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Water Levels Reference Study. Phase 1. Riparian Residential Work Group Report

International Joint Commission. Functional Group 3. Work Group 8

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RIPARIAN RESIDENTIAL WORK GROUP REPORT

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INTERNATIONAL JOINT COMMISSION
WATER LEVELS REFERENCE STUDY
PHASE I

JUNE 1989

INTERNATIONAL JOINT COMMISSION
REFERENCE STUDY ON
FLUCTUATING WATER LEVELS

RIPARIAN RESIDENTIAL PHASE I REPORT.

FG3 - Work Group 8
JUNE 30, 1989.

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EXECUTIVE SUMMARY

Riparians share an affinity for the lakes and most feel a strong attachment to their shoreline properties. However, in terms of the impacts of fluctuating water levels, riparians are a very diverse group. Their sensitivities to fluctuating water levels and to measures depends on many factors, such as:

1. Lifestage and lifestyle factors, whether they are retired riparians, urban high-rise dwellers, families with one or two commuters who live on the lake and work in a nearby city, cottagers, etc.

2. Geographic location, whether they are upstream or downstream of an existing control structure, whether they are on a lake or a river, whether they are on a low-lying beach or a high bluff, whether they are susceptible to wind-driven seiches or not, etc.

3. Personal experiences, values, and beliefs, their attitudes and approaches to coping with fluctuating water levels.

There may be other important factors as well. Based on current information, we cannot determine how many riparians fit into each type, or even which types are predominant. We can conclude, however, that riparians are not a single interest in this issue; they are several interests depending on where they live and what kinds of people they are.

The Riparian Work Group recommends that research be carried out during Phase 2 of the study that will enable a better characterization and understanding of riparians in the Great Lakes system. Specific plans for a census and survey are detailed in this report.

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INTRODUCTION/BACKGROUND.

BACKGROUND OF IJC STUDY.

On August 1, 1986, pursuant to Article IX of the Boundary Waters Treaty of 1909, the Governments of the United States and Canada forwarded a "Great Lakes Levels Reference" to the International Joint Commission (IJC). This Reference requests the IJC to examine and report upon methods of alleviating the adverse consequences of fluctuating water levels in the Great Lakes -- St. Lawrence River (GL/SLR) Basin. The IJC issued a Directive concerning this Reference on April 10, 1987, which outlined the IJC's plan to respond to the Reference. A Background Paper dated November 2, 1987, has also been prepared and is available to the public as a comprehensive guide to the goals, objectives, and methods for the study.

OBJECTIVES

First and foremost our task is to understand riparians. In this component of the study our primary objectives are: to identify the past, present, and future response of Great Lakes riparians to fluctuating water levels on the Great Lakes system; the significance of each riparian sub-group from a social and economic position; and an evaluation framework in which to assess impacts of measures to riparian interests addressing fluctuating levels as a basis for bi-national consideration of possible implementation of those measures. This study attempts to define the complex inter-relationships between riparians and non-riparians as well as the sub-groups within the riparian interest class. The study documents the diverse types of impacts that are experienced due to water level fluctuations. (It was felt to be more accurate to talk about "water level fluctuations" rather than "lake level fluctuations" because of the need to include connecting channels and the St. Lawrence River).

SCOPE

The study will emphasize the increased geographic scope including the Great Lakes and St. Lawrence Basins and surrounding areas that may be affected; water supplies greater and less than those historically experienced; a full range of measures and types of impacts to existing and potentially affected riparian interest groups; enhanced public information; broad-scope environmental considerations; and expanded attention to the institutional prerequisites for adoption of measures.

STUDY ELEMENTS

The study approach will include elements which clearly define the problem, present a broad range of measures, and provides an analytical tool to assist the IJC in recommending alternative solutions to Governments. Functional Group 3 (FG3) is responsible for providing an analytical framework in which to analyze and assess the socio-economic and environmental impacts associated with measures responding to fluctuating water levels. The study will utilize a two-phase approach consisting of the following general study elements:

a. This report contains the results of our Phase I research, considerations and consultations.

b. Phase II will consist of: the results of a survey of riparian property owners; a detailed evaluation of selected measures; design of a final Information Program for use by Governments; refinement of data bases and a final report.

Phase I is completed, (June 1989). Phase II will commence after a brief hiatus and will be completed in September 1991.

DESCRIPTION OF THE RIPARIAN INTEREST CLASS.

Definition of the Interest Class & Sub-Groups.

This paper represents a first-time attempt to comprehensively assess the relationship between Great Lakes water level fluctuations and riparian interests on the entire Canadian and United States Great Lakes shoreline.

Webster's New World Dictionary defines riparian as follows:

> "of, relating to, or living on the bank of a river, lake, etc: as, fishing and other riparian rights belong to owners of riparian land".

For the purposes of this study the following factors were considered in the process of defining "riparian" and sub-categories of "riparian".

ownership vs. rental
vs. land lease & structure ownership
distance from shoreline
urban vs. rural
river vs. lake
full-time vs. part-time

The broad definition given "riparian" for this study, as well as the subcategories within that definition, is of importance because it will act as a focus for the discussion and actions of all parties who use the study. We have employed the dictionary meaning of the term as a reference and as short-hand definition. Our use of the word, however, is derived from a functional prerequisite rather than a linguistic one. We are studying fluctuating water levels and the measures employed to deal with them. To be included in this interest class the individual's precise proprietorial status is not important. Whether they own, rent our lease is not important, whether they are impacted by measures or fluctuations is, however, very important. Necessarily, therefore, the "riparian" interest class has to be those who live at or near the water's edge and have the potential to be impacted by measures and levels.

Logically speaking, a definition of any subgroup within the "riparian" interest class must be consistent with the general definition of "riparian" that has been derived to describe all members of that class. When gathering specific information the combined categories must be all inclusive to insure that every member of the interest group can be considered and that no subcategory is underrepresented. Similarly, to avoid duplication, there should be no overlap between categories that might allow some subgroups to be counted twice and thus be overrepresented. To reiterate, subcategories of the "riparian" interest group must be consistent with the umbrella definition given the group. Also, to ensure accurate representation any subcategory must be able to include all the members potential to it and be mutually exclusive from all other subcategories.

In considering a definition of "riparian" and subcategories of riparian that are impacted by fluctuations in levels it is important to consider:

1. How far back from the shoreline will an individual need to be before being excluded from the category "riparian"?

2. The shoreline type influences both a riparian's experience and reaction to measures. Someone on a clay cliff will have a different set of concerns than will someone on a sand spit or someone on a reach of rock.

3. Areas of shoreline contain a variety of densities which range from uninhabited through densely populated.

4. Similarly, but differently, Great Lakes shorelines range from wilderness reaches through a variety of "rural" reaches to "urban" reaches.

5. Correlated with this is the variety of uses and purposes that riparians themselves perceive their domiciles as serving.

a. residences can be designated as full-time, part-time (all year), or seasonal (part-of-the-year).

b. people may be urban cliff dwellers, suburbanites, ex-urbanites, commuters, cottagers, retirees, farmers etc.

6. People may own property and structures outright, lease the land but own the structures, rent, or have a condominium set-up.

7. The quality and type of structure may vary from a shack to a mansion to a high-rise with the consequent problems varying accordingly.

8. Governmental aid and influence varies between the two countries, betweem the various states and the province as well as between the municipalites and regions. This leads to widely different responses, expectations and experiences among seemingly similar riparians.

Our society has tended to place a high priority upon living near the water. Individual riparians perceive their properties as being important. This perception varies with the stage that they are in in their lives, their family status, their level of affluence, their educational level, their occupational status, their use of the property, the value they attach to their property, shore type of property, and whether their property is urban, in the urban shadow, or rural. Categories of the riparian interest class can be created from combinations of the following variables: age, family stage, socio-economic status (SES), occupancy status, shore type, location etc. The perceptions, problems, and resources of a Yuppy couple cliff-dwelling near a break-wall in Chicago or Toronto are much different than a blue-collar family of five with a seasonal cottage on a sandspit in Lake Huron or a retired couple in a permanent residence on a clay bluff near Toledo. The various sub-categories of riparians, in conjunction with their locational specifics, represent significant predictors of perceptions. The incidence of these categories, and their relative locations are not known.

RIPARIAN COMMUTERS

All riparians are of sufficient affluence to purchase waterfront property. Currently we do not know the magnitude or range of this affluence. Riparians, by being riparians, have a commonality of experience. There are, however, categories within the larger designation of "riparian". We do know that in certain areas, (eg. the Niagara penninsula), the nature of riparians and the use they make of shore front property is undergoing change. Here there is a trend toward growth in shore-front property for

year round homes. Although some of this is for retirement purposes the trend seems to be sustained by a greater willigness and ability for people to commute long distances. Given the information we have been able to garner to date, we can characterize these riparian commuters into a "type" for purposes of discussion. This type can be found in empirical reality and constitutes a sub-category of riparians. The magnitude of this group requires investigation as does the patterns of their dispersion from the urban core.

The factors effecting a group's magnitude and the patterns of the groups density and dispersion along the shoreline are legitimate topics for an IJC study. Deliberate planning decisions by governments to enhance transportation facilites near the shore-lines has a direct influence on patterns of shore-line use and in that sense these decisions can be seen as fitting the category of a "measure". There are two essential types of measures: intended and unintended. The "intended" as the name implies are deliberately planned whereas the "unintended" occur even though not planned for. Land use trends, economic factors, and cultural values may shift and come to act as measures even though not explicitly intended as such.

Given recent escalations in property values purchases of shore-line properties that fall within the urban shadow are restricted to those with disproportionately high resources. This type of riparian tends to view their property as an investment much more than do other riparians (although not exclusively so). Thus they are much more inclined to be critical of the factors effecting that investment. This group tends to be populated by individuals from the professional and managerial classes. As such this group tends to be disproportionately higher in educational achievement than are the balance of the population. This gives them, both individually and as a group, the inclination to investigate and question the factors that impinge on them. Higher educational levels give them the skills to think abstractly and articulate that thinking. More so than other groups in society this group will have the political insights, the political skills and perhaps the political connections to influence the outcome of governmental decisions concerning fluctuations and measures.

In future versions of the papers we will be examining other types of riparians. An initial rough list might include: retired riparians, urban riparians, suburban riparians, rural riparians etc. The rationale for constructing such sub-types and for studying them empirically in Phase II would be that the sub-types indicate attributes, that when correlated with shoretype and coastal dynamics, predict perceptions and explain them.

A survey was carried out in 1986 which revealed some characteristics of Canadian Great Lakes riparians (Sudar - 87). The respondents to this survey were randomly selected from owners of shoreline property on Lake Ontario, Lake Erie, and the southern portion of Lake Huron.

The results of the survey show that shore property owners are much older than the norm for residents of Ontario (37% over 60 years of age). Shore property owners were also found to be better educated (34% having attended university) than the general public, and they had higher family incomes.

Most shore properties are cottages or seasonal residences (57%). 38% are permanent homes, 3% are farms, and 2% are vacant lots.

Responses to the length of ownership question indicate that the turnover rate in shore properties is not as high as many people had thought. 40% of the Canadian riparians had owned their properties for 21 or more years, 24% for 11-20 years, 16% for 6-10 years, and 21% for 5 or less years.

Slightly less than half of those interviewed (46%) had suffered personal damages to structures on their property due to flooding or erosion. Slightly more than half (51%) had taken action to protect their property from the effects of high water levels in the last two years. Of those who had taken action, 93% put in some form of shore protection, 4% raised or moved a building, and 3% did other things. Only a minority of these people received professional advice (17%) before taking action.

The results of this survey indicated that shore property owners had spent a great deal of money on shore protection during 1985 and 1986. 29% of those who took action spent $10,000 or more, 17% spent $5,000-$10,000, 33% spent $1,000 to $5,000, and 21% spent under $1,000. In addition to these financial impacts, a majority of the property owners surveyed (52%) said that storms cause them worry, anxiety, and stress.

APPROACH OF THE WORK GROUP.

METHODOLOGICAL PROTOCOL

Conceptual Underpinnings.

In this research study a unique combination of events are being abstracted from empirical reality. The factors abstracted are complex, sometimes hypothetical and often vague. The abstraction process faces the constant, but opposite, threats of either deteriorating into chaos for lack of a conceptual framework or of having reality forced into a stable conceptual framework which bears little relationship to the reality depicted therein.

Researching the impacts of water-level fluctuations and measures on riparians necessitates the forging of a hybrid or eclectic approach between disciplines. Sociology, geography, hydrology, anthropology, psychology, economics, political science, etc. are all potential contributors to our analysis. Each of these disciplines has a unique perspective for the reality being researched; each discipline has its preferred research methods; and each discipline has the methodological considerations legitimating these preferred methods. The disciplines selected and the weight given each are research decisions. Although this forging together of disciplines does not require the development of a sub-topic within the study to explain itself, it does require diligence to achieve a balance between the disciplines and to exhaust their possibilities while accurately depicting the reality being studied.

Meta-Organizational Considerations.

A research study can be organized in a variety of ways: Situations simply requiring an update of earlier information and/or those situations that have clear information requirements can be layed out in advance of the actual investigation.

Research projects not conducive to the preplanning of detail and perspective must necessarily evolve. The project must proceed yet the nature of the empirical configuration being researched, the concepts through which it is analysed, and the appropriate methodologies to rationalize the research cannot be known in advance.

The IJC reference level study in general, and this work group's study in particular can be viewed as an evolutionary system informed through a cybernated process. After the formulation of an initial conceptual framework information uncovered is fed back in a "loop" to steer the direction that the project takes and/or to guide the ongoing formulation of the conceptual framework that is evolving. Thus the project develops by consideration of the information assembled as it proceeds. After the nature of the empirical configuration being researched is understood the research tools, their logic and their justification must be considered anew through the perceptions generated from the newly evolved conceptual framework.

A potential trap, a Catch 22, emerges when we consider that our concepts emerge from considerations of the empirical domain while the empirical can only be formulated through the perceptions provided by the conceptual domain. A definitional circle emerges when the empirical domain is defined by precepts derived from the conceptual domain which has been legitimized in turn by referece to the self-same empirical domain that gave rise to the original impetus for definition.

Because this study involves an interdisciplinary or eclectic approach and because this study involves complex abstractions from empirical "reality", a cybernated research approach is the only one that can be justified given the need to evolve a conceptual framework and to avoid the potential trap of circular reasoning.

