit	MLCUCS Designation		Jaworski and Raphael's System, (Dickinson Island), (J&R, 1979)
Unit 1:	MLCUCS #5 - Water		
Open Water	5110	Small streams and rivers (15 ft wide)	Coastal Embayments Canals and Ponds
	5210	Ponds (4.9 acres)	
	5220	Small lakes (5-9.9 acres)	
	5310	Pond reservoirs (4.9 acres)	
	5400	Great Lakes and connecting waters	
Unit 2:	MLCUCS #6 - Wetland		
Deep Marsh	624	Deep marsh	Abandoned Channels
	6241	Cattail predominates	Bulrush and Open Water Marsh
	6242	Burreed, rushes, sedges	Cattail Marsh
Unit 3:	MLCUCS #6 - Wetland		
Transition Area	612	Forested wetlands	Tussock Sedge Marsh
	6126	Willow-buttonbush associations (less than 50% cover, more than 6" of water)	Transgressive Beaches and Island Shorelines (also Unit #4)
	6128	Standing dead trees, shrubs, and stumps	
	623	Shallow marsh	
	6231	Cattail predominates	
	6232	Burreed, bulrush, sedge, blue-joint grass	
	6233	Smartweed, mud plantain, pickerel weed, arrow arum, and arrowhead	
Unit 4:	MLCUCS #3 - Rangeland ("areas supporting early stages of plant succession characterized by grasses or shrubs")		
Open Meadow	3110	Upland herbaceous rangeland	Transgressive Beaches and Island Shorelines
	3120	Lowland herbaceous rangeland	Meadow Zone
	3124	Lowland herbaceous rangeland, (sedges predominate)	Shrub Ecotone or Swamp Margin (also Unit #5)
	3210	Upland shrub rangeland	
	3212	Upland shrub rangeland, (Dogwood predominates)	
Unit 5:	MLCUCS #4 - Forest Lands		
Upland Forest	4110	Upland hardwoods	Shrub Ecotone or Swamp Margin
	4118	White Oak predominates	Deciduous Hardwoods
	4119	Other upland hardwoods	
	4130	Lowland hardwoods	
	4139	Other lowland hardwoods	
Unit 6:	MLCUCS #1 - Urban and Built-Up		Not Applicable;
Man-Altered Areas	1100	Residential	(Referred to as "Urban" or "Cropland" in writings)
	1990	Open and other	
	MLCUCS #2 - Agricultural Land		
	2100	Cropland, rotation, and permanent pasture	

Figure B

SPECIES OF VEGETATION
ASSOCIATED WITH JAWORSKI AND RAPHAEL'S CLASSIFICATION CATEGORIES,
AS RELATED TO PHYSIOGRAPHIC UNITS

Physiographic Unit	Jaworski & Raphael's Classification & Associated Species	
Unit 1:	Coastal Embayments (Gooseneck Pond of Fisher Bay, Goose Bay)	
Open Water	Three square Scirpus americanus	Muskgrass Chara sp.
	Hardstem bulrush Scirpus acutus	Bur-reed Sparganium chlorocarpum
	Hybrid cattail Typha glauca	Sago pondweed Potamogeton pectinatus
	Water smartweed Polygonum amphibium	Pickerel weed Pontederia cordata
	Canals and Ponds	
	Yellow pond lily Nuphar advena	Waterweed Elodea canadensis
	White water lily Nymphaea tuberosa	Water smartweed Polygonum amphibium
	Green algae (unidentified)	Curly pondweed Potamogeton crispus
	Duckweed Lemna minor	Other pondweeds Potamogeton spp.
	Pickerel weed Pontederia cordata	Buttonbush Cephalanthus occidentalis
	Muskgrass Chara sp.	
Unit 2:	Abandoned Channels	
Deep Marsh	Buttonbush Cephalanthus occidentalis	Three square Scirpus americanus
	Arrowhead Sagittaria latifolia	Yellow pond lily Nuphar advena
	Hardstem bulrush Scirpus acutus	White water lily Nymphaea tuberosa
	Bulrush and Open-Water Marsh	
	Hardstem bulrush Scirpus acutus	Muskgrass Chara sp.
	Buttonbush Cephalanthus occidentalis	Various emergents and submergents
	Cattail Marsh	
	Hybrid cattail Typha glauca	Mud lettuce (unidentified species)
	Narrow-leaved cattail T. angustifolia	Duckweed Lemna minor
	Jewel weed Impatiens sp.	Watermilfoil Myriophyllum sp.
	Seedlings of grasses and sedges	Common bladderwort Utricularia vulgaris
Unit 3:	Tussock Sedge Marsh	
Transition Area	Tussock sedge Carex stricta	Nightshade Solanum dulcamara
	Dead shrubs Salix, Populus	Common comfrey Symphytum officinale
	Other sedges incl. C. laisiocarpa	Bluejoint grass Calamagrostis canadensis
	Smartweed Polygonum sp.	Scattered cattails and bulrushes
	Transgressive Beaches and Island Shorelines	
	E. cottonwood Populus deltoides	Sedge Carex stricta
	Staghorn sumac Rhus typhina	Jewel weed Impatiens sp.
	Willows Salix spp.	Thistle Cirsium sp.
	Canary grass Phalaris arundinacea	Stinging nettle Urtica dioica
	Bluejoint grass Calamagrostis canadensis	Morning glory Convolvulus sepium

