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Institutional arrangements for flood plain management in Ontario an analysis of the West Ferris Flood Plain management Study

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INSTITUTIONAL ARRANGEMENTS FOR FLOOD PLAIN MANAGEMENT IN ONTARIO AN ANALYSIS OF THE WEST FERRIS FLOOD PLAIN MANAGEMENT STUDY

Dan Shrubsole

A Thesis

Submitted in partial fulfillment

of the requirements for the

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ABSTRACT

The intent of this study is to investigate how river basin study delays could be avoided or shortened. Mitchell and Gardner (1983) identified the need for this type of research in order to make watershed planning credible. This study specifically focuses on how the institutional arrangement for flood plain management may be improved to provide more efficient and effective management. present institutional arrangement for flood plain management in Ontario.

The research was divided into two phases. The first phase was a literature review pertaining to comprehensive river basin management, institutional arrangements for water management, and general planning. This review led to a discussion of the historical development of the Ontario conservation authority movement, pertinent pieces of government legislation for flood plain management, and an overview of Ontario flood plain management policy. This literature provides the background and context from which the institutional arrangements for flood plain management were analyzed through a case study approach.

The second phase of research involved the selection of the West Ferris Flood Plain Management Study, completed for the North Bay Mattawa Conservation Authority, as a case study. The study, which was to have been completed in thirteen weeks, took over two and a half years. Interviews were conducted with the major study participants. These interviews revealed that the major cause for the delay was due to different institutional approaches for flood plain management.

The research concludes that the study delay could have been avoided if: the West Ferris Study terms of reference had been clearer, all participants had remained committed to the planning process, and a more effective bargaining or negotiation process had been present for the study participants to air differences of opinion. In order to avoid such delays in the future it is recommended that: study terms of reference be more detailed and more clearly stated, the Conservation Authorities Branch play a more active role in approving the technical aspects of water management studies, individual conservation authorities be responsible for final report approval to increase their accountability for studies and projects undertaken by them, and studies examining the protection of existing and future development be conducted by conservation authorities. The cost sharing for these studies should be based on the benefits derived from the protecting existing development to those derived from the protection of future development.

ACKNOWLEDGEMENTS

The author would like to express his sincere thanks and gratitude to the following individuals:

Dr. Graham Smith who agreed to be my advisor. I am indebted to him for allowing me to muddle through this exercise for the most part on my own and who always offered encouragement, advice, and critcisms when needed. I also wish to express my thanks to Dr. Jerry Hall and Dr. Jim Gardner for their patience and assistance as committee members. Much appreciation to Dr. John Radke for his last minute participation in this exercise.

The interview respondents for taking the time out of their schedules to talk to me about resources management and reviewing the thesis, my sincerest appreciation. At no point does this thesis question the dedication, or credibility of any individual connected with the case study. During the research this author found the advice and insights of all interview respondents most helpful. It is hoped that this study will contribute to more effective management of flood plains and I hope all readers will bear this in mind.

My classmates over the years, particularly those on 34 Bricker, with whom I have enjoyed many good times, I wish to thank for their friendship.

Undoubtably my deepest thanks is reserved for my parents, family and friends who have steadfastly supported my academic endeavors over the years.

A great number of people have contributed to this research study, however in the final analysis I take full responsibility for all errors, omissions, and shortcomings.

Danny Shrubsole
July 4, 1983

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CHAPTER I

INTRODUCTION

A national symposium on "River Basin Management: Canadian Experiences" concluded that "if river basin management is to remain credible, a need exists to reduce the time required to complete and implement plans" (Mitchell and Gardner, 1983,3). The North Bay Mattawa Conservation Authority (NBMCA) initiated a flood plain management study of three watersheds located in the former Township of West Ferris (now part of North Bay) in 1979. The study, known as the West Ferris Flood Plain Management Study (or West Ferris Study) was to have been completed in thirteen weeks, however due to problems which arose durung the course of the study it required over two years to be completed. This research study examines the causes of the study delay. By understanding the decision - making process through the interactions between the West Ferris Study participants, suggestions can be made to increase the efficiency of the river basin management system.

Comprehensive River Basin Management

Quinn (1977,229) stated that comprehensive water resource management in Canada "is almost by definition a joint federal - provincial approach." Patterson (1961,237) characterized the administrative framework for water management in Ontario as consisting of

> a large number of agencies administering a host of acts and performing numerous and often duplicative functions. ... The need for a co-operative comprehensive approach is readily apparent.

Resource management, including flood plain management, is essentially a decision - making process. In his discussion of decision - making and resources O'Riordan (1971,110) stressed the need to understand and to improve the process. He stated

> we need to focus upon the forces and resistances acting upon decision - makers when questions of resource management are judged, so as to understand more completely the factors that contribute to decisions which are ultimately reflected as changes in the landscape, and which affect the public use and enjoyment of the environment.

Memon (1970,154) claimed the real problem in attaining comprehensive water management in Ontario was not of a technological or methodological nature, but rather, the development of an appropriate institutional arrangement which would "foster the comprehensive approach to regional water management."

The West Ferris Study represents one aspect of comprehensive water management, specifically flood plain management. Flooding has caused millions of dollars in damages

and business losses in Ontario (Webster, 1981,1-2). The objectives of flood plain management in Ontario are to reduce flood losses, to prevent loss of life, and to develop a co-ordinated approach to land and water management (Dillon and MacClaren, 1976,31).

Flood plain management in Ontario is primarily based upon the cooperation between the Ministry of Natural Resources, local conservation authority, and municipalities. These were the central participants in the West Ferris Study. Since the responsibility for flood plain management is divided between several government agencies, this institutional arrangement is one of the important 'forces or resistances' influencing the resource management system which O'Riordan (1971,110) referred to. The complexity of decision - making in flood plain management is due to the views of different political units. The Ministry of Natural Resources (MNR) is involved in flood plain management through the Water Management and Conservation Authorities Branch which administers funding for many local authority programs and projects. The Ministry is also involved in flood plain management through enforcing the provisions of the Lakes and Rivers Improvement Act, and the Navigable Waters Act. A municipality is concerned with continued economic community growth and orderly urban development. While recognizing the need for flood plain management a municipality desires the maximum economic and social return from flood plain lands.

Ontario Conservation Authorities

The Ontario conservation authorities are unique resource management agencies and "stand out as potentially the most viable administrative response in resource management" (Wood, 1972,1). The Conservation Authorities Act provides for local initiative, cost sharing between the municipalities and the province, and a watershed jurisdiction. The broad objectives of conservation authorities, which include water, soils and land use, forestry, wildlife, recreational, political - institutional, economic, and social concerns, allow authorities to have a comprehensive understanding of regional resource management problems (Wood, 1972,38-39).

Several examinations have concentrated on individual authorities and programs. Coutts (1976) reviewed the Grand River Conservation Authority's (GRCA) role in water management. This discussion centered around the GRCA's flood protection programs and multiple purpose reservoirs. Community adjustments to the flood hazard in the Grand River watershed was researched by Mitchell, Gardner, Cook and Veale (1978). The five trends identified to cope with the flood hazard were: (1) a changing mix of adjustments, (2) incremental financing, (3) inconsistent enforcement, (4) inconsistent communications,

and (5) differences among communities (1978,xii). Veale (1979) evaluated flood plain management policies in the Grand and Credit River Valley Conservation Authorities. One of the factors identified for future research was "the policy-making process within the conservation authorities and its effect on policy formulation and implementation" (Veale,1979,307-308). Webster (1981) assessed flood warning systems in Ontario. She found the performance of a warning system was adversely affected by ignorance of the flood hazard and by apathy over implementation (1981,vi).

Other studies have examined the institutional arrangement of water management. Memon (1970) recommended a complete change in responsibility of all water related institutions in Ontario and a centralized decision-making, multi-agency body. He also suggested that while this institutional arrangement could encourage integrated comprehensive water resource management, it would likely be impossible to implement (Memon,1970,i). The institutional arrangement for water management in the Regional Municipality of Waterloo, conducted by Turkheim (1979), suggested the regional municipality "should increase its involvement in the management of its own water resources ... to increase financial and political accountability for decisions taken by elected representatives on water resource issues" (Turkheim,1979,iii).

The evolution of the Ontario conservation authority movement and the formation of the conservation authority as a resource management agency was summarized by Richardson (1974). Wood (1972) investigated the organizational goals and objectives of authorities. Wood concluded that the conservation authority program had been centred on the control and prevention of floods and identified the need for research on the political - institutional sector of the authority program. It is this aspect of the authority program which is investigated through the case study.

Statement of the Research Objectives

The key decisions in flood plain management are made by all levels of government. The MNR coordinates the programs of all conservation authorities and establishes flood plain management criteria and policies. Regional and local municipalities influence the types of land uses permitted on flood plains through the official plan and zoning by-laws. An authority is involved in flood plain management through the enforcement of flood and fill regulations. As well, studies, such as the West Ferris Study, require the involvement of all the previously mentioned participants due to an authority's municipal - municipal partnership. While the NBMCA sponsored

and coordinated the West Ferris Study, funds were provided by the City of North Bay and MNR. This is the institutional arrangement, or as Wood (1972) would term the political - institutional sector, of an authority flood plain management study. The central problem in flood plain mangement is who, or what combiation of actors will provide the most effective and comprehensive management most effeciently. The intent of this investigation is to answer this question through the examination of the West Ferris Flood Plain Management Study. While this research paper focuses on the institutional arrangement of flood plain management, one of the primary inputs in the decision - making process is also addressed. Hydrological analysis and modelling are incorporated as part of the information base from which resource management decisions by government are made.

Having briefly outlined the research need, intent, and evolution of the study, the specific research objectives are:

1. to relate the concepts of resources and resource management to decision-making, planning and institutional arrangements in implementing Ontario flood plain management policy;
2. to identify the types of public resource management agencies involved in flood plain management;

3. to identify the planning process which contributes to effective project formulation and implementation;

4. to indicate the study participants' perceptions of the present flood plain management policy and to identify their role in the West Ferris Flood Plain Management Plan or West Ferris Study;

5. to assess the planning process utilized in the West Ferris Flood Plain Management Study, by comparing it to the general planning process;

6. to present suggestions to improve the resource management system; and

7. to present recommendations for future research.

Study Approach and Limitations

Information sources included a literature review focused on the development of river basin management agencies and resource management, government legislation pertaining to flood plain management, agency documents and publications, newspaper articles, and personal interviews with individuals directly involved in the West Ferris Management Study.

The literature review provided the background material necessary to develop the concepts of policy, planning, institutional arrangements, and decision-making in a resource management context. A general planning process which allows one to develop a plan to meet future resource demands is described using river basin planning studies.

Government legislation facilitated the identification of the approach each agency has towards flood plain management. The component parts of the MNR, conservation authority, and municipal partnership in flood plain management could also be examined.

The chronology of events in the West Ferris Study was obtained through agency documents and personal interviews. A review of newspaper articles rendered little information regarding the progress of the study.

The personal interviews concentrated on the events in the study, the respondents' perception of the problems, flood plain management policy, and possible solutions to the problem(s). Interview lengths varied from 45 minutes to 2.5 hours. Respondents were selected based on their association with the study. Interviews were conducted with the General Manager and Planner of the NBMCA; a member of the West Ferris Study Technical Advisory Committee; the Director of Planning and Public Works for the City of North Bay, who was also a member of the technical advisory committee; the MNR Planner

for Nipissing District; the Conservation Authorities Program Supervisor MNR Northeastern Region; the Acting Manager, Technical Services, of the Conservation Authorities and Water Management Branch; Head of the Hydrological Modelling Division, Conservation Authorities and Water Management Branch; the Supervisor, Streamflow Forecast Centre, Conservation Authorities and Water Management Branch; Northland Engineering Ltd.'s Hydrologist and author of the West Ferris Flood Plain Management Study; and Northland Engineering Ltd.'s Senior Planner. These interviews were conducted between September 1982 and March 1983 in North Bay, Sudbury, and Toronto at the respondents place of work.

The case study approach was selected to limit the investigation and because of the author's familiarity with the area. The problems inherent in the case study approach are succinctly addressed by Platt et al. (1980,296).

> The case study is an imperfect snapshot of reality, marred by errors of omissions, emphasis and interpretation. At best they are approximate images of the actual rush of events and processes which have transpired. There is a danger in there use as a research tool that they emerge as complicated anecdotes, perhaps of individual interest but defiant by comparison. To avoid this pitfall, one tends to err on the side of "forcing" a case study into a common mold or pattern so as to facilitate comparability.

The author admits that these shortcomings are present in this study.

A second limitation which exists is the author's previous summer employment background with two conservation authorities, namely the Nottawasaga Valley (1975-1976) and more importantly the North Bay Mattawa (1978-1981). This employment background may bias the viewpoint of this investigation, however every effort has been made to conduct an objective study.

Study Organization

Chapter Two outlines the concepts of resources, resource management, decision-making, planning, and institutional arrangements. The types of water resource management agencies and their interaction are outlined in a Canadian context. General resource objectives in Canada and the development of Ontario conservation authorities prepares for the examination of flood plain legislation and policy in Canada. Pertinent planning literature provides a theoretical base upon which a general planning model can be developed. A full description of the regional setting and case study is presented in Chapter Three. Chapter Four uses the interviews to indicate the respondents perceptions to the West Ferris Study. These interviews and agency documents facilitate the analysis of the problems associated with the study process. This analysis is

is accomplished by evaluating the strengths and weaknesses of the West Ferris Study to the general planning model. Chapter Five suggests ways of improving the resource management process and identifies areas for future research.

CHAPTER II

THE WATER RESOURCE SYSTEM
IN
RIVER BASIN PLANNING

Introduction

Chapter I referred to resources, resources management, institutional arrangements, planning, policy and decision-making, integrated comprehensive management, and systems without affixing any definitions to these terms. Due to the complexity of the case study these terms will be defined through a systems theory approach. Having identified these concepts a general planning model is described. It is through planning that government institutions aim to achieve societal goals. This is followed by an historical overview of river basin planning, with particular emphasis upon the factors responsible for the formation of the conservation authorities in Ontario. Within this institutional framework, Ontario flood plain management policy is discussed.

Developing a Resource System Framework

The key concept in identifying, examining, and solving resource and environmental problems is found in the definition of resources. The 'functional concept of resources' states:

> resources are not, they become; they are not static but expand and contract in response to human wants and human activities (Zimmerman,1951,15).

O'Riordan (1974,4) believed

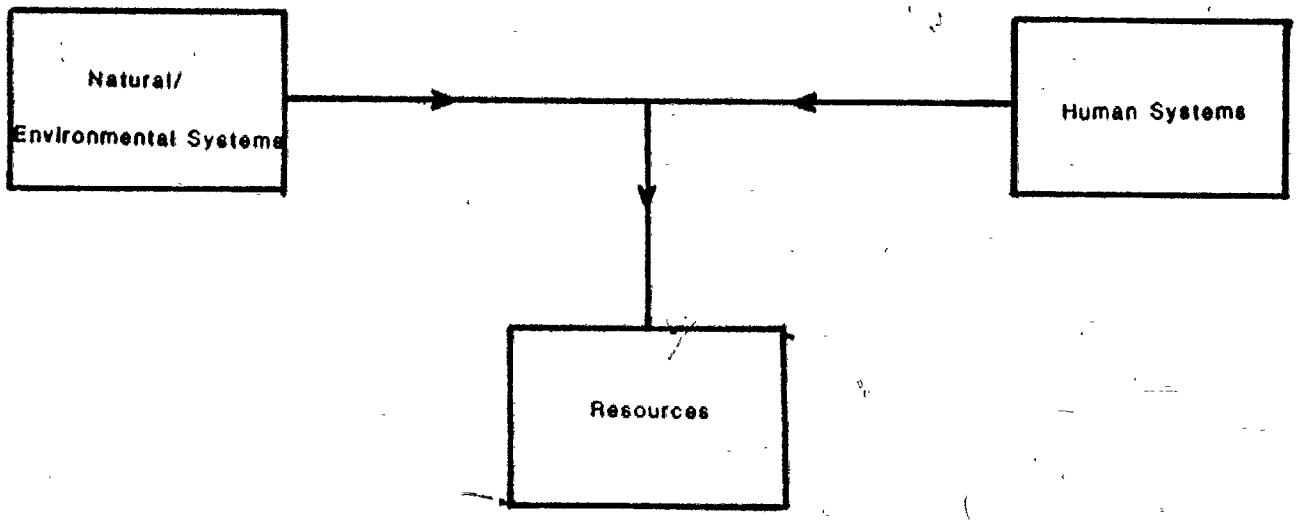
> resources are an attribute of the environment appraised by man to be of value over time with constraints imposed by his social, political and institutional framework.

These definitions suggest the physical and biological components of the environment become resources only after they have some value to society; they are a product of the interaction between environmental or natural systems and human systems (Figure 2.1). Also inherent in these definitions is the concept of resource evolution; they are not static, but develop in response to changing knowledge, technology, appraisal and perception (Wood,1972,6).

Water has the greatest variety of uses of all resources and provides society with many benefits but it can also constitute a devastating hazard (Chapman,1976,15). Important water uses and problems are identified in Table 2.1. An examination of these resource issues requires an understanding of both natural and human systems.

RGURE 2.1

THE CREATION OF A RESOURCE



(Jackson, 1981)

TABLE 2.1

Important Water Uses

Industrial
Municipal
Fisheries
Hydroelectric Power
Transportation
Agriculture
Recreation and Tourism

(Environment Canada, 1976)

All systems imply wholeness, interaction between units, and structure. "Wholeness implies system; organization implies locational aspects; interaction implies flows or movement" (Russworm,1970,2). Figure 2.2 illustrates the characteristics of a system. In a resource context, the environment provides inputs, or opportunities to the human system which transforms these into outputs (resources). Feedback represents a check in the system to ensure that societal resource goals and objectives are achieved (Burke et al.,1975,30).

The study of flood plain hazards and uses involves the investigation of the hydrological and appropriate human management systems. This is a difficult and time consuming task.

The Natural System

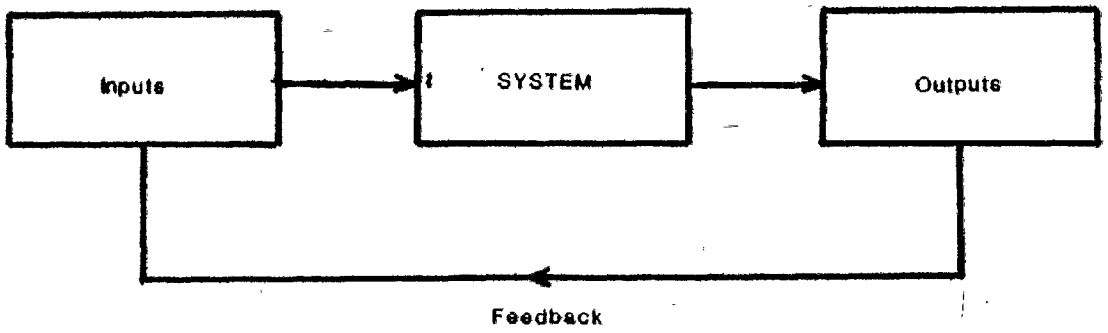
Within the water resource system the hydrologic system operates. Ven Te Chow (1964,I-2) explained hydrology as:

> the science that treats (the waters) of the Earth, their occurrence, circulation and distribution, their chemical and physical properties, and their reaction with their environment including living things. ... It is the scientific examination and appraisal of the ... water cycle.

Chow's definition has two important elements to this study. The first is the emphasis placed on waters interaction with man. This stresses the need to understand the processes of how man manages water. This management process will be developed

FIGURE 2.2

DEFINITION OF A SYSTEM



(Russworm, 1970)

shortly in a systems approach. The second element emphasizes the natural aspects of water. This study focuses on water quantity. Reynolds and Ujjainwalla (1974,244-247) identified the physical nature of Canada's water resources as 770,000 square kilometers of water, containing 18,800 cubic kilometers of water, 0.07 million cubic meters per second of stream flow, and locally important groundwater resources in the Fraser Valley, south-east Manitoba, parts of the Great Lakes-St. Lawrence regions, and parts of the Maritimes. This resource base has been an important factor in Canada's development. Tate (1981,151) noted the strong relationship of the major human settlements to lakes and rivers.

Platt et al. (1980,4-5) stated flood plains were the most visible landform developed as a result of the processes acting in a watershed system. Human occupation of these areas caused a threat of flooding; without human development in flood prone areas there would be no flood hazard.

The Human System

While the physical nature of Canada's water resources is important in the study of water resource problems, O'Riordan's definition of resources implies that human systems are of greater importance in resource studies since social, political, economic, and institutional forces, or human systems, constrain resource development.

A major problem in discussing human systems is to determine how to best present the interactions of the system. The compartmentalized flow chart was selected to conceptualize the human system because the author believes this method best illustrates the linkages between subsystems. Since society has the major role in determining resources and uses, the flow chart develops the human system first. Burke et al. (1975) examined decision-making in resource planning utilizing a social framework developed by Parsons (1966). The intent of this discussion is not to prove Parsons' theory of social organization but to develop a framework from which the concepts of policy, planning, decision-making, and institutions may be identified. Figure 2.3 illustrates Parsons' theory of social organization. Every social system must solve four basic problems. These are:

1) adapting to an environment. Societal goals cannot be satisfied without resources, but resources are not generally usable until they have been converted by facilities into useful forms (adaptive subsystem).

2) achieving collective goals. Closely related to the first problem because it includes goal selection and mobilization of necessary resources. Goal conflicts must be resolved through cooperation (Goal-attainment subsystem).

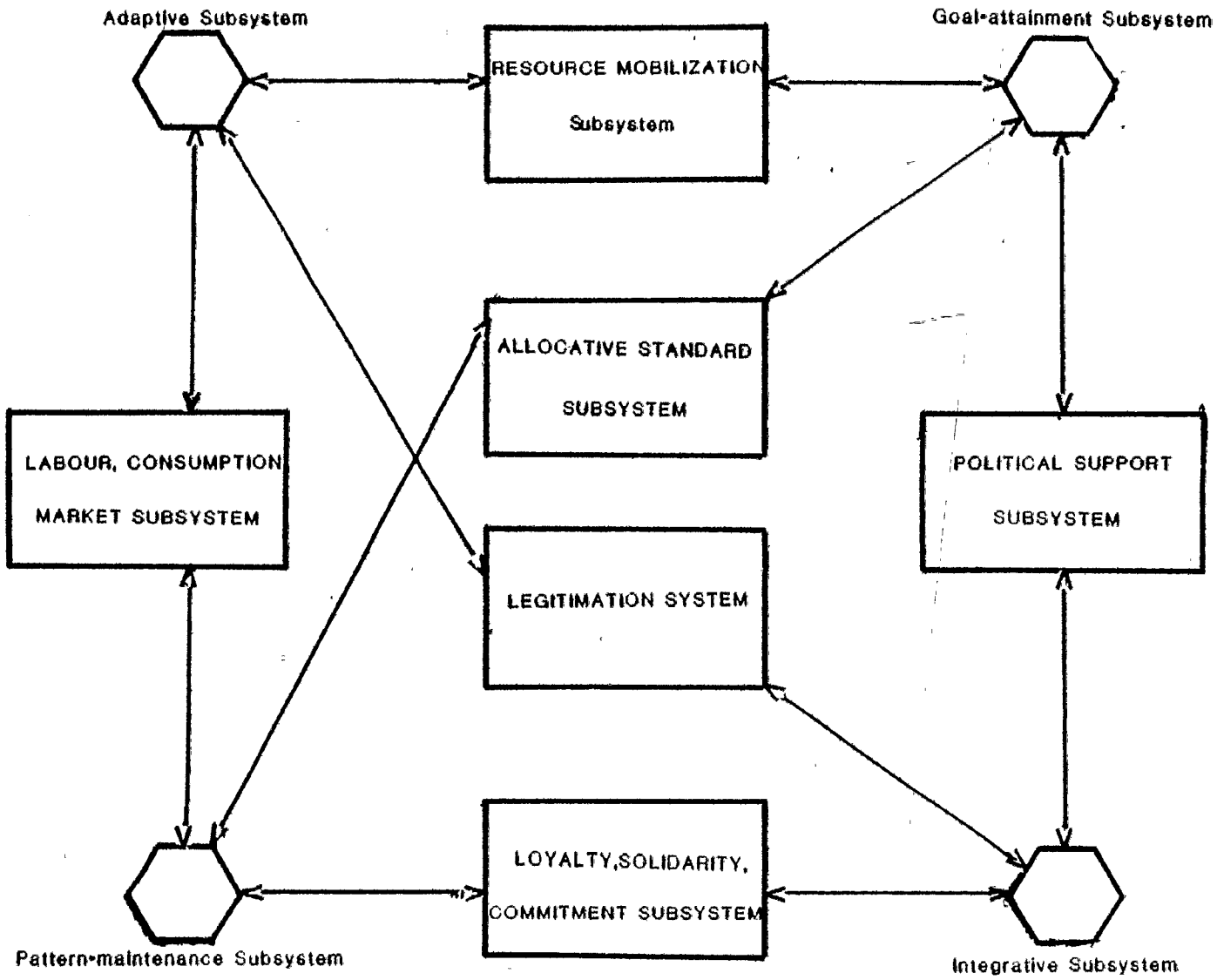


FIGURE 2.3

(Burke et al.,1975,26)

PARSONS' THEORY OF SOCIAL ORGANIZATION

3) controlling tension within the system. There must be a basic ordering of society's principles (pattern-maintenance subsystem).

4) integrating the actions of its members. This subsystem concerns the adjustment of relations among units of a system to ensure that all units will contribute to an order desirable to the entire social system (integrative subsystem) (Burke et al. 1975,22-29).

The six first order linkages (double interchanges) completely integrate these four functional subsystems to create six more subsystems. Burke et al. (1975,37) argued that essential planning and decision-making functions could be associated with only two of the four functional subsystems; the goal-attainment and the intergrative systems combine to form the political support subsystem (Figure 2.4).

The political support subsystem may be viewed as any resource management agency interacting between politicians and the public. Parson's (1966) examined extra-local and local interests involved in the exchanges of power and influence through government field level agencies. These agencies were found to be involved in both the 'polity' and 'integrative system' through their pursuit of goals and the distribution of benefits. Wengert (1957,259) believed the major task of the polity was to identify and achieve society's interests and goals. Government and politics shall refer to the total decision - making process based on the logical analysis by which public - government problems are solved (Wengert, 1957,258). Decision - making is:

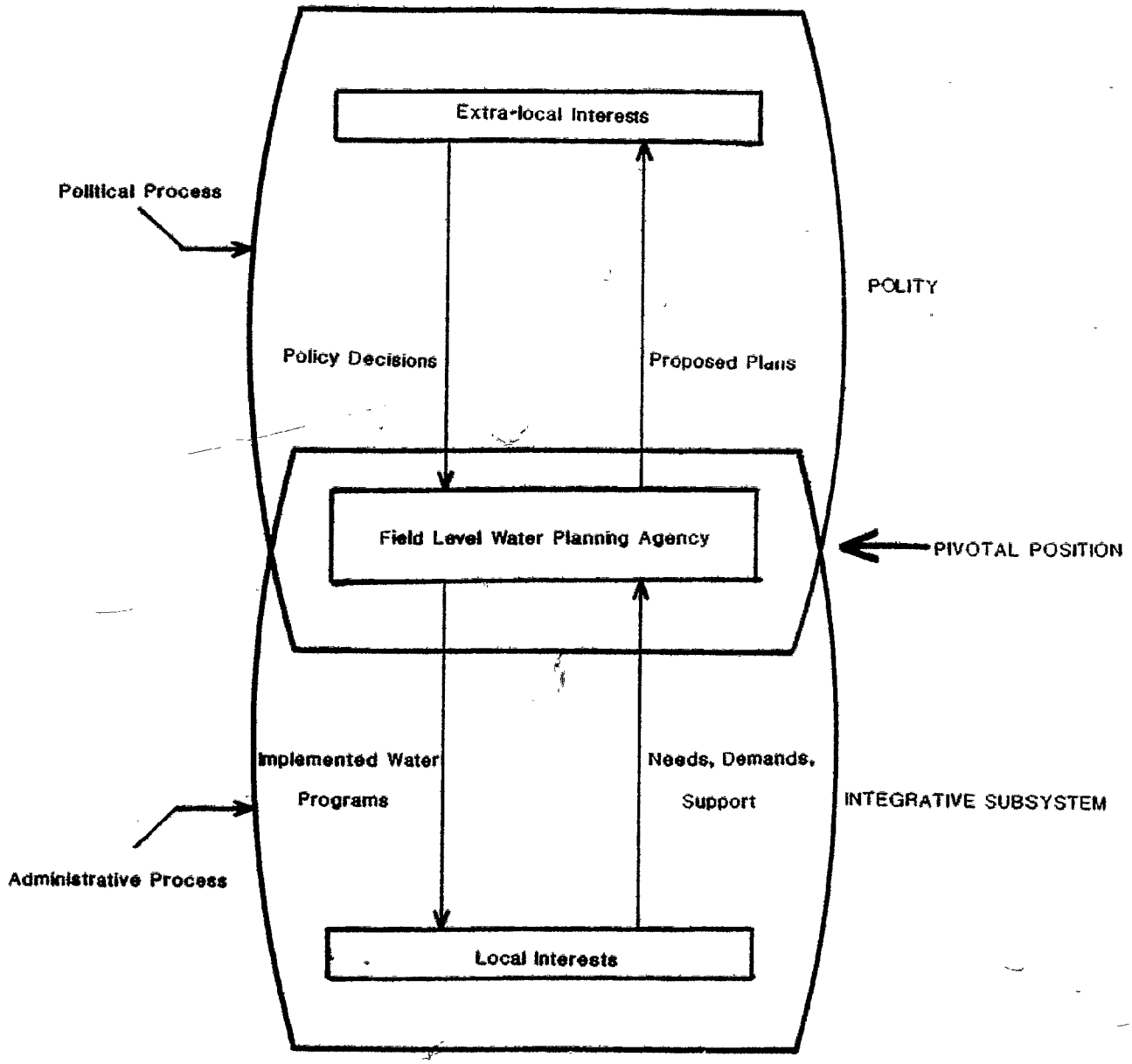


FIGURE 2.4

THE WATER PLANNING AND DECISION SUBSYSTEM

(Burke et al.,1975,38)

> a series of interconnected elements or steps leading from recognition of the problem and the identification of potential solutions, to the selection and adoption of an appropriate strategy (Sewell,1977,68).