Methodologoical Distinctions.

A crucial distinction is made here between "methodology" and "method". A "method" is a research technique or tool to gather data. "Methodology", on the other hand, represents the philosophy and legitimation of the "method" and consequently of the research process itself. The values and assumptions that give the research a rationale as well as the standards employed to construct variables and decide on the unit of analysis are methodological considerations. Rationales for research implicitly contain values, assumptions and standards. Methodology critiques these rationales and decides between them. Whereas one can only decide the tool for a job after one has decided what the job entails, methodological considerations logically precede considerations of technique or method.

Any research project requires decisions to be made. The factors demanding these decisions and dictating their outcomes emerge from considerations of: the purpose negotiated, the theory employed, the methodology sanctioned, the methods available, the funds allocated, the audience addressed and the paradigm assumed. Further, when these factors have been agreed upon and have become stable features, (parameters), of the project, day-to-day decisions are made within the boundaries of these factors. These day-to-day decisions give the project its unique character and its direction. These series of decisions, when traced, form a "logic chain" which configurates the research project and the evolutionary processes specific to it. A research project can only be fully appreciated after recognition of these decisions and the ground from which they emerge has been grasped. Every effort will be made to weave these decisions into the fabric of our report to enhance the readers appreciation of the features circumscribing the evolution of its results.

An example of a practical research question that required a decision was: "How can we trace the impacts of flucuating water levels in either a "do nothing" condition or a "with measure" condition?"

In the midst of rapid change a report on the status quo could become an historical document before it has been completed. In such an instance rate and direction of social change might reasonably become sub-topics within the larger study frame. If the rate of social change is rapid then studies of measures and their impact may be threatened by obsolescence while still being in the study stage.

Probable outcomes perceived as emerging from the choice of either the "do nothing" or the "with measure" scenario only gain reliability when considered against the backdrop of a set of conditions perceived as dynamic rather than static. The outcomes from this choice will impact a future society which may be very different from the present one.

If we imagine the Great Lakes basin in a pre-historical state and compare it with the present level of social development, the difference is startling. Similarly, if we compare the status quo with reasonable future scenarios even conservative estimates suggest dramatic differences. Population growth, transportation growth, economic growth, increases in shore-line densities, shore property values etc. are all indexes of change. Presently these indexes indicate that rapid changes are occurring in the social context of the Basin. The "do nothing" condition implicitly assumes a social context as does the "with measure" condition.

Society will change. Shoreline uses, water and recreational uses, as well as societies valuation of them will not be the same in the future. What these factors may become remains open to analysis and debate. Prediction is at best a risky art. However, without prediction and consequent planning there is inherent risk as well. In the process of describing the various riparian activities we will be describing their social context. In doing this we will be establishing a base-line from which to formulate the future social context in which the "do nothing" scenario and the "with measure" will occur.

Ideally a reliable social-geographic and sociological forecast for the GLB/SL would be developed to determine the social context within which probable outcomes will occur. (This would of course be invaluable to other FG3 work groups as well). Such a forecast is not, however, within our mandate as it now stands. In lieu of such a possibility the work group has decided that details concerning the status quo and the trends emerging from the status quo will be interwoven into the report. A caveat must be the recognition that the present social context within which measures and their impacts are envisaged remains in a state of dynamic flux, (see "do nothing alternative").

PROFILE OF STUDY AREA

Objectives of Profile

This section has two main objectives: providing as best as possible a first pass overview of the study area and the interest class vis a vis its prominent characteristics; initial development of the existing condition/ do nothing measure in so far as fluctuating lake levels and measures designed to moderate same are concerned.

While the overarching purpose of this paper is to explore and trace on a preliminary basis, using existing data, the impacts of measures designed to influence fluctuating lake levels, it is imperative that the appropriate contextual stage for such an analysis be set. Only when the essential parameters of an interest class are understood can the subsequent impact assessment (and further analytical byproducts) have legitimate substance.

It is generally felt that the riparian interest class in its aggregate composition is significant both in size and in breadth relative to its prominence regardless of what reach or lake is considered. Because of this spatially comprehensive feature, it stands to reason that the riparian interest group will be impacted by fluctuating lake levels and the concommittant flooding and erosion problems throughout the study area. For this reason alone, the riparian interest class must be considered of prime import in any study of impacts of lake fluctuations. In what follows, a preliminary evaluation of the subject group will attempt to quantify the degree of importance.

DATA SOURCES AND THE CURRENCY OF SAME

The accumulation of profile information on riparian property and more specifically residential riparian property is a formidable task. Very little primary data has been collected through time. What has been collected obviously decays in value as it becomes more dated. In addition because this is a joint US-Canadian study ideally it would be preferred if similar data was available for both. However the frames of reference in many instances are different, as are the methodologies employed. As such a one to one correspondence of descriptive information which allows for a better understanding of the interest class is not possible at this time, although future work will be targeted towards this objective.

HOUSING UNITS IN RIPARIAN OWNERSHIP

Suprisingly, after all the years of study, there is a paucity of definitive information relative to the number of housing units or residential structures located in the riparian zone. And this data cell is considered the grossest and most elemental in terms of detail and basic study requisites.

As a starting point therefore in what is envisaged as a series of successive reductions of data, finally yielding pure riparian ownership counts, it was decided that the maximum number of households should be determined. Accordingly, all zip codes fronting the Great Lakes and connecting channels were identified (US only at this stage) and computer retriveable Census of Housing data was accessed to provide an enumeration of units.

Figure 1 summarizes the distribution of the 1.8 million units (1980 values) by lake. The dominant majority, about 90 percent, are located on Lakes Michigan and Erie. This is principally traceable to the major metropolitan areas of Chicago, Milwaukee, Cleveland and Detroit (Lake ST. Clair) being located on these lakes. While no comparable data for households in Canada has been tabulated to date, the majority would likely be located on Lake Ontario, given the location of Toronto. In conclusion, as an upper limit on riparian ownership, it is safe to assume a base not to exceed 1.8 million units.

STATE DISTRIBUTIONS

Further delineations of the spatial distribution of housing units can be made by an analysis of the number of units by lake and state. As figures 2-4 clearly show (Lake Huron abuts only Michigan) Illinois and Michigan predominate. By relating the percentage distributions to the gross number of units cited above, a sense of location is created.

When this information is linked to the the various shoreline types (according to geological and erodibility descriptors) a further refinement of housing density according "risk" is possible. A summary table illustrates. For example, Illinois contains more than half of the Lake Michigan housing count; of this total over 75 percent are within reaches classed as artificial fill. The inclusion of Canadian data will enhance our understanding of at risk riparian ownership.

Figures 5 -9 recast the above data at the Lake level, cumulating state housing totals by shore type. Again, it should be noted that the numbers shown are for zip codes adjacent to the lakes, thereby yielding high counts of riparian structures.

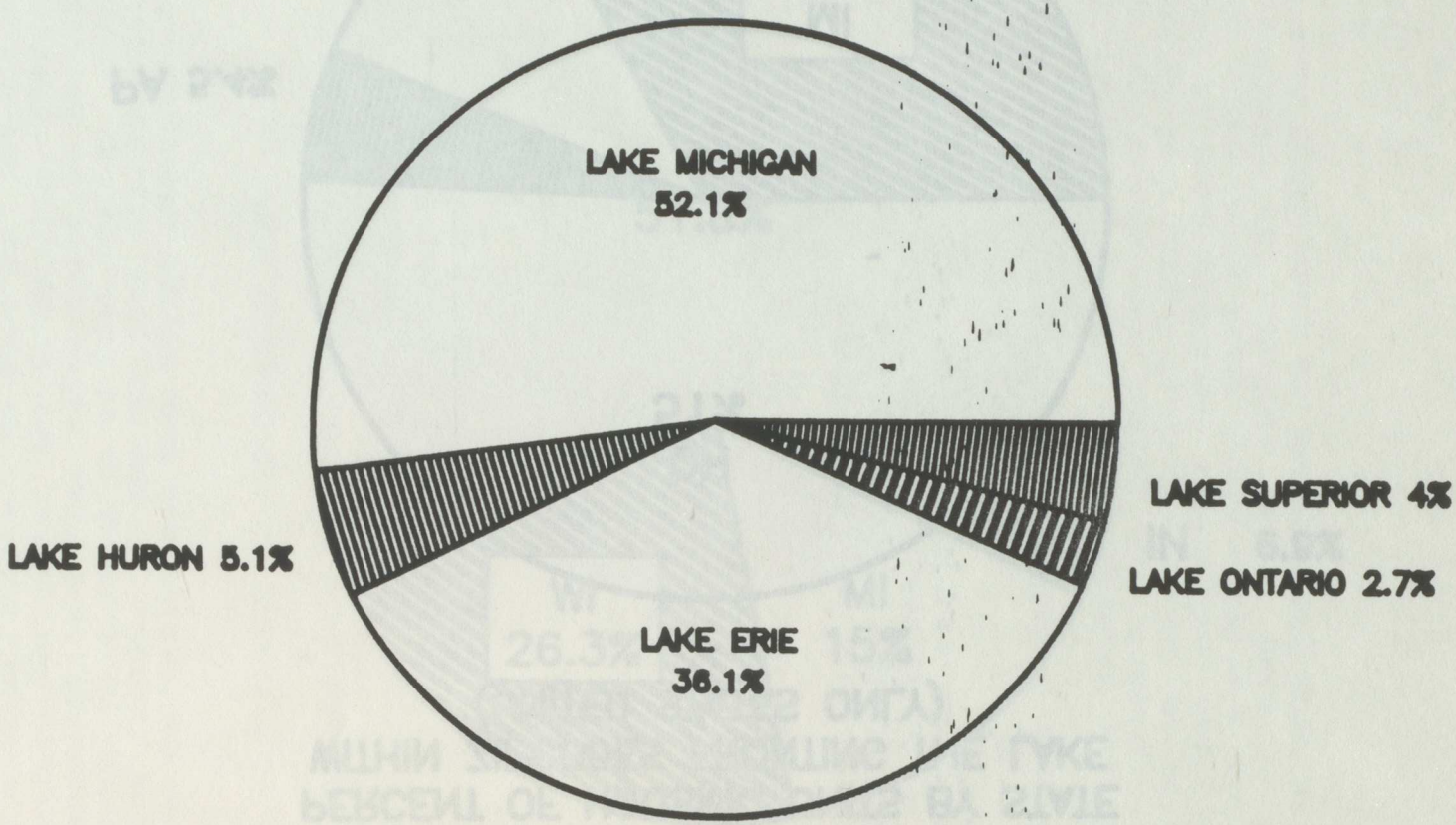
ATTEMPTS TO REDUCE DATA

A US study undertaken in the mid 1970's compiled a count of residences within 200 feet of all lakes. Approximately 41000 structures were located. Tables 2 and 3 summarize this data by lake and by state. No compatabile data for Canada is available in reproducable form, although such data is being worked on.

A key cross tabulation which doesn't appear to be available in any of the publications reviewed, but which is crucial to understanding the magnitude of the at risk riparian residential component is the shore classification versus number of units. At best we can only infer from tables 2 and 3 (if they are reasonably accurate) and from the foregoing figures something about this relationship.

GREAT LAKES

PERCENT OF HOUSING UNITS BY LAKE WITHIN ZIPCODES FRONTING THE LAKES (UNITED STATES ONLY)



LAKE ERIE

PERCENT OF HOUSING UNITS BY STATE WITHIN ZIPCODES FRONTING THE LAKE (UNITED STATES ONLY)

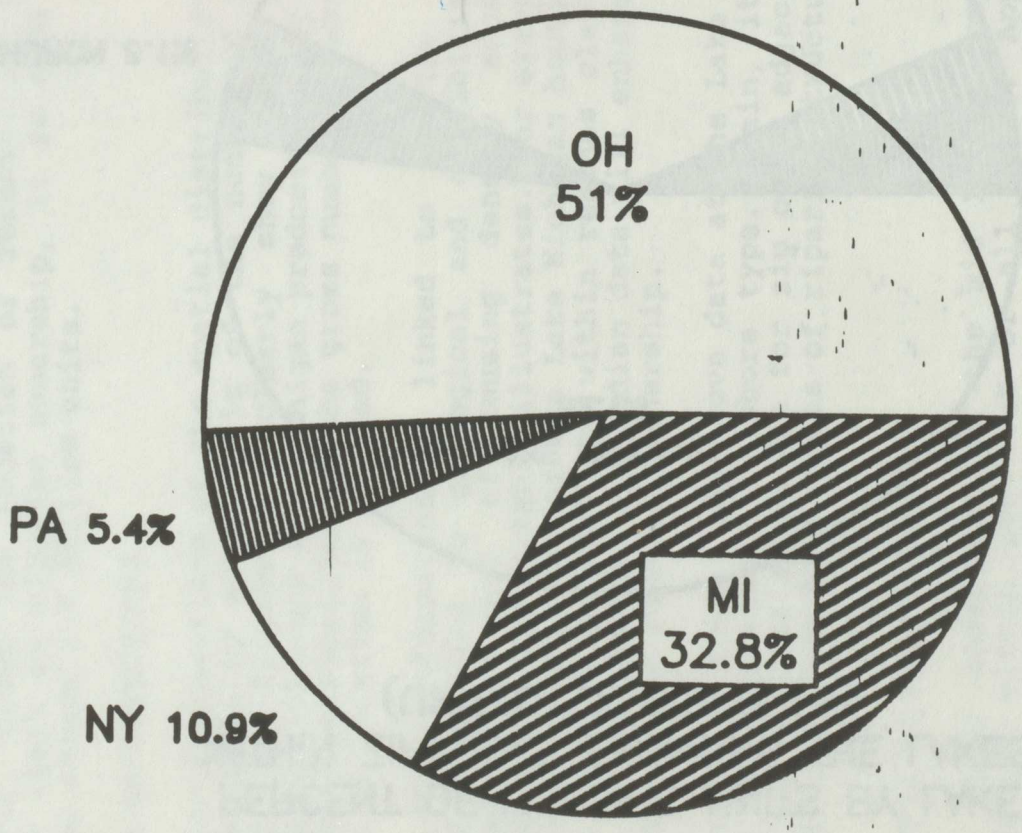
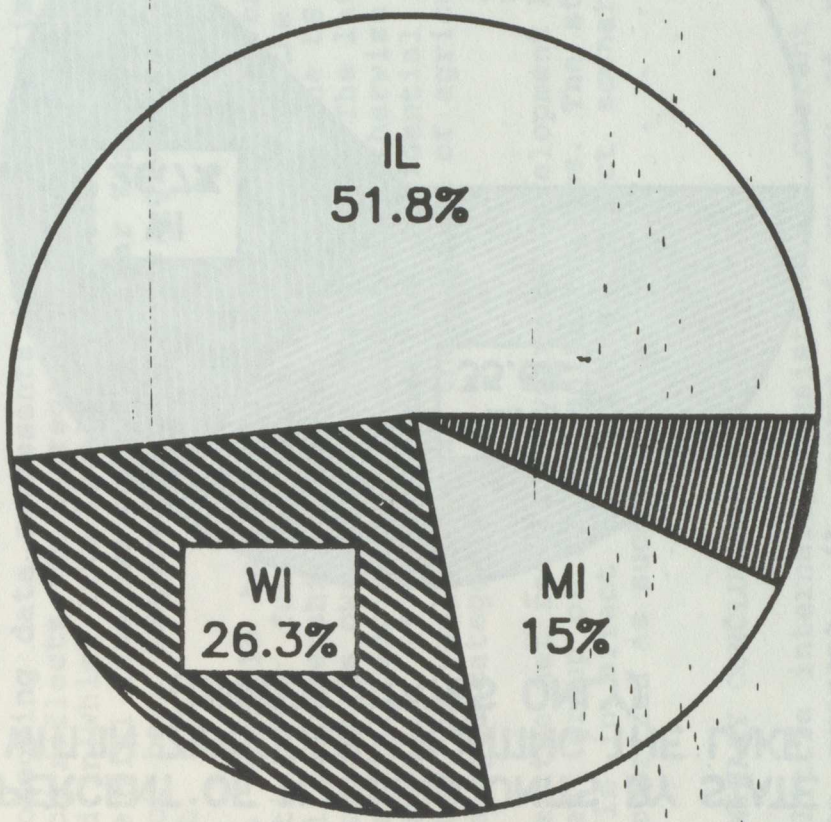