(Figure B continued on next page)

Physiographic Unit	Jaworski & Raphael's Classification & Associated Species
Unit 4:	Transgressive Beaches and Island Shorelines (See Unit 3, above)
Open Meadow	Meadow Zone
	Trembling aspen Populus tremuloides Red ash Fraxinus pennsylvanica Red dogwood Cornus stolonifera Gray dogwood Cornus racemosa Swamp rose Rosa palustris Goldenrods Solidago spp. Bluejoint grass C. canadensis Fowl meadow grass Poa palustris Rattlesnake grass Glyceria canadensis Cut grass Leersia oryzoides Panic grass Panicum sp. Sedge Carex stricta Freshwater rush Juncus sp. Silverweed Potentilla anserina Swamp milkweed Asclepias incarnata Morning glory Convolvulus sepium
	Shrub Ecotone or Swamp Margin
	Red ash Fraxinus pennsylvanica E Cottonwood Populus deltoides Trembling aspen P. tremuloides Red osier dogwood Cornus stolonifera Gray dogwood Cornus racemosa Wild grape Vitis sp. Understory plants (see Meadow, above)
Unit 5:	Shrub Ecotone or Swamp Margin (See Unit 4, above)
Upland Forest	Deciduous Hardwoods
	Pin oak Quercus palustris Swamp white oak Quercus bicolor Bur oak Quercus macrocarpa Shagbark hickory Carya ovata Silver maple Acer saccharinum American elm Ulmus americana
Unit 6:	
Man-Altered	(NOT APPLICABLE)

APPENDIX C

Estimated Acquisition and Development Costs
(All Study Area Properties)

Acquisition Costs	Number of Lots	Average Cost*	Total Cost
Deeded lots, w/homes and improvements	665	$ 29,000	$19,285,000
Leased lots, w/homes and improvements	222	22,000	4,884,000
Deeded lots, w/o homes	133	8,000	1,064,000
Leased lots, w/o homes	199	1,000	199,000
	1,219		$25,432,000

Costs Associated with Residential Development**

Lost Wetland Use***	Value per Acre per Year				
Sportsfishing	$ 374.00 [1]				
Waterfowl Hunting	$ 31.23 [2]				
Furbearer Trapping	$ 30.44 [2]				
Non-Consumptive Recreational Values	$ 138.24 [2]				
	$ 573.91	x	887 acres	=	$ 509,058

Costs of Development	Value per Home				
Potential Flood Damage to Homes	$ 8,000 [3]				
Sewer and Water Development	$12,000 [4]				
	$20,000	x	887 homes	=	$17,740,000
Minus Local Tax Revenue Generated by Development					- (51,855)
					$17,688,145

Lost Fish and Waterfowl Production****	Net Value per Acre[6]				
Fish Production	$16,450				
Waterfowl Production	$13,700				
	$30,150	x	887 acres	=	$26,743,050

*Average costs based on discussions with MDNR personnel and local officials familiar with real estate values in the Flats.

**Calculations are made using an average figure of one acre per lot. Thus, "lot" and "acre" are interchangeable values. Also, only lots which have homes or improvements on them are included in the calculations of costs of residentiaal development. However, it is likely that the fish and wildlife value of many unoccupied lots has been impaired or destroyed by man's activities, so calculated costs may be low.

***It may be argued that there is no evidence that these uses ever existed on every lot prior to development. However, values are dollars per acre per year and are calculated for only one year. They are likely to be low estimates, if the temporal dimension is considered.

****As above, it may be argued that these values do not consider pre-development differences in the productivity of lots. However, for purposes of making estimates, these figures are adequate.

Sources of Values:

[1] Jaworski and Raphael, (1978), p. 133.

[2] Jaworski and Raphael, (1978), p. 178.

[3] U.S. Army COE, (1974), Residential Flood Damage Curve read using (1) $20,000 as value of residential property, and (2) 1.5 feet as depth of water on first floor.

[4] Cost estimated in 201 Facilties Plan for Harsen's Island.

[5] Approximate tax paid in 1977. Information obtained from St. Clair County Tax Assessor's Office.

[6] Tilton, et al, (1978), p. 85. Study determined net values by calculating cost of replacing an acre of wetland by purchase or construction. The net value in this table is the average of the figures derived for purchase and construction of replacement wetlands.

NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 00001 3518