Studies in decision-making "attempt to relate the totality of forces, both natural and human, in operation and aid in the understanding of the processes involved" (O'Riordan,1971,110). O'Riordan (1971,109,119) and Krueger and Mitchell (1977,6) emphasized that resource management is essentially a decision-making process. In Canada, resource management is essentially a decision-making and planning process conducted by government institutions. The planning process may be viewed as a logical sequence of steps or processes to facilitate a decision(s) to solve or foresee problems. The key decisions in Canadian water management are made by governments agencies and politicians at all levels. Legislation, policy objective, municipal official plans, strategic land use guidelines, and watershed plans are examples of decisions which affect water management in Canada.

The interaction between the goal-attainment and integrative systems resembles a symbiotic relationship. Local interests desire higher economic growth, recreational activities, or other benefits derived from water resource development projects. These local interests are likely to support the politician who is responsible for obtaining the project (White,1969,58). Resource management agencies such as conservation authorities play an integral role in this relationship (Figure 2.4) because they play a major role (pivital position) in both the polity system and integrative system.

Government and public interests are exchanged in interactions of power and influence (support) through government field level agencies. These institutions exist for a variety of reasons. Most, however, justify their existence through some specific function which they perform or portion of society they serve (Van Loon et al.,1981,588). Since planning and resource management are primarily methods of goal attainment the water resource system is focused around the relationship between public, political and agency interests.

Institutions and Planning

Mitchell (1975 and 1979) reviewed institutional arrangement literature and resource studies. He concluded that there had been little consensus on the definition of institutions and arrangements "because institutions are deeply imbedded in history and tradition and reflect the complexity of social and political institutions" (1979,281). Part of this problem may also be attributed to the pivital role these agencies play in the polity and integrative systems (Figure 2.4). Policy studies have also been plagued with a lack of clear definition according to Mitchell (1979,293). Another reason for the lack of clarity in defining these terms is the case study methodology utilized by researchers as the

literature review implied in Chapter I. The case study research approach makes comparison difficult because of the different techniques to evaluate policy implementation and the effectiveness of the institutional arrangement as Platt et al. (1980,296) pointed out. Clearly, institutional arrangement research can involve aspects of policy making and policy implementation. Policy implementation is visible in studies conducted and implemented by government agencies. The West Ferris Study which will be outlined in Chapter 3 is an example of flood plain management policy implementation.

Perhaps the most comprehensive definition of institutions and institutional arrangments has been provided by Craine (1971,522).

> 'Institutions' and 'institutional arrangements' (are a) definable system of public decision-making, one that includes specific organizational entities and government jurisdictions, but transforms the conventional emphasis upon organizational structure, per se. In addition to being concerned with component organizational entities, the term 'institutions' suggests special attention to the configuration of relationships:
>
> (1) established by law between individuals and government;
> (2) involved in economic transactions among individuals and groups;
> (3) developed to articulate legal, financial, and administrative relations among public agencies; and
> (4) motivated by social-psychological stimuli among groups and individuals.
>
> ...Thus institutional studies focus on the linkages which tie authority and action centres together into a public decision- making system which is responsive to the environment within which it must operate.

This study has indicated that government legislation and

policy statements, and administrative arrangements for flood plain management will be examined through the case study. The key element in Craine's definition links institutions to the planning process which is the method of analysis incorporated in this research effort. The institutional arrangement is one of the factors which enhances or constrains the planning process, the other factors being social, economic and political. Due to the nature of resource management in Canada the responsibility for flood plain management is divided between several government agencies. Platt et al. (1980,26-31) identified three types of fragmentation. These were:

> vertically
> functionally between agencies at the same level; and
> horizontally between government units sharing the same flood plain.

This study investigates these aspects of fragmentation but is centred on the vertical relationship between the Ministry of Natural Resources, North Bay Mattawa Conservation Authority, and the City of North Bay. Specifically, the resource management function of mediation (Mitchell,1979,283) is addressed through the case study. Mediation or bargaining between these government agencies would appear to be the cornerstone upon which integrated comprehensive resource management is achieved. This is due to the fragmentation of responsibility in Canadian resources management.

TABLE 2.4

Major Water-Related Legislation in Canada and Ontario

CANADA

Arctic Waters Pollution Prevention Act
Boundary Waters Treaty Act
Shipping Act
Canada Water Act
Environmental Contaminents Act
Fisheries Act
Indian Act
International Rivers Improvement Act
National Parks Act
Navigable Waters Protection Act
Northern Inland Waters Act
Ocean Dumping Control Act
Oil and Gas Production and Conservation Act
Regional Development Incentives Act
Terretorial Land Act

ONTARIO

Beach Protection Act
Beds of Navigable Waters Act
Conservation Authorities Act
Drainage Act

Environmental Assessment Act
Environmental Protection Act
Game and Fish Act
Lakes and Rivers Improvement Act
Mining Act
Ontario Planning and Development Act
Ontario Water Resources Act
Petroleum Resources Act
Pits and Quarries Control Act
Pollution Abatement Incentives Act

TABLE 2.5

Water Resource Development Objectives

1. Maximum economic development

2. An equitable and fair distribution of income

3. A physical environment whose quality is protected and enhanced

4. Regional development

(Environment Canada, 1976,9)

The United Nations (1972,3) and Windstrand (1980,108) interpreted planning as consisting of four features; (1) assessment of the future, (2) selection of objectives and a course of action to attain them, (3) problem solving, and (4) matching resource development to meet resource needs. The actions of assessing, selecting, problem solving, and developing all imply or require decisions to be made. Planning can be considered a form of decision-making which aims to attain the optimal use of resources to meet short and long term societal needs through a "systematic means of identifying problems, marshalling facts, and preparing solutions so that decisions may be more deliberate and consequent" (Wengert,1957,272).

Planning is considered to have three levels of hierarchy:

1) an operational level such as project plans (West Ferris Flood Plain Management Study)
2) a strategic level which identifies alternative methods to achieve goals (a municipal Official Plan, a conservation authority watershed plan, or MNR Strategic Land Use Plans);
3) a normative level which identifies general societal goals and objectives often found in government legislation and policy statements.

Policy making is used interchangably with normative planning and, as such is part of the overall resource management or decision - making process. This study examines operational level planning. The West Ferris Study represents the implementation of provincial flood plain management policy. This policy is implemented through government agencies which operate under specific pieces of legislation.

The primary government agencies involved in the case study are MNR (Conservation Authorities Act), NBMCA (Conservation Authorities Act) and City of North Bay (Planning Act). Secondary government actors are the Federal Department of Regional and Economic Expansion and the Ontario Ministry of Housing. These agencies and the consulting firm which conducted the West Ferris Flood Plain Management Study represent the institutional arrangement in the planning process. This research study examines the interaction between the primary government agencies and the consulting firm contracted to do the West Ferris Study.

The major problem in planning according to Wengert (1957,272) is who plans and to what end? Planning is conducted by individuals who are not experts in any field of study, but rather are generalists. Planning to what end questions whether planners should be responsible for plan formulation exclusively or plan implementation as well. Unfortunately a planning document which ignores implementation could likely be classified in 2 of 3 categories identified by Wengert (1957,272) - good, bad, or ineffective. Where this oversight occurs, plans are frequently ignored and decision-makers are unable to assess the merits of the alternatives presented (Booy,1968,132). Clearly, a planning document must make an evaluation of alternatives for decision-makers. The decision of whether to implement the plan is left up to politicians. This will solve the problem associated with planners planning and implementing. The following is a six step general planning model which will be used as a framework for analysis.

The General Planning Model

Watershed planning represents a medium-to-long range approach to the solution of environmental problems as well as the promotion of economic growth (Environment Canada, 1976, 4). Ontario Ministry of Natural Resources Minister Alan Pope (1983, 11) identified three levels of comprehensive basin management planning activities. These were:

> 1) an integrated resource development plan based on environmental, social, and economic development objectives for the area; 2) basin water management plan relating how overall water management can be integrated into the existing objectives for forestry, mining, agriculture, manufacturing, and other activities to maintain water quality and reduce flooding and erosion; and 3) a plan designed to resolve a specific water management problem.

The West Ferris Study would be classified in the third category. It was undertaken to examine methods of protecting existing and future development from flooding (Northland Engineering Ltd., 1979).

In order to accomplish stated goals a plan must be thoroughly inventoried, researched, evaluated, and implemented by competent individuals. It is vital that all plans completed for or by any level of government are integrated into all pertinent local, provincial, and federal planning documents. The planning framework to allow planners to successfully complete this difficult task must be structured to facilitate

the gathering of sufficient data which will be analyzed to form future forecasts, yet flexible enough to allow for leeway if societal needs should change. Public input, a vital component throughout the entire process must be incorporated into the recommended plan.

Several general planning models are available from which the West Ferris Study planning process may be evaluated (Mitchell, 1971; Booy, 1972; Sewell, 1977; and Windstrand, 1980 to name a few). Table 2.2 suggests a suitable design adapted form these authors which would allow for the orderly development of a watershed plan. The following sections will briefly outline the activities which occur at each step of this planning process.

1) Commitment to the Plan

A commitment to the plan by all participants is the initiating step of the process. This commitment would include both moral and financial support for the duration of the planning exercise. The moral support would indicate that all participants recognize the need for the plan, have established goals and objectives and defined the study scope. The financial support obtained prior to the inventory and assessment of data would serve as a visible sign of moral support and indicate agreement by all regarding the study objectives, schedules, and costs.

TABLE 2.2

Six Step Planning Model

1) Commitment to the Plan

2) Inventory

3) Analyses and Forecasts

4) Selection of Candidate Programs

5) Candidate Plan Circulation, Review, and Adoption

6) Plan Implementation and Evaluation

A watershed technical advisory committee comprised of politicians and experts in the fields of resource management should be appointed by the general authority. This advisory committee will ensure all segments of the study design are adequately completed.

2) Inventory

The collection of data on past and present watershed conditions is the first operational step in the planning process. The crucial need for this unbiased and accurate inventory is the vital base for a successful management program. This information system consists of three components. These are:

1) the scientific system that must deal with a wide range of physical, biological, economic, and social data.

2) the management information system that must deal with financial, operational, and scheduling information, and

3) the public information system which is concerned with the flow of information to the public, municipalities, MNR, and other ministries (after Environment Canada, 1976b,67).

The Conservation Authorities are primarily concerned with the analysis and sometimes the collection of hydrometeorological data. The North Bay Mattawa Conservation Authority does not operate any stations for this type of data collection. The information for the West Ferris Study was provided by the Atmospheric Environment Service of Environment Canada.

An accurate data base is essential for modelling and resource management decisions. Rechard (1972,98) indicated that snowfall measurements in the western United States were not adequate or accurate enough for many management decisions. Peter Gryniewski MNR Supervisor, Streamflow Forecast Centre, suggested that the quality of information provided by the Atmospheric Environment Service is quite good although the length of record and density of the network can be problem areas (interview February, 1983).

Communication between all participants and the administration for the study is accomplished through the management information system. This system ensures that the authority is kept up dated on the progress of the plan. The authority then disseminates this information to the public, municipality, MNR, and other agencies. Regular meetings and progress reports between the advisory committee, consultant, MNR, and municipality should facilitate this. A reporting system should be outlined in the Terms of Reference. In a project such as the West Ferris Study the public should be kept informed about the progress through regular news releases.

3) Analyses and Forecasts

Once the inventory of data has been completed, estimates of future land requirements and watershed conditions must be made. The accuracy of forecasts is a function of the personnel and the amount of money allocated to the project. If sufficient funds are available, detailed computer analyses are preferable over 'in office' manual analyses. Inaccuracies in forecasts may result in the proposal of unneeded projects or the omission of necessary projects. In flood plain studies inaccuracies would result in the over or under estimation of the flood plain. A document detailing all analyses should be forwarded to the technical advisory committee for their approval.

4) Selection of Candidate Programs

Based on the analyses and forecasts approved by the technical advisory committee, candidate programs for the plan should be selected. These programs represent the total range of alternatives available to solve present and future management problems. Each solution should be thoroughly evaluated based on the following criteria:

1) engineering and technical feasability
2) environmental impact
3) financial and economic feasability
4) legality
5) public acceptability.

(United Nations, 1972, 6)

While criteria 1-4 involve no public participation, public acceptance of the management proposals is essential to obtain successful plan implementation.

5) Candidate Plan Circulation, Review and Plan Adoption

Prior to plan approval by the general authority the plan should be circulated to the municipality, MNR, and interested government agencies for comment. The plan should also be open for public scrutiny. This step represents bargaining between government agencies and public interest groups to achieve the most successful program. Once the authority was satisified the planning document was complete it would be endorsed by MNR, the municipality, and the general authority.

6) Plan Implementation and Evaluation

The decision of whether to implement the plan should be left up to the politicians responsible for plan initiation and implementation. The plan should outline who is responsible for which aspects of the recommended program and set a schedule for project deadlines and identify necessary secondary planning reports which should be conducted. A recommended flood plain management program might include dyking, the construction of dams, or land aquisition. A review and evaluation of the plan should take place to ensure the project has fulfilled the objectives of the plan. If objectives have not been met, several questions must be raised. Should changes be made in the goals and objectives of future projects so these may be more realistically achieved? Are the analyses and forecasts correct? Was the planning framework adequate to achieve the schedules, costs, and objectives identified in the terms of reference?

Watershed planning is a time consuming and costly process. To reap the benefits of the investment, this type of systematic approach is necessary in order to understand all aspects of the watershed and their inter-relationships. If properly approached, an integrated - comprehensive plan can save public money and inconvenience over the long term and maintain, if not improve, the quality of life.

This brief and general discussion of watershed planning is the framework from which the strengths and weaknesses of the West Ferris Study may be examined. Prior to introducing the background material to West Ferris (Chapter III) the following discussion examines resource institutions and the resource management process.

Water Management Institutions and Planning

The following is a brief literature survey pertaining to project delays and institutional arrangements. A survey of American flood plain management systems concluded that the fundamental weakness was the lack of co-ordination between inter and intra - government agencies (Platt et al.,1980,26). A lack of co-operation and conflict between water management agencies in Mississippi has resulted in "fragmentation, duplication, and redundancy in the planning, promotion, and development of water projects (Williams and Coutes,1972,71).

Institutional arrangements for irrigation revealed that conflict most often occurs during drought when the demands for water are the greatest and the availability scarcest. While climate may influence the occurrence of conflicts, administrative practices were found to be the most important factor (Windstrand,1980,140). A detailed case study of a water projects in the United States suggested that current legislation was inadequate to accomplish many of the resource management objectives deemed important by individuals in society. Parks and Monk (1972,32) identified three types of conflict areas with: (1) private versus public water users, (2) agricultural versus recreational water users, and (3) current versus future water users. This last problem illustrates the difficulties associated with defining the equitable use of a water resource. This problem is compounded if the institutional arrangement for managing resources is ineffective.

A report prepared for the United States Water Resources Council (now defunct) reviewed the factors responsible for delays in water projects. "Institutional issues seem to be the governing forces in the water resource development process" (Galloway,March 1983,3).

Clearly, this brief literature review indicates that administrative conflicts, project delay, and poor project implementation can result from an inadequate institutional arrangement. The study of institutional arrangements and management strategies is important if water planning is to be more effective as indicated by this brief literature survey.

White (1956,16) identified four types of institutional approaches that have been employed to manage water resources (Table 2.3). Although White utilized this framework in his examination of river basin commissions, the approach to water resource management under each type of institution will be the focus of the following discussion.

Multiple purpose storage reservoirs have been firmly established as a management strategy by the U.S. Corps of Engineers (White,1957,162). Reservoir water is used for a combination of power development, irrigation, flood control, pollution dilution, low flow augmentation, navigation, and water supply; all important water uses identified in Table 2.1. The shortcomings of this management strategy are illustrated in the management of reservoirs during the 1974 flood on the Grand River.

In contrast to the first strategy, land and water management represents a non-structural approach to river basin management. This approach gained popularity in western Europe and the United States during the 19th century when foresters pressured the governments to acquire forest land. Vegetation, paricularily forests, can influence runoff characteristics (Gregory and Walling,1976).

> The removal of vegetation from a forested area ... can lower the infiltration capacity enough to generate large amounts of storm runoff where the previous runoff process was a slow subsurface percolation. ... Such increases can be very damaging and costly on a local scale (referring to increased flooding damages) (Dunne and Leopold,1978,255-256).

TABLE 2.3

Types of Water Resource Institutions

1) Multiple purpose storage
2) Land and Water Management
3) Comprehensive Regional Development
4) Unified basin wide administration

(White,1957,161)

Properly planned land use would reduce runoff, flooding, erosion, and increase infiltration, stream base flow and water quality without costly engineering works such as multiple purpose reservoirs. Usually land management programs are recommended in conjunction with engineering works. Reforestation, erosion control, bank stabilization, and wetland management are common types of programs initiated by a land and water management agency.

The Hoover Dam Project and some projects conducted by the Tennessee Valley Authority resulted in the increased economic well being of local residents as measured by per capita income, diversification of industry and agriculture, and stability of employment. White (1957,174) stated these regional effects were "intimated but not planned, then enjoyed but not managed." Comprehensive regional development projects such as these, initiated by the third type of management approach (Table 2.3), were selected based entirely upon the primary benefits of flood control, navigation, or power production, rather than the secondary benefits which would change the quality of life for local residents. Marshall (1957,245) identified primary or direct benefits as those arising directly from projects and secondary benefits as "values added over and above the value of immediate products or services of the project stemming from or induced by the project." Often however, it is difficult to accurately predict

the secondary effects of water resource projects on the quality of life. Comprehensive regional development agencies desire to increase the economic well-being of local residents through water resource development.

The fourth management approach to water resources is through basin wide administration. On a river basin scale one institution would deal with all water and associated resource problems. The Tennessee Valley Authority is an American example of this type of institution.

There are two schools of thought then in regards to the institutional arrangement for water management. The first is some combination of the approaches 1, 2, or 3 (Table 2.3). Each agency would be responsible for one aspect of water management. The second is the single multi - functional, or unified basin administration approach. This institutional arrangement would have one agency responsible for all aspects of water management.

Ingram (1973,10) asserted that unified basin wide management has been disappointing due to political constraints imposed on it. Successful unified administration must: 1) fit into the existing institutional/political framework; 2) recognize the need for one; and 3) overcome political inertia and obtain support from interest groups (private and public) in the region.

McMillan (1976,46) advocated that single function management bodies responsible for water supply, or water quality, or fisheries were preferred over unified multipurpose agencies. Vote-trading by representatives of a unified body may, according to him, "lead to suboptimal social decisions". Single function management agencies would be forced to work together and the bargaining between these agencies would achieve programs of maximum benefit to society according to MacMillan (1976). Mitchell (1980,94-95) also suggested that the Tennessee Valley Authority not be copied as a multifunctional unified administration. Instead, he maintained that there must be better understanding of land and water management policies among researchers, planners, and decision-makers in order to better manage resources.

Platt et al. (1980,26) and Windstrand (1980,140) indicated that administrative conflicts, project delay, and poor project implementation can result from an inadequate institutional arrangement. Administrative conflicts however may be beneficial according to Ingram (1973,10) and MacMillan (1976,46) in having a planning agency consider a wider range of alternative solutions. This should lead to a better plan. Thus the problem is to maximize effectiveness and minimize unnecessary delays. This research study examines methods of minimizing conservation authority study delays without affecting plan quality. Since water planning in Canada is fragmented between several government agencies this increased efficiency must be obtained through more effective communication between participants in the present

institutional arrangement.

Mitchell and Gardner (1983,2-3) summarized the problem of which institutional arrangement would provide for the most effective management as follows:

> The overriding question (of institutional arrangement research) becomes how to coordinate the numerous interests and agencies which have a role to play. In this regard, Parker and Penning-Roswell (1980,19) have identified the tradeoffs which are involved. ...First, there is pressure for fewer but larger organizations responsible for many or all water functions. Such organizations aim to minimize conflicts between functions and maximize the potential for multipurpose use of water and economies of scale. However, the fewer and the larger the water planning organizations the greater the potential for inflexibility and the less the public is protected from the excessive concentrations of economic and political power. Here arises the second pressure which is for greater local accountability of the water planning system, to ensure effective satisfaction of local needs and specialist agencies to promote particular function areas. ... Debate on the merits of the different approaches will be endless since there is no perfect solution which maximises all aspects of effectiveness yet is sufficiently flexible to accommodate the shifting expectations of water planning ....

Since there is fragmentation of responsibility for resource management in Canada the unified basin administration would likely meet with the greatest resistance as a solution to avoid project delays. Mitchell and Gardner (1983,2-3) have indicated that the answer to which institutional approach will provide the most effective management is really a question of local accountability versus efficiency in the planning and implementation process. The type of resource agency will be greatly influenced by the water management function an agency is responsible for. The resource management approach will also be dictated by the societal goal (Table 2.5) the agency is to achieve.

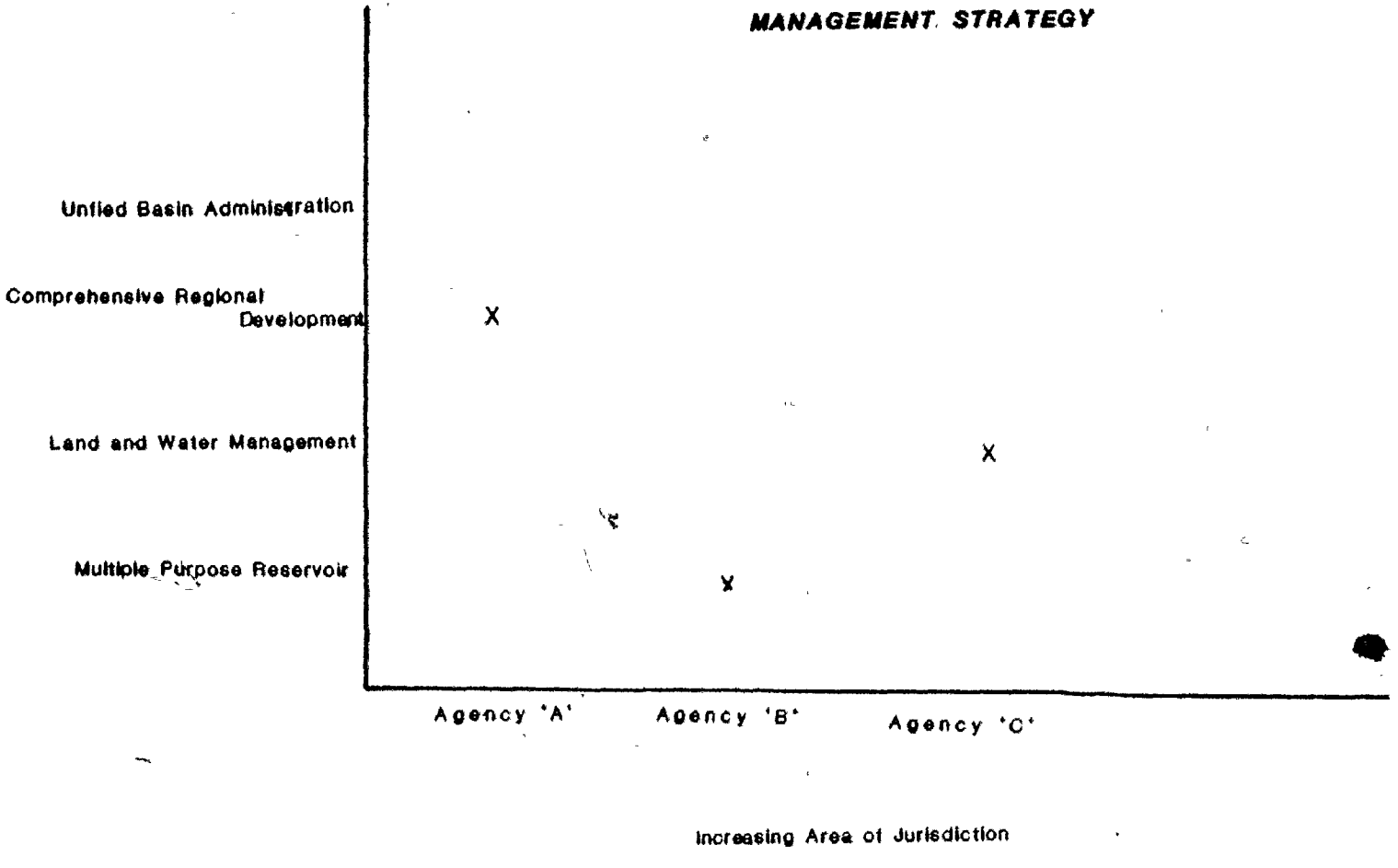
It is possible to match in matrix form the water management agency to the water resource approach. Figure 2.5 demonstrates this concept. The correlation of institution to approach can be conducted at a normative level, utilizing goals and objectives identified in legislation and policy statements; at a strategic level using official and secondary plans; and at an operational level, through the analysis of past and present programs and projects. This matrix will aid in analyzing the cause of the delay in the West Ferris Study.

Institutional Arrangement for Water Resource Planning in Canada: An Overview

Memon (1970,154-155) believed a lack of co-ordination and definition had plagued the water resources field in Ontario for years. This is in part due to the fragmentation in responsibility for the planning and management of water resources between federal, provincial, regional, and municipal governments. Which department will be the 'lead agency' will depend on a " process of interdepartmental bargaining, cabinet decisions, and on the political influence of each department's clientele" (Van Loon et al.,1981,588). The provinces are able to manage and authorize developments, license uses, regulate flows, and levy fees on water resources since they own them.

FIGURE 2.5

CORRELATION OF WATER RESOURCE MANAGEMENT AGENCY TO MANAGEMENT STRATEGY



The provinces also have jurisdiction over water empowering them to legislate over the uses of water. The municipalities are under provincial jurisdiction and are responsible for aspects of water supply and waste treatment (Environment Canada,1976,1). The federal government has legislative jurisdiction over commercial navigation and fisheries (Reynolds et al.,1974,251).

> The federal government also has certain general powers to legislate for peace, order, and good government, and numerous matters of national importance ... which can influence water development both directly and indirectly (Environment Canada,1976,1).

All levels of government have passed legislation and established agencies to administer and/or enforce them. Table 2.4 identifies major water related legislation in Canada and in Ontario. This legislation provides the base from which comprehensive water resource management in Canada is achieved. Comprehensive water resource management in Canada by definition is a co-operative effort by all levels of government (Quinn,1977,229). Water management research on institutional arrangements in Canada must focus on the vertical, functional, and horizontal institutional relationships (Platt et al., 1980,26-28).

Four generally accepted objectives of water resource development in Canada are found in Table 2.5. These objectives play an important role in determining the approach of agency strategy and programs (Table 2.3).

TABLE 2.4

Major Water-Related Legislation in Canada and Ontario

CANADA

Arctic Waters Pollution Prevention Act
Boundary Waters Treaty Act
Shipping Act
Canada Water Act
Environmental Contaminents Act
Fisheries Act
Indian Act
International Rivers Improvement Act
National Parks Act
Navigable Waters Protection Act
Northern Inland Waters Act
Ocean Dumping Control Act
Oil and Gas Production and Conservation Act
Regional Development Incentives Act
Terretorial Land Act

ONTARIO

Beach Protection Act
Beds of Navigable Waters Act
Conservation Authorities Act
Drainage Act

Environmental Assessment Act
Environmental Protection Act
Game and Fish Act
Lakes and Rivers Improvement Act
Mining Act
Ontario Planning and Development Act
Ontario Water Resources Act
Petroleum Resources Act
Pits and Quarries Control Act
Pollution Abatement Incentives Act

TABLE 2.5

Water Resource Development Objectives

1. Maximum economic development
2. An equitable and fair distribution of income
3. A physical environment whose quality is protected and enhanced
4. Regional development

(Environment Canada, 1976,9)

> Since water underlies so many activities in society (Table 2.1), it has a role to play in achieving, and is affected by the objectives set by government (the polity system Figure 2.4) Overall societal goals guide the planner throughout the planning exercise, and have a profound impact on resource management decisions (Environment Canada,1976,8-9).

Project objectives, which are related to resource objectives, will also affect the method of alternative solution evaluation employed in operational studies such as the West Ferris Study. Societal goals set in the polity system provide the ground rules for project planning by the resource field agency in the integrative system (Figure 2.4).

Flood plain management is important in the achievement of societal resource objectives. Jackson (1977,290,305-306) stated:

> lake and reservoir shorelines and other riparian interfaces are important water resources, and their planning and management are key issues today. As riparian interfaces of land and water, shorelines play an important role in the economy and lifestyles of most societies. ... Shorelines must be planned and managed as a biophysical system.

In managing flood plains as a biophysical system it is important to note that these areas have historically been and continue to be attractive areas for development (Bruce,1976,9).

Prior to examining flood plain management in Ontario the concept of river basin planning will be developed. It has been revealed that water resources play an important role in our society, and all levels of government are responsible for some

aspect of water management. An historical overview of the river basin planning concept will present a better perspective from which flood plain management programs administered by Ontario conservation authorities may be reviewed.

History of River Basin Planning in Ontario Conservation Authorities

The watershed planning concept was initiated by the United States conservation movement at the turn of the 20th century. President Roosevelt's speech to the 1908 Governors' Conference expressed a fear of resource exhaustion, which was shared by conservationists. As well, he presented a possible solution.

> We come together now because of the enormous consumption of these resources, and the threat of immenent exhaustion of some of them due to reckless and wasteful use once more calls for common effort, common action. (It is believed) water resources could be conserved best if waterworks were made multipurpose and planned and correlated on a river basin scale (Teclaff,1967,2).

Early river basin planning focused exclusively on water resources, however by 1929 river basin planning was accepted as a method to develop all natural resources in order to stimulate employment during the depression. The Tennessee Valley Authority formed in 1938 is a prime example of such a watershed agency responsible for resource conservation and development intended to assist in regional economic growth. The Muskingham Concervance District (1932) in Ohio managed the natural resources of much smaller watersheds on a multiple purpose basis.

Wengert (1957,267-268) attributed the appeal of river basin agencies as the integrated development of all resources. "Watersheds are seen as an organic whole, therefore it is a logical basis for economic development ... ." Teclaff (1967,10-13) argued that water is the only unifying force in river basin management. Few rivers have regular outlines and often times they are difficult to discern; however this type of management agency has proven popular in the United States and Canada. An early example of Canadian water resource planning was the Grand River Conservation Commission (1936). The primary force behind water resource conservation in Canada was to find employment for war veterans. A sub-committee of the federal government's Advisory Committee on Reconstruction (1941), the Conservation and Development of Natural Resources Committee,

> considered the policy and programme appropriate to the most effective conservation and maximum future development of natural resources (Richardson, 1974,14).

Resource development and conservation were seen as a viable means of providing jobs for war veterans.

Conservationists attending the Guelph Conference on Conservation (1941) recommended an investigation be conducted of the Ganaraska watershed to examine soil, water, wildlife, and land resource problems. The second recommendation from this study stated that:

> legislation be enacted combining the best features of the Grand River Conservation Commission, and the Muskingham Watershed Concervancy District, Ohio, so that municipalities in any part of Ontario may undertake a similar conservation program (Richardson, 1974,18).