FIG 2

Source: 1990 Census of Housing

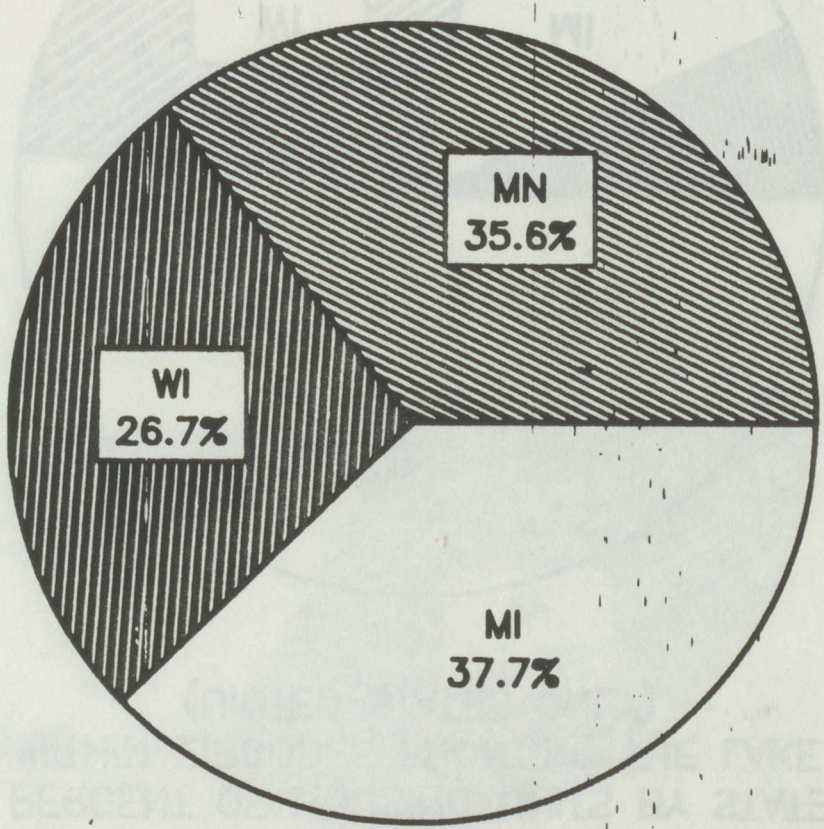
LAKE MICHIGAN

PERCENT OF HOUSING UNITS BY STATE WITHIN ZIPCODES FRONTING THE LAKE (UNITED STATES ONLY)



LAKE SUPERIOR

PERCENT OF HOUSING UNITS BY STATE WITHIN ZIPCODES FRONTING THE LAKE (UNITED STATES ONLY)



F1C4

Source: 1990 Census of Housing

Accordingly, we can see how the upper limit of housing units can be justifiably reduced from 1.8 million to 41,000- a 98 percent change. We also know that not all reaches of the lakes and connecting channels are subject to the same risk from flooding and/or erosion. Further, we know that the dispersion of units is not uniform throughout the study area. Therefore it is likely that somewhat less than 41000 units on the US side are within what would be classed as at risk reaches. Assuming similar numbers for Canada, it appears that the aggregate interest group would be decidedly less than 80,000 throughout the study area.

CHANGE IN RIPARIAN COUNTS THROUGH TIME

The foregoing data represents the latest estimate available and as such reflects the aggregate buildup through time (covering the period in which lake levels fluctuated and were regulated) of the residential land use component. Near term versus long term change has not been compared, nor can be, given the state of the data extant.

It is possible however to gain insight (eventually) into the potential for future change by analyzing the current state of shoreline ownership. For both Canada and the US the vast majority of shoeline is owned by private sources. The latter would include residential, agricultural, forest and otherwise undeveloped land. In general, if any change in residential typing could be expected, it would come at the expense of agricultural, forest or undeveloped categories.

In sum, the net result of years of development has resulted in an interest group of 80,000 units or less. The status quo alternative is in effect the without project scenario and should be characterized as such.

PRELIMINARY CONCLUSIONS

Very little internally consistent and current data is available at the present. (A census and survey of riparians will be completed in the late fall of 1989). What is known suggests that the riparian residential ownership group is less than 80,000. Of that only a portion are classed as at risk. And for these, the degree of risk varies according to location. The impacts of measures upon the fluctuating lake levels must be viewed in this light.

REVIEW OF PAST STUDIES

LITERATURE SEARCH

A literature search was performed to locate recent publications which addressed the issues of fluctuating lake levels on the Great Lakes and consequential shoreland damages from flooding and/or erosion. A listing of the data bases which were used in the search includes:

National Technical Information Service (1964-88)
Government Printing Office Monthly Catalog (Jul 1976 - Apr 1988)
Magazine Index (1959 - Mar 1970, 1973-88)
Pais International (1976-88)
Social SciSearch (1972-88)
ABI/Information (1971-88)
Management Contents (1974-88)
Dissertation Abstracts (1861 - Apr 1988)
Waternet (1971-88)

The following key words were used to target the desired information: (damage or flood?) and (Great w/ Lake? or Lake w/ Erie or Lake w/ Ontario or Lake w/ Huron or Lake w/ Michigan or Lake w/ Superior). Note: A question mark (?) following a word denotes that any combination of letter endings will be accepted. For example, an entry of flood? would locate flood, floods, flooding, flooded, floodplain, etc. The rationale was to select key words general enough so as to insure that all pertinent publications would be located. The list of publications produced by the search was then examined and only relevant ones were retained.

After further examination of the list, publications that appeared to hold particular interest were chosen. The library of the North Central Division (NCD), Corps of Engineers had many of the recent studies on shelf. An attempt was made to obtain copies of those publications not held by the NCD library. With the aid of the NCD librarian, most were located within the borrowing network system and a request was made to borrow these materials. While some were obtained, others were not, due to any of the following reasons : the publication was already checked out of the lending library, the lending library did not want to lend the material for no charge (NCD cannot pay borrowing rates), the lending library did not wish to lend it for unknown reasons, etc.

The literature search produced the titles of 60 relevant publications. Copies of 15 were obtained. In addition, other publications found in the NCD library or various Corps' offices were also included in this study. A total of 28 reports, articles, or other publications were examined. A complete list is included at the end of this report.

CHRONOLOGY OF MAJOR REPORTS

The first major survey of damages resulting from high lake levels covered the period May 1951 - Apr 1952. In 1952 price levels, total damages to all lakes were $61 million. Of the total, about $50 million in damage was attributed to wave action. The Dec 1965 report written by NCD and entitled "Water Levels on the Great Lakes" applied the 1951-52 damage estimates by reach to stage-frequency curves. Prices were updated to July 1964 levels via the construction cost index. Ultimate water level (the sum of storm water level and run-up) was computed. Recorded adjusted storm water levels were kept by month for the period 1904 through August 1964. NCD developed stage-damage curves for unprotected shoreline property along the United States portion of Lake Erie. During the period 1951-65, levels on the Great Lakes were on the decline and therefore further information relating high lake levels to damages could not be observed.

In a report to the International Joint Commission (IJC) dated Dec 7, 1973, the effects of lake level regulations for both Canada and the United States were investigated. Although the Great Lakes were at a very high level during 1972-73, at the onset of the IJC study, damage data were scarce. For the United States shoreline, the only reliable data available were the results of the 1951-52 survey. No such information had been collected along the Canadian shoreline for the 1951-52 period. Some data were collected by field crews during 1966-67. This information was supplemented by historical records.

The IJC study borrowed the methodology of the earlier (Dec 1965) NCD report to assess damages along the United States shoreline. This methodology, which employed the use of ultimate water levels, produced a total of both wave impact and inundation damages. The Canadians evaluated erosion and wave impact damages using wave energy calculations. Inundation damages were determined using the ultimate water level approach.

During the high-water period 1972-73, the Corps of Engineers (COE) investigated potential damages and possible protective measures for the United States shoreline. This undertaking was known as Operation Foresight. Three COE Districts - Detroit, Chicago, and Buffalo - were involved in the study. Site-specific stage-damage curves were developed by field crews.

A 1975 study by the Great Lakes Basin Commission "Shore Use and Erosion" estimated future damages related to economic use. Only the United States was included. The 1951-52 survey was used as the basis for damage estimates. Current data on land use was collected by the Corps of Engineers in co-operation with the Great Lakes states. Future land use was projected from changes determined in a 1966 field survey. Estimates of land usage damage potential were made for the years 1980, 2000, and 2020.

It appears that the estimated damages are based on a recurrence of conditions as they were during the high water period Spring 1951 - Spring 1952. It was assumed that once the economic value exceeded the expected damage protective measures would be built and damage to that reach would no longer occur. The study concluded that generally damages would be four times greater in the year 2020.

"Canada/Ontario Great Lakes Shore Damage Survey" was written in Oct 1975. It represents a compilation of information of most of the Canadian shoreline. Lake Superior and northern Lake Huron were found to be non-erodible and therefore were not included in the study. The report computed erosion rates for the other areas and assigned a monetary value to the loss.

Following the 1973 IJC study, concern arose among shore property owners that the results of that study (based on the 1951-52 damage survey) did not adequately reflect subsequent shoreland development. A pilot study was completed in May 1976 by NCD. Eleven representative counties within four states (in the US) were chosen to participate in a damage survey. Each state selected an agency responsible for co-ordinating the effort. All riparian owners were identified and contacted. Survey forms were mailed to all residential property owners. Some sample follow-up interviews ensued. Non-residential property owners received a letter requesting an appointment for a personal interview. Damage estimates covered the period from Labor Day 1972 through Labor Day 1974. The results of this study suggested that damages were 2-3 times higher (after adjustments for price levels and development) than the damages based on the 1951-52 surveys. The pilot study concluded that additional work was necessary if a comprehensive evaluation of shoreline damage was desired.

Another study prepared by NCD, entititled "Great Lakes Shoreland Damage Study" and written in Feb 1979, compares damages from the 1951-52 period with those occurring in years 1972-76. All damages are in Sep 1973 price levels. Damages are aggregated by lake. The aforementioned pilot study (survey from Labor Day 1972 - Labor Day 1974) was used to design an efficient survey approach, which was used for further survey work. A statement in the introduction to the Shoreland Damage Study notes that the remaining Great Lakes shoreline was surveyed during 1976-78. This is not consistent with the summary tables within the report, which provide damages for the years 1972-74, 1975, and 1976. The report concludes that damages accruing during 1972-76 ($401 million) are 2.37 times higher that the damages from 1951-52 ($169 million).

Another IJC study was published in July 1981. "Lake Erie Water Level Study" evaluated damage reduction associated with regulating Lake Erie. Erosion and inundation damages for the United

States portion of the shoreline are based on a damage survey that extended from Labor Day 1972 through Labor Day 1976. Inundation damages on the Canadian portion were based on the Canada/Ontario Great Lakes Shore Damage Survey, which covered the 1-yr period Nov 1972-73. Damages on the Quebec portion of the St. Lawrence River were based on flooding events which occured in 1974 and 1976. Inundation damages were estimated from stage-damage curves (based on stormwater levels). Erosion losses were determined using the wave-energy approach.

OVERVIEW

For the United States shoreline, comprehensive damage data are available during the high lake level periods, 1951-52 and 1972-74. These data have been used extensively in many of the major reports cited above. The 1951-52 data was still being used even after 20 years had expired. In addition to the damage surveys, a land use survey was performed in 1966-67 along the entire Great Lakes shoreline (Canada and United States), which provides extensive information regarding shoreland use (e.g. residential/commercial, agricultural, forest, etc), environmental value, and shoreline characteristics (e.g. low dunes, high bluff erodible, etc.). Less damage data are available for the Canadian portion of the Great Lakes shoreline. No survey information was obtained during the 1951-52 high water period. Primary data is available from the 1972-73 period for much of the Canadian shore.

The available data sources cover limited time spans and do not provide a comprehensive analysis. There are several comments to be made concerning the availble data and how it is used to estimate shoreland damages attributable to a particular water level.

1. Because of the many political boundaries within the Great Lakes region, usually many agencies are involved in gathering this data and consistency among areas cannot be assumed.

2. Long-term information would be helpful in determining damages attributable to fluctuating lake levels. Generally, riparian property owners are contacted after a high water event and asked to recall damages which may have occurred up to a year or more ago.