This recommendation was acted upon by the Ontario Parliament in 1946 when the Conservation Authorities Act was passed.

The formation of the conservation authorities was influenced by three factors:

> 1) The Tennessee Valley Authority as an example of regional resource planning for economic development.
>
> 2) The Muskingham Concervancy District and the Ohio Concervancy Code which promoted local initiative in the use and control of water.
>
> 3) The emphasis in America on the watershed management unit, the need for upstream land and water management and local initiative on small and medium sized watersheds (Memon,1970,29).

Memon (1970), Wood (1972), Richardson (1974) and Veale (1979) identified flood plain management and the provision of jobs for World War II veterans as major purposes behind the passage of the Ontario Conservation Authorities Act. Structural adjustments to flooding such as dam and dyke construction would create employment for these veterans and reduce the flood hazard.

The Conservation Authorities Act had three basic concepts:

1) Local initiative - an authority could only be formed at the request of the local people. Local municipalities would financially support the operation of the authority.

2) Cost sharing - originally projects were financed jointly by the province and local governments on a 50/50 basis.

3) Watershed jurisdiction - to better manage flood and erosion problems (Richardson,1974,x).

The local authorities' programs were co-ordinated by the Conservation Authorities Branch (CAB). The CAB was also responsible for providing technical advice, and the processing of provincial grants and approvals (Wood,1972,34). The CAB is presently under the administration of the Ministry of Natural Resources. It is now known as the Conservation Authorities and Water Management Branch.

The CAB would also conduct a survey of a watershed patterned after the Ganaraska Survey, once an authority was formed, to provide program guidance (Richardson,1974,26-27). These studies emphasized [illegible]onic erosion areas where good conservation management practices could be used. This report also served as a long term plan since "authorities were not equipped to undertake the investigations necessary to indicate what and where work should be done" (Veale, 1979,61). The Conservation Report advocated wise land use management to improve water resources, specifically to reduce the flood and erosion hazard. The early history of the formation of conservation authorities was to provide jobs for war veterans and promote flood plain management.

A new attitude towards the environment developed after the Resources for Tomorrow Conference (1961) (Veale, 1979,205). The Conference "represented a shift away from the the control of resources to maximize economic gain to the management of resources according to ecological principles. (Veale,1979,205). This shift was towards a comprehensive and co-ordinated approach to ensure the wise use of renewable natural resources. In contrast, Quinn (1977,230) expressed the theme of the conference as:

> concerned not with resources alone but with resources in relation to capital and labour and our complex of institutions as they all, in turn, relate to the objectives of growth ... . We must be able to turn resources into income and employment opportunities.

Quinn contended that the conference was to promote a better interaction between conservationists and promoters of economic growth. The type of resource management agency which advocates this type of approach is the comprehensive regional development agency (Table 2.3). At this time conservation authorities continued to emphasize the land and water management approach in their programs.

White (1969,101) believed water management institutions were adopting a more complex strategy which considered a wider range of solutions to solve resource problems. The emphasis of this 'regionally integrated' approach on the part of government agencies shifted from "construction to scientific probing, and from long - term commitment to short - term flexibility" (White,1969,123).

To summarize the general resource objectives (Table 2.5) of authorities could be considered as primarily the provision of a physical environment where quality is protected and enhanced. Through the construction of dams and dykes a secondary objective was to provide for an equitable and fair distribution of income.

Flood Plain Management - General

"Flood losses may be defined as the destruction or impairment, partial or complete, of the value of goods or services, or of health, resulting from the action of flood waters and the silt and debris they carry" (Hoyt and Langbien,1954,1977). Flood plain management reduces the losses caused by flooding. Murphy (1958,3) noted development type and location on the flood plain were the primary causes of flood losses. Developments on flood plains displace water storage areas during a flood. Since the storage volume is reduced, water levels and the damage potential rise. Water infiltration rates may be decreased, expediting flow rates especially where floodwaters flow over impermeable surfaces such as pavement. Channel constrictions, such as bridges, and the failure of upstream structures also significantly increase the potential for flood damage.

Bruce (1976, 9) found the following factors contributed to flood plain development:

1) It is frequently the last remaining or most easily developed land in a municipality.

2) Developers, municipal governments and house buyers are not aware of the flood hazard of such areas because large floods occur infrequently.

3) Even when the hazard is known, experience has shown that the prospect of short-term gains through exploiting flood-vunerable land prompts developers to exert pressure on local and municipal government on flood vulnerable land.

4) The mobility of the Canadian population is likely to mean that a high percentage of the population is not familiar with local flood possibilities.

Flood plain management reduces flood losses of existing development and proposed developments through a combination of land and water management. White (1975) identified seven major adjustments used to cope with flooding:

1) control and protection works,

2) floodproofing buildings and their contents,

3) forecasting and warning systems,

4) land use management, including land management and treatment upstream,

5) flood insurance,

6) relief and rehabilitation services, and

7) do nothing.

Table 2.6 outlines possible flood plain management projects initiated by individuals, communities, or basins to reduce the flood hazard. In part, land use management (Table 2.6) refers to local, regional, provincial and federal land use planning including acquiring and regulating the use of flood prone areas. White (1975,xviii) believed:

> flood plain land use regulation may be the single adjustment most likely to reduce flood losses. Structural measures, flood warning systems and flood proofing will be of little value if the reduction in damages that they likely accomplish is more than offset by new damage potential in the flood plains.

Land use regulation can be particularly effective in minimizing the flood hazard of proposed developments. "Reliance is seldom placed on only one type of adjustment, and usually several types are applied depending on the nature and magnitude of the flood hazard" (Sewell,1965,37). Land use regulation is a long term solution to reducing a flood hazard while structural adjustments will immediately reduce the flood hazard. Therefore, successful flood plain management will include a mix of land use regulation and structural adjustments or contingency planning.

Flood Plain Management in Ontario - The Legislation

Six provincial ministries, Ontario Hydro, as well as several federal agencies and ministries administer various

TABLE 2.6

Flood Adjustments

1. Control and protection works

   a) dam
   b) levee
   c) channel improvements
   d) land treatment upstream
   e) emergency flood control

2. Flood proofing

   a) permanent
   b) contingent
   c) emergency

3. Forecasting and warning systems

   a) emergency preparedness plans

4. Land use management

   a) flood plain development policies and plans
   b) redevelopmnt and renewal policies and plans
   c) encroachment lines/cut and fill lines
   d) zoning ordinances
   e) subdivision regulations
   f) building codes
   g) sanitary and well codes

5. Insurance

   a) emergency and regular programs

6. Relief and rehabilitation

   a) grants
   b) loans
   c) tax deductions
   d) feeding and sheltering of flood victims

7. Do nothing

   a) individual must bear own losses

(White,1975,8)

aspects of water resource management in Ontario (Dillon and MacClaren,1976,34). The participants involved in the West Ferris Flood Plain Management Study are the Federal Department of Regional and Economic Expansion, the Ontario Ministry of Natural Resources, the North Bay Mattawa Conservation Authority, and the Corporation of the City of North Bay. A brief summary of the most important legislative acts pertaining to the case study is given below.

The Regional Development and Incentives Act

Briefly, the Regional Development and Incentives Act (1969) was established to reduce economic disparities in Canada (Phidd,1974). The Department of Regional and Economic Expandion (DREE) provides funds for land and water development and for economic growth. Although this program is sponsored at the federal level, half the funds are obtained from the benefitting province on a project by project basis. The City of North Bay obtained a DREE grant in 1978 to service and to improve storm drainage in a proposed industrial park in West Ferris.

The Planning Act

The Planning Act administered by the Ministry of Municipal Affairs and Housing, is the most important planning

statute in Ontario (Estrin and Swaigen,1978,352). This Ministry is responsible for land use planning; however, municipalities do most of the actual planning. The Planning Act allows municipalities to control the nature and location of development within their jurisdiction, subject to the approval of the Ministry.

> Since the Ministry of Municipal Affairs and Housing is in a position to approve all municipal official plans and plans of subdivisions as well as the review of zoning by-laws and local decisions on consent applications, it is automatically in a position to influence the nature of the various municipal planning policies that apply in these areas (Dillon and MacClaren,1976,40-41).

An official plan is defined as:

> a program and policy covering a planning area designated to secure the health, safety, convenience or welfare of the inhabitants of the area (R.S.O. 1970, c.349, s.1(h)).

Zoning by-laws indicate what may or may not be done with land and as such, indicate the future use of an area. A zoning by-law must conform to the programs and policies identified in an official plan. Through the official plan and zoning by-law, a municipality can incorporate flood plain management practices into planning policies and regulations (Dillon and MacClaren,1976,41).

Conservation Authorities, through flood plain mapping, contribute significantly to the creation of appropriate urban land use regulations for flood plain areas. This information can be incorporated by municipalities into the official plan and zoning by-law. Studies conducted by the NBMCA, including the West Ferris Flood Plain Management Study, will provide this information to the City of North Bay.

A number of provincial ministries contribute to the development of official plans and zoning by-laws. The MNR provides much of the technical expertise for the Ministry of Municipal Affairs and Housing during the approval process. The MNR and the local conservation authority ensure flood plain policies contained in the official plan and/or zoning by-law adhere to provincial policy. Should objections to an official plan or zoning by-law arise during the approval process it may be referred to the Ontario Municipal Board (OMB).

The OMB is a tribunal appointed by the provincial cabinet

> to hear and determine all questions of law or fact ... brought before it for such purposes as give directions, make orders, rules and regulations (R.S.O. 1970, c.343, s.36(a)).

It can often review decisions of a municipal council to ensure they constitute and conform to provincial policies. Any zoning by-law passed by a municipal council must receive OMB approval before it takes effect (R.S.O. 1970, c.349, s.35(9)). The OMB also hears individuals objection(s) to any official plan, zoning by-law or amendment.

The Conservation Authorities Act

Under the Conservation Authorities Act municipalities sharing one or more watersheds may form a conservation authority. The objectives of an authority outlined in the Act are to:

> establish and undertake, in the area over which it has jurisdiction, a program designed to further the conservation, restoration, development and management of natural resources (R.S.O.,1970, c.78,s.19).

Section 27 of the Act empowers the authority to make regulations prohibitting the development and dumping of fill in flood plains. These regulations must receive provincial government approval prior to being enforced. Development in the flood plain must, therefore, adhere to any conservation authority regulations and any applicable municipal zoning requirements (Dillon and MacClaren, 1976,38). Conservation authorities are also responsible for information collecting and reporting under Section 20 of the Act. The broad legislative mandate of the Conservation Authorities Act allows municipalities to develop programs and priorities which reflect "local resource management concerns and to respond to specific conservation and resource management needs on an individual watershed basis" (MNR, April 1979,7).

The Ministry of Natural Resources

The Department of Regional and Economic Expansion, the municipality, the Ministry of Municipal Affairs and Housing and the local conservation authority are required through legislation to be involved in flood plain management. The Ministry of Natural Resources is also involved in flood plain management through the Lakes and Rivers Improvement Act, and enforcin the provisions of the Navigable Waters Act however this is of secondary importance in the case study to be presented.

The Conservation Authorities Branch is responsible for establishing policy guideline for all conservation authorities and the maintenance of effective communication between other provincial agencies. The CAB provides hydrologic and hydraulic advice to authorities and operates a hydrometeorological forecasting centre to co-ordinate flood warning systems in the province. Program review and approval for authority programs is issued from the Regional MNR office. Sudbury is the location of this office for the NBMCA. Technical review, financial statements, and technical assistance are provided through the Regional Conservation Authorities Program Supervisor (R.C.A.P.S.). The District MNR offices and local conservation authorities share responsibility for many aspects of municipal planning concerns such as reviewing development proposals. Cooperationn between these agencies is essential for effective policy implementation (MNR, April 1979,15).

Ontario Flood Plain Management Policy

Prior to the mid 1970's the MNR and conservation authority policy was to prevent all development on the flood plain. The application of this policy was difficult in areas where the flood plain encompassed much of the urban area. Strict enforcement of this policy would severely restrict community

growth. Municipalities and the Ministry of Municipal Affairs and Housing were continually going before the OMB for ruling to allow flood plain development according to MNR Nipissing District Planner Bill Andrews. Municipalities were concerned

> that areas defined as 'flood plain' under existing criteria were too large and policies which regulated development in those area of the flood plain which could expect only shallow flooding have become economically unjustifiable (Dillon and MacClaren, 1977,1).

Some municipalities felt more flexibility was required in applying flood plain policy, particularly land use regulation, in order to recognize unique local situations. Dillon and MacClaren consulting firms were contracted by the Ministries of Housing and Natural Resources to evaluate existing flood plain management policy and to recommend a rationalization of flood plain management programs to MNR. This policy would be a cabinet policy if adopted thereby avoiding the continual conflict between MNR and local authorities with MOH and municipalities.

The objectives of flood plain management in Ontario are:

1) to prevent loss of life
2) to minimize property damage and social disruption
3) to encourage a co-ordinated approach to the use of land and management of water (Dillon and MacClaren, 1976,31).

The land use management techniques which were the basic recommendations of this policy evaluation have recently been introduced to the NBMCA. These concepts will be utilized in municipal official plans, zoning by-laws, and authority regulations. The zoning concepts are:

one zone

two zone, floodway - flood fringe

special policy area

development constraint.

One Zone Concept

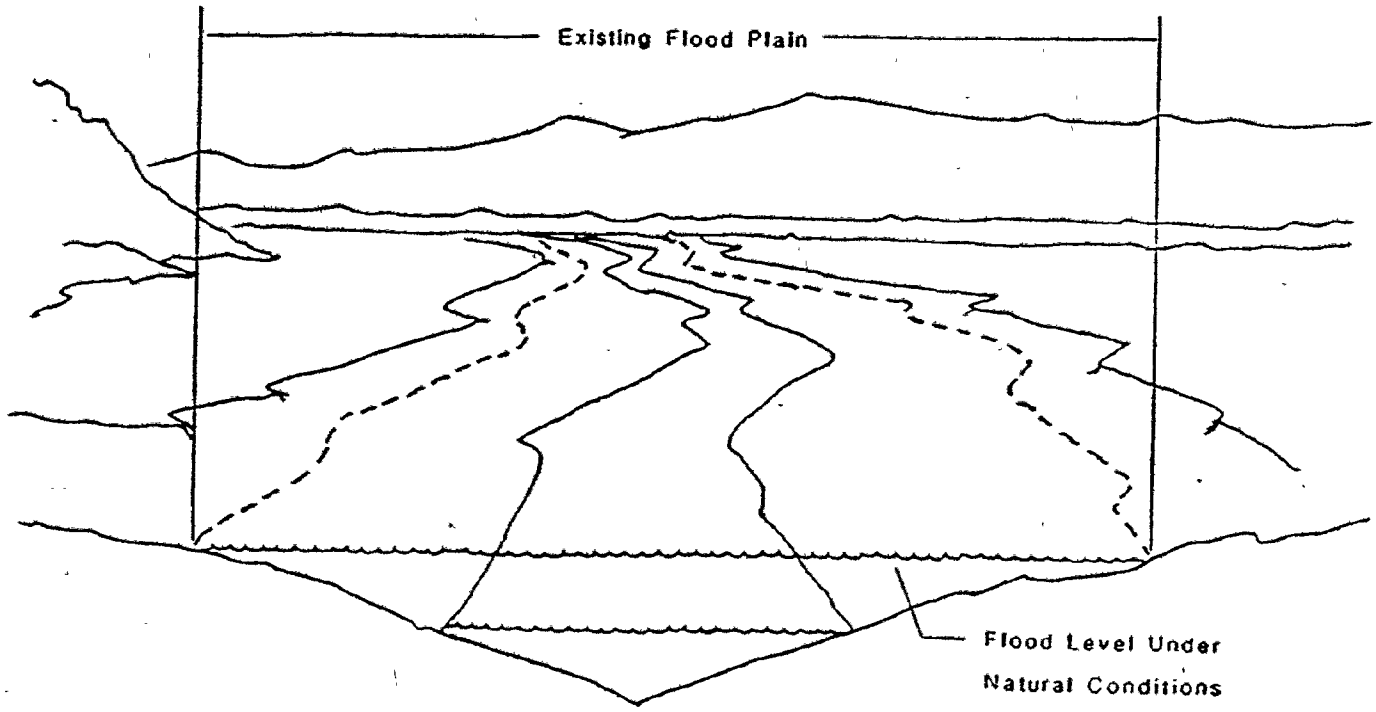
The flood plain is defined, in North Bay, as the Timmins Regional Flood or the 100 year flood, which ever is greater. Under this policy no development is permitted within the flood plain. This is the former policy of the MNR and conservation authority regarding flood plain development.

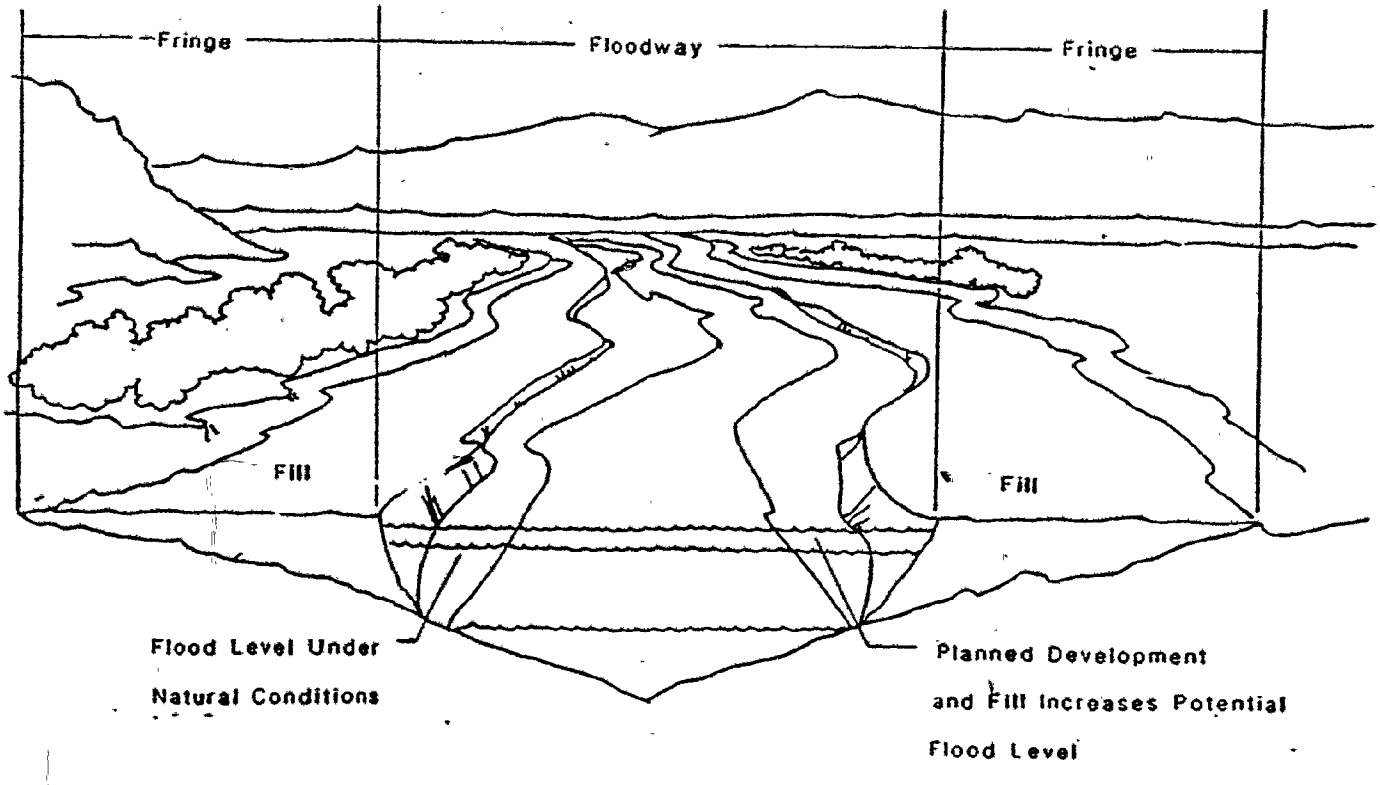
Two Zone Concept, Floodway - Flood Fringe

This is one of two exceptions to the previously noted basic flood plain policy. In this approach to flood plain management, the flood plain has two components (Figure 2.6). The flood fringe is the area between the regional flood line and the 100 year flood line. The floodway is located between the 100 year floodlines. No development is permitted within the floodway; however, development is permitted within the flood fringe conditional upon the floodproofing of all new structures to the regional flood be filled so as to reduce its area and, thus, the ability to contain the regulatory flood. Before development is permitted in the flood fringe several hydraulic, hydrologic, and socioeconomic factors must be considered. These are listed in Appendix 'A'.

FIGURE 2.6

THE TWO ZONE FLOODWAY-FLOOD FRINGE CONCEPT





(Dillon and MacLaren, 1976, 73)

Special Policy Areas (SPA)

This is the second exception to the basic flood plain policy. Historically, the development of many villages, towns, and cities in Ontario has been situated on the flood plain (Dillon and MacClaren, 1976,7). The continued viability of these centres depends on a reasonable approach to flood plain management. The concept of Special Policy Areas (SPA) has been adopted by the province to provide this flexibility.

In situations where the two zone concept is either unsuitable, or the fringe area is too small or non-existant, and no other alternatives exist, a municipal council may consider allowing flood plain development to maintain community viability. It must be stressed however, that SPA designation will only be approved in exceptional circumstances. The SPA will proceed with an approved amendment to the Official Plan and must be documented with an engineering study subject to the approval of the local conservation authority, MNR, and MOH. Appendix 'A' identifies the factors which must be considered prior to SPA approval.

Development Constraint Areas

Development constraint areas are lands where no engineered flood lines exist. These areas are estimated through air photo interpretation and may be based on proximity to water, bank stability, extent of wetlands, or minimum

setbacks from a flood level to prevent the dumping of fill. Development in these areas is not necessarily precluded but this designation acts as a warning that additional consideration may be needed to minimize any hazard. Development could occur based on site inspection and the severity of the hazard (NBMCA, March 1982).

Summary

Government agencies responsible for policy implementation serve both the public and politicians as indicated in Figure 2.4. Effective management will be influenced by two factors efficiency and accountability. An efficient decision - making process will save time and money. Since several agencies are involved in flood plain management efficiency is affected by the degree of co-operation and communication between these agencies. "Accountability is what makes democracy work" according to Palmer (1978, 94). Public institutions must be accountable to the people they serve, both the public and politicians, in formulating and implementing policy. The criteria of efficiency and accountability will be utilized to indicate how the delay associated with the West Ferris Study could have been shortened without affecting the final recommendations and findings of the report.

The West Ferris Study represents the implementation of Provincial Flood Plain Management Policy. The intent of this study was to determine which institutional arrangement would provide for the most effective management of flood plains and to identify the reasons for the study delay. Chapters IV and V will evaluate the delay associated with the West Ferris Study through the criteria of efficiency and accountability. Suggestions to improve the effectiveness of flood plain management in Ontario can then be brought forward. Prior to this Chapter III will provide the necessary background material in order to familiarize the reader with the regional setting and context.

Endnotes

1. Mitchell (1979,4) defined resource development as "the actual exploitation or use of a resource during the transformation of neutral stuff into a commodity or service to serve human needs and operations."

CHAPTER III

BACKGROUND INFORMATION TO THE CASE STUDY

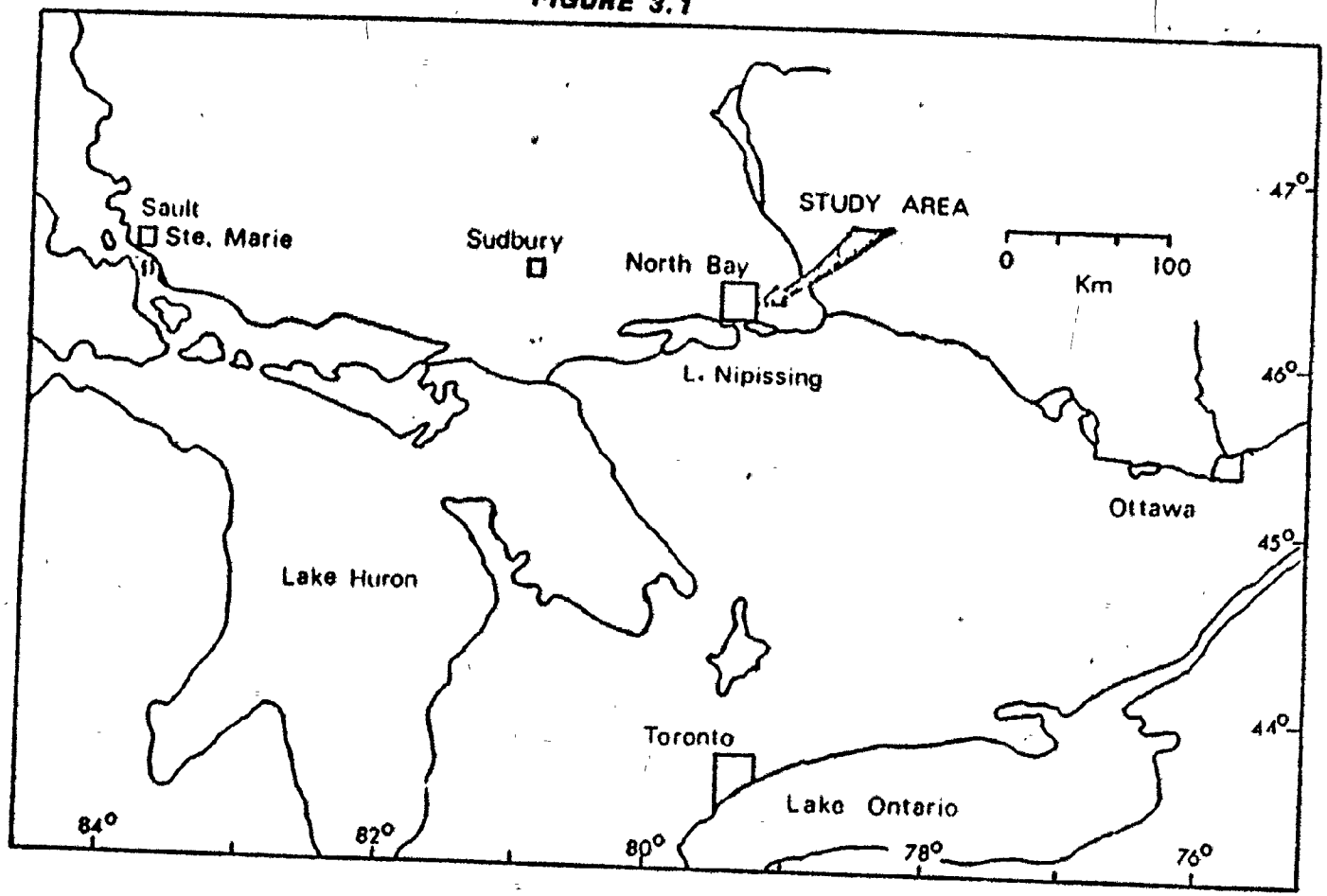
Introduction

This chapter will provide an overview of the regional geography and settlement history of the North Bay area. This information leads to a discussion of the events leading to the formulation of the West Ferris Flood Plain Management Plan.

Location

North Bay is located on the eastern shore of Lake Nipissing (Figure 3.1). West Ferris, situated in the southern portion of the city, refers to the former Township of West Ferris which amalgamated with the City of North Bay and the former Township of Widdifield in 1968. The West Ferris Water Management Study area (Figure 3.2) consists of the Parks Creek, Jessups Creek and LaVase River watersheds and "is bounded to the north by present city development, to the east by Hwy. No. 11, to the south by Hwy. No. 11B and to the west by Lake Nipissing" (Northland Engineering Engineering Ltd., 1982,1).

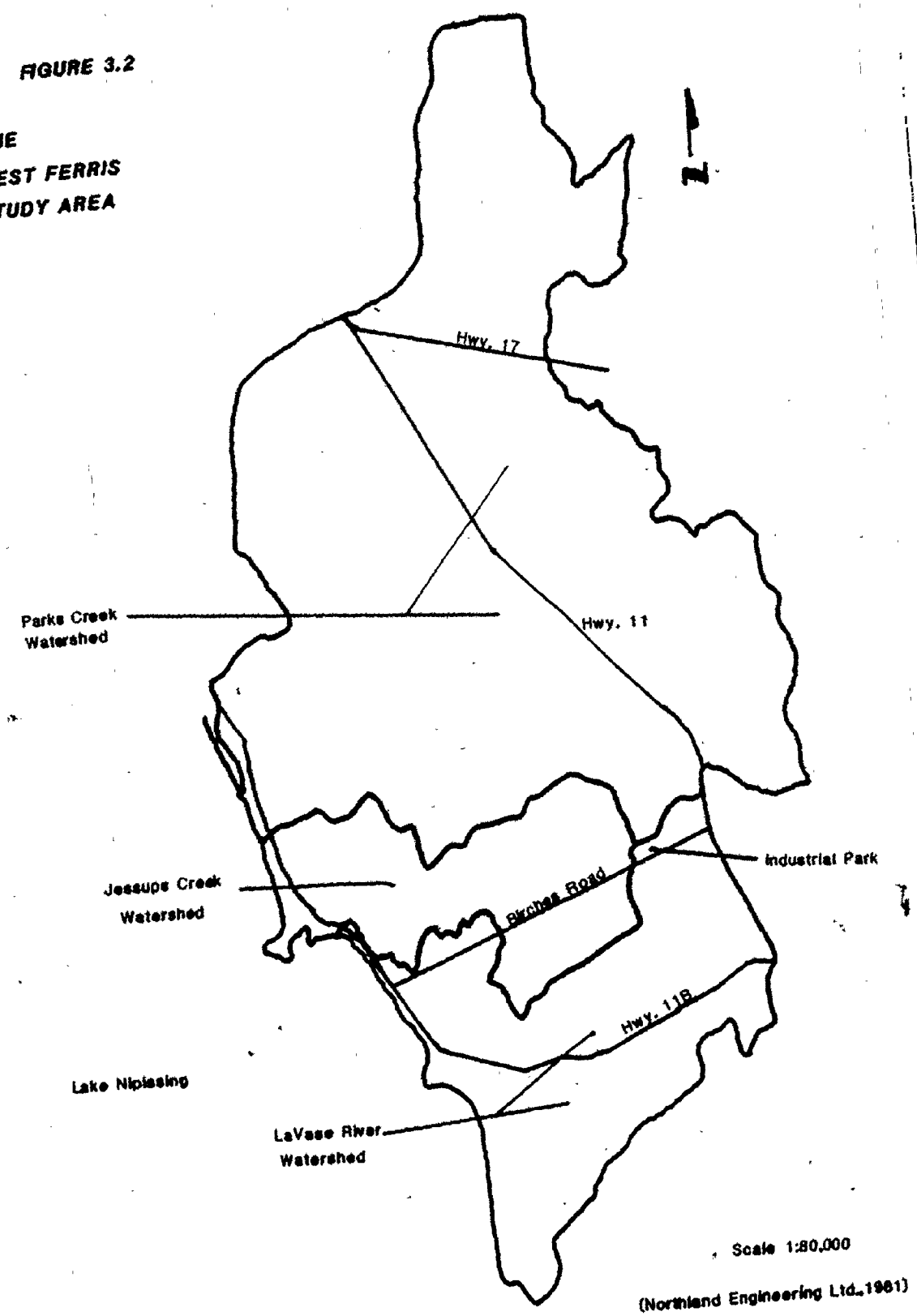
FIGURE 3.1



LOCATION OF STUDY AREA

FIGURE 3.2

THE
WEST FERRIS
STUDY AREA



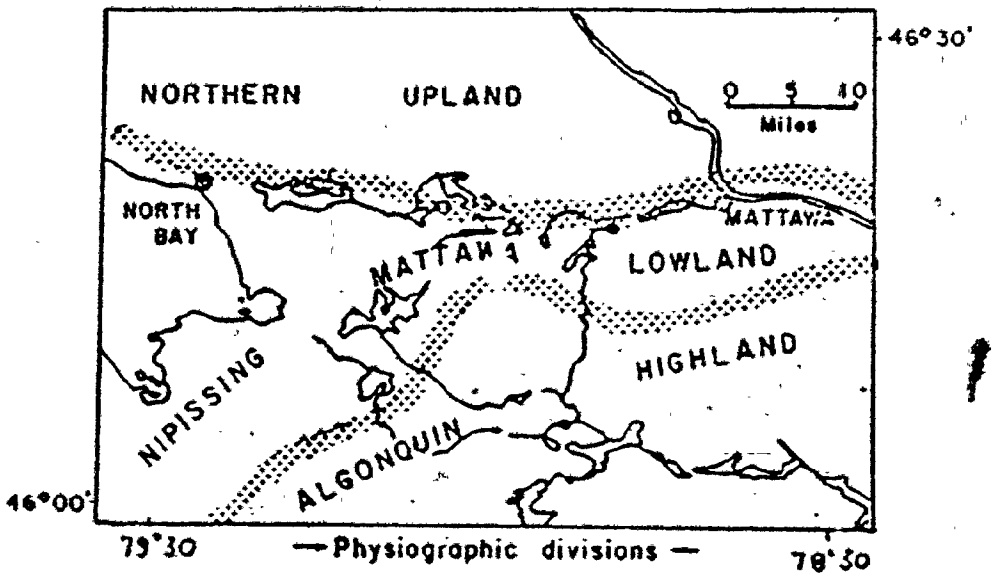
Physiography and Climate

The North Bay area is dominated by three physiographic regions (Figure 3.3); the Algonquin Highlands to the south, the Nipissing-Mattawa Lowlands in the central portion, and the Northern Uplands to the north. Harrison (1972) indicated that these regions have been created through the combination of bedrock faulting and glacial/fluvial processes. Lumbers (1970/71) identified the Nipissing-Mattawa Lowland as the Ottawa-Bonnechere Graben formed prior to the Cambrian era.

Drainage patterns are influenced to some extent by faulting, however, the major control on drainage is unconsolidated sediments deposited by glaciers and present river systems (Lumbers,1971,4). The latter is particularily true for the study area watercourses which are located entirely in the Nipissing-Mattawa Lowland (Figure 3.3). This lowland consists of "extensive lake sediments around and between numerous rock outcrops" (Harrison,1972,3). The relief of this area is 304.8 meters (1000 feet) a.s.l. and contains two major rock outcrop areas. One of these is located in the LaVase River watershed.

FIGURE 3.3

PHYSIOGRAPHIC REGIONS OF THE NORTH BAY AREA



(Harrison, 1972, 4)

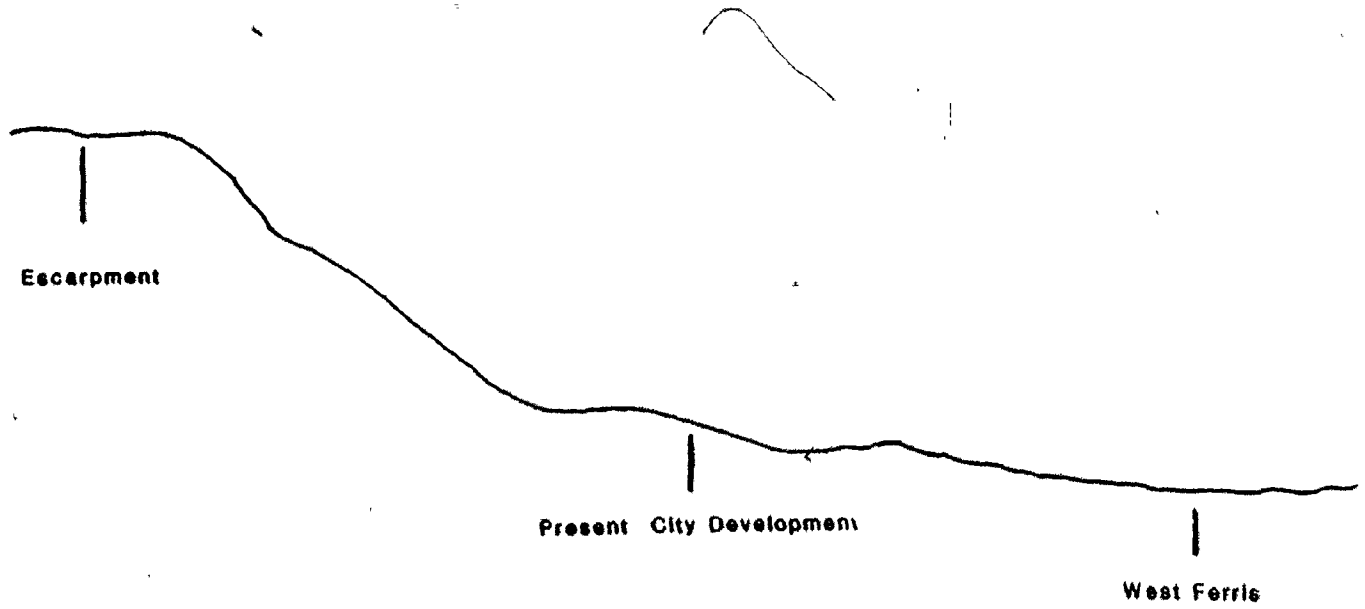
The lake sediments and subdued topography are the result of glacial melt waters occupying this area for approximately 6000 years (Harrison, 1972). During this period the glacial Great Lakes flowed through North Bay into the Ottawa River system. Aproximately 4,200 years B.P. the Great Lakes drainage system that now exists was established. Lake Nipissing reversed its flow and drained into Lake Huron while the Mattawa River continued to drain into the Ottawa River (Harrison,1972). A schematic profile of the City of North Bay is shown in Figure 3.4 and illustrates the low relief of the Nipissing - Mattawa lowlands. Bedrock, glacial till, swamp/peat/bog and sand are the dominant surface materials in the study area. Lumbers (1971) identified biotite gniess containing mainly biotite, quartz, feldspar and horneblende as the common bedrock type.

Soils are dominated by organic and gleysolic types. Organic soils are formed by accumulated organic materials, such as grasses, sedges, or leaves, and are covered by water most of the year slowing the process of decomposition (NBMCA,1978,21). Gleysolic soils are affected by the high fluctuating water table and inadequate drainage.

Climate is classed as Dfb[2] according to the Koeppen classification. Two meteorlogical stations operated by Environment Canada are located near the study area, at the North Bay Airport (established 1938) and King Street

FIGURE 3.4

SCHEMATIC PROFILE OF NORTH BAY



Not to Scale

(established 1936). The data for the LaVase River guage (established 1974) is available on an annual and monthly basis from Environment Canada. The seasonal distribution of maximum daily and instantaneous peak discharges. The meteorologic and hydrologic stations provide the data from which flood flows can be modelled (NBMCA,1982,Section 3.0).

Settlement of the Region

Physiography has played an important role in influencing settlement patterns. Several Indian sites have been identified in the North Bay area along the Mattawa River (Laroque et al.,1980, 20-22). Wright et al. (1975) believed Indians habitated the area for about 6,000 years. This would place Indian occupation in the area during the time that the glacial Great Lakes drained through North Bay.

Europeans began to explore the area in the early 1600's. For 200 years the LaVase River was a major portage along the original Montreal - Lake Superior trading route (Wright and Saunders,1980, 16). The LaVase Portage consisted of three segments totalling 10.1 kilometers (6 miles) in length down the LaVase to Lake Nipissing. Daniel Harmon (1800), Alexander MacKenzie (1801) and J. Bigsby (1816) travelled through the portage and mention the rocky, swampy nature of the area. (Wright et al., 1980,17).

In 1837 the Upper Legislative Assembly requested a survey be conducted to investigate the feasibility of a canal from the Ottawa River to Lake Huron. One of the three alternate routes selected for examination was through the Mattawa River to Lake Nipissing. Construction has never been initiated due to high costs as well as the completion and subsequent expansion of the Welland Canal (Halloran, 1971,83-96).

The building of the Canadian Pacific Railway in 1881-1882 led to increased settlement in the North Bay area (Laroque et al,1980,25). In 1895 the Town of North Bay was established as the county town and the location for government offices. The city developed outward from the CPR station and the adjacent downtown core. North Bay's importance as a transportation centre increased with the construction of the Temiskaming and Northern Ontario Railway in 1902 (North Bay Planning Board,1968b,2).

Present and Future Development in North Bay

Development has primarily occurred below the escarpment as municipal water and sewage disposal systems could most easily be extended to service this area (North Bay Planning Board,1968b,3). The Noise Control Bylaw No.142-76 prohibits future development in the northeast portion of the escarpment due to airport traffic.

> To the east topography and Trout Lake affect the direction of growth, and as the source of the City's water supply it is not considered desirable to allow intensive development in this area. To the south-east surface rock and swamp conditions make extensive urban development both expensive and less attractive than areas to the north and similar reasons limit the amount of growth to the south. Although it is conceivable that intensive development could fill in the areas south to Lakeshore Drive or the LaVase River it should not go south of here. This all suggests that the future form of North Bay is essentially pre-determined, and there are few alternatives from those outlined in the future land use concept (North Bay Planning Board,1968b,2).

The escarpment and the limit of urban services are the primary factors influencing the location of future development. One of the areas indicated for future development is West Ferris, principally above Lakeshore Drive. Present residential development has been permitted in the Parks and Jessups Creek flood plains according to mapping which was completed for the NBMCA in 1979 (Dillon, April 1975).

The Official Plan indicates that the development in the West Ferris area will be of general and restricted industrial, and residential types. The City of North Bay owns a 137 acre parcel of land in the vicinity of Birches Road and Hwy. 11 which will be developed as an industrial park through DREE funding (Figure 3.2).

Past Flooding

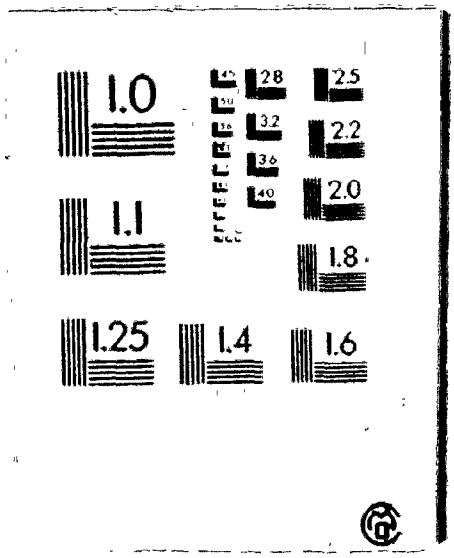
Landriault (1980,4) investigated past flooding events in the North Bay - Mattawa watershed. There has been no documentation of flooding solely from the study area watercourses; however it was noted that during the Lake Nipissing floods of both 1947 and 1979 Parks and Jessups Creeks overflowed their banks. Existing development in these areas was protected by a sandbag dike during the 1979 flood.

The West Ferris Study Approach

Essentially, Northland Engineering had to determine the 1:100 year flood flows for the three watersheds, map the flood plain, and identify and evaluate alternatives to protect development from flooding. The first task was accomplished through hydrologic analysis; the second was obtained through benefit cost analysis.

Fleming et al. (1971,1442) identified the three purposes of hydrologic modelling as: (1) to simplify and generalize a complex reality, (2) to predict the future, and (3) to plan the future of water resources. The determination of which type of model to use will depend on the goals of the study, the

2



cost of data collection, specifications for the model, and the cost of model development and/or computer time. Fogel et al. (1972,118) believed a cost - effective approach to the model selection process "provided a framework for consideration." This is the method Northland Engineering utilized in selecting the hydrologic models for the West Ferris Study.

There are generally three approaches to hydrologic estimation; empirical, runoff frequency, and rainfall/runoff studies (Ministry of Transportation and Communications, year unknown, B1-5). Unfortunately the short flow record at the LaVase River prevented the accurate and credible application of an empirical or runoff frequency approach for the study. Northland Engineering's only alternative was to examine rainfall - runoff relationships for the LaVase River. This approach has the advantage of utilizing the longer record period available from the meteorologic station at the North Bay Airport. Generally this approach attempts to relate snowmelt and rainfall events to river flow. The Storm Treatment Overflow Runoff Model (STORM) accomplishes this objective.

> This model utilizes actual hourly precipitation and daily temperature data (from the North Bay Airport) to simulate snow accumulation and melt and runoff from rainfall, producing flow rates and volumes on a continuous basis. ... The STORM Model is ... most appropriate as a screening tool in the selection of significant and extreme events, along with appropriate antecedent conditions (soil moisture) (Northland Engineering Ltd.,1979,6).

STORM basically identifies when the 1:100 year flood is most likely to occur and indicates expected soil moisture conditions. The Storm Water Management Model (S.W.M.M.) was used to determine the amount of runoff from urbanized areas.

More detailed runoff calculations would be provided by the Hydrologic Model (HYMO).

> This is a computer model for developing and routing hydrographs in rural areas. It computes unit hydrographs for the sub basins, combines them, routes them through channels and reservoirs. HYMO is widely used for calculating discharges where the effects of flood control measures or of urbanization are to be evaluated (Ministry of Transportation and Communications, Year unknown b, Section 6.61).

These models require calibration which is obtained from the flow record for the LaVase River at North Bay 1974 - 1978 and precipitation data from the North Bay Airport (Northland Engineering Ltd., 1979,7).

Flood height and flow velocity are determined by a third model, the Hydraulic Backwater Model (HEC-2). These parameters can be determined through the HYMO simulations for selected river cross-sections. This model would be utilized to simulate present and future watershed conditions. Future watershed conditions are estimated by using the development illustrated in the West Ferris Secondary Plan and any drainage improvements made to the drainage system. The improvements would lower the peak flow. These improvements were assessed in terms of:

1) capital cost of implementation,
2) effectiveness of controlling flood flow levels and associated floodway and flood plain extent,
3) comparison of the extent of land available for development, and
4) comparison of the effects on existing development (i.e. extent of the flood damage) (Northland Engineering Ltd., April 1979,11).

Depth - damage curves from the United States Federal Insurance Administration was utilized to evaluate improvement 4. These curves relate depth of flooding to the potential value of damage according to building type.

The total cost of the study was estimated to be $23,000 with an upset limit of $25,000 (communication McLean, January 22, 1979). Duration of the study was to be thirteen weeks. Both the NBMCA and MNR Sudbury agreed with this approach to the study and the study objectives (Appendix 'B').

Background to the Study

In February 1977 North Bay Planning Board held a meeting "to discuss and review the effects of floodplain calculation on the draft policies of the proposed West Ferris Secondary Plan in the City of North Bay" (Meeting Minutes of North Bay Planning Board, February 15,1977). The possibility of an engineering study to examine flood protection measures along Parks Creek, Jessups Creek, and the LaVase River was

discussed. The MNR indicated that it was provincial policy not to fund projects which would not directly benefit existing development but could fund 75% of a flood protection engineering study which focused solely on existing development. In his review comments, Andrew McClellan, Regional Conservation Authorities Program Supervisor (R.C.A.P.S.), gave the position of the Ministry of Natural Resources.

> Since the resulting flood protection measures along Parks Creek will have a direct benefit on existing approved development, it would seem appropriate that the Ministry of Natural Resources would consider an engineering study and perhaps related channel improvements as being an eligible project for funding through the NBMCA upon request from the City of North Bay ... . Since channel improvements etc. relating to the LaVase River would have limited benefits on existing development, engineering improvements should be bourne by the municipality or developer. It is provincial policy not to fund projects which do not have a direct benefit on existing urban development (February 16, 1977).

It was generally agreed that a proposal for a special policy area designation in the Parks Creek basin would be acceptable as part of the development in the West Ferris Secondary Plan.

A $10.3 million grant from the Federal and Provincial governments under DREE funds obtained to construct services and to improve storm drainage in a 137 acre municipally owned industrial park. Portions of the Parks Creek and Jessups Creek watersheds are located in this area (Figure 3.8). In October 1978 the City of North Bay contracted a local engineering firm, Northland Engineering Engineering to conduct a Storm Water Drainage Project in West Ferris as part of the DREE development.

In January 1979 Northland Engineering proposed a flood plain management study for West Ferris; the need for which had previously been identified at the meeting between the City, NBMCA, and MNR in February 1977. Comments from W.G. Cleaveley, Regional MNR Director, (March 5 1979) pertaining to the proposed study agreed with its principles and offered some suggestions to better identify the study area, the purpose and other general considerations. The major concern revolved around the applicability and accuracy of the STORM model for northern watersheds and for basically undeveloped areas. In a letter to MNR Engineer Bruce Peterson (March 16, 1979) from Northland Engineering Ltd. Engineer Neil Castanguay it was revealled that STORM had been successfully utilized in studies by the Metro Toronto, Rideau Valley, and Raisin River Conservation Authorities in undeveloped watersheds. On March 28, 1979 the terms of reference were adopted by the City, NBMCA, Northland Engineering and MNR. Written approval for the study from the Ministry of Natural Resources was sent on October 12, 1979 to NBMCA.

The primary objective of the study was to

> formulate an overall flood plain management plan for the study area ... which (would) be compatible with existing development and the development proposals contained in the West Ferris Secondary Plan and comply with the requirements of the Ministry of Natural Resources. (Northland Engineering Ltd., April 1979,2)

The MNR requirements pertained to the funding of projects for existing approved development. The contract signed between the NBMCA and Northland Engineering defined the project as:

> Study of the West Ferris area including the drainage areas of Parks Creek, Jessups Creek, LaVase River and Lake Nipissing affected by the Regional Flood and to investigate various alternative watershed management controls and assess their effects on the extent of the flood plain. The study and the summary report would be in accordance with the proposal by Northland Engineering Engineering Ltd. dated April 1979 (Appendix 'B'). (Contract, September 19, 1979)

It was noted in the contract that regional flood flows for existing conditions had previously been calculated for the Authority's Flood Line Mapping by Dillon Ltd. (1977). This meant that Northland Engineering would calculate the 1:100 year flows for existing and post development conditions as well as post development regional flood flows and do the evaluation of alternative solutions. The cost was estimated to be $25,000 and completion time of the final report 13 weeks. Appendix 'B' contains the Terms of Reference for for the study. Gore and Storrie Ltd., Consulting Engineers, were retained by Northland Engineering for computer services required for hydrologic and hydraulic modelling. A progress report on November 14, 1979 indicated the final report would be completed by January 18, 1980. Difficulties arose which significantly delayed completion of the report on schedule.

The NBMCA also had a significant delay associated with its flood plain mapping which influenced the West Ferris Study. The Regional Flood Flows (Timmins) had previously been calculated by the Conservation Authorities Branch in 1972 in in preparing of the Conservation Report for the NBMCA. Although the Authority has never received a final report, a draft containing the Regional Flood Flows was forwarded in 1979. The NBMCA hired Dillon Ltd. to map all flood plains as defined by the Regional Flood in 1974 (NBMCA,1975). Dillon was able to obtain the MNR Regional Design Storm Flood calculations for the entire watershed and proceeded to map these. This project commenced in 1974 but due to several discrepancies in recorded elevations, the mapping was not completed to the satisfaction of the Authority until 1979 (NBMCA, 1979). The original mapping received Regional MNR approval, despite the errors in elevations because these would not effect the areas or depths of flooding (interview McLellan, March 1983). The MNR (region) hoped that the mapping would be used by the authority to establish flood and fill regulations. The Authority, however, did not want to establish regulations based on unreliable mapping and was willing to wait for the corrections (interview Beckett, September 1982). Unfortuately by 1979, when the errors had been righted, provincial policy had changed and the two zone and special policy areas were acceptable land development controls.

Calculation of the 1:100 year flood is required for implementation of the two zone policy and Regional Flood flow velocity and depth are necessary for the adoption of a special policy area designation (Appendix 'A'). The West Ferris Study would provide this information.

The Report Delay

The problem which arose during the West Ferris Study was not due to mapping elevations, but in differences in flow calculations for the Timmins Storm as calculated by MNR, and by Northland Engineering. The consultants' hydrologic analysis is shown in Table 3.1. Note that the modelled versus actual flows for the calibration runs varies from 50% of guages to 118% of guaged. A meeting of January 9, 1980 resulted in all parties agreeing to another meeting between MNR, Mr. MacPherson a consultant to MNR and Gore and Storrie Ltd. to discuss the hydrologic modelling. Mr. MacPherson's review of consultants' output suggested that

> while "considerable effort" had been made to calibrate the models, the intensity and duration of these events were much lower than the 1 :100 or Timmins;
>
> their use and manipulation of model input parameters did not follow accepted procedure; and
>
> problems with the use of the Airport rain gauge which has a higher precipitation than at lower altitudes.

TABLE 3.1

WEST FERRIS FLOOD MANAGEMENT

LAVASE RIVER

HYMO CALIBRATION AND VERIFICATION

(using K & Tp)

Precipitation Date	Rainfall		HYMO		Lavase River Gauge	Comments
	Volume (in.)	Duration (hrs.)	CN	Peak Flow (cfs)	Station P.F. (cfs)	
Calibration						
Sept. 19, 1977	1.38	17	85	162	160	101% of gauged
Verification						
Oct. 30, 1974	2.28	21	75	237	265	89% of gauged
Oct. 6, 1976	1.29	24	75	39	48	81% of gauged
July 26, 1978	1.87	84	65	9	18	50% of gauged
				14	25	54% of gauged
↓				33	28	118% of gauged
July 29, 1978				14	17	82% of gauged

> Conclusions: From the examination of the work and the data submitted I would conclude that the results obtained ... on all basins in the West Ferris Management Study are not of sufficient merit or accuracy so as to be considered as a basis for any flood management program. I would submit that the work be redone in a manner consistent with the accepted practices of the Ministry of Natural Resources, Conservation Authorities Branch (John MacPherson, February 18,1980).

A meeting held on February 28, 1980 re-enforced the lack of agreement in the approach and the results of the analysis undertaken by Northland Engineering compared to the original analysis undertaken by the Ministry of Natural Resources in 1972. The consultants, in an attempt to validate their original calculations contracted Dr. Paul Wisner of the University of Ottawa to review the hydrologic study. He suggested minor adjustments to the input parameters so as to marginally increase the original flows calculated by the consultants. The conclusions of this review were:

> The difference between the consultants' approach and the one suggested by Mr. MacPherson's criticisms reflect a difference of viewpoint. As a modeller, Mr. MacPherson seeks more detailed simulations in an attempt to get "more accurate" hydrologic prediction. As water resource planners, (the consultants) have tried to use the simplest modelling compatible with the data which can be used to derive "optimum planning decisions". The latter approach has also considered the balance to be kept between hydrology and technical analysis for solutions for a given level of total effort (Wisner, April 1980, 5).

The MNR did not attend a meeting held on April 29, 1980 arranged to discuss the flows. The City of North Bay was anxious to have the flows resolved because the construction of

> Conclusions: From the examination of the work and the data submitted I would conclude that the results obtained ... on all basins in the West Ferris Management Study are not of sufficient merit or accuracy so as to be considered as a basis for any flood management program. I would submit that the work be redone in a manner consistent with the accepted practices of the Ministry of Natural Resources, Conservation Authorities Branch (John MacPherson, February 18,1980).

A meeting held on February 28, 1980 re-enforced the lack of agreement in the approach and the results of the analysis undertaken by Northland Engineering compared to the original analysis undertaken by the Ministry of Natural Resources in 1972. The consultants, in an attempt to validate their original calculations contracted Dr. Paul Wisner of the University of Ottawa to review the hydrologic study. He suggested minor adjustments to the input parameters so as to marginally increase the original flows calculated by the consultants. The conclusions of this review were:

> The difference between the consultants' approach and the one suggested by Mr. MacPherson's criticisms reflect a difference of viewpoint. As a modeller, Mr. MacPherson seeks more detailed simulations in an attempt to get "more accurate" hydrologic prediction. As water resource planners, (the consultants) have tried to use the simplest modelling compatible with the data which can be used to derive "optimum planning decisions". The latter approach has also considered the balance to be kept between hydrology and technical analysis for solutions for a given level of total effort (Wisner, April 1980, 5).

The MNR did not attend a meeting held on April 29, 1980 arranged to discuss the flows. The City of North Bay was anxious to have the flows resolved because the construction of

bridges and culverts associated with the West Ferris DREE development was being delayed. The City of North Bay therefore applied pressure to the NBMCA and Northland Engineering to complete the study (interviews with Beckett (September 1982); Bourne (February 1983); and Daiter (February 1983).

Unable to resolve the flow controversy the Authority went to the Minister of Natural Resources, the Hon. James Auld, in early August 1980 requesting his involvement. On August 6, 1980 John Ding, Head, Model Development Conservation Authorities and Water Management Branch MNR, reviewed Dr. Wisner's review report. He suggested that an adjustment factor based on the actual and predicted calibration flow runs should be computed. This brought the number of peak flow values for the Timmins Storm at the LaVase River gauge to five. These are listed in Table 3.2. At a meeting in Ottawa on August 8, 1980 the Regional Flood Flows were essentially agreed upon. John Anderson of Gore and Storrie Ltd. estimated the extra costs associated with calculation of the flows was $20,000 (September 30, 1980).

The final summary report was forwarded to the Authority for approval and this was given in principle at the General Authority meeting May 20, 1981. The report was then forwarded to the Regional MNR and the City for approval. Municipal council accepted the report but MNR Regional Engineer Harvey Walsh had serious reservations regarding the content of the

TABLE 3.2

Peak Flow Comparisons for the LaVase River Guage
for the Timmins Storm

MNR - Dillon Ltd.	6720 cubic feet/s
HYMO (adjusted)	5680
Northland: STORM	3400
Northland: HYMO	2262
Wisner's adjusted	2525

(Ding,1980,4)

study (September 9 and 18, 1981). Mr. Walsh desired several wording changes, further details primarily dealing with hydrologic and hydraulic calculations, and the deletion of all sections of the report pertaining to future development. Northland Engineering Engineering Ltd. agreed to wording changes and some flow calculations could be provided for if they were acceptable to the NBMCA and to the municipality. However, Northland Engineering would not provide flow information that was not covered under the terms of reference and could not delete sections pertaining to future development (communication Bourne, November 1981). In 1982 the amended report was accepted by NBMCA and MNR.

The Study Results

A range of alternative solutions were evaluated through cost - benefit analysis. The recommended projects are as follows:

LaVase River Watershed

A two - zone policy was recommended. This allows development in the flood fringe at no cost to the public.

Jessups Creek Watershed

"Channelization to accomodate the regional flood for post - development conditions ... . Construction of approximately 5800 feet of open channel would be involved. Structural improvements would also include the reconstruction or replacement of the existing flow structure (a bridge) under Lakeshore Drive in order to accomodate the regional flood.

Acquisition and subsequent relocation or demolition of an existing motel along Jessups Creek immediately downstream of Lakeshore Drive would also be required. Non - structural improvements would consist of acquiring the right - of - way necessary for channelization and its future maintenance.

Parks Creek Watershed

The recommended flood control scheme for the Parks Creek Watershed involves the following structural improvements:

- construction of two storage ponds which result in decreases in the post - development regional flows.
- 16,000 feet of channelization to contain the post - development regional flows.
- enlargement of existing structures at Lakeshore Drive, Marshal Park Drive, CPR and CNR rail lines to accommodate the regional flood.

A right - of - way and acquiring land for the storage ponds would also be required (Northland Engineering, 1981,20-22). Generally, adjustments are control and protection works, flood proofing, and land use management. Using this information the City of North Bay was able to identify the zoning for the official plan and zoning by-law amendments.

Northland Engineering also recommended the establishment of a flow guage on Jessups Creek and two precipitation guages in order to improve the information system. The completed study is included in Appendix 'C'.

Endnotes

1. Dfb refers to a climate having severe winters, is moist all seasons, and has a short, warm summer (Critchfield, 1960,168).

CHAPTER IV

THE CAUSES OF THE STUDY DELAY AND ANALYSIS

Introduction

During the course of interviews with representatives from the three public agencies - NBMCA, MNR, and City of North Bay - and Northland Engineering each respondent was asked to recall the events in the study and to suggest possible solutions which would have avoided the delay. A discussion and analysis of these interviews will conclude this chapter. At no point does this chapter question the integrity or knowledge of the interview respondents or any individual who was involved in the case study.

Northland Engineering Viewpoint

The representatives for Northland Engineering stressed municipal planning considerations. They mentioned that although the NBMCA had floodline maps for the City of North

Bay, they were never adopted due to the elevation discrepancies (see Chapter III). MNR had received a copy and had been using them to comment on proposed developments. During the late 1960's and early 1970's West Ferris was growing quite quickly. Minimum flood elevations were incorporated into subdivision agreements to afford some protection to homeowners. However, some buildings were located on flood plains. From Northland's viewpoint the purpose of the West Ferris Study was twofold; to investigate measures of protecting this existing development from flooding and to develop guidelines to protect future development from flooding.

In December 1979 Northland Engineering advised NBMCA that the MNR Timmins flows were excessively high. Both the Authority's technical advisory committee, established to oversee the study, and Northland Engineering attempted to negotiate the flows with MNR. A total of six meetings were held to resolve the flow calculations, and at one meeting Regional MNR representatives did not inform anyone that they would not be attending. The City required the flows from Northland Engineering to develop road culverts and applied pressure on Northland Engineering to complete the study. Shortly after the City and Authority approached the Minister of Natural Resources to complain about this situation a compromise was reached. Northland Engineering questioned the

role on the Ministry in checking and questioning in such detail the hydrologic calculations. One representative stated if the Ministry wishes to do such a thorough job checking the calculations why hire a consultant in the first place?