3. Information is lacking with regard to the percentage of property owners actually affected. What percentage of survey respondents report $0 damages?

4. Data are generally aggregated into broad reaches and stage-damage curves are developed. The curvilinear function which the data seem to suggest has never been proven by further study. Also what characteristics do the reaches share? It would seem that such large areas would contain diverse shoreline types and

land uses. Does an equation realistically describe damages for a shoreline distance of approximately 100 miles? Finally, the ultimate water level approach, as used by the United States in some studies, estimates both inundation and wave impact damages for a given ultimate water level. Since the ultimate water level is defined as the sum of the storm water level and run-up, weak winds combined with a high lake level could possibly produce the same ultimate water level as strong winds on a moderate lake level. Intuitively, one would expect the latter condition to generate greater wave impact damages. The equation would produce identical results for the two conditions.

5. The 1966-67 land use survey provides information on both land use and shoreline type. However, the classification "residential/commercial/public structures" does not provide the reader with information on the actual number of structures involved. Hence, it is impossible to establish the number of homes on high non-erodible bluffs in comparison to the number on low dunes. This would have considerable impact on damage estimates. If in fact the most vulnerable areas are devoid of intensive development, the damage risk would be much lower.

6. The Dec 1965 report on Lake Erie deals only with unprotected shoreline. It cannot be assumed that structural protection will provide complete protection against all events. A combination of high still water levels and severe winds could produce an ultimate water level that would cause damage even to protected areas. Eliminating those areas may underestimate damages. Furthermore, other studies assume that once the anticipated damages exceed the cost of protective works, the shoreline will be protected and no damages will occur in the future. First, as stated above, total protection cannot be guaranteed against all combinations of water levels and run-up. Second, it is not always possible for a property owner to anticipate future conditions. Third, the financial capability for the property owner to take action cannot be assumed. Fourth, structural protection would need to be approved through the permit process and could potentially be denied if such action would cause adverse effects elsewhere. In conclusion, protected areas (existing or potential) need to be addressed in a damage analysis.

Finally, if one were to characterize the foregoing studies as to their utility insofar as assessing current problems and conditions, it could only be concluded that the usefulness was minimal, and perhaps misleading. There was no attempt (and if there was, it was not successful) to integrate the various components of an impact analysis into a meaningful whole. Instead there exist a number of important investigations and data gathering exercises which can only be regarded as "ad hoc" because of the missing step of integration. The so called "big picture" was ignored; the parochial pictures were developed. The audience was

unable to track and fully understand the import of the overall plot. This shows quite clearly the need for a good director, and of course a good plot in future endeavors.

RECENT MAJOR STUDIES ON SHORELAND DAMAGES

TITLE: Water Levels on the Great Lakes
AUTHOR: North Central Division
DATE OF PUBLICATION: December 1965
SCOPE: unprotected shoreline of Lake Erie, US only

DAMAGE DATA --
DATE COLLECTED: previously collected in May 1951-Apr 1952
COLLECTED BY: COE in co-operation with local co-ordinators designated by the Great Lakes states
METHOD OF COLLECTION: field damage survey

UPDATING METHOD: Updated to 1964 price levels via construction cost index.

DAMAGE ANALYSIS METHODOLOGY: Shoreline divided into 3 reaches. Ultimate water levels by month for the maximum recorded adjusted stormwater levels 1904-Aug 1964 were used to determine stage-frequency relationships. Updated damages for each reach were applied. Stage-damage curves were developed based on 3 points-(1) zero-damage water level, (2) ultimate water level for survey damages 1951-52, and (3) potential damage with 1 ft higher ultimate water level. Equation derived which would predict damages for a given stage -- $D = 121.9 (S - 570.6)^{2.17}$, where D is the average damage per month per mile and S is the ultimate Lake Erie water level.

COMMENTS: Includes only unprotected shoreline.

*****

TITLE: Regulation of Great Lakes Water Levels
AUTHOR: International Great Lakes Levels Board
DATE OF PUBLICATION: December 7, 1973
SCOPE: United States and Canada

DAMAGE DATA --
DATE COLLECTED: United States - previously collected in May 1951-Apr 1952; Canada - some information collected during 1966-67
COLLECTED BY: United States - COE in co-operation with local co-ordinators designated by the Great Lakes states
METHOD OF COLLECTION: field damage survey

UPDATING METHOD: 1971 price levels

DAMAGE ANALYSIS METHODOLOGY:
United States -- Same methodology as previously developed in the Dec 1965 report, "Water Levels on the Great Lakes". Inundation and wave impact damages were estimated from stage-damage curves based on the ultimate water level approach. Future damages were derived from the 1966-67 land use survey in conjunction with projections of population, personal income, and employment developed by the Dept. of Commerce or various regional/local planning agencies.

Canada -- Inundation damages were based on the ultimate water level approach described above. Erosion and wave impact damages were developed using a wave-energy approach. Future damages were projected using the 1966-67 land use survey. Additional information on future shoreline development was provided by the Ontario Provincial Departments of Tresury and Economics, Trade and Development, and Natural Resources, and from other governmental offices.

COMMENTS:

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TITLE: Operation Foresight -- After Action Report
AUTHOR: Detroit District, COE
DATE OF PUBLICATION: 1973-74
SCOPE: United States shoreline, except Lake Superior

DAMAGE DATA --
DATE COLLECTED: 1972-73
COLLECTED BY: Detroit, Chicago, and Buffalo Districts
METHOD OF COLLECTION: field survey crews

UPDATING METHOD: none necessary

DAMAGE ANALYSIS METHODOLOGY: Field crews visited damages sites and developed stage-damage curves for each. Damages were estimated based on predicted water levels as prepared by the Detroit District.

COMMENTS:

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TITLE: Shore Use and Erosion (Appendix 12)
AUTHOR: Great Lakes Basin Commission
DATE OF PUBLICATION: 1975
SCOPE: United States

DAMAGE DATA --
DATE COLLECTED: previously collected in May 1951-Apr 1952
COLLECTED BY: COE in co-ordination with local co-ordinators as designated by the Great Lakes states
METHOD OF COLLECTION: field damage survey

UPDATING METHOD: unknown

DAMAGE ANALYSIS METHODOLOGY: Damages are related to economic use. Future damages for the years 1980, 2000, and 2020 were estimated based on projected land use. A 1966-67 land use survey was utilized to make these projections. It appears that projected damages were determined assuming conditions identical to those in 1951-52.

COMMENTS:

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TITLE: Summary Report of Pilot Study Program
AUTHOR: NCD
DATE OF PUBLICATION: May 1976
SCOPE: 11 counties within 4 states (US)

DAMAGE DATA --
DATE COLLECTED: damage estimates for the period Labor Day 1972 - Labor Day 1974
COLLECTED BY: Minnesota - MN Dept of Natural Resources
Wisconsin - WI Dept of Natural Resources
Michigan - Coastal Zone Laboratory, Univ of MI
New York - St. Lawrence-East Ontario Commission

METHOD OF COLLECTION: State contractor collect information on ownership and assessed value of all riparian shoreline property. A mailed survey form was sent to all identifed residential owners. Follow-up personal interviews among a sample group was used to check for statistical bias. Non-residential owners were interviewed.

UPDATING METHOD: none necessary

DAMAGE ANALYSIS METHODOLOGY: No method for determining damages. This study served only as a report for what damages occured during the 1972-74 time period.

COMMENTS: The main conclusion of this report is that a comprehensive evaluation of damages is not possible without adequate funds, staff, and time for such a task.

*****

TITLE: Canada/Ontario Great Lakes Shore Damage Survey
AUTHOR: Environment Canada
DATE OF PUBLICATION: October 1975
SCOPE: Canadian shoreline, except Lake Superior and northern Lake Huron

DAMAGE DATA --
DATE COLLECTED: Nov 1972-1973

COLLECTED BY: Environment Canada and Ontario Ministry of Natural Resources

METHOD OF COLLECTION:

UPDATING METHOD:

DAMAGE ANALYSIS METHODOLOGY: No method for estimating damages. This study served to report past damages.

COMMENTS:

*****

TITLE: Summary Report - Great Lakes Shoreland Damage Study
AUTHOR: NCD
DATE OF PUBLICATION: February 1979
SCOPE: United States

DAMAGE DATA --
DATE COLLECTED: approx 1972-74
COLLECTED BY: see Pilot Study Program

METHOD OF COLLECTION: survey, see Pilot Study Program

UPDATING METHOD: none necessary

DAMAGE ANALYSIS METHODOLOGY: No method for estimating damages. This report served to estimate past damages.

COMMENTS:

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TITLE: Lake Erie Water Level Study
AUTHOR: International Lake Erie Regulation Study Board
DATE OF PUBLICATION: July 1981
SCOPE: Canada and United States

DAMAGE DATA --
DATE COLLECTED: Canada - Nov 1972-73
St Lawrence River - 1974 & 1976 floods
United States - Labor Day 1972-76
COLLECTED BY: Canada - see Canada/Ontario Great Lakes Shoreland Damage Survey
United States - see Pilot Study Program
METHOD OF COLLECTION: Canada - field survey
United States - see Pilot Study

UPDATING METHOD: July 1979 price levels

DAMAGE ANALYSIS METHODOLOGY: Stage-damage curves (based on storm water levels) were used to assess inundation damages. The wave-energy approach was used to develop stage-damage curves to estimate erosion damages.

COMMENTS:

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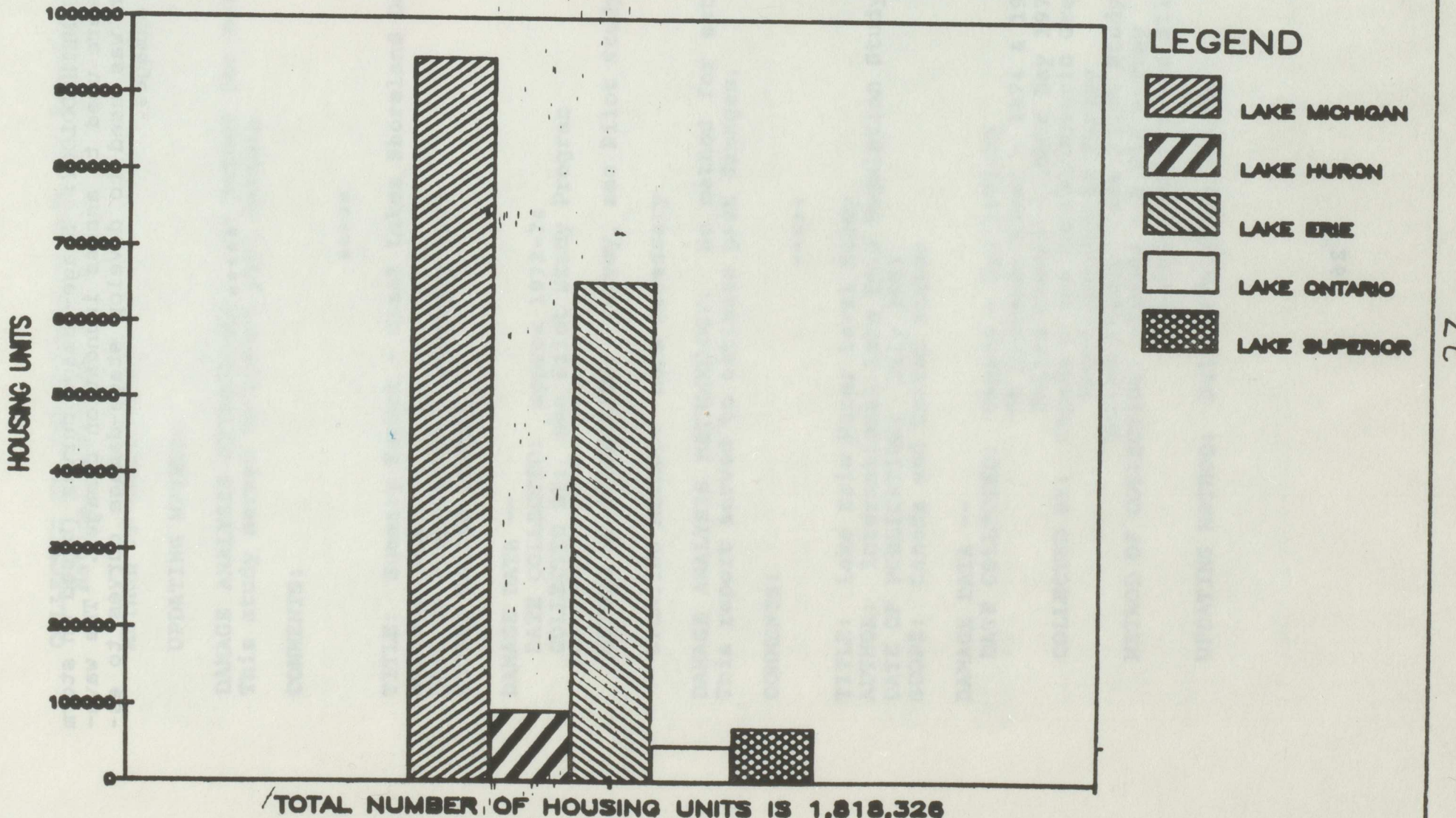
GREAT LAKES

NUMBER OF HOUSING UNITS BY LAKE WITHIN ZIPCODES FRONTING THE LAKES (UNITED STATES ONLY)

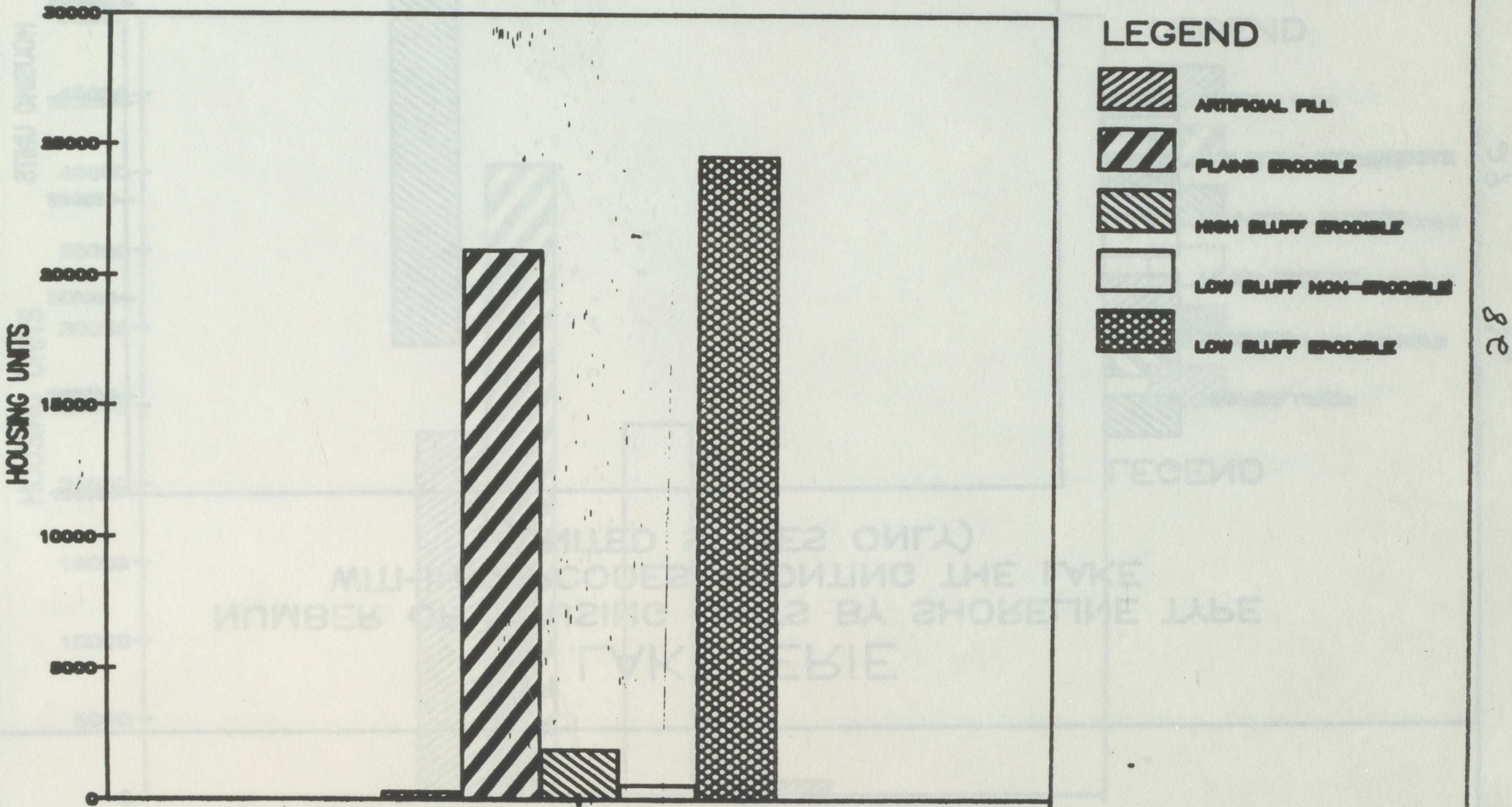


TOTAL NUMBER OF HOUSING UNITS IS 1,818,326

Source: 1980 Census of Housing

LAKE ONTARIO

NUMBER OF HOUSING UNITS BY SHORELINE TYPE WITHIN ZIPCODES FRONTING THE LAKE (UNITED STATES ONLY)



TOTAL NUMBER OF HOUSING UNITS IS 48,463

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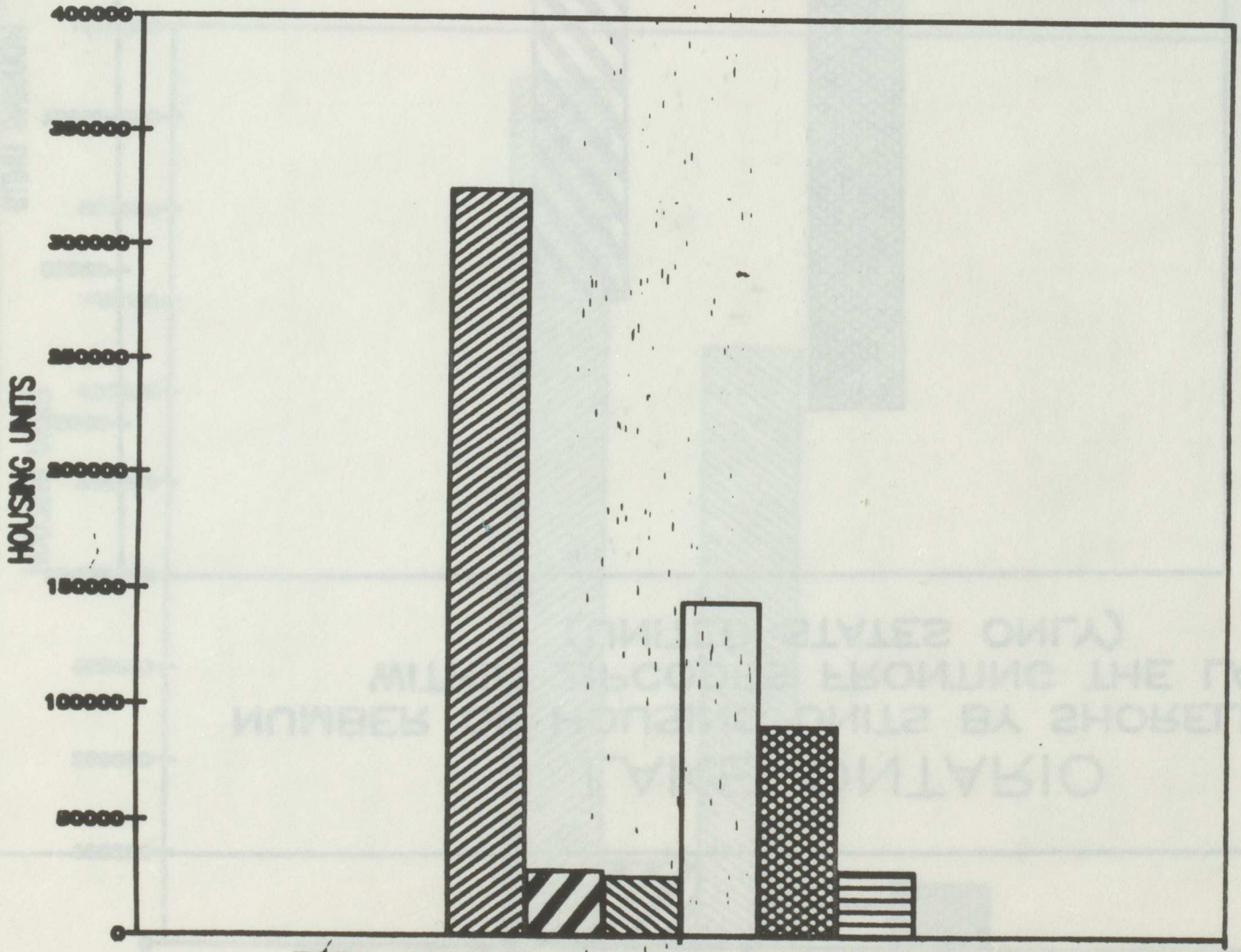
LAKE ERIE

NUMBER OF HOUSING UNITS BY SHORELINE TYPE WITHIN ZIPCODES FRONTING THE LAKE (UNITED STATES ONLY)



LEGEND

- ARTIFICIAL FILL
- WETLANDS
- PLAINS ERODIBLE
- HIGH BLUFF ERODIBLE
- LOW BLUFF NON-ERODIBLE
- OTHER

TOTAL NUMBER OF HOUSING UNITS IS 655,978

Source: 1980 Census of Housing

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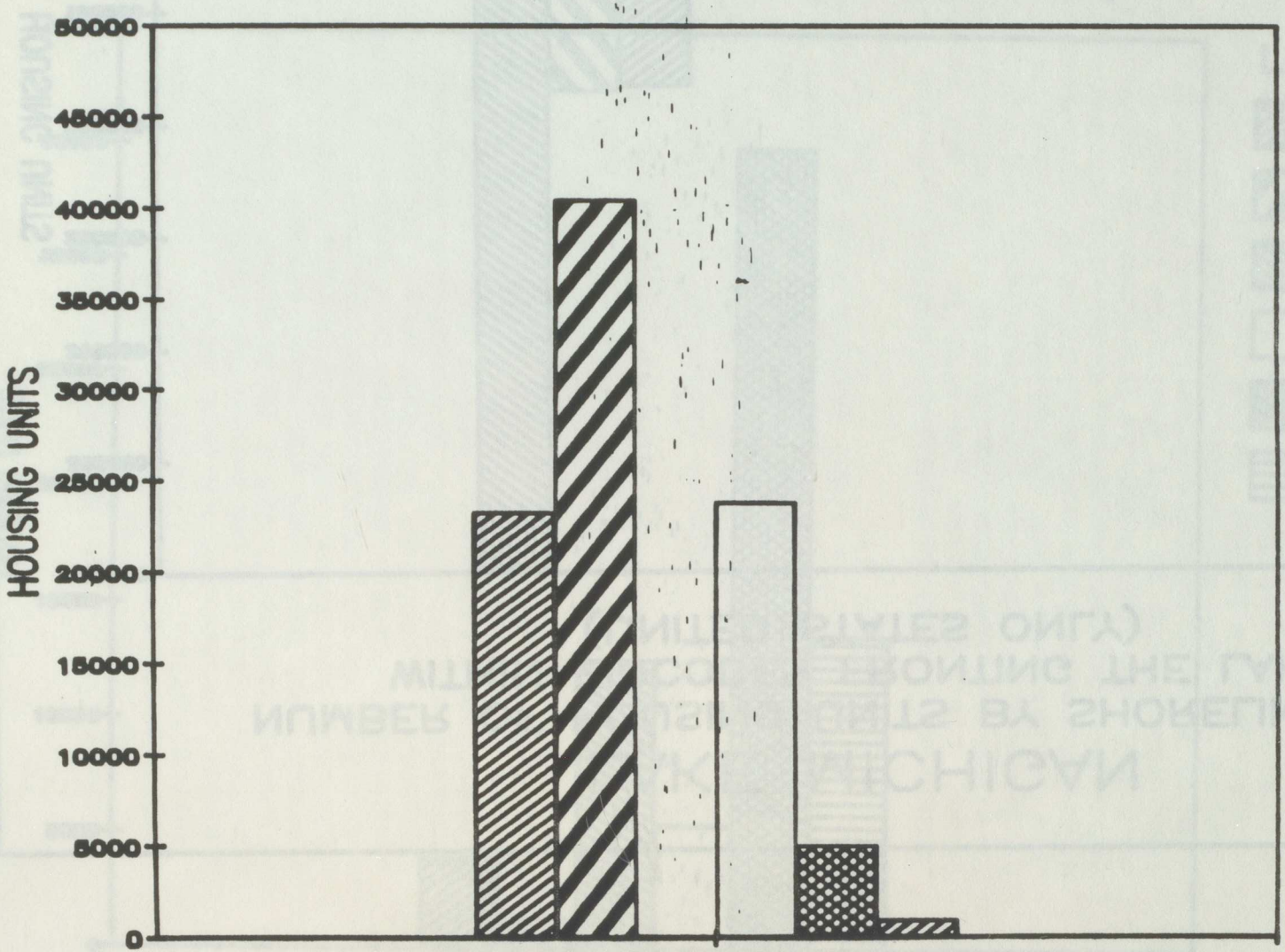
LAKE HURON

NUMBER OF HOUSING UNITS BY SHORELINE TYPE WITHIN ZIPCODES FRONTING THE LAKE (UNITED STATES ONLY)



LEGEND

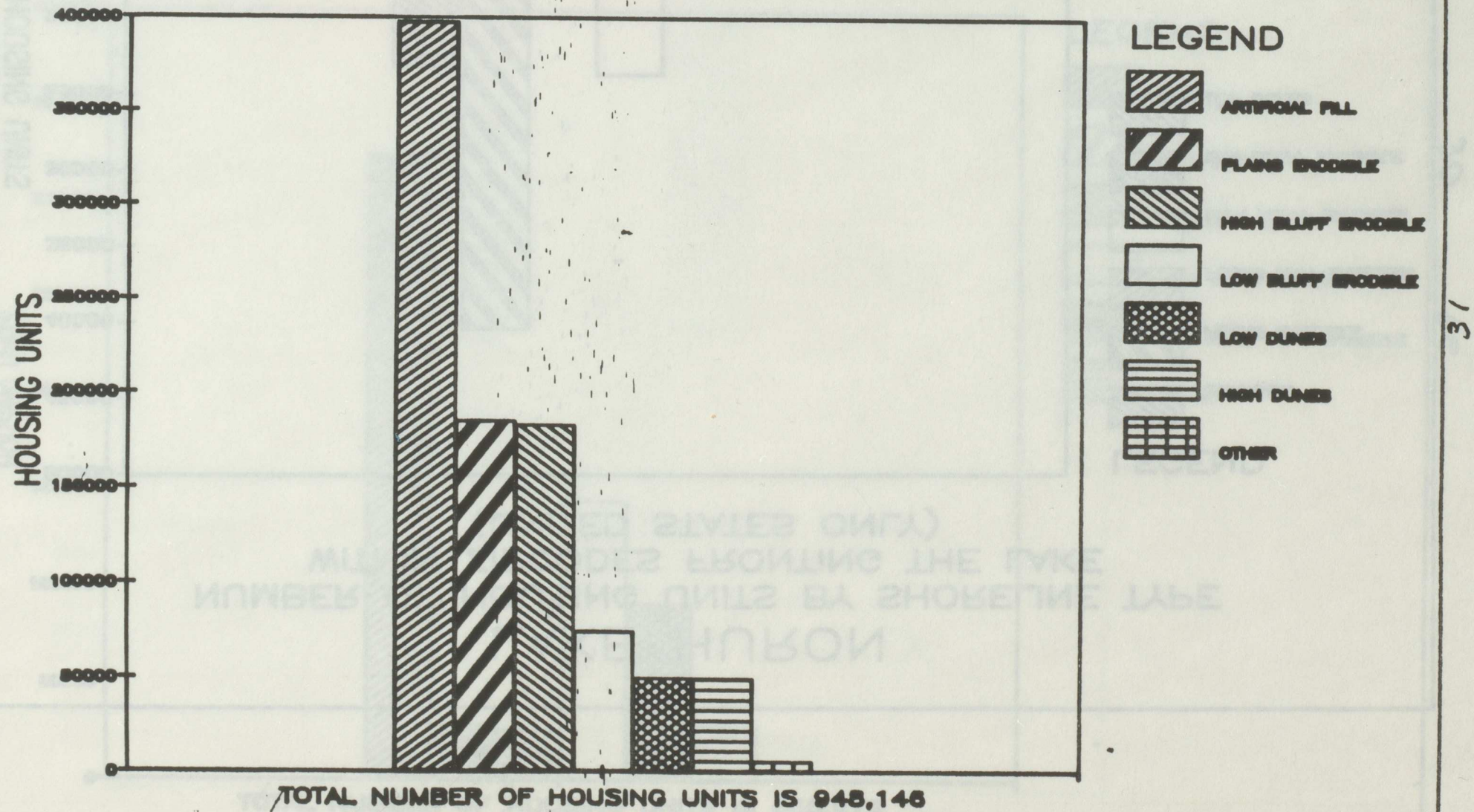
- WETLANDS
- PLAINS ERODIBLE
- PLAINS NON-ERODIBLE
- HIGH BLUFF ERODIBLE
- LOW BLUFF ERODIBLE
- LOW DUNES