A second perceived problem with the MNR is their lack of understanding with the planning process and municipal requirements. Northland Engineering represented East Ferris Township at an Ontario Municipal Board hearing concerning a zoning by-law. The MNR objected to the by-law due to its deficiency of flood plain content. Specifically, MNR wished to use Authority mapping (completed by Dillon) to identify these areas. The accuracy of the mapping had always been questioned but the West Ferris Study cast further doubt regarding the flow calculations. The LaVase River flows through the township. The OMB decided to allow the township more time to better identify flood plain areas in cooperation with the Authority.

A similar situation occurred with the North Bay zoning by-law amendment. The City had attempted for two years to obtain MNR approval on hazard lands. An agreement between the City, MNR, and NBMCA was made before an OMB hearing thus giving the zoning by-law approval on the condition that hazard lands be identified as soon as possible.

The Municipal Viewpoint

The municipality was concerned with the provision of infrastructure and drainage improvements associated with the DREE grant. The West Ferris Study was established to provide the flows necessary for bridge and culvert construction and to identify flood plains for the official plan and zoning by-law amendment. The completion of the study was delayed due to the lack of agreement between MNR and the consultants on the flows.

The staging of land uses in the official plan was primarily based on the availability of municipal services below the escarpment. Since formulation of the official plan there has been a sharp curtailment in growth - projected 2% versus an actual 0.75% - and there has been a higher density of development. Although there is not the demand for land which the official plan anticipated, it will be required by the municipality to accomodate future development.

The municipality believed that the MNR is too far removed from the grassroots level to deal effectively with municipalities. Too often MNR ties up land which is serviced, penalizing the municipality and landowner, by making 'bureaucratic decisions' based on policy rather than

considering the implications of these decisions on people. It was the municipality's perception that conservation authorities were better able to comment on municipal flood plain development due to its local focus and the MNR should be entirely removed from the local planning process.

The MNR Viewpoint

The District MNR representative clarified their role in commenting on development proposals and municipal planning concerns. He explained that the NBMCA at one time had a Resource Manager on the MNR payroll until 1976. The Resource Manager had always objected to individual development proposals on the flood plain and the MNR had inherited this role when he was not replaced in 1976. The MNR continued to object to flood plain development. Minimum setbacks, building elevations, or building design were negotiated with developers based on the NBMCA's preliminary flood plain mapping (Dillon mapping).

Regarding the zoning by-laws in East Ferris and North Bay, he stated that the NBMCA is working with the planning boards in both municipalities to complete the hazard land deliniation. At the East Ferris hearing the MNR failed to have an engineer attend the hearing to support the original flows

and preliminary mapping. However, the Regional MNR Engineer had forwarded a letter which verified the accuracy of the original flows and mapping. Instead of ruling not to allow the zoning by-law to be approved the OMB forced all participants, MNR, NBMCA, and East Ferris Township, to work together to identify these areas.

The original North Bay consolidated zoning by-law made no references to flood plains. The MNR objected to the OMB when negotiations with the City appeared to fail in having these references included. The MNR Regional Engineer was prepared to attend the OMB hearing and defend the flood flows and mapping. The Ministry's position in regards to the Dillon mapping was the hydrological analysis conducted by the Branch was correct but the field checks for the mapping was inadequate. More accurate mapping would marginally effect the extent of the flood plain since backwater (hydraulic) calculations look at relative depths. While the absolute elevations in terms of feet above mean sea level were inaccurate, the relative delination of the flood plain was correct.

At a meeting between City planners, NBMCA, MNR (Region and District), and the Ministry of Housing, it was agreed that the City and Authority would complete the schedules for the official plan amendment and zoning by-law. The City and MNR agreed that the MNR would withdraw its objection if the City adopted NBMCA regulations for the city and the official plan

and zoning by-law were amended and conformed to cabinet flood plain management policy. This arrangement was explained at the OMB hearing and was formally agreed upon. It will take more than a year for these areas to be identified in the plan and zoning by-law. In the interim, the City has not changed its attitude and is still processing proposals which allow development in the flood plain.

The Provincial Flood Plain Management Policy provides the framework from which flood plain management must be seen was the perception of the Regional MNR representative. This policy is essentially directed at the Planning Act and requires municipalities to accept increased involvement in flood plain management.

The Regional MNR representative believed the delay in the West Ferris Study was due to the consultant's lack of appreciation for the principles of flood plain and flood flow calculations. Neither firm has extensively dealt with flood plain management studies, but rather with water supply and sewage problems.

Essentially the problem was made in the model assumptions. The data from the LaVase River gauge was adequate in itself but the difficulty arose in applying the HYMO model using low flood events to the Timmins Flood. Mr. MacPherson was hired by MNR as the most experienced, practical engineer available for small watershed analysis to examine the

consultants' calculations. At a later meeting, Mr. MacPherson and the Regional Engineer worked through the analysis with the consultants' officials believing that MNR and Mr. MacPherson had more experence in this area of hydrology. Unfortunately, the Northland Ltd. did not agree with the results of the MNR-MacPherson calculations.

Although the consultants retained the services of Dr. Wisner to examine the flow calculations, his approach was more theoretical, less practical, and did not indicate which calculations were correct. The CAB review provided a more direct solution to the flows as evidenced by the agreement of all study participants approximately one month after the CAB was involved.

The original report was unacceptable to MNR because it indicated projects would be initiated through MNR funding which would allow future development to occur. Existing flood plain development must be addressed in the report and future development in hazardous areas must not occur from the MNR viewpoint. The proponent of development, in this instance the municipality, should fund studies which indicate how to relieve land from the flood plain.

Since the province has invested taxpayers money into the project the MNR is interested in obtaining the best report possible. This means that the consultant should work through the project with the Ministry since the MNR has more

experience in dealing with this type of study according to the Regional representative. It also requires the support of the conservation authority since they are not in a position to comment on the technical merits of the report. Cooperation between all participants is important, particularly in the conceptualization stage in order to obtain the best report possible.

The primary concern of the Region is that the NBMCA and City of North Bay establish regulations based on the engineering studies which have already been completed. It is hoped that this will occur in 1983.

The regional MNR representative views resource planning as a negotiation process. The City desired to create more developable land in West Ferris. The NBMCA provided the means necessary to get the engineering study to do this funded primarily by the province. The MNR wished to examine protection of existing flood plain development. The negotiation process to achieve an efficient planning process has two key elements, cooperation and communication. By accepting the advice and guidance of the Region the NBMCA will obtain the information it requires to get the best investment returns. The interpretation of guidance and advice have a wide range. The Regional representative felt the NBMCA does not welcome MNR meddling in Authority programs. When one partner is reluctant to communicate it is difficult for the other to cooperate.

In the final analysis the study made little difference in the depths and areas of flooding as identified in the Dillon mapping, however a document has been developed which will allow the NBMCA to adopt regulations in North Bay and the municipality will be able to develop a new zoning by-law (Appendix 'C').

Provincial representatives with the MNR Conservation Authorities Branch (CAB) stressed the priorization of projects and the engineering approach to flood plain management. An authority must identify projects based on local needs. These projects are submitted to the Region where regional priorization occurs. These are then forwarded to the CAB where a provincial evaluation is made. Unfortunately some authorities may not have critical problems in flooding, and the broad mandate of authorities provided for in the Conservation Authorities Act allows authorities to be involved in a wide range of other projects. These needs must also be serviced on a provincial, regional, and local basis. Political pressure plays a role in funding many of the projects authorities operate outside the realm of water management.

The primary role of the CAB is to be the lead agency in the sciences of hydrology and hydraulics. In the West Ferris Study the Branch served as an arbitrator. The CAB felt that the consultants' flows were very low and a more conservative approach was desirable. This over-estimation of flows provides

some margin of safety. It is also easier to remove areas from a flood plain designation if it is later found not to be in a flood prone area. Low flood flow estimates could defeat the objectives of provincial flood plain management policy and result in loss of life and higher flood damages.

Proponents of development must be accountable for development on the flood plain. MNR policy excludes examination of future development and studies must examine existing development. The time required to complete the West Ferris Study represents the bargaining concerning the issues of hydrological analysis and study scope. Two years is a relatively brief period in comparison to larger scale projects such as dam construction.

The hydrological aspects of the study were also brought forward. The basic problem faced by hydrologists is that of calibration. When extrapolating the calibrated rainstorm event parameters (for STORM and HYMO) to the Timmins Flood difficulties arise. In Texas, where these models were developed, several intense and long duration storms are utilized in analyses. Ontario has not experienced many intense and long duration storms and must extrapolate low intensity events to model the 1:100 and regional design floods. The West Ferris Study consultants made a linear extrapolation using the LaVase River gauge and North Bay Airport rainfall record. The CAB preferred the use of a non-linear relationship as outlined

in the U.S. Army Corps of Engineers Procedures Manual. The calibration of models will improve over time as a longer period of record is available and more stations are established to improve the areal extent of measurements in watersheds.

The NBMCA Viewpoint

The study was initiated as part of the Authority's program of identifying hazard lands in North Bay. The study had two objectives; to protect existing development, and to assess what areas could be safely developed. While the old flood plain management policy allowed no development on the flood plain, the new policy would permit development to occur in low velocity and shallow flood plain areas under the two zone and S.P.A. designations. An enginering study and the other criteria (Appendix 'A') are required to support these zoning classifications. The NBMCA approached the City of North Bay and they concurred with the need for the study.

A Technical Advisory Committee was formed to meet with the consultant for guidance. This committee was comprised of two NBMCA Board members, a University Professor in fluvial geomorphology, the Director of Planning and Public Works for the City of North Bay, and the General Manager of the Authority.

Northland Engineering lacked the computer facilities to do the study on their own and utilized Gore and Storrie Ltd.'s computer for the hydrologic and hydraulic analyses. During the course of the study MNR believed the consultants had made incorrect assumptions in applying the hydrologic models. The NBMCA, MNR, and consultants met several times unsuccessfully in order to try and come to a concensus regarding the flows. The NBMCA felt squeezed between the City and MNR. The municipality was anxious to continue road, sewer, culverts, and bridges associated with the DREE project which was due to expire in March 1981.

When negotiations failed, the NBMCA approached the Hon. James Auld, Minister of Natural Resources to intervene. The Branch was requested shortly thereafter to review the hydrologic analysis. On August 6, 1980, MNR engineers from the Region and Branch, the consultants, and representatives from the NBMCA met. The analysis was worked through item by item until the flows were agreed upon to everyones' satisfaction.

The Region's next concern was regarding the West Ferris Study's examination of future development. Two letters were received from the Regional Engineer (September 9 and 18 1981) which essentially desired to change the agreed upon study objectives. This was unacceptable to the NBMCA. Since there was no longer the pressing need to immediately complete the study it was placed on hold. The City had the flows necessary

to continue with the DREE construction. This second area of concern was essentially resolved by splitting the benefits derived allowing future development in West Ferris and the benefits from the protection of present flood plain development. The delay appears to be due to a lack of communication according to the NBMCA official. It is also the result of the division of duties at the Regional MNR office. The Regional Conservation Authorities Program Supervisor is directly responsible for advising and guiding all regional authority programs. The R.C.A.P.S. was involved in dicussions in February 1977 regarding flood plain policies in the West Ferris Secondary Plan and the formulation of the West Ferris Flood Plain Management Study. The major objections to the study were received from the Regional Engineer, not the R.C.A.P.S.. Since the study requires technical approval from the region the NBMCA wonders who approves the study, the R.C.A.P.S. or the Regional Engineer?

The NBMCA believed that reporting directly to the CAB could have prevented many delays. The Branch would have been better aware of past studies by Northland and Gore and Storrie than the region. This would also facilitate a more uniform treatment of all authorities by the province.

One of the NBMCA complaints towards MNR has been the conflicts between the two agencies on a project by project basis. In July 1980 the City of North Bay requested the NBMCA

to purchase 3.5 acres of property along the shoreline of Lake Nipissing. One half of the property was in the 1:100 year flood plain of Lake Nipissing. A proposal was forwarded to the Region under the grant rate of the Water and Related Land Management Program (85% provincially funded). The Region suggested that the portion of the property in the 1:100 year flood plain would receive the 85% grant rate while the remainder would receive a 50% grant rate. Similar purchases by the NBMCA have not been subjected to this split grant rate. This is one example of MNR, NBMCA conflicts. The NBMCA representative believed MNR interferes with the Conservation Authority program by viewing proposals only from the Ministry's concerns.

Due to the extra work involved in the study, Northland Engineering has requested another $20,000 from the NBMCA in addition to the original $25,000 agreed upon. Much of the delay was the result of the Region's lack of confidence in engineering firms and desire to check all calculations in detail. Presently the municipality is utilizing the DREE money to complete work on Jessup's Creek as recommended in the West Ferris Study. It will likely be a few years before any work on Parks Creek is initiated. At that time the Authority will again hire a consulting firm to conduct a complete analysis of the watershed to ensure the flood flows are as accurate as possible.

The NBMCA official concluded by stating that the province appears to be 'dragging its feet' on the objectives and scope of such studies. The two zone and SPA policies require technical reports to support their implementation. These policies also allow development in areas where under the former one zone policy an authority would have objected to. While the NBMCA will not support development in hazardous flood prone areas, it feels obligated to the municipalities to examine future development through flood plain management studies. This is not to indicate however that the NBMCA will fund projects which allow this future development to occur.

Analysis of the Interviews

To deny the existence of resource management problems in the West Ferris Study would seem contrary to the evidence given by the long report delay. The water resource managers confirm the existence of these problems, however the degree of severity, duration, and indeed type vary considerably. This perhaps depends upon the different legislative mandates under which the managers operate and their professional associations. The City of North Bay and Northland Engineering talked quite candidly of the need to remove MNR from local level planning. This remark is due to the confrontation

between the City and MNR in regards to flood plain development. The City has developed in areas identified by the Dillon mapping as being located in the flood plain and the MNR has consistently opposed such development. Appendix 'D' illustrates such an objection from MNR to a proposed zoning change in the Chippewa Creek watershed.

This year the Hon. Alan Pope, Minister of Natural Resources, announced that where a conservation authority exists the MNR will not comment on flood plain criteria. The local conservation authority will assume this role exclusively. While this will alleviate some of the bureaucratic red tape from the municipal point of view, MNR still retains technical and final study approval for programs and plans such as the West Ferris Study.

The MNR viewpoint varied between the three levels of the organization although all agreed bargaining or negotiation was important in flood plain management. The CAB believed two years for report completion was a relatively short period of time to complete the study. The engineering aspects of data collection and model calibration were also primary areas of concern at this niche. The Regional MNR representative stressed the need for cooperation between authorities, and the MNR as a means of solving problems. He also questioned the competency of the original consultants' hydrological analysis. The District MNR viewpoint pertained to municipal planning and

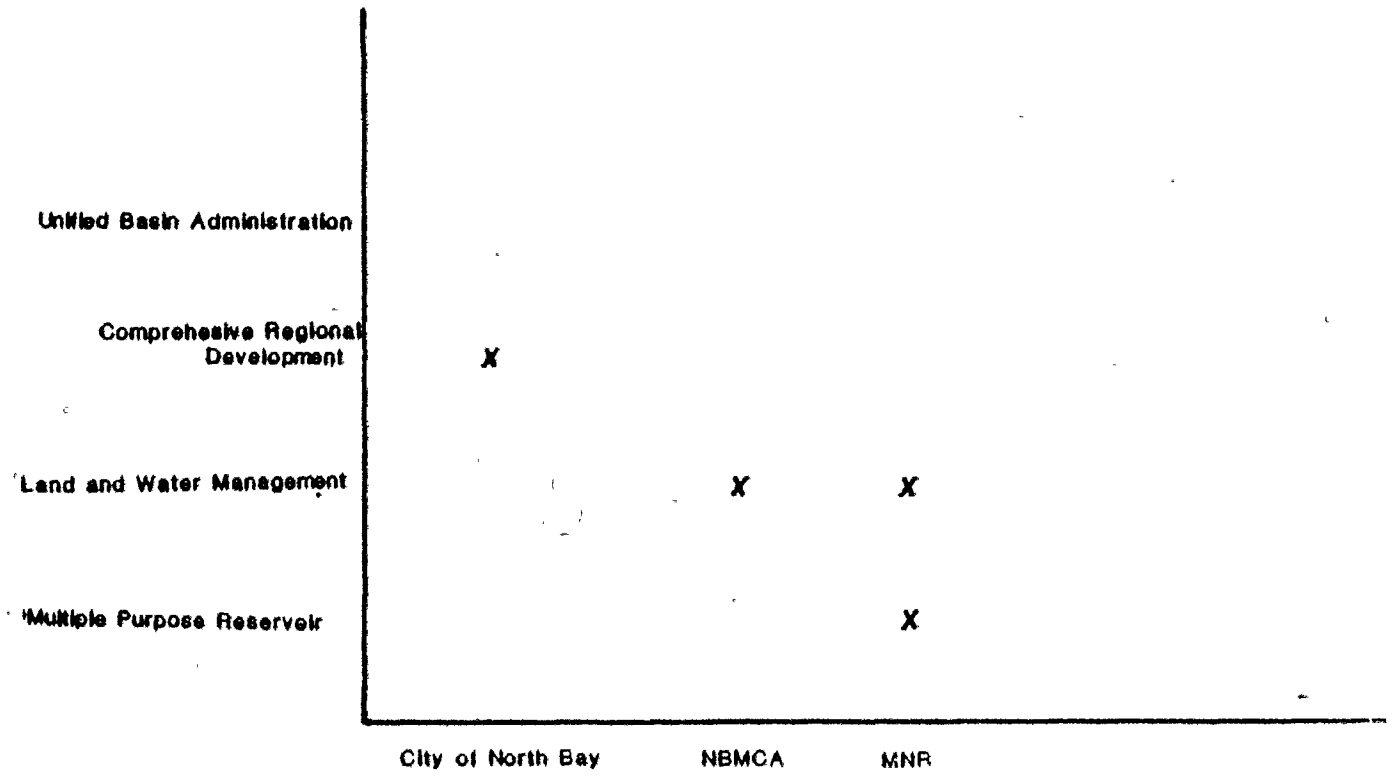
development in flood prone areas. He believed the NBMCA should have been opposing this development with the MNR rather than "standing on the sidelines watching." When the NBMCA adopts flood and fill regulations it will have an active role in this aspect of municipal planning although it will have taken over 10 years to arrive there.

The NBMCA does not want the MNR to force the Authority into any projects. In the past the Ministry has applied pressure on the NBMCA to adopt flood and fill regulations before the mapping was adequately and accurately presented. In the West Ferris Study the MNR pressed the Authority to: 1) accept the original CAB flows for the Timmins Flood , and 2) remove all references to future development in the final report. The NBMCA is quick to point out that if an authority represents a partnership between the province and member municipalities how can the MNR continually be dictating what authority policy should be.

The mandates of the study participants may be viewed in the matrix of agency approaches to water management introduced in Chapter II (Table 2.3). This is displayed in Figure 4.1. Traditionally, the NBMCA could be classified as a land and water manager as evidenced in the past erosion control, fish stocking, conservation education, and flood plain acquisition programs. The MNR could be classified in this category as well since it funds a major portion of these

FIGURE 4.1

AGENCY APPROACHES IN THE WEST FERRIS STUDY



programs. Since all dams within the North Bay - Mattawa watershed are operated by the Ministry, primarily for lake level control, it may also be identified as a multiple purpose storage agency. The City of North Bay in receiving the DREE money seeks to promote economic growth and has been grouped into the regional development approach to water management.

The West Ferris Study represents a shift in this arrangement of approaches. Through the new provincial flood plain management policy the NBMCA may under certain circumstances consider development in the flood plain. When the City of North Bay requested the NBMCA to undertake the West Ferris Study to examine future development in the watersheds, the Authority, was in a broad definition of the word, considering regional development. Much of the areas removed from the flood plain designation are available for light industrial and residential development. The NBMCA representative stated that the authority was obliged to the municipalities to examine future development in flood plain management studies.

The Official Plan of North Bay approved by the Ministry of Housing, after receiving public and goverment agency input, indicated West Ferris was a vitally important area for the future growth of North Bay. This was confirmed in the West Ferris Secondary Plan which detailed the future development in this area. These documents may be viewed as the normative and

strategic levels of planning by the municipality under the framework outlined in the Planning Act. The West Ferris Study is seen as an operational document for the municipality which addresses the following question:

> given that much of the West Ferris area is situated in flood prone areas, and that this area is important to accommodate the future growth in the City of North Bay, how can maximum development in this area be safely achieved. Also, how can existing structures in flood prone areas be most effectively protected.

While it is reasonable not to expect the MNR through the NBMCA to finance the construction of works to protect future development, the question which must be addressed is whether or not the Authority should study this aspect of resource development. The clarification of this aspect of flood plain policy would have resulted in the West Study being completed in 1981 rather than 1982.

The MNR viewpoint would indicate a negative response to this question. The Report of the Working Group on the Role and Mandate of Conservation Authorities (April 1979,4) identified the primary responsiblity of conservation authorities as:

> (the development and implementation) of a program of water and related land management to prevent loss of life and minimize property damage from flooding and erosion ... consistent with social, economic and environmental consideration.

This statement infers the protection of existing flood plain development and prohibiting future flood plain development as as the primary authority responsibilities. Sections of the Conservation Authorities Act however specifically refer to resource development. Under the Act an authority's role is:

> to study and investigate the watershed and to determine a program whereby natural resources of the watershed may be conserved, restored, developed, and managed (Section 20(a)).

Section 19 of the Act defines the objectives of an authority as follows:

> the objects of an authority are to establish and undertake, ... a program designed to further the conservation, restoration, development, and management of natural resources ... .

Wood (1972,111) believed authorities had failed to achieve the programs necessary to achieve these objectives of the Act. Instead authority programs had focused on physical water related projects (Wood, 1972,102-104) largely aimed to protect existing development and to provide recreation areas. These programs could be classified as the restoration or improvement of natural resources and to promote tourism and recreation. Wood (1972,111) concluded that conservation authorities had failed to be the integrated comprehensive resource management agencies which they were meant to be. This failure was attributed to be the result of too broad a mandate and too narrow a perspective on the part of authority managers.

White (1968,102) noted that water management strategy in the United States had evolved from single purpose private construction to regionally integrated planning. Since the West Ferris Study is so closely linked to the Official Plan it represents a regionally integrated or comprehensive water management document. Integrated regional development is an umbrella term encompassing the concepts of regional water management and regional development planning.

> Regional water development and comprehensive planning of regional development are inseparable parts of community planning and both will be more successful if carried out on the basis of similar frameworks, namely multipurpose general regional governments and incorporated in an area plan of a ... municipality (Memon,1970,140).

The problem is how government agencies can better cooperate to achieve comprehensive flood plain management. Entangled within this aspect of the problem are the issues of hydrological analysis, inter-agency bargaining, and commitment in the planning process.

Hydrological Analysis

A problem with the West Ferris Study was not the quality of precipitation and flow data but the length of record and particularly the lack of high flood events. This is a problem which only a longer period of record and the occurrence and measurement of intense runoff events will solve.

The consultant utilized four storms to calibrate HYMO ranging from 1.29 inches to 2.28 inches of rainfall and 17 hours to 84 hours duration (Table 3.1). Table 3.1 also illustrates the difficulties in model calibration. The model accuracy ranged from 50% to 118% of gauged (or actual flows), averaging 82% of guaged. It is upon these calibration efforts that the recommended projects for the West Ferris area are made.

There is certainly a lot to be said for 'making decisions in an uncertain world.' The uncertainty of the calibrated model are compounded when the Timmins Storm which assumes 7.60 inches of rainfall in 12 hours is utilized as the rainfall input (Northland Engineering Ltd., 1981,8).

In examining the consultants' analysis the CAB believed only 2 of the 4 events, (September 19, 1978 and October 30, 1974) merited calibration efforts. The other storms did not produce sufficient runoff to be considered (Ding, August 6, 1980,2). As previously mentioned a correction factor was applied to these events (Chapter III) which substantially increased the original West Ferris Study Timmins flows from 2262 cfs to 5680 cfs. The problems associated with extrapolating low flood events to much higher ones is plainly evident. Bob Chang, Acting Director of the CAB, stated that it was for this reason that the Branch uses a 'conservative approach' when estimating flows.

A intense rainfall - low duration storm event would improve the accuracy of calibration. In July 1958 Hurricane Agnes passed over North Bay causing the highest flow recorded on the Duchesnay River guage. This watershed is similar in size and surficial geology to the LaVase River watershed, and is located at the north end of North Bay draining into Lake Nipissing.

The author suggests this storm be used to calibrate the LaVase River HYMO model. By comparing the responses of the LaVase and Duchesnay hydrographs since 1974 to the same storm events some statistical relationship could be established. This relationship could be imposed for Hurricane Agnes flows recorded on the Duchesnay to the LaVase. The rainfall data would be provided from the North Bay Airport station. This could increase the accuracy of HYMO calibration.

This could have been conducted between 1977 and 1979 when the West Ferris Study was in the formulation stages. A temporary rain guage network could also have been established, particularly in the summer months when student employment programs could be of assistance.

The problems of the scientific information system will remain because of the problems of model complexity versus efficiency and cost. Blake Dwady, Hydrologic Enginneer with Northland Engineering, pointed out that while models such as the Sanford Watershed Model can provide very accurate flow predictions they require detailed data on evapotranspiration and soil moisture which are not readily available. The cost of collecting such data is prohibitive and the same problems will remain; extrapolating low intensity storms to the Timmins.

In Northern Ontario a recent MNR study indicated that an additional 300 meteorological stations will be required to achieve a density of 5 stations per 10,000 square kilometers.

Peter Grynowski, CAB Hydrometeorologist estimates the cost for establishing a rain guage will vary from $1,000 to $5,000 depending on the gauge type. A stream guage will range from $5,000 to $7,000. The MNR cooperates with the Water Survey of Canada in the establishment of guages. At present MNR supports a network of 150 (out of a total of 500 province wide) river guages in conjunction with the Water Survey and only 7 - 10 new flow stations in the province are established each year through this arrangement.

The paucity of data collection will remain a problem in the North Bay Mattawa watershed for the foreseeable future. Budget tightening by the Authority, municipality and MNR prohibit the expenditure of funds to "go it alone" in any data collection network. It is recommended that the NBMCA assess the adequacy of data based on expected future water management projects. If difficiencies exist summer student or other government funded programs could improve this information system.

The Bargaining Process

Much of the project delay was the result of legitimate technical problems and differences in analysis between the MNR Region and the consultants. When these participants were unable to resolve the flows the MNR enlisted the support of

Mr. MacPherson. Unfortunately his report did nothing to resolve the controversy and, if anything, probably added to it. When the consultants did not agree with his report they sought the advice and support of another engineer, Dr. Wisner. MacPherson's report stated the consultants' analysis was inadequate while Dr. Wisner's suggested minor modifications to the analysis, but essentially substantiated their calculations. Both of these individuals mirrored the point of view of the participants which requested their involvement. It is the conservative approach of MNR versus the consultants' approach which seeks to safely relieve as much land as possible from hazard designation which is the source of this conflict. It was only when the CAB entered into the study process that the flows were finally agreed upon. This involvement came at the request of the Minister of Natural Resources. The NBMCA delegation which met with him in August 1980 asked him to choose which study was correct (interview Beckett, 1982). Bob Chang, Acting Manager, Technical Services of that CAB stated that the Branch is the recognized expert in the field of hydrology in Ontario. This author suggests that the Branch play a more active role in the study process to better utilize this expertise. Rather than having the Region approve the technical merits of a study it is recommended that the CAB be given responsibility for this function. The Branch would have been responsible for the hydrologic and hydraulic, and cost - benefit analyses approval in the West Ferris Study. This would ensure a consistent approach to MNR technical comments across the province.

If this is not possible many difficulties in the West Ferris Study could have been avoided if the flow calculations had initially been forwarded to the CAB immediately instead of asking other outside engineer's opinions. The CAB would essentially act as an arbitrator between the Region and the consultant in this institutional arrangement. Under no circumstances should the extra costs of hiring outside consultants be contemplated to aid this negotiation process. The failure of the latter approach is clearly evident in the case study.

Commitment to the Plan

The NBMCA and City of North Bay believed that comprehensive flood plain management was being accomplished through the West Ferris Study and the MNR should be involved in the study. The MNR feels it should not be expected to fund the major portion of a study which examines future development since this will not benefit the province through the reduction in flood damages.

The study participants originally agreed to the terms of reference outlined in Chapter III and contained in Appendix 'B'. While the stated purpose of the study can be considered somewhat general in nature it clearly indicates that future development will be examined in the study. The benefits

arising from relief of lands from hazard land designation is also being used to determine the feasability of any alternative solution in the cost - benefit analysis. The NBMCA and City of North Bay were surprised when MNR requested all references to future development be dropped from the report. This represents a loss of commitment to the agreed study. The study objectives state:

> the primary objective of the study is to formulate an overall flood plain management plan for the study area ..., which will be compatible with existing development and the development proposals contained in the West Ferris Secondary Plan and comply with the requirements of the Ministry of Natural Resources (Northland Engineering Ltd., April 1979, 3).

In February 1977 the MNR through the R.C.A.P.S. had clearly stated it would not fund a project which examined future development (McClellan, February 16, 1977). Whether the MNR failed to note the references to future development in the terms of reference or misunderstood the meaning is not clear. The interview with the Regional MNR official indicated that the objective of the West Ferris Study was to examine existing development exclusively. It is quite evident however that when the MNR desired this change during the study, the municipality was losing the benefits derived through increasing the tax base as a result of reducing the extent of hazard lands. As the general planning model noted, commitment to the plan is the most important part in the planning process since all methods of analyses and participant roles are identified here.

The MNR position was moderated in a letter from the Regional Engineer to the NBMCA which commented on the lack of communication between the consultant, NBMCA, and MNR, and expressed hope that this situation would not be permitted to develop again (Walsh, September 18, 1981).

This can be most effectively achieved if the study participants agree during the formulation of the study objectives the role(s) of each actor, the methods of analyses, the modelling techniques, and data requirements. This was generally lacking in the case study.

Northland Engineering was quite surprised that MNR checked all calculations in detail. Their comment was that if MNR wishes to supervise the analysis that closely why hire the consultant in the first place? MNR closely scrutinized all studies to ensure they were conducted properly. MNR readily admitted that it prefers to be on the conservative side in flow calculations to add in an extra safety factor. Bob Chang (Acting Manager, CAB) stated that it is easier to remove lands from a hazard designation than to enlarge developed areas into the hazard land designation. Underestimation of the regulatory flood flows will defeat the objectives of the provincial flood plain management policy. One of the 'requirements of the Ministry of Natural Resources' is that the hydrologic and hydraulic analysis be completed to their satisfaction. Since the MNR is funding the major portion of the study they are entitled to carefully scrutinize, in an objective manner, these analyses.

The letter from the Regional Engineer of September 18, 1981 also noted the lack of communication between the study participants stemming from the Terms of Reference. The Regional Engineer questioned the use of the U.S. flood damage curves to evaluate the benefits to existing development instead of comparable curves were available from Canadian sources. The Terms of Reference clearly stated the U.S. curves would be utilized for the analysis (Appendix 'B').

While the study objectives are being formulated it is imperative that all participants negotiate and bargain with each other, in good faith, to achieve the best and most efficient reporting system possible. It is difficult for the author to discern the difference between beligerence based on personality conflicts between individuals associated with the study and valid agency concerns which the author noted during the research. Personality conflicts aside this study should not have taken over two years to be completed.

The problems stem from the lack of definition on the study reporting system. When the terms of reference are agreed upon all participants must remain committed to the planning process. Any changes in purpose or methodology must be agreed upon by all. The consultant appears to be caught in the middle in this case. The original terms of reference indicated that Northland Engineering would not be responsible for providing the Timmins Flood flows and would use those generated by the

CAB in 1972. When the large difference between the 1:100 and Timmins was noted by Northland it evaluated the Timmins flows as well, with no written authority to do so. The extra cost of $20,000 for doing the study is to a large degree the result of this extra analysis. To the author's knowledge the NBMCA has not yet considered payment of the additional cost. Unfortunately Northland Engineering did not have written approval to consider the Timmins flows and may not receive the additional $20,000 they requested. This points out the need for all parties to agree upon changes in the Terms of Reference prior to one participant doing something they are not responsible for.

Comprehensive Water Management

While the consideration of land enhancement may be considered irrelevant for Authority projects according to MNR, they are considered to be vitally important by the municipality and NBMCA in any comprehensive flood plain management plan for West Ferris. The City has already completed much of the work recommeded in the West Ferris Study with the DREE funds.

Chapters I and II outlined the need for cooperation between all levels of government to achieve comprehensive water management in Canada. The lead agency approach is often utilized in Canadian water resource planning. The Committee reviewing the role and mandate of the Conservation Authorities stated:

> given their direct responsibilities for flood and erosion control, Conservation Authorities must be actively involved in the development and implementation of comprehensive water management plan ... and may be designated to assume the lead role in the preparation of comprehensive water management plans (MNR, April 1979,5).

If the West Ferris Study is to be a comprehensive plan it must examine the range of alternative solutions and benefits to the municipality, MNR, and NBMCA. Since the NBMCA is best suited to solve flood and erosion problems it was selected to be the lead agency for the West Ferris Study.

If the NBMCA is to truly be the lead agency in the West Ferris Study it must also be accountable for the project. At present the MNR Regional Director has final approval over studies such as the West Ferris Flood Plain Management Study. This present arrangement puts the accountability squarely on the agency which has final approval, the Ministry of Natural Resources.

This has been cited as a major shortcoming in Authority management structure by Turkheim (1979,42).

> (An authority) is virtually powerless to choose priorities, especially where a high priority item requires the designation of a benefitting municipality. In effect, the choice rests with the municipality in terms of acceptance of its apportionment of cost for a project, yet, it bears little or no accountability for a bad choice or one made parochially.

The MNR also has a major influence on authority priorities since this agency funds a majority of NBMCA programs and studies. An authority is caught between balancing MNR and municipal interests. This is particularly evident in the West Ferris Study.

In his review of Regional Government in Waterloo the Palmer Commission concluded that the Grand River Conservation Authority, (and all conservation authorities) was missing two key characteristics which prevented it from being truly accountable to the public:

> it does not have an electoral base and it cannot levy taxes. Without these "tools" the authority is at the mercy of the Province and Municipalities (March 1979,195).

If the NBMCA is to be held accountable for the study success or failure it must have final study approval. This does not indicate that the NBMCA should not receive technical approval for the study from the Ministry. The process of negotiation between the municipality, MNR, and NBMCA will continue to be critically important in the plan conceptualization stage. Prior to authority approval comments from these participants as well as any other interested agencies should be sought.

Perhaps the most difficult aspect of the West Ferris Study is to differentiate between solutions which ameliorate flooding for existing development and those which facilitate future development. Unfortunately they are not mutually exclusive. The structural adjustments recommended in the study will result in the reduction of peak flood flows. Hence, the protection of existing development and the provision of more land for future development is provided for at the same time. The MNR does not wish to be examining projects which allow

future development, believing instead that these costs should be bourne by the proponent of the development. What is required is a different cost sharing arrangement for the cases where both existing and future development are examined. It is recommended that this sharing be based on the benefits arising from the protection of existing development (by the MNR) and the benefits arising from allowing development in former flood plain lands (by the municipality).

The flooding problems in West Ferris had been recognized for some period of time. The DREE funds permitted the industrial development to be located here. The author believes it is reasonable that an allocation of funds for identifying flood prone areas be included in the original DREE submission. Instead the West Ferris Study was not initiated until two years after the moneys had been received. This could be co - ordinated between DREE and Environment Canada through the Canada Flood Reduction Program. The environmental compatibility of land development is the aim of this recommendation. The MNR and NBMCA should clearly state that although they are involved in examining future development through the West Ferris, their participation in recommended projects is not necessarily guaranteed. Project involvement by an authority and MNR is presently justified on the basis of existing development only.

The framework for fostering comprehensive flood plain management is identified in the official plan. Since the present flood plain management policy is directed at the official plan it follows that the municipality must accept more responsibility for land use planning within its boundaries. Provincial flood plain policy identifies the municipality as a key agent to control future flood plain development through land use regulation. The author therefore suggests that all municipal, conservation authority and provincial agency planning documents centre around the official plan. Since no national or provincial water management strategies exist at the present time, the framework for allowing comprehensive water resource management must be developed from these local level planning documents.

Agencies such as the Ministries of Housing and Natural Resources and conservation authorities have input into these documents to ensure their concerns are included. At this normative level then, operational plans (West Ferris Study) and strategic level documents (Watershed Plans, Strategic Land Use Plans) may be integrated by other agencies. Platt et al. (1980,vii) believed comprehensive management could be achieved if flood plain management were better integrated with other local planning documents, such as official plans, secondary plans, recreational plans, and transportation plans. By identifying the need for future projects in official plans,

institutions such as MNR, and conservation authorities may be better able to serve municipal needs. This notice of future projects will also facilitate the improvement of the scientific information sytem, if required, and necessitate a greater degree of cooperation, or bargaining between these agencies. It will not be an easy task. Chapter V summarizes how this co - operation may be developed through the examination of the existing institutional arrangement for for flood plain management.

CHAPTER V

SUMMARY DISCUSSION AND CONCLUDING REMARKS

Chapter I identified that the intent of this research paper was to determine who or what combination of actors would provide the most effective management of the flood plain. Resource management, including flood plain management was described as a decision - making process carried out by government institutions at all levels. Normative, strategic, and operational planning exercises were important components in the resource management process to achieve the societal objectives discussed in Chapter II. A general planning model was presented in Chapter II to familiarize the reader with general planning concepts. As identified by White (1956), four types of institutional approaches to manage river basin resources, multiple purpose reservoir, land and water, comprehensive regional development and unified basin administration, were described. Effective management was influenced by two factors, accountability and efficiency, which would be used to evaluate the West Ferris Study project delay.

Within this institutional and planning framework Ontario flood plain management agencies were discussed. The fragmentation of responsibility was noted between the major flood plain managers in Ontario, the conservation authorities, MNR, and municipality. The provincial flood plain management policy was outlined as a framework to achieve societal objectives, specifically the enhancement of the natural environment. The history of the Ontario conservation movement showed that resource management and economic development were important contributing factors to the formation of the Conservation Authorities Act.

The West Ferris Flood Plain Management Study illustrated the difficulties in managing the flood plain. This was explained in Chapter IV to be the result of the differences in legislative mandates, perception of the participants, and professional experience on the part of the participants. While conservation authorities have traditionally conserved and enhanced natural resources through flood plain management, the present provincial policy allows an authority to permit development on the flood plain in certain circumstances (Appendix 'A'). The question and central problem which arises from the West Ferris Study is should a conservation authority be the lead agency in promoting flood plain studies which examine future development. Secondary issues which must be addressed pertain to aspects of Ontario flood plain management policy, the nature of institutional arrangement research, and areas for future research.

The alternatives which were considered to improve the institutional arrangement for flood plain management in the case study were:

1) MNR assume 100% responsibility for conducting the engineering aspects of water management studies.
2) NBMCA conduct the study without requiring MNR technical and final plan approval;
3) the municipality be responsible for conducting the study on its own using DREE funds; and
4) clarify and better deliniate the present roles of flood plain managers.

Unified basin administration was not considered because the author felt the need for one had not been clearly established. This was one of the three factors that Ingram (1973) indicated were necessary if this management approach was to be effective. The interviews indicated that alternatives 1 and 2 were not desired by any respondent. Co-operation, bargaining, and communication were frequently used terms by most respondents in suggesting ways to improve the process. Alternative 3 would solve the question of who should pay for the study; however the MNR and conservation authority have input into the official plan and zoning by-law. If MNR or local authority did not does not agree with the flow calculations in the municipalities watershed study, then the confrontation between these bodies would occur again. Therefore, alternative 4 would appear to be the most acceptable solution to the problem. The following discussion is premised on this fine tuning of the present institutional arrangement.

3

The Institutional Arrangement for Flood Plain Management in Ontario

This central question can be best answered through the examination of vertical, functional, and horizontal levels of institutional fragmentation as identified by Platt et al. (1980,26). These authors noted that the responsibility for flood plain management in the United States "is vaguely assigned to "the public", but this conveniently overlooks the complex nature of public decision - making ..., especially where resource management is concerned" (Platt et al., 1980,26). The same comment holds true for Ontario flood plain management policy. The vertical or hierarchically division of responsibility between, local, regional, and provincial governments has shown that municipalities have allowed development to occur on the flood plain in the past and turned to conservation authorities and/or the provincial government for solutions when flooding has occurred. The present flood plain policy was introduced after the municipalities had complained that the flood plain policy had previously been too restrictive (the one zone concept).

The question at the vertical level is which agency should be responsible for flood plain management. All interview respondents agreed that conservation authorities were the best equipped agency to deal with flood and erosion problems because of their watershed jurisdiction. This allows authorities to examine the broad implications of any proposed solution to these problems. Other government agencies, such as local Planning Boards and MNR, will continue to be involved as secondary participants in flood plain management. Conservation authorities should continue to be the lead agency.

While all interview respondents agreed on who should be the lead agency there was no concensus as to which institutional approach to flood plain management should be followed or how the authority could more effectively be the lead agency. This arrangement will depend to a great extent on which societal goal(s) are to be met in flood plain management. Presently flood plain management goals are geared exclusively to the enhancement of the environment through the reduction of the flood hazard. However, economic growth is also facilitated through this policy according to the municipal and authority respondents.

Both the enhancement of the environment and the provision for economic growth were the motivating factors behind the passage of the original Conservation Authorities Act (Richardson,1974). The MNR viewed the West Ferris Study

objectives exclusively from the enhancement of the environment. Van Loon and Whittington (1981,599) believed societal goals were not the problem in planning "but rather to develop the most practical and effective procedures for achieving agreed upon goals." The conservation authorities can play an important role in solving this problem. As previously noted by Wood (1972,38-39) the broad mandate provided for in the Conservation Authorities Act allow this agency to have a wide perspective in solving resource management problems. The projects recommended through the West Ferris Flood Plain Management Study will result in the solution of the flood problem, identification of future land uses in the official plan and zoning by-law, and the promotion, or at least the opportunity of increased economic development. While these are all legitimate areas for authority involvement implied in the Conservation Authorities Act, the Ministry of Natural Resources does not wish to fund studies which examine future development options. If comprehensive water management is the goal of the West Ferris Flood Plain Management Study then this aspect must be addressed. The West Ferris Study illustrated the difficulties of single function management agencies bargaining to achieve comprehensive water resource management. Memon (1970), Ingram (1973), MacMillan (1976), and Mitchell (1980) believed that the competing programs of various agencies would enhance the wider consideration of alternatives

to achieve societal goals. The reason for the breakdown in this process in the West Ferris Study is that "agencies can co-ordinate their efforts only to the extent that their policies are mutually consistent" (White,1969,72). This is a function of the legislative mandate and institutional approach.

Van Loon and Whittington (1981,521) viewed agency interaction as:

> a set of bargaining relationships. ... When decision - makers discover that not all the demands they consider important cannot be satisfied, they will begin to trade off one project against another.

This agency interaction results in the strengthening of policy and its effective implementation (White,1969,72). The Conservation Authorities Act must be more explicit in defining the nature of its political/institutional concerns to better facilitate the bargaining between municipalities and the Ministry of Natural Resources in order better achieve societal goals. Which societal goals (Table 2.5) are to be achieved must also be clearly defined. One of the objectives of flood plain policy is "to encourage a co-ordinated approach to the use of land and management of water" (Dillon and MacClaren, 1976,31). This 'catch-all' phrase seems to be one of the contributing factors to the agency conflict present in the West Ferris Study. The NBMCA and municipality perceive this co-ordinated approach to be achieved through the examination of present and future land use options in the West Ferris Study.

Bargaining was identified by Parks and Monk (1972,37) as an effective technique to obtain agreement on project purpose and objectives. The case study clearly indicated that the bargaining between the MNR, NBMCA, and municipality is confrontational in nature. Much of the study delay could have been avoided if the reporting system, methods of analysis and evaluation, and study objectives, been negotiated and agreed upon by all participants prior to the commencement of the West Ferris Study. By spending more time to establish these points prior to study initiation, less time will be wasted during the study process. A factor which Parks and Monk (1972,38) identified as necessary for effective bargaining was that all parties must have a similar measure of power. At the present time the conservation authority lacks this equal measure of power.

The West Ferris Study could have been an excellent opportunity to easily attain comprehensive flood plain management through bargaining. Both the MNR and City of North Bay desired action from each other. The Ministry wanted the municipality to have a consolidated zoning by-law which recognized provincial flood plain management policy and have the municipality adopt flood and fill regulations administered by the NBMCA. The City of North Bay wanted the West Ferris Study to identify existing and future development in the area. This information would be used to identify flood plain areas

and policies in the official plan and zoning by-law. This was essentially the agreement made at the Ontario Municipal Board hearing between the MNR, NBMCA, and City of North Bay regarding North Bay's official plan amendment.

The DREE grant provided the funds necessary to provide the infrastructure necessary for the industrial park. Since this area was in a known flood plain the City wished to determine where the flood lines were located and what projects could be undertaken to reduce the hazard. The DREE grant would also provide the funding for these projects. The City believed the NBMCA would be the means through which 75% of a flood plain study could be funded by the province. A Conservation Authorities Administrative Procedures Committee examined the authority, MNR, and municipality relationship. They stated:

> for almost 30 years, the Conservation Authorities of Ontario have operated on the understanding that they are autonomous corporate bodies representing a full and equal partnership between their member municipalities and the Province. ... Conservation Authorities are really a group of 38 municipal organizations; their primary purpose in life as 'delivery' agents for their member municipalities (Powell et al., 1975,4).

The West Ferris Study is an example of an authority acting as a 'delivery' agent for the City of North Bay. The Committee pointed out that an authority is an autonomous corporate body representing municipalities acting at arms length from the province. The numerous communications between the MNR and study participants consistently stated that MNR policy which would not fund projects considering future development. This

author wonders what happened to the arms length approach? Clearly, the NBMCA is not at arms length because of their dependence upon MNR for technical and final plan approval, and the majority of funding.

This author completely concurs with the policy which prevents the MNR funding projects which exclusively examine future development. Programs such as DREE and other provincial ministries (Treasury and Economics, Northern Affairs) can provide funds to municipalities for industrial and economic growth. The problem remains however as to funding arrangements for studies which examine both present and future flood plain development such as the West Ferris Study.

If authorities are to better serve municipalities as a 'delivery agent' they must be 'in tune' to local needs. Since a municipality is concerned with all aspects of local affairs, an authority must be able to respond to these municipal concerns.

Perhaps the broad mandate of the Conservation Authorities Act and the authority's role as a 'delivery' agent would be better served if an authority had more independence from the MNR. Rather than MNR policy being consistently stated, communications should state "it is conservation authority policy ...". This would allow authorities to operate more independently of the province. By doing this however the likely result will be more MNR - authority confrontations

because of divergent approaches to resource management. Perhaps the best solution would be to adjust the grant rates for water management studies based upon the benefits derived from protecting existing development and from those derived from protecting future flood plain development. It should be stressed that an authority should not be involved in funding projects which allow future development to occur. Municipalities will eventually be compensated for investments in these studies and subsequent projects through an increased tax base.

Platt et al. (1980,30) noted the fundamental weakness of United States flood plain policy was the lack of co-ordination between intra and intergovernmental agencies. The report stressed the importance of co-ordination between managers in applying non - structural adjustments to flooding. The new provincial flood plain policy should solve the past conflicts between municipalities and the Ministry of Housing against MNR and authorities. In order to achieve this however, greater commitment is required by all participants in flood plain management.

During the interviews it was implied by some respondents that the Ministry of Natural Resources be removed from water management all together. It was suggested that the conservation authorities assume greater responsibility for water management. While this institutional arrangement would

result in conservation authorities being more accountable for their actions, many, including the NBMCA, lack the technical support staff to assume a greater role in water management. This would also reduce the bargaining between agencies which was considered necessary to implement programs best suited to achieve societal needs. If comprehensive water management is to be achieved through the conservation authority program better negotiation between agencies concerning the issue of conflict resolution (in the case study the differences of hydrological analysis) is needed. The interviews and the events of the West Ferris Study indicate more effective intergovernmental collaboration is required. The City of North Bay must not allow future flood plain development to occur as the District MNR official cited has occurred on Chippewa Creek in 1980. The degree of collaboration and who should be active in this process will be dictated by the mix of adjustments (Table 2.6) employed in a given watershed. Bargaining will again play an important role in this process.

At the project level, the planning process must encourage a dialogue between study participants. All study participants roles' must be clearly defined in the terms of reference and the study objectives. At the vertical level, bargaining is the key to better achieve effective management. The MNR must be more flexible in interpreting and implementing the Conservation Authorities Act. Bargaining during step 1 of the planning process, commit ment to the plan, is particularly important in avoiding study delays as illustrated in the West Ferris Study.

Platt et al. (1980,26-27) defined functional relationships as the division of power within any level of government. Although the case study essentially examined vertical relationships there were functional problems in flood plain management noted during the interviews. Better communication between the planning staff and building inspectors is required to prevent future flood plain development from occurring. Flood lines should be forwarded from the NBMCA to the planning staff in order that this information be made more available.

Platt et al. (1980,28) identified horizontal fragmentation as "the most perplexing and least studied issues in intergovernmental flood plain management." Specifically referring to flood plain development downstream of reservoirs, these researchers noted the need for a watershed approach by all communities. The present flood plain policy also requires a similar approach. In West Ferris any land use changes in adjacent municipalities will influence the hydrologic response of the watersheds. Conservation authorities can provide a forum for municipalities of a watershed to negotiate on future land uses which will affect the deliniation of the flood line. Municipalities can also have input into the selection and operation of alternative solutions to the flood hazard through this watershed approach. Structural and non-structural alternatives recommended in the

West Ferris Study should be adequate to protect existing and planned development based on estimations of watershed changes anticipated in the future (Northland Engineering Ltd., 1983). The official plan allows for the estimation of expected runoff co-efficients based on land use changes.

Solutions to the West Ferris Study Project Delay

Chapter IV outlined a possible solution to avoid unnecessarily long project delays. The Water Management and Conservation Authorities Branch should assume a more active role in approving the technical merits of local authority projects. This will ensure a more consistent approach in dealing with all authorities across the province.

Incomplete information, or at least a short period of record will continue to be a problem in the North Bay Mattawa watershed. The paucity of high runoff events is particularly problematic in extrapolating calibrated models to the 1:100 year and Timmins floods. For this reason the MNR should continue to use a conservative approach to flood flow calculations. The NBMCA in co-operation with the Conservation Authorities and Water Management Branch should determine the adequacy of the present river precipitation and river guage network to meet future watershed study requirements.

Municipalities can play an integral role in determining future watershed studies through the official plan. It has been problematic for the province to adopt a provincial water policy given the incremental fashion in which priorities and funding have been applied in flood plain management (Mitchell et al., 1978,109-115). Van Loon et al. (1981,598) believed incremental planning was the rule rather than the exception in government projects.

> In a situation of incomplete information it is risky to attempt "great leaps" forward with radical policy options, for the "great leap" may precipitate unforseen consequences which are more serious than the policy is designed to solve in the first place.

This incremental planning can be avoided if official plans identify the roles of various agencies and organizations in the future land use strategy. For instance, the North Bay Official Plan could have specifically noted the flood hazard in the West Ferris area when it was identified as the primary area for future industrial growth. This would have been a signal to the NBMCA that a study would be necessary and allowed this agency to establish guaging equipment as quickly as possible. This would also increase the grass - roots approach of the conservation authority program.

Areas for Future Research

This study illustrates the policy and decision-making

process for conservation authorities. Municipal amd authority interview respondents criticize MNR for dominating this process. The MNR officials at all levels stressed the need for a co - operative approach.

Future research could focus on establishing whether the present institutional arrangement has effectively allowed the conservation authority to be the autonomous corporate body and 'delivery' agent for the municipalites it was meant to be. The case study approach, if employed would have to use a cross - section of authorities across the province and utilize a structured framework of evaluation such as Suchman (1969), or Palmer (1979). These studies should also centre on how accountable a conservation authority is for the consequences of its own action or inaction.

The intent of this research should be to examine the suitablity of the present institutional arrangement. If it is deemed unsuitable then perhaps the conservation authorities could better serve the municipalities under another ministry such as Environment, or Housing. Bargaining, negotiation, communication, and co -operation between all participants in water management will continue to be the key words when discussing the effectiveness of flood plain management in Ontario.

The theoretical base for institutional arrangement research should be more closely tied to policy studies. The development of flood plain management policy has been incremental in nature. The funding for water management programs such as dam construction and land aquisition has not remained constant over time (Veale, 1979). The location of the Conservation Authorities Branch in terms of the administering provincial department or ministry has also been incremental in nature. Originally, the Department of Planning and Development oversaw the CAB. The Departments of Energy and Resources, and Ministry of the Environment have also administered the authority program. Since 1972 the present arrangement with the Ministry of Natural Resources has existed. Research should be conducted to examine the effects of this change in the institutional arrangement on policy implementation. Through the use of policy study theory such as incremental or mixed scanning approaches, the geographer will be better able to understand the relationship between the policy participants. Through this more systematic approach policy and institutional arrangement studies will be more clearly defined. This approach will also foster a greater understanding of this 'force or resistance' in resource management policy referred to by O'Riordan (1971,110) and aid in promoting a more effective decision-making process.

APPENDIX

Appendix 'A'

Factors to be Considered in Two Zone and S.P.A. Designations

Factors to be considered in Two Zone and S.P.A. Designations

a) a detailed landscape inventory and evaluation;

b) the existing physical and environmental hazards;

c) the potential impacts of these hazards;

d) the potential impact of the proposed development upon these hazards;

e) the proposed methods by which these impacts may be overcome in a manner consistent with accepted engineering techniques and resource management practices;

f) an evaluation of alternatives to the proposed undertaking; and

g) the cost and benefits in monetary, social and biological value terms of any engineering works and/or resource management practices needed to overcome these impacts.

Appendix 'B'

West Ferris Study Terms of Reference

WEST FERRIS

FLOOD PLAIN MANAGEMENT STUDY

PROPOSAL FOR ENGINEERING SERVICES

NORTHLAND ENGINEERING LIMITED
CONSULTING ENGINEERS & PLANNERS
NORTH BAY - SUDBURY - THUNDER BAY

JANUARY, 1979.

CHAPTER 1

INTRODUCTION

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1.1 BACKGROUND

The City of North Bay is proposing to develop an area of industrial land east of the present City development and referred to as the West Ferris Secondary Plan. The area is generally bounded on the west by the present City development, on the north by Highway No. 11, on the east by Highway No. 11B and on the south by Lake Nipissing.

Two watercourses traverse the area, including Parks Creek, with a watershed area of approximately 5.8 square miles and Jessups Creek, with a watershed area of approximately 1 square mile. In addition, the La Vase River, which has a drainage area of approximately 27.2 square miles, abuts on the east boundary of the area.

1.2 STUDY OBJECTIVES

Since much of the land in the West Ferris Secondary Plan area is affected by the "Regional Flood", it was acknowledged that planning and design of the proposed development could not be undertaken without due regard to flood plain policies and flood restrictions. Consequently, an engineering study was proposed to determine requirements for flood control management for the West Ferris Secondary Plan area and the existing residential area downstream. This study would be funded jointly by the City of North Bay and the North Bay-Mattawa Conservation Authority and would be undertaken by Northland Engineering Limited, since this firm had already been retained by the City of North Bay for related engineering work.

The need for such a study was described at a meeting held on February 15, 1977 and attended by the City of North Bay Planning Staff, representatives from the North Bay-Mattawa Conservation Authority, and the Ministry of Natural Resources. From our review of the development plan proposals, the comments contained in minutes of the February 15, 1977 meeting, and our subsequent conversations with the City, Conservation Authority and Ministry of Natural Resources Staff, we see that the primary objective of the study is to formulate an overall flood plain management plan for the study area shown on the attached plan, which will be compatible with existing development and the development proposals contained in the West Ferris Secondary Plan and comply with the requirements of the Ministry of Natural Resources.

CHAPTER 2

STUDY APPROACH

CHAPTER 2

STUDY APPROACH

2.1 GENERAL

This section of our proposal, presents our proposed approach to the study, the methodology to be used in the analysis and the approach to the development of recommendations.

The basic study requirements and objectives have been described in Chapter 1 and form the framework to be done. Our general approach will be to investigate various alternative watershed management control options, and assess their effects on the extent of the floodplain and the resulting land available for development. In addition, any associated detrimental effects such as possible increased upstream flooding problems will be assessed. This approach will require the:

- Development of Watershed Management Alternatives
- Evaluation of watershed hydrology
- Hydraulic analysis of alternatives
- Overall benefit evaluation of alternatives and the development of a recommended scheme

2.2 FLOOD MANAGEMENT CONTROL ALTERNATIVES

There are two primary options for flood management and control which will be considered in this study:

1) Contain the Regional Storm Flood within a defined floodway, where no development is permitted.
2) Apply a two zone floodway-flood fringe concept, wherein a floodway is defined (perhaps a 100 year flood) and where no development is permitted. Controlled and protected development is permitted within the flood fringes of the Regional Storm Flood Plain beyond the defined floodway where the depth of flooding is minimal.

Associated with each of these primary options is the possibility of application of other management and control techniques, such as the following:

- provide storage in the upper areas of the watershed, to control and attenuate peak discharge rates along the downstream reaches of the various watercourses;
- construct channel improvements, including the possibility of some selected filling along the watercourses to provide a defined floodway.
- combination of upstream storage and channel improvements.

Additional alternative control options may be identified as the study progresses.

2.2.1 Regional Storm Flood Within a Defined Flood Plain

The present Ministry of Natural Resources policy in Ontario is to restrict development within the Regional Flood Plain.

Depending on the geographical location within Ontario, the Regional Flood Plain is defined by the area flooded, as a result of either a:

- Hurricane Hazel flood
- Timmins Storm flood
- 1 in 100 year flood

The criteria used for flood plain delineation for watercourses in North Bay, is the Timmins Storm. Flood plain mapping of the La Vase River, Jessups Creek and Parks Creek, has been undertaken by the North Bay and Mattawa Conservation Authority and the Regional Flood Plain has been delineated for each of these watercourses.

The criteria used for flood plain delineation for Lake Nipissing is the 1 in 100 year flood level. This level has also been established and the corresponding flood plain delineated in the area under study.

Because of the topography of the area, the amount of flooded lands as a result of the Timmins Storm Flood is quite extensive. In order to provide more land for development, the following control techniques will be investigated using hydrologic and hydraulic data previously generated for the above mentioned flood mapping:

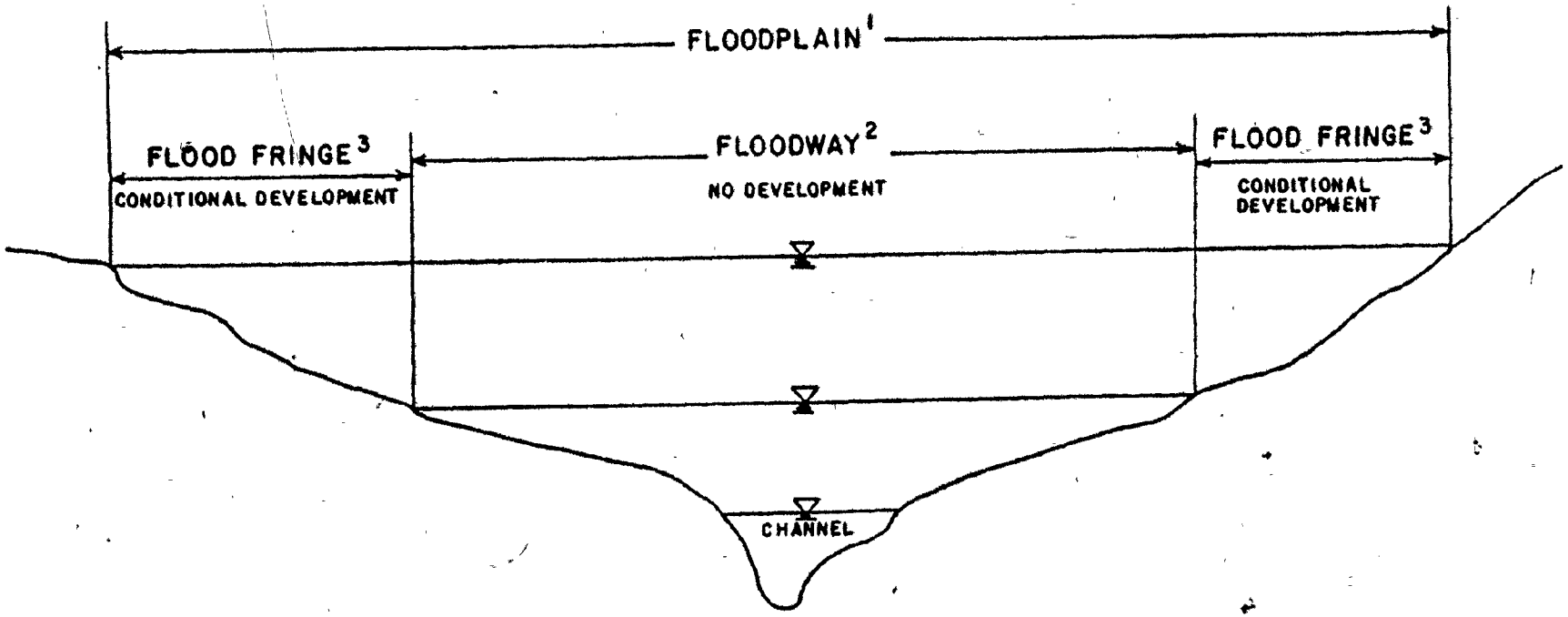
- upstream storage,
- channelization improvements along with some selected filling to assess their effectiveness in reducing the extent of the Regional Flood Plain
- combination of upstream storage and channel improvements.