TOTAL NUMBER OF HOUSING UNITS IS 93,610

30

LAKE MICHIGAN

NUMBER OF HOUSING UNITS BY SHORELINE TYPE WITHIN ZIPCODES FRONTING THE LAKE (UNITED STATES ONLY)

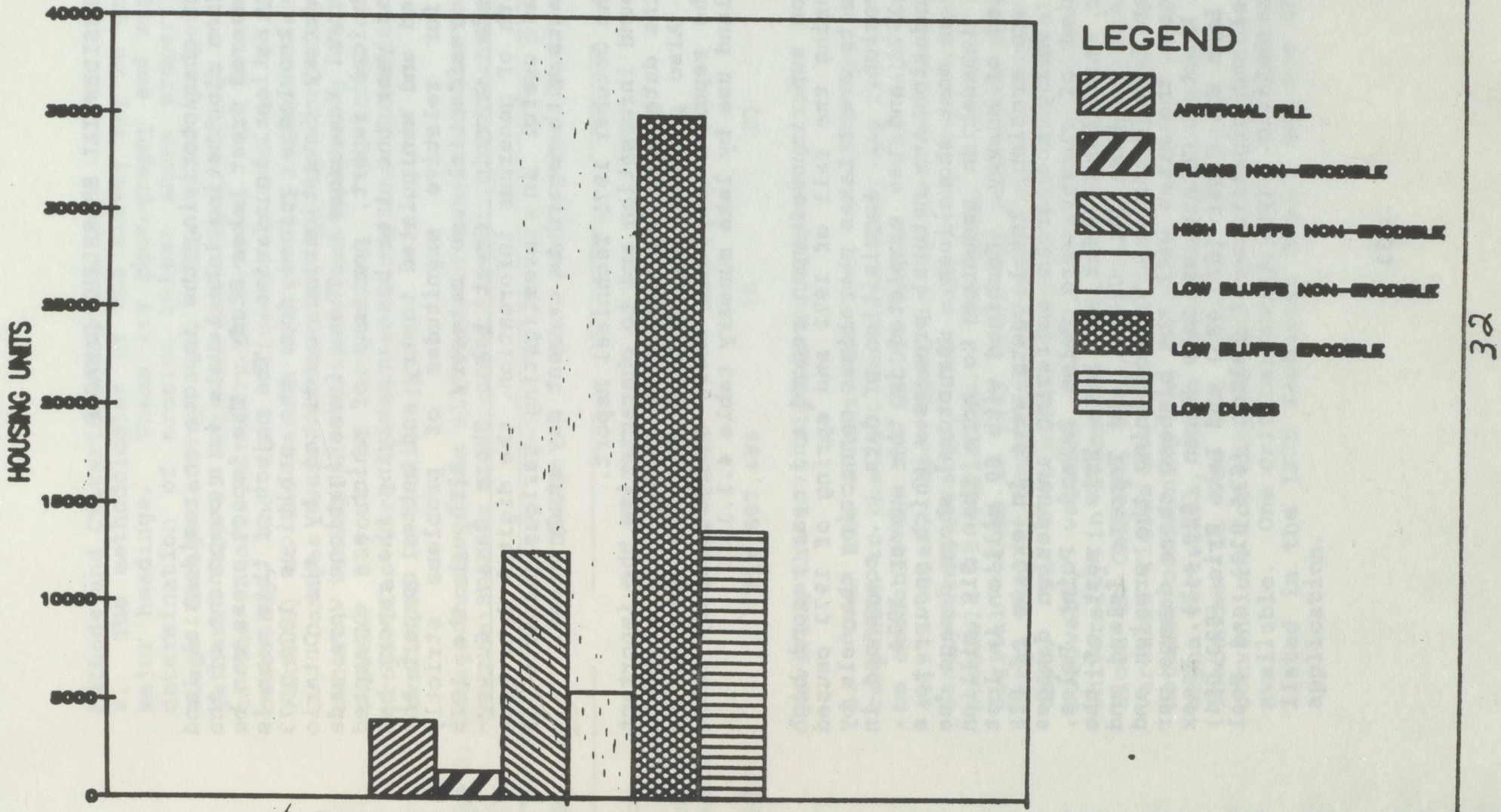


TOTAL NUMBER OF HOUSING UNITS IS 948,146

Source: 1980 Census of Housing

LAKE SUPERIOR

NUMBER OF HOUSING UNITS BY SHORELINE TYPE WITHIN ZIPCODES FRONTING THE LAKE (UNITED STATES ONLY)



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ONTARIO CANADA RESIDENTIAL SHORELINE DAMAGES

Introduction.

1. The task of characterizing the impacts on residential land use shoreline from fluctuating lake levels is a component of the current IJC sponsored Great Lakes Study. The impact areas can be separated out by national boundaries. The object of this memo is to present the knowledge gained from the ambitious 1972-1973 shore damage survey investigation conducted by the Ontario Ministry of Natural Resources. Those investigations were made part of a technical report, portions of which are excerpted below. This past year the data base underlying the report has been resuscitated and manipulated to try and better compare the impact areas for relative magnitudes of problems strictly concerning the residential use category. Although the 1975 report - Canada, Ontario, Great Lakes Shore Damage Survey- contains a wealth of generous information, the digital data base has also proved useful in investigating various aspects of residential impacts with regard to current day study needs.

Excerpts From The October 1975 Technical Report.

2. For background information and to characterize the important dimensions of the data base the following report text excerpts are provided. Also provided as table 1 in this memo is an excerpt from the report's regional shore damage summary table 4.2.1 and shoreland use by lake summary table 4.1.1.

Summary.

3. Storm action superimposed upon record and near record high water levels during the fall of 1972 and spring of 1973 caused extensive damage to Great Lakes shorelines connecting channels by flooding and erosion. ... Acquisition of data ... commenced in the spring of 1973 and was completed in the summer 1974. ... erosion and inundation are natural processes which occur, to a varying extent, on most shorelines. Structural shore damage due to erosion and inundation amounted to more than $19 million during the period of survey. Combined with $9 million in lost land value due to erosion, total costs were in excess of $28 million. ... Among the areas suffering inundation damages during the period of survey were Pelee Island, Point Pelee, Rondeau Harbour, and Long Point on Lake Erie, most of the Canadian shoreline on Lake St. Clair, and Toronto Island and Frenchman Bay on Lake Ontario. In combining the erosion and inundation damages, the areas with the highest shore damage per kilometer were Lambton County on Lake Huron ($20,447), Essex County on both Lake St. Clair ($75,488) and Lake Erie ($23,084) and the regional municipalities of Halton ($26,313) and Peel ($36,193) on Lake Ontario. (pp. ix).

Methods and Criteria of Survey.

4. The methodologies of the survey may be grouped under four major headings. These are photography and mapping procedures; determination of erosion rates; shore property inventory; and stage damage survey. ... The shore property inventory was gathered from 25 Regional Assessment Offices with the cooperation of the Ontario Ministry of Revenue. The data on land use, land ownership, and land value is stored in a mass data program (SAFRAS) at the Canada Centre for Inland Waters in Burlington. ... Damages were documented by interviewing shore property owners, taking photographs, and preparing sketches showing the overall layout of properties. A total of 8,439 damaged properties were identified along the shoreline and subsequently evaluated in detail. (p. x)

Table 1. Damage Summary from all Types of Lakeshore Use for Ont. Canada (Source: Tables 4.1.1 and 4.2.1 Oct. 1975 Technical Report)

LAKE	Total '72-73 Damage	SHORELAND Res. Perm	Res. Seas.	USE (%) Agr.	Vacant
Huron	$ 2,473,111	17	27	5	44
Clair	$ 4,219,851	36	3	23	13
e	$ 4,763,545	18	31	27	16
Ontario	$ 3,240,951	16	20	43	13
al	$14,697,458	18	23	28	22

Reviving the 1975 Digital Data Base.

5. Over the summer and fall of 1988 the digital data base companion to the 1975 Canadian study was retrieved and revived to be readable in IBM EBCDIC format. The data based consisted of 41,975 cases. Each case, in the revived format, consisted of 15 lines/cards/records, and each case held reference to over a possible 75 variables. The total data base measured in mere digital volume is very large for processing purposes, but not so large that it could not be dumped onto a single 9 track computer tape. The Statistical Package for the Social Sciences (SPSS) software, version 6.02B, available through Northwestern University in Evanston, Ill. and the through the Corps NCD offices in Chicago, Ill., was used to re-explore the data. Most variable fields were identified by variable name but no further details concerning the measured variable were available. For alpha variables, where coding conventions were employed, in many instances it was not possible to break the code. Coding conventions for many of the variable fields identifiable were not available. One critical exception is the land use code which was listed in the 1975 Technical Report and was thus available for application.

Damages to Residential Properties.

6. All variables on the data tape were profiled and the data base was pared to various pertinent layers of variables and cases. The listing below represents the case paring:

Case Definition	Number
Total All Cases	41,975
Total All Cases In Residential Use Category	30,327
Total All Cases Residential Permanent and Seasonal	27,285
Total All Cases Permanent Residential Str.'s Only	12,982
Residential Use Category Reporting Damage	5,067
Residential Permanent and Seasonal Reporting Damage	4,885
Residential Permanent Structures Reporting Damage	3,797

Table 2 and Table 3 provide a listing of the cases by county for the six residential layered populations listed above. Of individual shoreline uses 72 percent are considered residential land use; 65 percent are considered permanent or seasonal residential structures; and 31 percent are considered permanent structures. Of all properties with residential structures more than 17 percent reported damage in '72-'73. Of all properties with permanent residential structures more than 29 percent reported damage in '72-'73. Figure 1 represents the distribution of the 30,327 lakeside Ontario residential parcels by lake. All residential parcels along the St. Lawrence River, 2,540 (e.g. county codes 1,4,5,7,8); and 266 residential parcels along Lake Huron's Georgian Bay north of Port Severn (e.g. county codes 44), were apparently not a part of the shore damage survey although they form part of the land use designations and record load in the digital data base.

Table 2. Summary of Cases and Damages For Residential Designated Real Estate as Recorded on the Data Base Companion to the October 1975 Report: Canada - Ontario Great Lakes Shore Damage Survey Technical Report.
Number of Cases: All Properties Which Are in Data Base

County Name	County Code	Permanent + Seasonal + Vacant	Permanent + Seasonal Structs.	Permanent Structs. Only
TOTALS:		30327	27285	12982
ESSEX	37	4937	4005	3867
SIMCOE	43	3607	2950	2706
BRUCE	41	2478	2424	121
HALDIMAND	28	2199	2075	204
PRINCE ED	13	1888	1494	652
LAMBTON	38	1543	1462	713
LEEDS	8	1541	1495	337
HURON	40	1422	1403	16
GREY	42	1323	1236	267
NIAGARA	27	1282	1264	232
LENNOX AD	11	1031	979	366
KENT	36	916	878	252
FRONTENAC	10	909	882	362
NORTHUMBE	14	739	666	207
NIAGARA	26	630	554	480
HALTON	24	613	566	517
GLENGARRY	1	561	533	149
YORK	19	522	481	455
HAMILTON	25	439	398	326
GRENVILLE	7	349	322	152
HASTINGS	12	265	221	189
MUSKOKA	44	263	191	4
ELGIN	34	241	234	47
PETERBORO	17	201	181	51
DURHAM	18	197	183	128
PEEL	21	130	119	119
DUNDAS	5	45	39	25
STORMONT	4	44	39	34

Table 3. Summary of Cases and Damages For Residential Designated Real Estate as Recorded on the Data Base Companion to the October 1975 Report:
Canada - Ontario Great Lakes Shore Damage Survey Technical Report.
Number of Cases: All Properties Which Are in Data Base And Which Responded With a Positive Damage Estimate

County Name	County Code	Permanent + Seasonal + Vacant	Permanent + Seasonal Structs.	Permanent Structs. Only
TOTALS:		5067	4885	3797
ESSEX	37	2413	2303	2284
HALDIMAND	28	482	468	55
LAMBTON	38	310	308	192
HALTON	24	299	293	290
HAMILTON	25	258	253	243
KENT	36	198	198	47
YORK	19	195	179	167
NORTHUMBE	14	137	133	49
SIMCOE	43	113	105	105
HURON	40	102	102	0
NIAGARA	26	93	88	86
PEEL	21	91	88	88
GREY	42	87	85	24
LENNOX AD	11	73	72	47
FRONTENAC	10	59	55	49
DURHAM	18	47	47	35
BRUCE	41	39	39	3
NIAGARA	27	20	20	9
PETERBORO	17	20	20	13
PRINCE ED	13	17	15	6
ELGIN	34	10	10	1
HASTINGS	12	1	1	1
MUSKOKA	44	0	0	0
LEEDS	8	0	0	0
GRENVILLE	7	0	0	0
DUNDAS	5	0	0	0
STORMONT	4	0	0	0
GLENGARRY	1	0	0	0

Residential Damage Incidence Not Distributed by Development Location

7. An interesting distinction is apparent when the total number of cases by county (figure 2 corresponds to the middle column of table 2) are compared to the number of cases reporting damage (figure 3 corresponds to the middle column of table 3). Figure 4 presents this comparison for counties sorted by cases reporting damage. As these figures demonstrated, when the data base is defined geographically by county boundaries there is not a strong correlation between the number of residential permanent and seasonal structures in a county and the number of residential permanent and seasonal properties having been damaged. A comparison of the damages reported from residential parcels compared to the total number of residential parcels by lake is presented as figure 5. The number of residential parcels is shown not to be a good indicator of the distribution of damage incidence.