2.2.2 Two Zone Floodway - Flood Fringe Concept

The amount of flooded lands after applying the flood control techniques in 2.2.1 may still be excessive. The two zone floodway - flood fringe concept would then be applied.

For a two zone system, the floodway is normally defined as the area of the flood plain required to pass the deeper, fast flowing floodwater, while the fringe is the peripheral area, which may on rare occasions be flooded to a depth of a few feet. For the subject area, and in accordance with our discussions with the Ministry of Natural Resources, we would consider the floodway to be the stream channel required to pass the 1 in 100 year flood. The flood fringe area would be that zone extending beyond the 100 year floodline limit to the limits of the Regional Flood Plain (Timmins Storm Flood).

THE TWO-ZONE
FLOODWAY - FLOOD FRINGE CONCEPT



1. The floodplain would be defined by the Hazel flood, the Timmins flood or the 1 in 100 year flood, depending upon the location in the Province. (See map on page 16)
2. Floodway is defined as the danger zone in which no building or filling to be permitted.
3. Flood fringe is the area, where filling and development may be permitted if special flood protection measures are adopted.

Figure 1

This approach allows some development within the flood fringe areas. However, development in these areas will require flood protection measures.

Figure No. 1, opposite, is a drawing outlining the basis of the two zone floodway-flood fringe concept as described in "A Discussion Paper on Flood Plain Management Alternatives in Ontario", by the Ministry of Natural Resources, dated August 1977. This concept has been adopted by the Federal Government in the United States and, in Ontario, is gaining support as a viable alternative to present, more prohibitive flood plain policies.

The two zone concept will be investigated both in terms of the present watershed configurations and also in terms of additional control techniques such as:

- upstream storage
- channelization improvements along with some selected filling
- combination of upstream storage and channel improvements.

In conjunction with this concept, we will develop and define the flood plain management policies necessary to control and protect both new and existing developments in the study area including development bordering Lake Nipissing and affected by lake flood levels.

2.3 HYDROLOGY

A proper flood management study and analysis must be based on a sound and realistic hydrologic analysis.

2.3.1 Traditional Approaches

A traditional approach to estimating flood flows has often been based on the premise that a rainfall event with a particular frequency of recurrence will result in a flow with the same recurrence frequency. In the absence of long term stream flow data, rainfall data which is generally more readily available, is often statistically analysed to predict various return frequency storm events. A "design storm" is then selected and flood flow calculations are produced, using one of several various methods, the most common being the SCS Method, as developed by the Soil Conservation Service of the U.S. Department of Agriculture.

A second approach often used is a Regional Flood Frequency analysis. This approach utilizes flow records from a number of different watersheds within a hydrologic region. Techniques are applied to test for regional homogeneity. Frequency analyses of the flow records for the different watersheds are then combined to produce a Regional Flood Frequency Curve relating the ratio to mean annual flood for different flood frequencies. A relationship between mean annual flood and physical characteristics of a watershed is then derived either graphically or by regression analysis thus permitting the computation of floods for ungauged watersheds in the hydrologic region. The index flood method proposed by the U.S. Geological Survey is a widely employed method of summarizing regional hydrologic characteristics.

Both of the above approaches have some significant limitations which must be recognized.

a) Design Storm

It is important to recognize in a hydrologic analysis, that a rainfall event, with a particular frequency, will not necessarily result in a stream flow of the same frequency, primarily because of the effects of antecedent conditions in determining the amount of runoff for the particular rain storm. Analysis of rainfall data and the use of synthetic design storms with assumed antecedent conditions, will not result in a correct analysis.

b) Regional Flood Frequency Analysis

A regional flood frequency analysis should consider the flow records of watersheds within the hydrologic region of a size relative in magnitude to the particular ungauged watersheds to be studied. Both the Parks Creek watershed (5.8 sq. mi.) and the Jessups Creek watershed (1.0 sq. mi.) are relatively small and few, if any, watersheds of this size within the region have the long term data necessary for a proper regional analysis.

2.3.2 Model Simulation

The easy access and increasing use of electronic computer technology has led, over recent years, to the development of a large number of both hydraulic and hydrologic models, which allow simulation of the rainfall runoff process throughout a watershed. A large number of models are available and these vary widely both in degree of sophistication and applicability.

Some models are one event simulation models, while others are continuous simulation models, which may be used to simulate the hydrologic reaction of a watershed over a continuing long-term record of meteorological data.

It is, of course, most desirable to develop flood flows from actual long term recorded flow data on the watershed. However, the absence of such long term data, at appropriate locations along the watercourse, such as is the case for each of the watersheds within the study area, the use of accepted hydrologic models can be a very valuable tool for the development of simulated flow data from long term recorded meteorological data.

The approach is to apply a continuous simulation model to screen significant and extreme flood events, along with their associated antecedent conditions. These events, along with appropriate antecedent conditions, may then be applied to single event model analysis to develop appropriate flow rates at various desired locations along the watercourse.

It is this approach which we propose to employ for the West Ferris Flood Management Study and for this purpose, we propose to employ the following models in the hydrologic analysis:

Storage Treatment Overflow Runoff Model (STORM) - as developed by the U.S. Army Corps of Engineers

This Model utilizes actual hourly precipitation data and daily temperature data, to simulate snow accumulation and melt and runoff from rainfall, producing flow rates and volumes on a continuous basis. Being a continuous simulation model, antecedent conditions are accounted for in terms of an evaporation loss factor. The STORM Model is, therefore, most appropriate as a screening tool in the selection of significant and extreme events, along with the appropriate antecedent conditions.

The STORM Model allows various user options for runoff calculations, one of which involves the U.S. Department of Agriculture, Soil Conservation Service SCS Method. This method is considered to be appropriate to apply to the watersheds within the study area and is the method which we propose to utilize.

Hydrologic Model (HYMO) - as developed by the U.S. Department of Agriculture

This is a single event unit hydrograph model, which will be utilized to develop flow hydrographs at various points along the watercourse, for selected individual events and antecedent conditions, chosen on the basis of the screening undertaken with the STORM Model. The HYMO Model takes into consideration additional watershed characteristics, such as watercourse geometry and utilizing this information, undertakes channel and reservoir routing in the calculation of flow hydrographs. Assessment of the effects of upstream storage reservoirs on flood flow hydrographs can also be readily undertaken using this model.

Both models require initial calibration prior to simulation of long term flow data and for this purpose, we propose to utilize the data available from the existing gauging station on the La Vase River at North Bay. Records for this station are available for the period 1974 through 1978, which is adequate for model calibration purposes.

After initial calibration of the models, the procedure described above will be utilized to develop simulated long-term flow data, which will subsequently be used in the preparation of flow-frequency relationships at various selected points along the individual watercourses.

2.4 HYDRAULIC ANALYSIS

We propose to utilize the HEC-2 Hydraulic Backwater Model, as developed by the U.S. Army Corps of Engineers, in the calculation of water levels along the watercourses, through those areas of particular concern within the proposed development area.

The HEC-2 Model calculates water and energy levels at pre-selected and successive upstream locations, and includes the hydraulic effect of such constrictions as bridges and culverts. Input data requirements include flow, detailed channel cross-sections, Manning roughness co-efficients and hydraulic characteristics of all conveyance and control structures, such as culverts, bridges and dams.

This Model will be used in the hydraulic analysis of an improved watercourse system for the Regional Flood and, in addition, for the 100 year flood both for the existing waterway as well as an improved watercourse. Flow data for the Regional Flood, we understand, is readily available from previous works undertaken in the area for the Conservation Authority. Flow data for the 100 year flood will be developed in accordance with the methods described previously herein. Other data, such as base mapping, watershed areas, channel cross-sections and culvert characteristics, we understand, is also readily available from previous work undertaken for the Conservation Authority.

2.5 ASSESSMENT OF ALTERNATIVES AND DEVELOPMENT OF RECOMMENDED SCHEME

Alternatives will be assessed in terms of:

a) Capital cost of implementation
b) Effectiveness of controlling flood flow levels and associated floodway and flood plain extent
c) Comparison of extent of land remaining available for development
d) Comparison of the effects on existing development (i.e. extent of flood damage)

It is possible to compare flood damage prevention as a result of various control alternatives in (d) above, even in the absence of actual specific site data. Depth-damage curves, for example, are available through the United States Federal Insurance Administration (FIA), which relate depth of flooding in feet to damage as a percent of the total value for various classifications of building construction and use. The latter can be estimated by retaining the services of a qualified appraiser. This procedure is proposed in the study for the purposes of comparing the various schemes' effectiveness in preventing flood damage.

A review of the various schemes in terms of all of the above, will result in the development of a recommended scheme. A preliminary design will be presented, including an estimated project cost summary for the recommended scheme.

CHAPTER 3

STUDY SCHEDULE & ESTIMATED COSTS

CHAPTER 3

STUDY SCHEDULE & ESTIMATED COSTS

3.1 TENTATIVE PROJECT SCHEDULE

A tentative project schedule is shown in Fig. 2 PROJECT CONTROL CHART. We estimate that approximately 2½ months would be required to complete the study. The durations shown for the various operations, however, do not include approval times.

3.2 ESTIMATED COSTS

We propose to perform the work for a fee based on the "Schedule of Fees" suggested by the APEO, namely:

1) For principals and senior officers - $50./hr.
2) For permanent staff - payroll cost plus 100%
3) Disbursements such as computer time, properly incurred in the performance of the work - actual cost.

A breakdown of the estimated costs and staff requirements for the various work activities associated with the study are summarized as follows:

	Activity	Man-Days	Cost
1.	Review and assembly of existing mapping and data	4	$ 800.
2.	Computer data assembly coding and testing	15	$3,000.
3.	Model Calibration	10	$2,000.
4.	Analyses of alternatives	15	$3,000.

	Activity	Man-Days	Cost
5.	Development of recommended scheme	10	$2,000.
6.	Report writing and preparation of report exhibits	12	$2,400.
7.	Client meetings	4	$ 800.
			$14,000.
	Computer Costs		9,000.
	TOTAL ESTIMATED STUDY COST		$23,000.

Respectfully Submitted

NORTHLAND ENGINEERING LIMITED
Consulting Engineers & Planners
NORTH BAY - SUDBURY - THUNDER BAY

REVISED APRIL, 1979

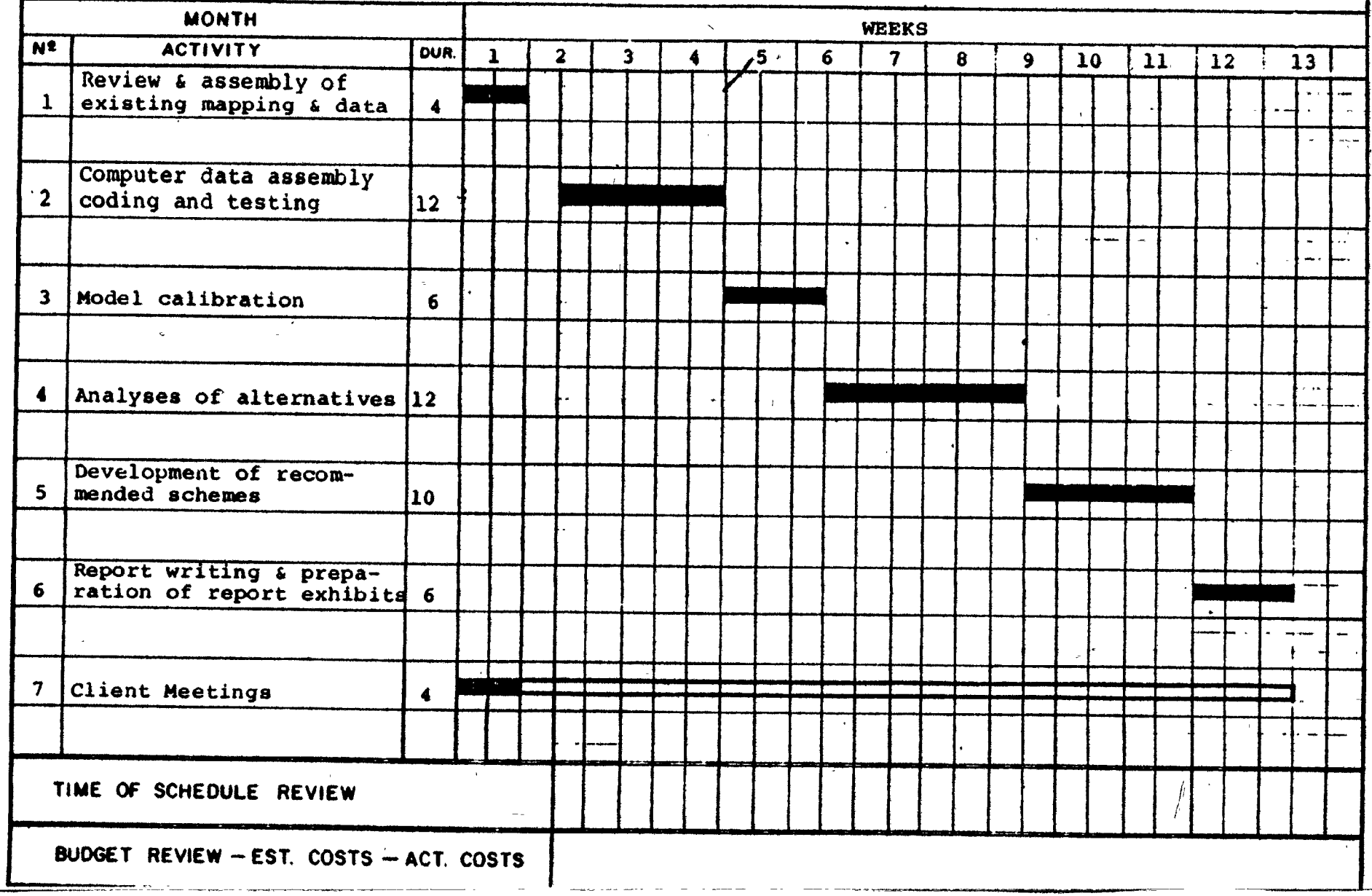
SCHEDULE		FLOAT TIME
ACTUAL	75	100

Fig. 2

PROJECT CONTROL CHART

PAGE Nº 1

PROJECT Nº 1878 DIV. Nº _____ REV. Nº _____



Appendix 'C'

The West Ferris Flood Plain Management Study

528 Cassells Street,
NORTH BAY, Ontario.
P1B 3Z7

May 20, 1982.

Our File : 2059

North Bay-Mattawa Conservation Authority,
P.O. Box 1212, 348 Fraser Street,
NORTH BAY, Ontario.

Attention : Mr. W.F. Beckett,
Secretary-Manager.

Dear Sir :

Please find following the revised West Ferris Flood Plain Management Study. The revisions incorporated are in response to the comments of the regional office of the Ministry of Natural Resources dated September 18, 1981, and the discussion of March 19, 1982, held at your office with yourself, Messrs. H. Walsh, A. McClellan and N. Paroschy of the regional office.

Please review and advise as to whether this is acceptable.

Yours very truly,

NORTHLAND ENGINEERING LIMITED,

B.F. Dawdy, P.Eng.

BFD:MLW.
Encls.

northland
engineering
limited

Consulting Engineers and Planners

Head Office 528 Cassells North Bay Ont P1B 3Z7 (705) 474-2720 • 101 Durham S. Sudbury Ont P3C 3M9 (705) 674-4401
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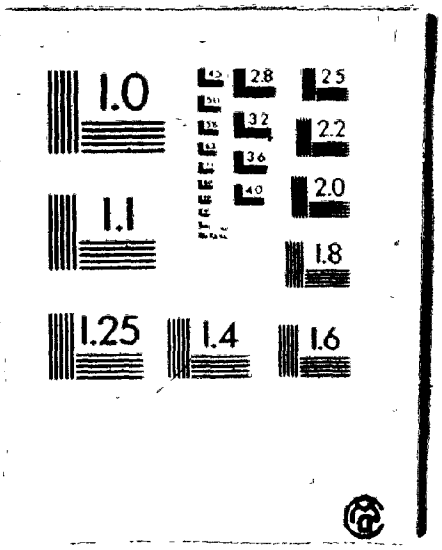

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REPORT SUMMARY

1. The purpose of this study is to formulate a plan for flood control management in the West Ferris Area which will be compatible with existing development and development proposals contained in the West Ferris Secondary Plan.

2. Flood flows generated for the purposes of this study were slightly less than flows used in preparing the original (1977) North Bay-Mattawa Conservation Authority's Flood Plain Mapping. Differences in corresponding flood lines, however, do not warrant revising the Authority's Flood Plain Mapping.

3. Proposed development in the La Vase River watershed is not very significant in relation to the total size of the watershed. Consequently, there is negligible difference between simulated pre-development and post-development flows.

4. Adoption of a two zone floodway-flood fringe policy by the Authority for the La Vase River watershed in the West Ferris Area is recommended. Restricted development, with appropriate protective measures, would be permitted within the flood fringe i.e., the area between the 1-100 year and Timmins Storm flood lines. No new development within the 1-100 year flood plain would be permitted. Expenditures of public funds would not be required for this scheme.

5. Urbanization of both the Jessups Creek and Parks Creek watersheds without controls substantially increases storm run-off rates.

6. Channelization to contain the regional flood for post-development conditions is the recommended flood control scheme for Jessups Creek. Comparison of the costs and direct benefits to future development of this scheme weighs in favor of its implementation.

7. The recommended flood control scheme for Parks Creek involves two sets of measures. The first set of measures involves channelization and reconstruction of structures to contain the regulatory flood to protect existing development. The second set of measures involved channelization and construction of two storage ponds to minimize the impact of and protect future development. Comparison of the costs and direct benefits of each of these sets of measures weigh heavily in favour of their implementation.

8. Additional hydrologic data collection stations are recommended as follows:

a) Stream flow gauge on Parks Creek between Marshall Ave. and Lakeshore Drive. b) Automatic recording rainfall gauges in West Ferris and at Corbeil.

NOTE : Conservation Authority Projects funded by the Ministry of Natural Resources as flood damage reduction programs involve only those activities necessary to provide protection to existing development.

SECTION 1

INTRODUCTION

SECTION 1 - INTRODUCTION

1.1 STUDY AREA

This study addresses itself to largely undeveloped lands in the City of North Bay commonly referred to as the West Ferris Area. The area is bounded to the north by present city development, to the east by Highway No. 11, to the south by Highway No. 11B and to the west by Lake Nipissing.

Two comparatively small watercourses traverse the study area, namely Parks Creek and Jessups Creek. In addition, a larger watercourse, the La Vase River, flows along its southern boundary.

Study limits are delineated on Dwg. 1.

1.2 STUDY OBJECTIVES

The City of North Bay is proposing a large amount of additional development in West Ferris, predominantly industrial, as outlined in the city's West Ferris Secondary Plan. Since much of the land in West Ferris is affected by the "Regional Flood", it was acknowledged that planning and design of the proposed development could not be undertaken without due regard to flood plain policies and flood restrictions. In addition, much of the existing development in West Ferris, predominantly commercial and residential and concentrated mainly along the shores of Lake Nipissing is presently susceptible to potential flood damage. Consequently, an engineering study, funded jointly by the North Bay-Mattawa Conservation Authority and the City of North Bay was undertaken to determine requirements for flood control management in the area.

1.2 STUDY OBJECTIVES - Cont'd.

The primary objective of this study, therefore, is to formulate an over-all flood plain management plan for the study area which will be compatible with existing development and development proposals contained in the West Ferris Secondary Plan.

1.3 STUDY ORGANIZATION

Northland Engineering Limited was engaged as the prime consultant for the study. Assistance in computer modelling of the watersheds involved was provided by Gore & Storrie Limited in Ottawa. In addition specialist services in reviewing hydrologic analyses were sought from Dr. P. Wisner, P.Eng., of the University of Ottawa.

A technical advisory committee consisting of members of the North Bay-Mattawa Conservation Authority was set up, for the purposes of this study, to oversee the Consultant's investigations, and periodically review and approve study findings. Members of this committee consisted of the following persons:

- Mr. W.F. Beckett, Secretary-Manager of the North Bay-Mattawa Conservation Authority
- Mr. M. Dalter, P.Eng., Director of Planning & Works, City of North Bay
- Professor D. Rees, Board Member of the North Bay-Mattawa Conservation Authority
- Professor B. VandenHazel, Board Member.

1.4 TERMS OF REFERENCE

An engineering proposal to undertake this study was submitted to the Conservation Authority in January, 1979, was subsequently revised, and accepted by the Conservation Authority in April, 1979.

The proposal listed study approach, scheduling and costs. The scope of the study, however, was expanded out of necessity during the course of the study to include a reassessment of regional flood hydrology and associated flood levels in the West Ferris Area. The engineering proposal is contained in Section A of the Appendices.

SECTION 2

WATERSHEDS

SECTION 2 - WATERSHEDS

2.1 LA VASE RIVER WATERSHED

The La Vase River watershed consists of approx. 34.5 sq.mile (8935 Ha) of largely undeveloped forested precambrian shield interspersed with swamps and small creeks. Some 27.2 sq.miles (7,045 Ha) of the above mentioned drainage area contribute to flow at the Lavase River gauging station near Hwy. 11B.

Since the La Vase River watershed is comparatively far removed from the North Bay core, and in view of existing development plans for the North Bay area, it is unlikely that much additional development will occur in this watershed in the foreseeable future.

2.2 JESSUPS CREEK WATERSHED

The Jessups Creek watershed covers 0.63 sq.miles (163 Ha) of mainly low lying marshy area with scattered rock outcrops. The watershed, as shown on Dwg. 2 is bounded on the south by the La Vase River watershed, on the north by the Parks Creek watershed, and on the west by Lake Nipissing. A future arterial road proposed in the West Ferris Secondary Plan will approximately coincide with the east limit of the watershed.

A mixture of residential and commercial development presently exists along Lakeshore Drive in the west section of the watershed. The remaining watershed area is primarily slated for future light industrial development.

2.3 PARKS CREEK WATERSHED

The Parks Creek watershed consists of 5.81 sq.mile (1505 Ha) area extending from the Circle Lake area north of Hwy. 11 to Lake Nipissing. The watershed is immediately south of the City of North Bay development core and adjacent to the Jessups Creek watershed. It is traversed by Hwy. 11 and 17, and by both the CNR and CPR Railroad lines. Existing development west of the CPR line is predominantly residential with some large commercial centres located along Lakeshore Drive. The remainder of the watershed, east of the CPR line, consists of undeveloped low lying marshy area with scattered rock outcrops.

Relocation of railroad marshalling yards from the downtown area of North Bay to the Parks Creek area is presently planned for. The West Ferris Secondary Plan also calls for future light industrial development to be located in the Parks Creek area.

2.4 LAKE NIPISSING

The study area is bounded on the west side by Lake Nipissing, along the shores of which most of the existing development is located. Some of this existing development is susceptible to flood damage as a result of extreme lake levels. The projected 1-100 yr. level of Lake Nipissing is elevation 647.14 (197.25 m) GSC according to a recently completed lake level study [1]; the approximate summer mean lake level is elevation 642.5' (195.83 m) GSC as outlined in Environmental Canada's "Historical Water Level Summary - Ontario".

1. MacLaren Plansearch
   Flood Damage Reduction Study of the Sturgeon River/Lake Nipissing/French River System
   Report to Ontario Ministry of Natural Resources and Environment Canada - September 1981.

2.4 LAKE NIPISSING - Cont'd.

In determining backwater elevations for the three watercourses under study, it was assumed that river design floods would coincide with the latter lake elevation, "since the design storm is expected to occur during the summer or early fall period rather than during springtime when lake levels are highest." It should be noted, however, that the starting lake level does not control backwater elevations in the watercourses since in all cases the normal depth of flow in the channels for the regional and 1-100 year floods is high in relation to the lake and results in a "free discharge" condition.

SECTION 3
APPROACH TO ANALYSES

SECTION 3 - APPROACH TO ANALYSES.

3.1 GENERAL

The basic approach to the study was to undertake computer assisted simulations of the rainfall-runoff process in the study watersheds for pre-development and post development conditions (development according to the West Ferris Secondary Plan). The purpose of these simulations was to compare the rainfall-runoff process for these conditions and to determine the extent and type(s) of flood control schemes required to 1) alleviate or mitigate flooding of existing development and 2) permit implementation of West Ferris Secondary Plan development.

3.2 MODELS APPLIED

A number of hydrologic and hydraulic computer models were used in simulating the rainfall-runoff process in the study. Brief descriptions of these models are included in Appendix 'E'.

3.3 CALIBRATION & MODEL ADJUSTMENT

It is desirable to calibrate both the S.T.O.R.M. and H.Y.M.O. Models in order to confidently simulate the precipitation runoff process in a particular watershed or area.

Consequently time and effort were expended in calibrating both the S.T.O.R.M. and H.Y.M.O. Models using Environment Canada's streamflow records for the La Vase River and precipitation records at the North Bay Airport. A detailed description of the calibration effort is contained in the Technical Appendix to this report.

3.3 CALIBRATION & MODEL ADJUSTMENT - Cont'd.

The calibration effort indicated that the watershed's response to rainfall events was significantly slower than assumed in the original flow simulations. However, deficiencies in the data base used for calibration (short length of record, distance of rainfall gauge from the catchment, and lack of runoff events greater than 0.5 inches of direct runoff) were felt to be too severe to permit usage of the calibrated watershed response. Consequently an empirical relationship developed for southern Ontario was adopted as the basis for flow predictions.

3.4 ANALYSES PROCEDURES

The regional flood in the study area is, by definition, the greater of either the Timmins Storm Flood or the 1-100 yr. flood.

In considering options for flood management and control, simulations of the Timmins Storm Flood and the 1-100 yr. flood were required.

The Timmins Storm is an actual meteorological event (7.60 inches of rainfall in a 12 hour period) which occurred in Timmins on August 31, 1961. A specific probability is not attached to this flood.

The 1-100 Yr. flood, however, is not the result of a specified meteorological event, but is determined, preferably, by single site or regional flood frequency analyses. Unfortunately, the streamflow records for the study area are not of sufficient length (4 years) to permit a reliable single site flood frequency analysis, nor are there adequate streamflow records of other similar size watersheds in the

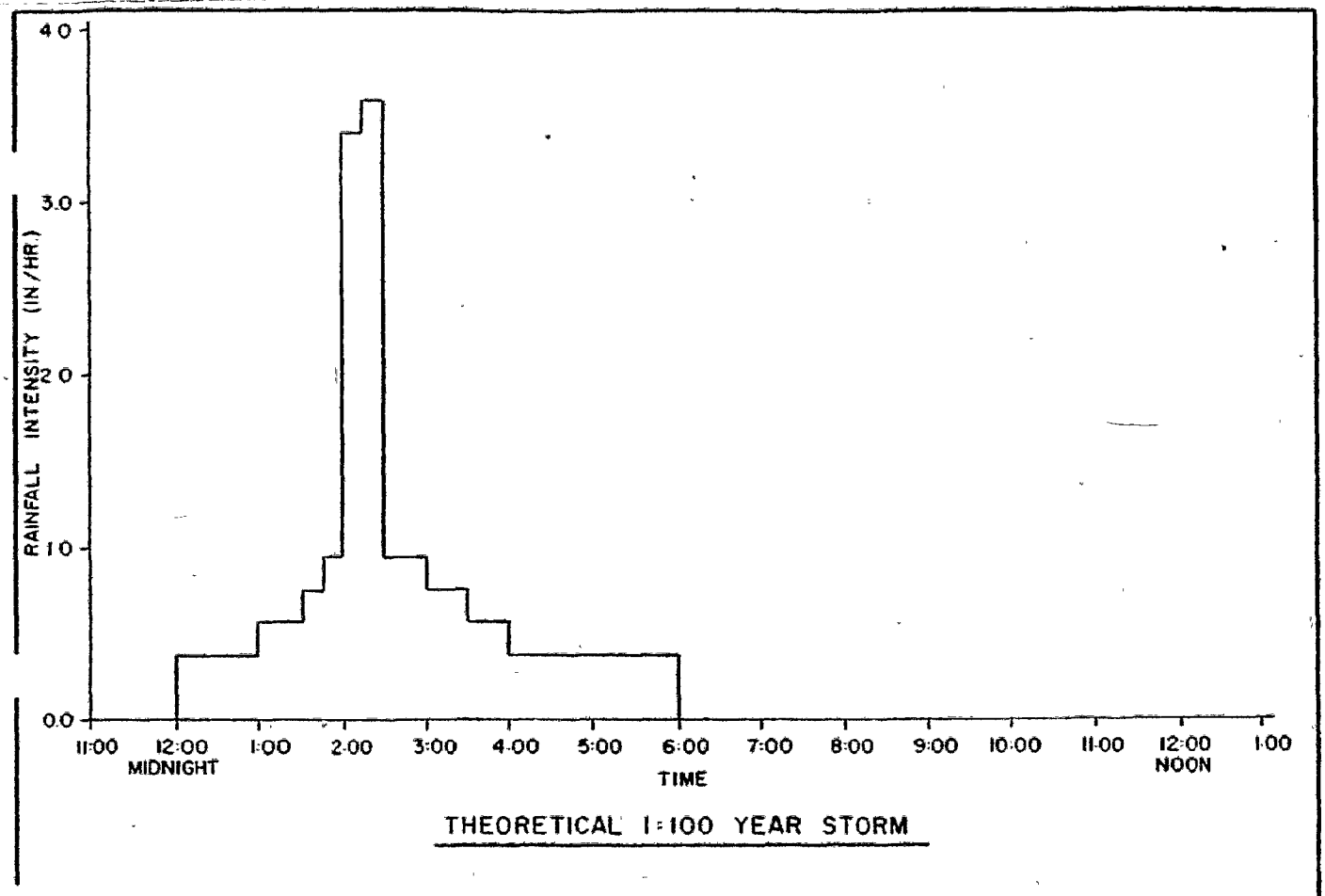
3.4 ANALYSES PROCEDURES - Cont'd.

area which would permit a regional flood frequency analysis. In the absence of long term streamflow data, it was therefore necessary to statistically analyze meteorological data.

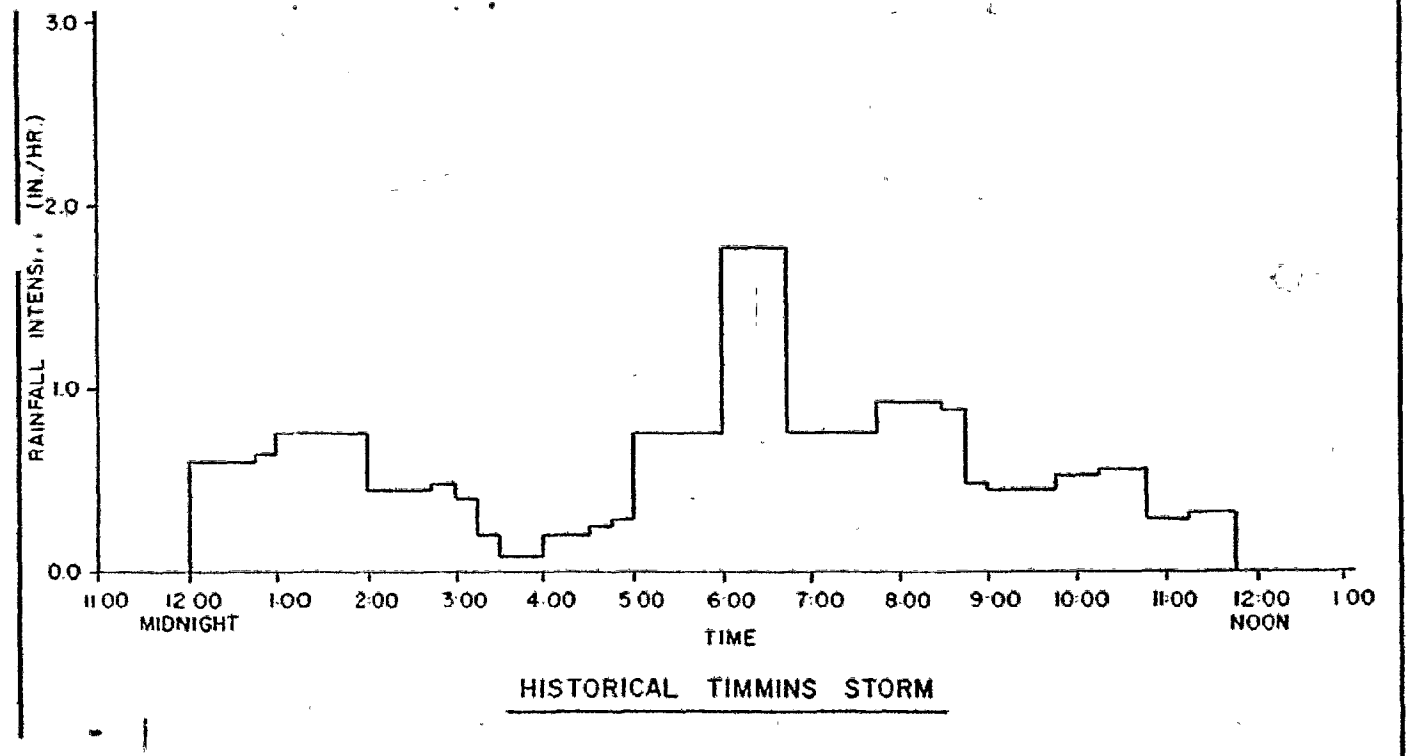
A point rainfall volume frequency analysis based on 15 years of observations at the North Bay Airport and on data from the "Hydrologic Atlas of Canada" by Environment Canada was undertaken. The resulting gumbel extreme value distribution (included in Section 'B' of the Appendices indicates a 1-100 yr. point rainfall volume of 4.71 inches.

In order to verify that the 1-100 year flood results from a summer storm and not from snowmelt, frequency analyses of S.T.O.R.M. Model Flood predictions using the 15 years of meteorological record at the North Bay Airport was undertaken. These analyses indicate that the 1-100 year flood for the study area would result from a summer storm.

Design hyetographs which show the rainfall distribution for both the Timmins and 1-100 year storms are shown in Fig. 1. The design storm distribution used for the 100-year storm was the S.C.S. Type II distribution.



THEORETICAL 1:100 YEAR STORM



HISTORICAL TIMMINS STORM

DESIGN STORM HYETOGRAPHS

FIG. 1

3.4 ANALYSES PROCEDURES - Cont'd.

FLOOD FLOWS

Flood flows corresponding to the Timmins Storm and 1:100 Year Storm at various points in each of the three study watersheds were simulated for pre-development and post-development conditions using H.Y.M.O. and S.W.M.M. Various flood plain management control schemes were then considered in light of these flows.

HYDRAULIC ANALYSES

Flood profile computations for the three watercourses under study were undertaken using the HEC-2 Model. Input for the model was copied from the data utilized in the Authority's original floodline mapping project (1977).

SECTION 4

ALTERNATIVE FLOOD MANAGEMENT CONTROL SCHEMES

SECTION 4 - ALTERNATIVE FLOOD MANAGEMENT CONTROL SCHEMES

4.1 GENERAL

Urbanization of a watershed changes its response to precipitation. The most common effect are reduced infiltration and decreased time of concentration due to increased impervious areas and more efficient conveyance paths; this results in higher peak rates of run-off. These higher run-off rates can adversely affect flooding downstream. In such an instance, it is imperative that urbanization of the watershed be accompanied by measures to avoid or control the increased flooding and damage to existing development.

Present Provincial flood plain management policy recognizes three types of flood plain zoning

1) No development within the floodlines predicted for the regulatory storm

2) The two zone floodway-flood fringe concept which allows conditional development within the flood fringe. (This concept is illustrated in Figure 2).

3) Special policy areas.

Additionally to minimize adverse impact from future development on existing development, measures should be adopted to limit post-development peak flows and flood elevations to predeveloped levels.

4.2 ALTERNATIVE FLOOD CONTROL SCHEMES

A variety of methods to control runoff in urbanizing areas are available, the most common of which are :

- storage
- channel improvements
- site controls

Site controls, such as roof top storage, ponding and detention measures on impervious surfaces, contoured landscapes, etc., are site specific measures whose effects cannot be accurately assessed prior to their design. Consequently, these controls were not considered in the analyses for this study. Planning Authorities should bear these controls in mind, however, when specific proposals for development in the study area are put forth.

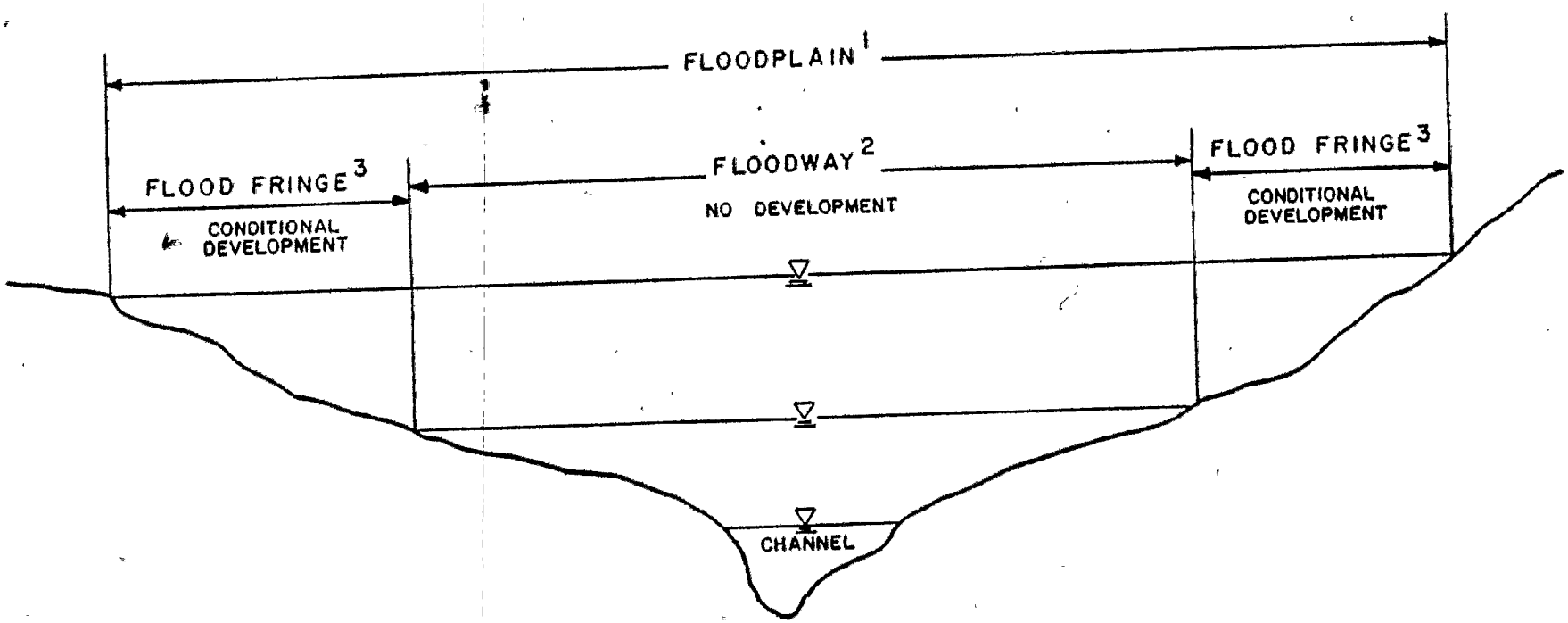
4.3 RESULTS OF ANALYSES

La Vase River Watershed

Both the Timmins and 1-100 year storm flood flows for pre-development and post-development conditions at various points along the La Vase River were calculated using the H.Y.M.O. Model. These peak flows are listed in Table 1. Corresponding flood hydrographs are included in the Technical Appendices to this report. (Section 'C') proposed development in the La Vase River watershed, as previously mentioned, is not very significant in relation to the total size of the watershed. Consequently, there is a negligible difference between simulated flood flows for present and future conditions.

The peak flood flows derived from the H.Y.M.O. model were incorporated into the H.E.C.-2 model and floodlines were generated for the Timmins and 1-100 year runoff events. These floodlines are presented on Drawing 2. It is noted that despite the lower flows no significant difference exists between the Authority's existing floodlines and the lines developed in the course of this study.

THE TWO-ZONE
FLOODWAY - FLOOD FRINGE CONCEPT



1. The floodplain would be defined by the Timmins flood or the 1 in 100 year flood, whichever is greater.
2. The floodway is defined as the danger zone in which no building or filling is to be permitted.
3. The flood fringe is the area where filling and development may be permitted if special flood protection measures are adopted.

FIG. 2

4.3 RESULTS OF ANALYSES - Cont'd.

a) Future Development

In considering alternative flood plain zonings for the La Vase River Watershed the most appropriate seems to be the two zone flood fringe concept. The low water depths and flow velocities anticipated in the flood fringe areas would allow development in these areas with relatively minor measures required to protect life and property. Adoption of the two-zone concept would remove 242 Acres (98 Ha) of undeveloped land from flood hazard area. The placing of fill in the flood fringe would not affect the predicted flood elevations as these areas were regarded as ineffective for conveying flow in the hydraulic analysis. The measures suggested would not require any expenditure of public funds. By adopting the two zone concept as the basis for the Authority's flood plain policy in this area, the benefits in terms of enhanced land value is estimated to be $2,420,000. based on a "bench mark" figure of $10,000./acre.

b) Existing Development

In terms of protection of existing development within the floodplain no reasonably cost effective measures were identified in the course of the study.

4.3 RESULTS OF ANALYSES - Cont'd.

Jessups Creek

Using H.Y.M.O. and S.W.M.M. Models, both the Timmins and 1-100 Year Storm flood flows were simulated at various points along Jessups Creek. These peak flows for both pre-development and post-development conditions are listed in Table 2. Corresponding flood hydrographs are included in the Technical Appendices

Simulated peak flows indicate that urbanization of the Jessups Creek watershed without controls substantially increases storm run-off rates. It is also interesting to note that the peak flow rate for post-development condition is higher for the 1-100 Year Storm Flood than the Timmins Storm Flood. This can be attributed to the rainfall distributions of the design storms (the 1-100 year storm has a maximum rainfall intensity of 3.6 in/hr. compared to 1.8 in/hr. for the Timmins Storm) and to the watershed's very quick response to rainfall for post-development conditions.

a) Existing Development

Existing development within the flood plain of Jessup's Creek is limited to three motels. No cost-effective measures have been identified for protection of these properties other than the status quo.

b) Future Development

If further development is allowed to take place in the watershed, measures would be required to either reduce peak flow rates to pre-development conditions or accommodate the increased flows without increasing flood elevations.

4.3 RESULTS OF ANALYSES - Cont'd.

Jessups Creek - Cont'd.

The following flood control alternativs were considered for implementation in the Jessups Creek watershed:

ALTERNATIVE	DESCRIPTION
A	Channelization to accommodate regional flood (1-100 Year Storm Flood)
B	Application of two zone floodway-flood fringe concept, with upstream storage to attenuate peak flows
C	Implementation of existing flood plain policy, i.e., no development within the flood plain.

A matrix approach to selection of the most viable flood control alternative was employed. Details of this matrix selection are contained in Section 'D' of the Appendix.

Of the three flood control schemes considered for the Jessups Creek Watershed, Alternative 'A', i.e., channelization of the regional flood (1-100 Year post-development flood) was deemed to be the most viable. Implementation of this alternative would remove approximately 102 Acres (41 Ha) of undeveloped lands from flood hazard areas.

Flood profiles for both the Timmins and the 1-100 Year Storm Floods for both pre-development and post-development conditions were computed using the HEC-2 Model. Resulting flood lines are shown on Dwg. 2.

4.3 RESULTS OF ANALYSES - Cont'd.

Parks Creek

Simulations of the Timmins and 1-100 Year Storm Floods for pre-development and post-development conditions were also undertaken in the Parks Creek watershed. As in the case of Jessups Creek, urbanization of the watershed without flood control measures substantially increases storm run-off rates.

The following flood control alternatives were therefore considered for implementation in the Parks Creek watershed:

ALTERNATIVE	DESCRIPTION
A	Channelization to accommodate regional flood (Timmins Storm Flood)
B	Application of two zone floodway-flood fringe concept with upstream storage to attenuate peak flows
C	Application of two zone floodway-flood fringe concept with channelization to accommodate 1-100 Year Storm Flood
D	Combination of upstream storge and channelization to accommodate regional flood (Timmins Storm Flood)
E	Implementation of existing flood plain policy i.e., no development within the flood plain

Again, a matrix approach for selection of the most viable flood control alternative was employed. Details of this selection process are outlined in Section 'D' of the Appendices.

4.3 RESULTS OF ANALYSES - Cont'd.

Parks Creek - Cont'd.

Of the five flood control schemes considered for Parks Creek, Alternative 'D', i.e., upstream storage and channelization to contain the regional flood for post-development conditions was deemed to be the most viable flood control alternative. Implementation of this alternative removes some 545 dwellings, an estimated 20 Acres (8 Ha) of commercial/light industrial developmen, and approximately 297 Acres (120 Ha) of undeveloped land from flood hazard areas.

Peak flows at various locations along Parks Creek for pre-development conditions with flood controls are listed in Table 3. Corresponding hydrographs are included in Section 'C' of the Appendices.

Flood profiles for the Timmins and 1-100 Year Storm Floods for both present and future conditions were computed using the HEC-2 Model. Resulting flood lines are shown on Dwg. 2. (See back pocket).

An estimation of the extent of spill anticipated for the two storm floods under present conditions is illustrated on Dwg. 3. (See back pocket). This area was delineated from limited available information. A detailed hydraulic analysis was not attempted due to the relative coarseness of the existing contour mapping and the extreme complexity of the analysis.

Two locations for flood retention facilities, off the main channel, are proposed as shown on Dwg. 2. A compatison of the effects of different storage volumes and discharge rates for these flood retention facilities was undertaken. The recommended scheme provides for storage of 155 Acre-ft. (191,000 m^3) and 80 Acre-ft. (99,000 m^3) and controlled outflows of 285 cfs (8.1 m^3/s) and 85 cfs (2.4 m^3/s) for ponds #1 and #2 respectively.

SECTION 5

RECOMMENDED SCHEMES

SECTION 5 - RECOMMENDED SCHEMES

5.1 RECOMMENDED SCHEMES

As a result of our analyses and evaluations, the following flood plain management and control schemes are recommended in the West Ferris area:

La Vase River Watershed

A two-zone floodway-flood fringe policy is recommended for the La Vase River watershed in West Ferris. This policy would allow development in the flood fringe area of the watershed (i.e., the area between the Timmins Storm and 1-100 Year Flood lines) provided appropriate protective measures were taken to the Timmins Storm flood level. Implementation of this scheme would not require the expenditure of public funds nor would it require structural improvements.

Jessups Creek Watershed

Channelization to accommodate the regional flood (1-100 Year Flood) for post-development conditions is recommended in the Jessups Creek watershed. Construction of approximately 5800' (1770 m) of open channel as shown on Dwg. 2 would be involved. Structural improvements would include the reconstruction or replacement of the existing flow structure under Lakeshore Drive in order to accommodate the regional flood.

Acquisition and subsequent relocation or demolition of an existing motel along Jessups Creek immediately downstream of Lakeshore Drive would also be required. Non-structural improvements would consist of acquiring the right-of-way (recommended 100' (30 m) width) necessary for channelization and its future maintenance.

5.1 RECOMMENDED SCHEMES - Cont'd.

Jessups Creek Watershed - Cont'd.

The benefits of these measures would be almost entirely to future development.

Implementation of this scheme would effectively remove the whole watershed from flood hazard as a result of the regional flood in Jessups Creek.

Tentative cross-sections for the proposed channelization are shown on Drawing 2.

Parks Creek Watershed

The recommended flood control scheme for the Parks Creek watershed involves the following structural improvements:

(1) Construction of two (2) storage ponds which would limit post-development (urbanized) peak flow rates in Parks Creek to pre-development peak rates.
(2) Approximately 16000 ft. (4900 m) of channelization (8000 ft. (2450 m) along main branch and remainder along tributaries) to contain the Timmins Storm flood.
(3) Enlargement of waterway openings of existing flow structures under Lakeshore Drive, Marshall Park Drive, and both the CNR and CPR Railways to accommodate regional flood flows.

Non-structural improvements would consist of acquiring channel right-of-way (recommended 100' (30 m) width) and property necessary for construction of the proposed storage ponds.

5.1 RECOMMENDED SCHEMES - Cont'd.

Parks Creek Watershed - Cont'd.

The benefits of this scheme are shared by both existing and future development.

Implementation of this scheme would limit post-development peak flows to less than pre-development peak rates and would effectively protect the whole watershed from flooding as a result of the regional flood in Parks Creek.

The location of proposed storage ponds and channelization are shown on Dwg. 2. "Tentative Cross-sections" for channelization are also shown on Drawing 2.

5.2 COST-BENEFIT COMPARISONS - METHODOLOGY

A large number of benefits and costs are normally associated with implementation of flood management control projects. For the purposes of gauging the cost-effectiveness of the recommended schemes in this study, however, the following direct benefits and costs only were quantified and assigned dollar values:

BENEFITS	COSTS
- Reduced Flood Damage to Public and Private Facilities	- Construction Costs
- Land Value Enhancement	- Property Acquisition Costs

Assigned dollar values are order of cost in 1981 dollars.

5.2 COST-BENEFIT COMPARISONS - METHODOLOGY - Cont'd.

Estimates of the value of flood damage reduction are based on the U.S. Federal Insurance Administration's "Flood Damage Factors - depth damage curves" September, 1970. Construction costs are based on "bench mark" or average costs for the type of construction considered. Land value enhancement and land acquisition costs are based on estimated average land costs in the area.

5.3 COST-BENEFIT COMPARISONS - EXISTING DEVELOPMENT

A. La Vase River

The recommended scheme has minimal impact on existing development both in terms of costs and benefits.

B. Jessups Creek

The recommended scheme of channelization for the regulatory storm has an adverse impact on the motel immediately downstream of the structure at Lakeshore Drive. The recommended scheme cannot be justified in terms of flood damage reduction to existing development.

C. Parks Creek Watershed

The recommended flood management control scheme for Parks Creek would have significant benefits for both existing and future development. The breakout of costs associated with existing and future development respectively that follows is a simplification but corresponds with the likely scheme implementation.

5.3 COST-BENEFIT COMPARISONS - EXISTING DEVELOPMENT - Cont'd.

C. Parks Creek Watershed - Cont'd.

The following benefits and costs to existing development are associated with implementation of this scheme.

BENEFITS	ESTIMATED VALUE
(I) Flood Damage Reduction- Residential Development (545 Dwellings removed from Flood Hazard Areas)	
Assume - Single Family Dwellings - One storey with Basement - Structural Value $40,000. - Contents Value $20,000. - Flooding to 1' below floor level	
Reduction Structural Damage * 6% x $40,000. x 545	$1,308,000.
Reduction Contents Damage * 8% x $20,000. x 545	$ 872,000.
(II) Flood Damage Reduction- Commercial/Industrial (Approx. 20 Acres Development removed from Flood Hazard Area)	
Assume - 2' Flooding prior to implementation of scheme	

BENEFITS	ESTIMATED VALUE
20 Acres @ $90,000/Acre Reduction in Structural and Contents Damage **	$1,800,000.
TOTAL BENEFITS	$3,980,000.

* U.S. Federal Insurance Administration - Depth Damage Curves

** From Fig. VI-3 "Per Acre Flood Damages Curve - Commercial Development" in report entitled "Urban Drainage and Flood Control Projects, - Economics, Legal and Financial Aspects" Colorado State University, July 1975.

5.3 COST-BENEFIT COMPARISONS - EXISTING DEVELOPMENT - Cont'd.

C. Parks Creek Watershed - Cont'd.

COSTS	ESTIMATED VALUE
(I) Channelization - 8000' Grass-lined Trapezoidal Section with 2:1 side slopes, 25' bottom width or hydraulic equivalent @ $57.00/L.F.	$ 456,000.

COSTS - Cont'd.	ESTIMATED VALUE
(II) Reconstruct existing flow structures under Lakeshore Drive, Marshall Park Drive	
Two (2) Structures @ $180,000.	$ 360,000.
RND	$816,000.

A majority of the right-of-way for Parks Creek in developed areas has already been secured by the Authority and the City of North Bay.

5.4 COST-BENEFIT COMPARISONS - FUTURE DEVELOPMENT

A. La Vase River Watershed

The recommended scheme for the La Vase River watershed in the West Ferris Area is adoption of a two-zone floodway-flood fringe policy wherein protected development would be allowed in flood fringe areas lying between the Timmins Storm and 1-100 Year Storm flood lines.

The following summarizes the benefits and costs (to the public) associated with this non-structural scheme:

BENEFITS	ESTIMATED VALUE
(I) Land Value Enhancement of 242 Acres in flood fringe area @ $10,000/Acre	$2,420,000.
TOTAL	$2,420,000.

COSTS	ESTIMATED VALUE
Nil	Nil

5.4 COST-BENEFIT COMPARISONS - FUTURE DEVELOPMENT - Cont'd.

B. Jessups Creek Watershed

The recommended scheme for the Jessups Creek watershed is channelization to contain the 1-100 Year Flood for post-development conditions (in this case, the regional flood).

The estimated value of benefits and costs of this scheme are as follows:

	BENEFITS	ESTIMATED VALUE
(I)	Land Value enhancement of 102 Acres removed from flood hazard area @ $10,000/Acre	$1,020,000.
(II)	Addition of green belt area (acquired right-of-way & land) 3 Acres @ $2,000/Acre	26,000.
(III)	Reduction of flood damage to existing motel adjacent to Jessups Creek downstream of Lakeshore Drive	
	Assume - Structural Value $100,000.	
	- Contents $50,000.	
	- Flooding to floor level	
	Reduction Structural Damage * 8% x 100,000.	8,000.
	Reduction Contents Damage * 5% x 50,000.	2,500.
	TOTAL BENEFITS	$1,056,500.
	RND	$1,057,000.

* U.S. FEDERAL INSURANCE ADMINISTRATION DEPTH-DAMAGE CURVES

5.4 COST-BENEFIT COMPARISONS - FUTURE DEVELOPMENT - Cont'd.

B. Jessups Creek Watershed - Cont'd.

COSTS	ESTIMATED VALUE
(I) Channelization	
- 1800' grass-lined trapezoidal section with 2:1 side slopes, 16' bottom width or hydraulic equivalent @ $44.00/L.F.	$ 79,200.
- 1600' grass-lined trapezoidal section with 2:1 side slopes, 14' bottom @ $42.00/L.F.	67,200.
- 2400' grass-lined trapezoidal section with 2:1 side slopes, 10' bottom @ $37.00/L.F.	88,800.
(II) Reconstruct existing flow structure under Lakeshore Drive	160,000.
(III) Property acquisition	
- Acquisition and demolition of existing motel adjacent to Jessups Creek downstream of Lakeshore Drive	170,000.
- Acquisition of Greenbelt	2,000.
TOTAL COSTS	$567,200.

Approximately 5200' of right-of-way (suggested 100' width) for channelization and future maintenance would be required. Since most of the area involved is unsubdivided, the bulk of the required right-of-way can probably be acquired under subdivision agreement at no cost to the public.

5.4 COST-BENEFIT COMPARISONS - FUTURE DEVELOPMENT - Cont'd.

C. Parks Creek Watershed

The following benefits and costs are associated with implementation of this scheme:

BENEFITS	ESTIMATED VALUE
(I) Land value enhancement of 297 Acres removed from flood hazard area @ $10,000/Acre	$2,970,000.
(II) Addition of green belt area (acquired right-of-way & storage pond areas) 75 Acres @ $2,000/Acre	150,000.
TOTAL BENEFITS	$3,120,000.

COSTS	ESTIMATED VALUE
(I) Channelization	
- 8000' grass-lined trapezoidal section with 2:1 side slopes, 25' bottom width or hydraulic equivalent @ $57.00/L.F.	
- 2200' grass-lined trapezoidal section with 2:1 side slopes, 15' bottom width @ $43.00/L.F.	$ 94,600.
- 2200' grass-lined trapezoidal section with 2:1 side slopes 12' bottom width @ $39.00/L.F.	78,000.
- 2600' grass-lined trapezoidal section with 2:1 side slopes, 10' bottom width @ $37.00/L.F.	96,200.

5.4 COST-BENEFIT COMPARISONS - FUTURE DEVELOPMENT - Cont'd.

C. Parks Creek Watershed

COSTS	ESTIMATED VALUE
1200' grass-lined trapezoidal section with 2:1 side slopes, 5' bottom width @ $300,00/L.F.	$ 36,000.
(I) Storage 235 Acre-Ft. @ $10,000/Acre/Ft.	235,000.
(II) Reconstruct existing flow structures under CNR and CPR Railways Two (2) Structures @ $60,000.	120,000.
TOTAL COSTS	$ 659,800.

Required right-of-way (suggested 100' width for main channel) for channelization and property required for flood detention facilities are located in unsubdivided areas. Consequently they can probably be acquired under subdivision agreement at no to the public. Channelization measures for future development could also be implemented at this stage.

5.5 DEVELOPMENT CRITERIA

Where development is proposed within the flood fringe of a particular watercourse (e.g., Lavase River Watershed in West Ferris) certain measures would be required to ensure its protection from flood damage. These measures would consist of the following structural and non-structural controls:

A) Structural Controls

- Waterproofing of buildings by constructing berms, lot grading.
- Prohibit external openings in structures below regional flood level.

B) Non-structural Controls

- Prohibit habitation below flood level.
- Regulate types of development within the flood fringe.

5.6 HYDROMETEOROLOGICAL NETWORK

In the course of the hydrologic analysis undertaken in this study the scarcity of streamflow and rainfall data became readily apparent. The reliability of the results presented is very dependent on the data available for calibration and validation. As hydrologic work will be ongoing in these watersheds we would recommend that an effort be made at this time to improve the data collection network in the study area in order to facilitate future work.

The basic scheme suggested is presented in Figure 3. The scheme would consist of a streamflow gauge on Parks Creek located between Marshall Park Drive and Marshall Avenue as well as two rainfall gauges, one at the proposed Marshall Avenue Fire Station and one located in Corbeil.

5.6 HYDROMETEOROLOGICAL NETWORK - Cont'd.

Additionally, consideration might be given to installing a streamflow gauge and a rainfall gauge on Jessup's Creek. The value of these gauges will be to develop basic data for a small watershed undergoing urbanization. Such information is not currently available for any such watershed in Northern Ontario despite the fact that a large number of urban watershed planning and drainage problems are concerned with similar watersheds.

Order of costs for these improvements would be as follows:

Installation of Streamflow Gauge	$5,000.
Installation of Telemetry (i.e., Remote Monitoring)	$3,000. - $4,000.
Annual Operating Cost 1981 (by Water Survey of Canada)	$2,800.
Installation of Rainfall Gauge	$1,000.
Annual Operating Cost 1981 (by Authority Personnel)	300.

Appendix 'D'

MNR Comments on a Proposed Flood Plain Development

Ministry of Natural Resources
Ontario

Ontario Government Building
199 Larch Street
Sudbury, Ontario
P3E 5P9

Your file

Our file
4.6.24.12.1.

February 22, 1982

Mr. R.F. Barton
Clerk of the Corporation
of the City of North Bay
P.O. Box 360
North Bay, Ontario
P1B 8H8

Dear Mr. Barton:

SUBJECT: By-Law No. 5-82
Designating a Site Plan Control Area on Certain Lands at Cassells Street (Mayco Homes)

The property under consideration appears to be located in the flood plain of Chippewa Creek, according to map sheet number M-6 of the North Bay Mattawa Conservation Authority's flood plain mapping. Although the City of North Bay is moving towards an official plan amendment and revised zoning by-laws, which may or may not permit this development (i.e. two zone concept) such legislation is not in place and there is no evidence that the potential for increased flood damage to existing uses has been considered.

In view of provincial flood plain management policies, we can only object to By-Law No. 5-82 which does not appear to recognize the hazardous nature of the lands under consideration.

Members of my staff will be available to attend any hearing called by the Ontario Municipal Board as a result of this objection.

Yours very truly,

W.G. Cleaveley
Regional Director
Northeastern Region

/br

District Manager, North Bay
Regional Engineer, Sudbury
Lands Co-ordinator, Sudbury
Regional Conservation Authorities Program Supervisor, Sudbury
Legal Services, Toronto, J. Pounder

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