Residential Damages Associated with Permanent and Seasonal Structures.

8. Working with the 4,885 cases in the "residential permanent and seasonal reporting damage" category, total damages reported sum to $10,672,461. This is 73% of damages reported for the entire Ontario Canada Survey as listed in table 1. For those cases reporting damages the case count and damage totals by lake are shown in table 4. No price adjustment have been attempted. Price levels are those reported in 1973-74 for 1972-73 occurrences. Figures 6, 7, and 8 depict the data in table 4 in graph form for mean damage, case count, lake damage, respectively. Figure 9 shows that for all specified damage by residential cases, structure damage is the greatest component 42.4%, followed by landscape damage 36.5%, and contents damage 21.1%. However, these three categories together total less than 25% of the total residential damage reported: another 78.5% of the residential damage total ($10,672,451) is not specified as indicated by figure 10.

Table 4. Damage Summary from all Permanent and Seasonal Residential Lakeshore
Use for Ont. Canada for the 1972 and 1973 Season.
(Source: Digital Data Tape From the Oct. 1975 Technical Report)

Lake	Total Damage	Cases	Mean Damage
Huron	$ 2,851,042	636	$ 4,483
St. Clair	$ 3,140,143	1346	$ 2,333
Erie	$ 2,767,576	1635	$ 1,693
Ontario	$ 1,722,952	1132	$ 1,522
Total	$10,672,451	4749	$ 2,185

Note: A number of cases reporting damage, 136, were not identified by lake.

ONTARIO CANADA – LAKESIDE RES. PARCELS

TOTAL CASE TYPE RESIDENTIAL = 30,327

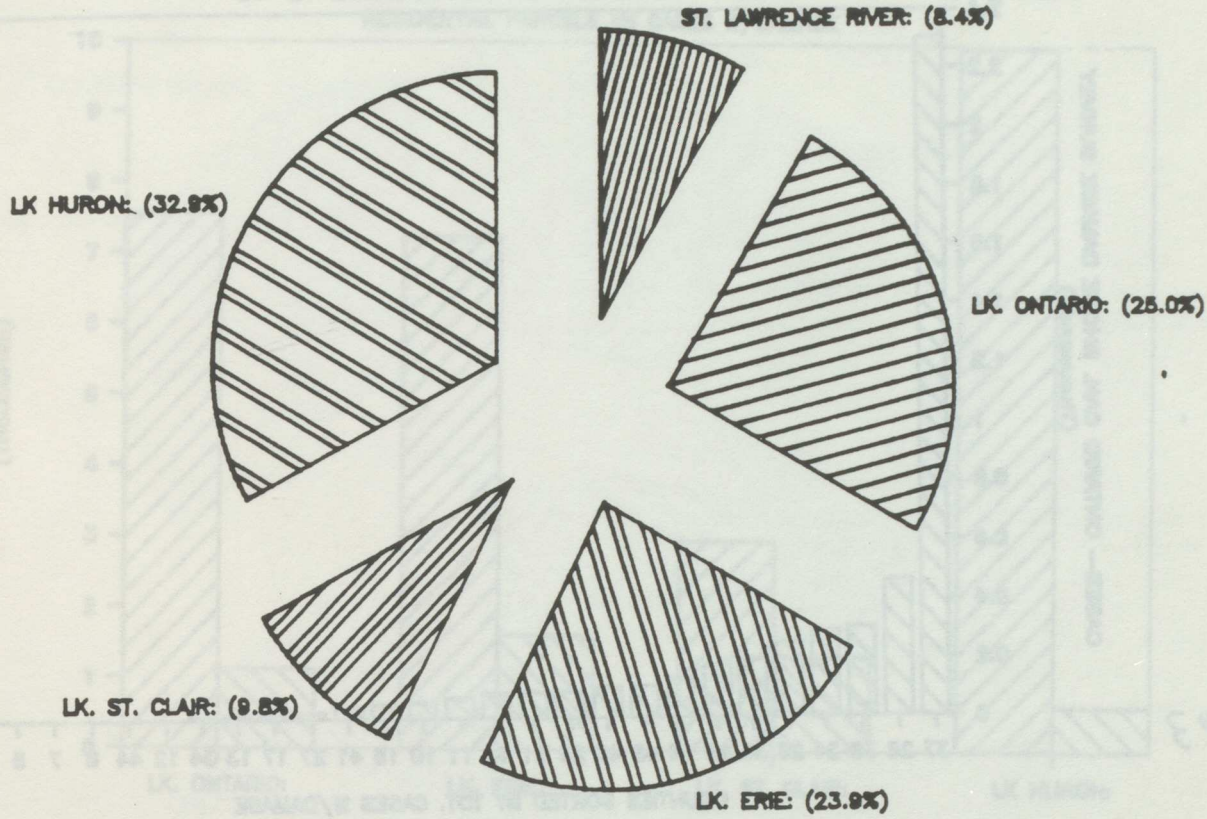

FIG #1

ONTARIO CANADA RESIDENTIAL STRUCTURES

TOTAL CASES PERMANENT AND SEASONAL

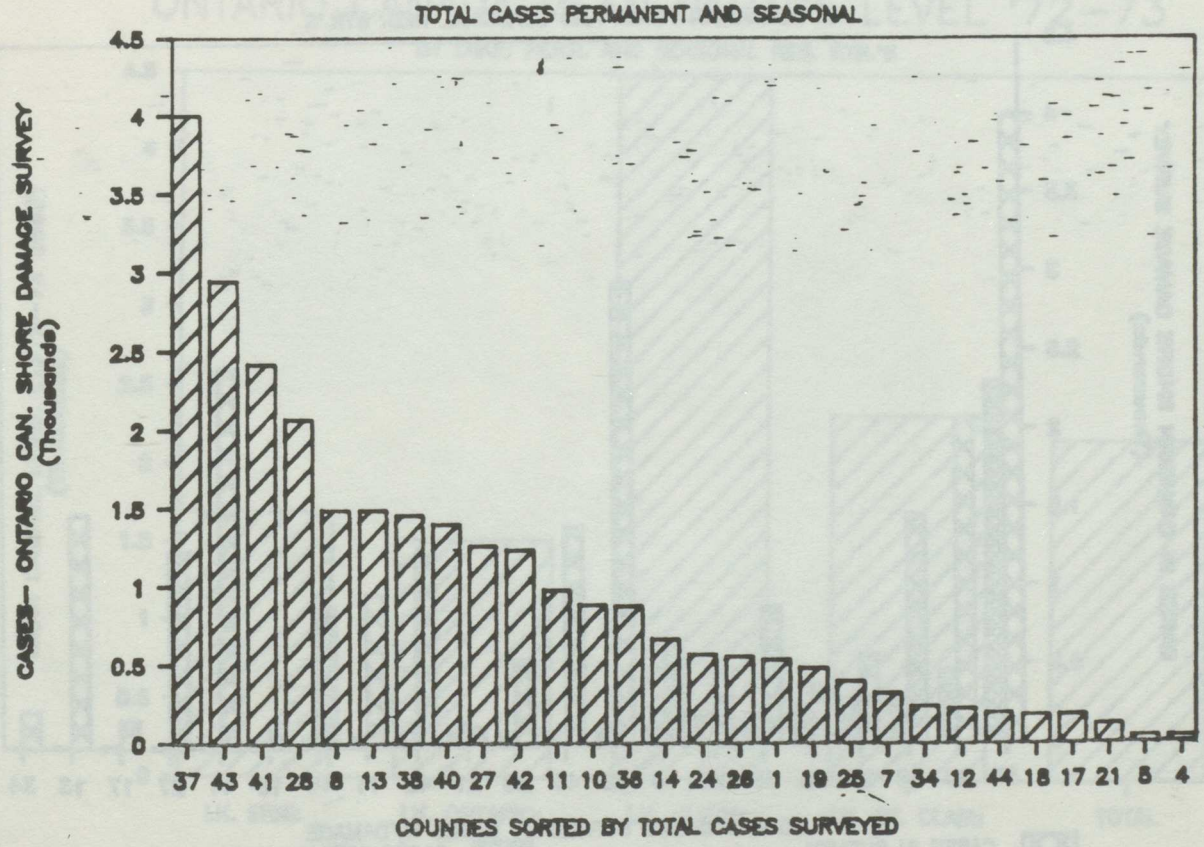

FIG #2

ONTARIO CANADA RESIDENTIAL STRUCTURES

CASES PERMANENT AND SEASONAL '72-'73

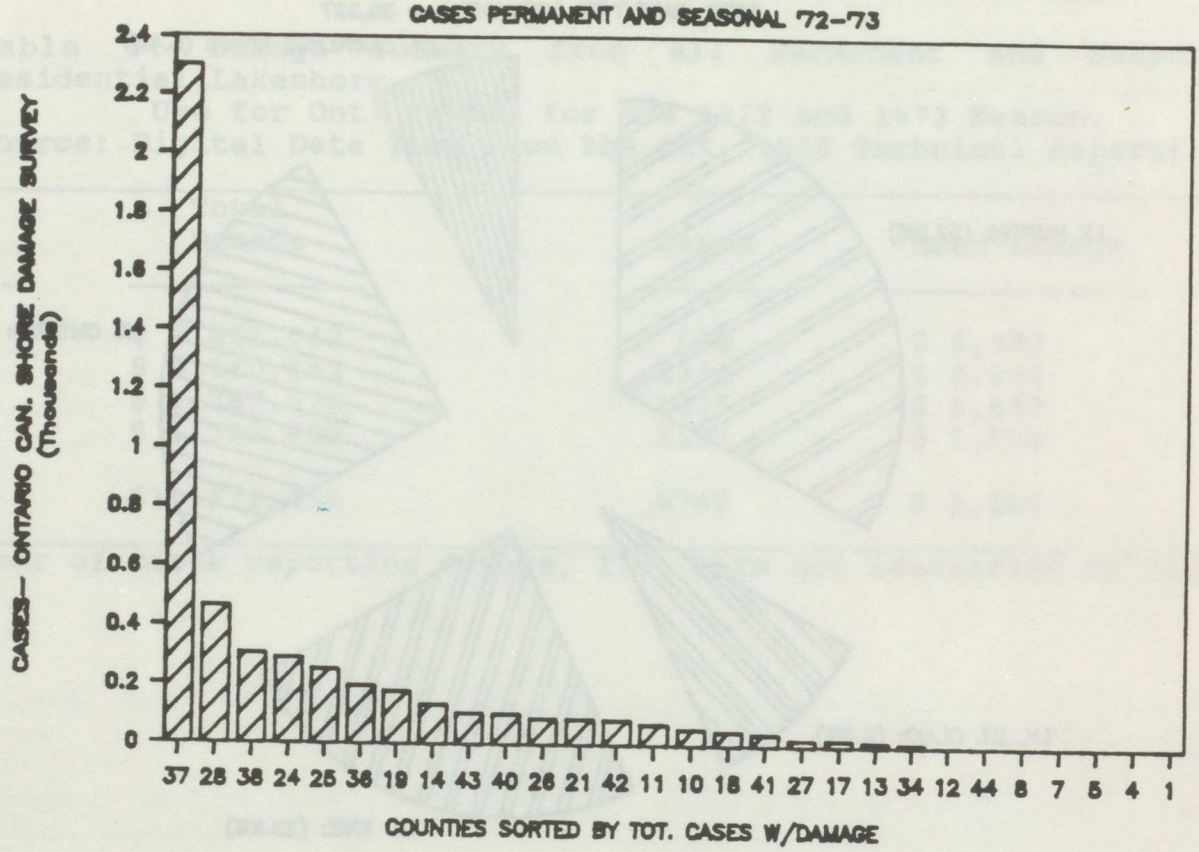

FIG #3

INCIDENCE OF REPORTED DAMAGES

CANADIAN PERM. AND SEASONAL RES. STR.'S

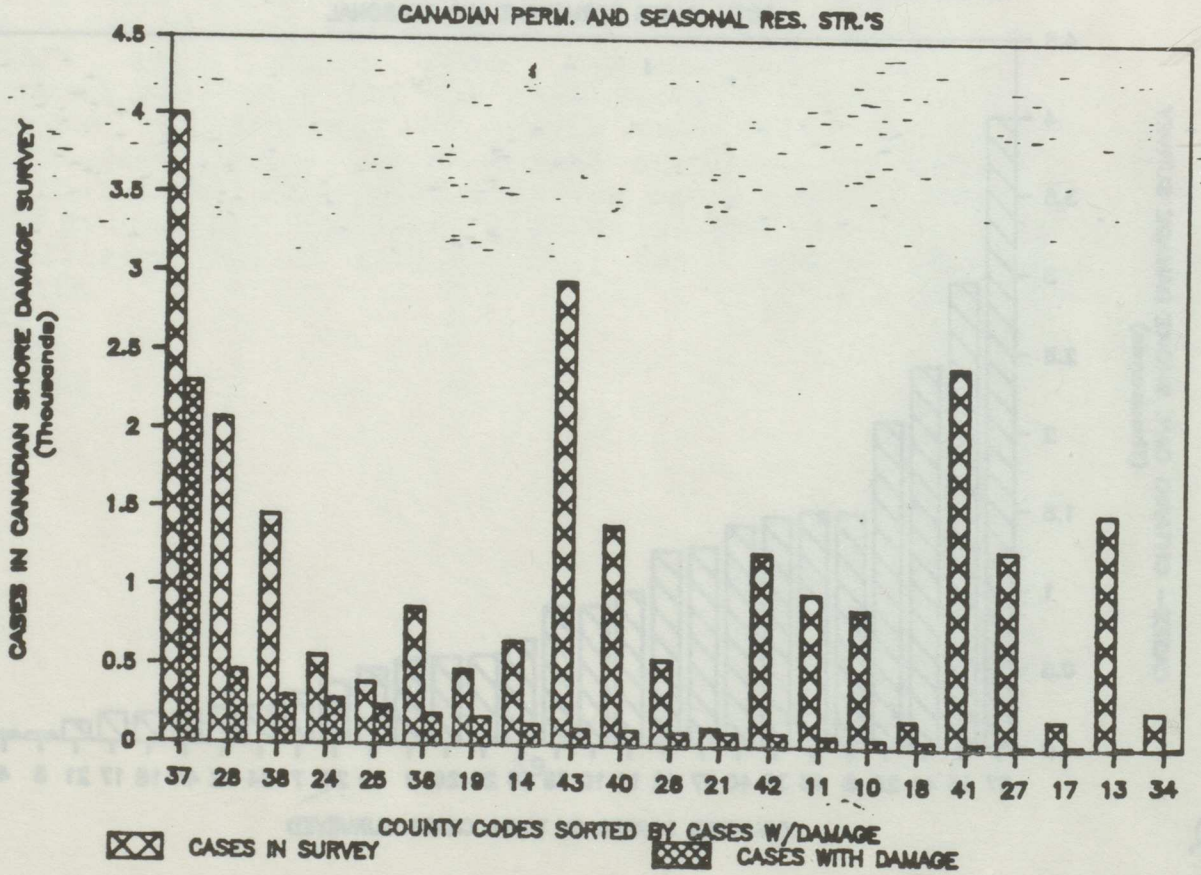

FIG #4

ONTARIO CANADA – LAKESIDE RES. PARCELS

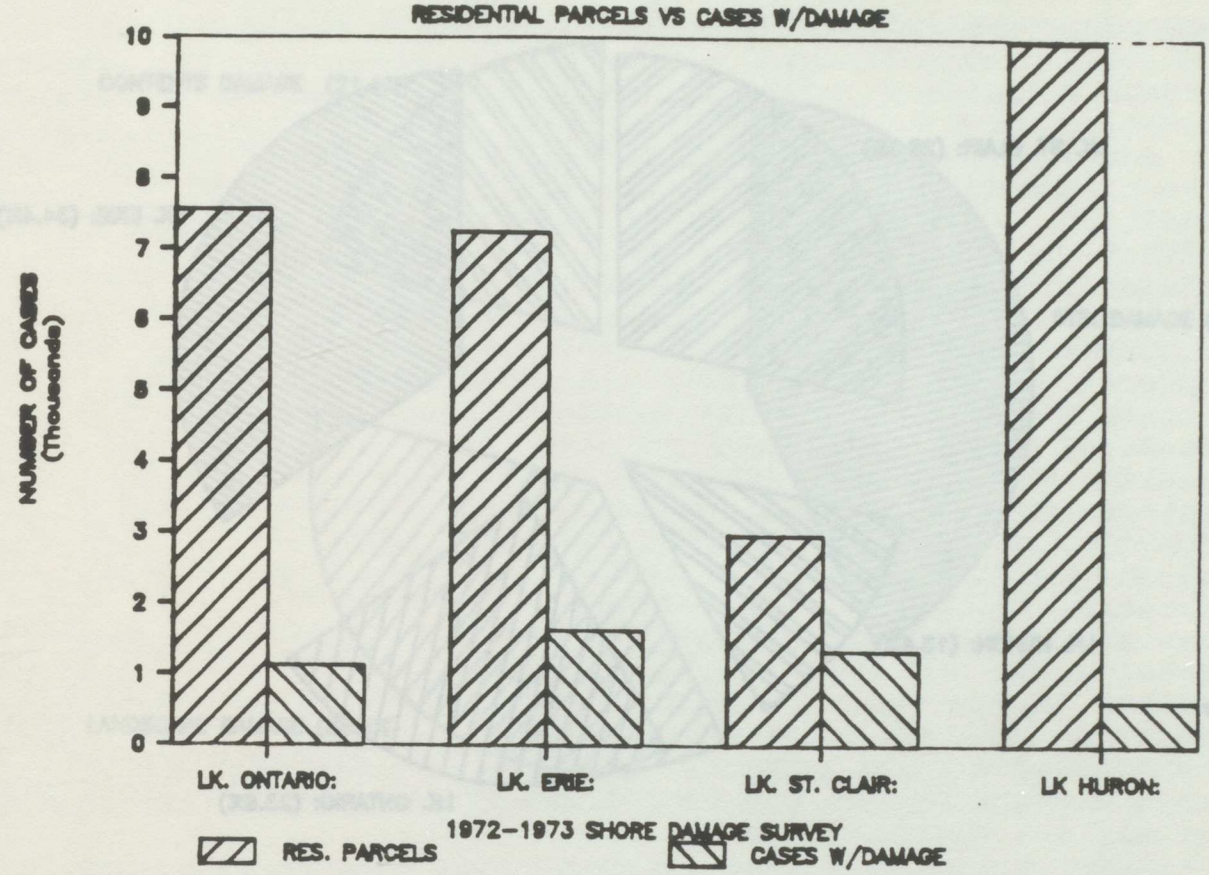

FIG #5

ONTARIO CANADA MEAN DAMAGE LEVEL '72–73

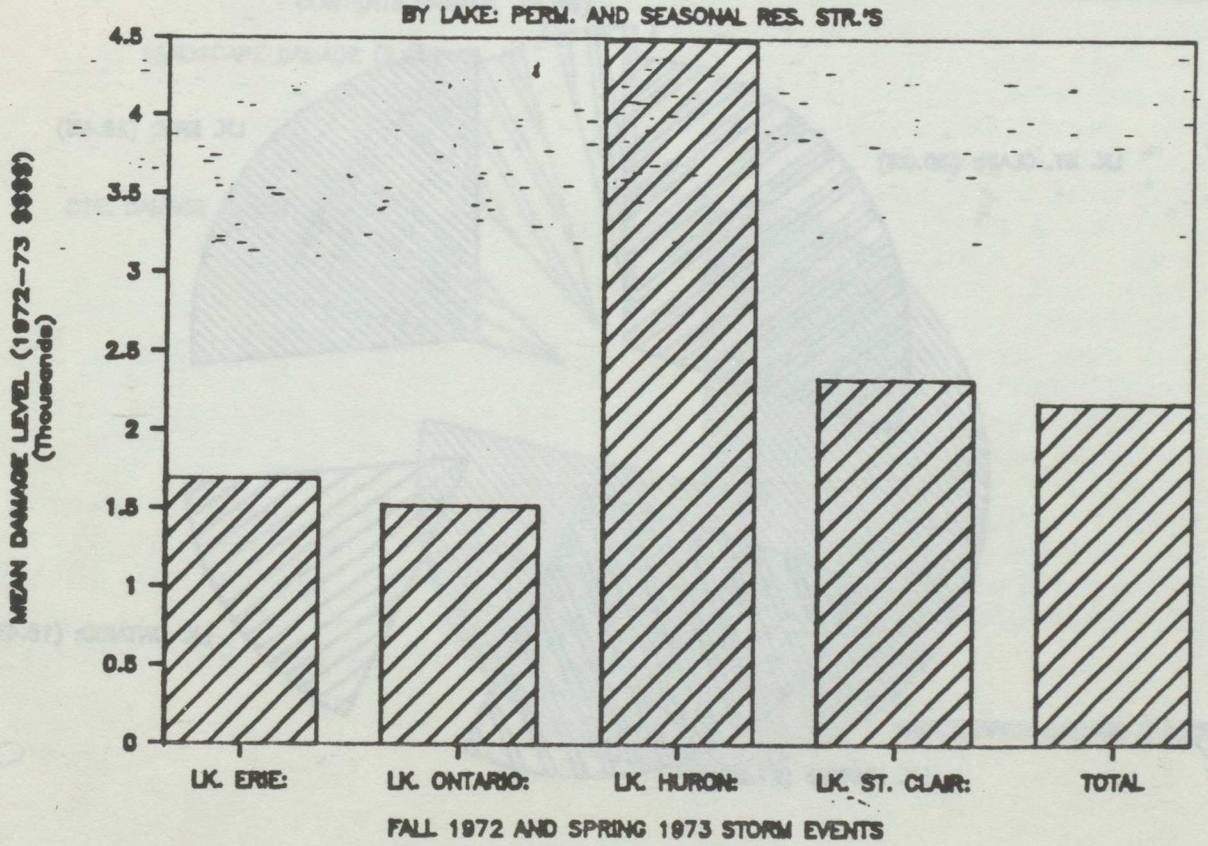

FIG #6

ONTARIO CANADA CASES OF DAMAGE '72–'73

TOTAL RESIDENTIAL CASES W/DAMAGE: 4,885

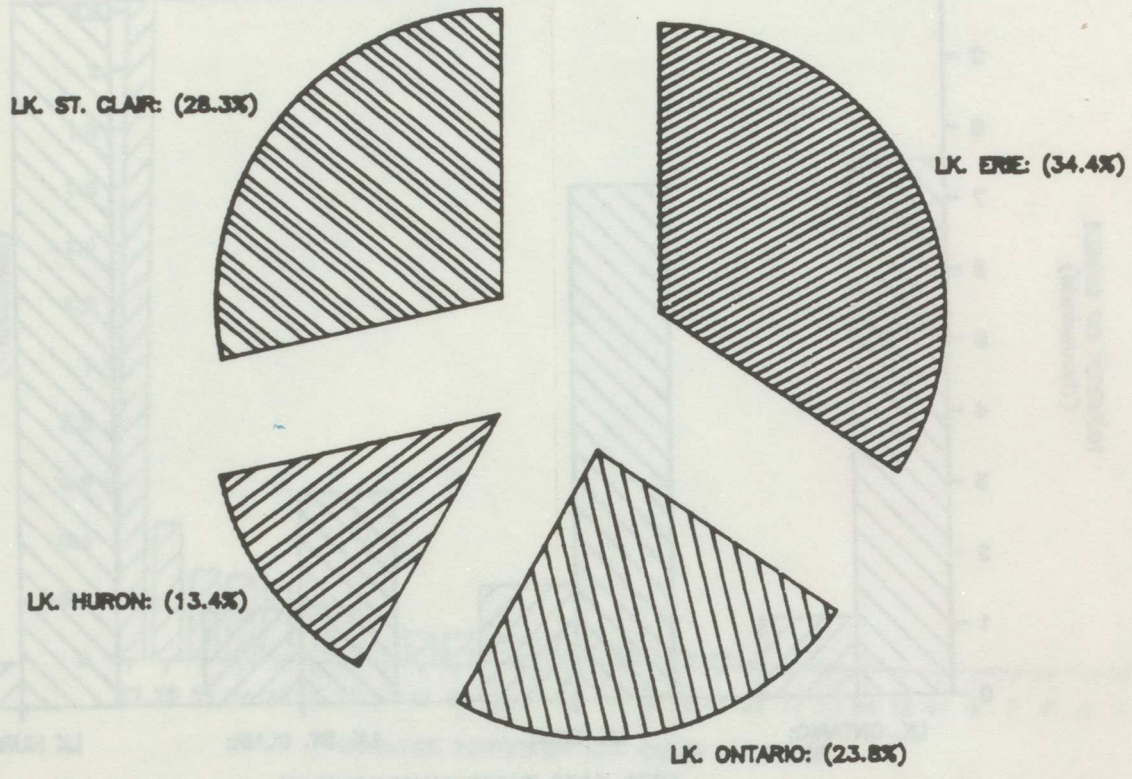

FIG #7

ONTARIO CANADA REPORTED DAMAGES '72–'73

TOTAL RESIDENTIAL DAMAGES: $10,672,481

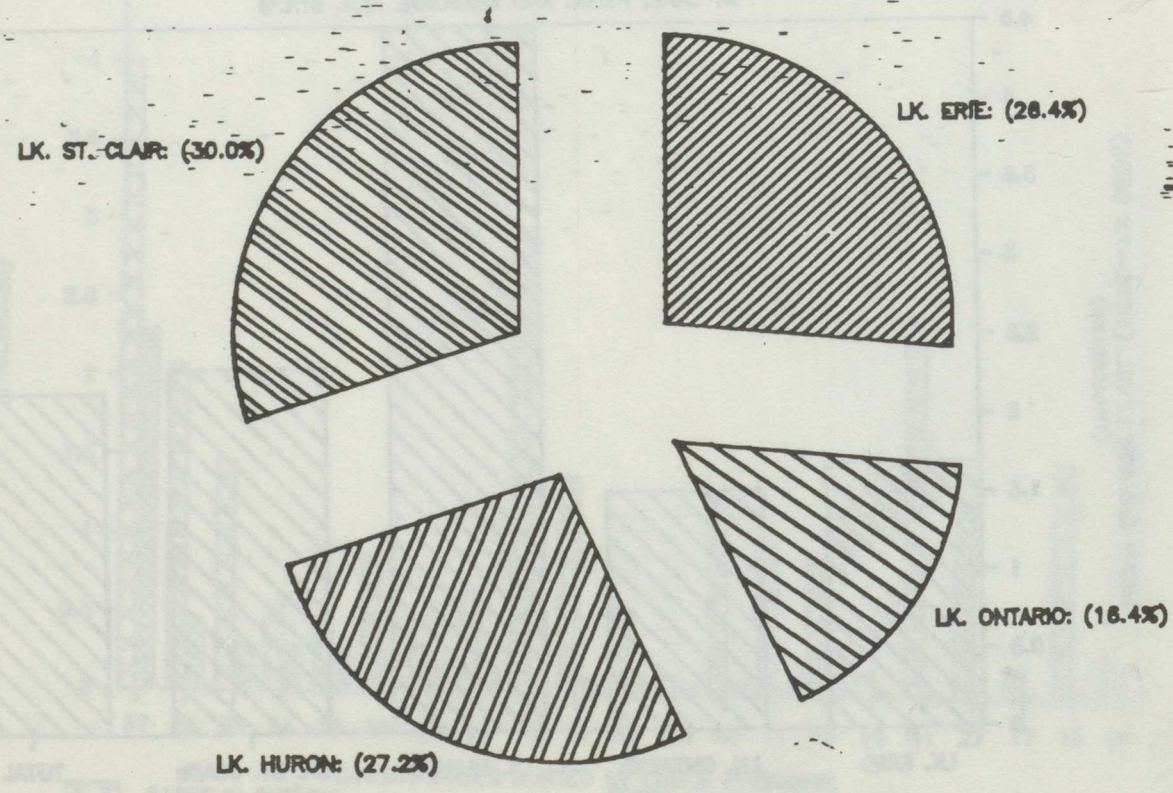

FIG #8

ONTARIO CAN. – SPECIFIED DAMAGES '72–73

TOTAL SPECIFIED DAMAGE = $2,297,816

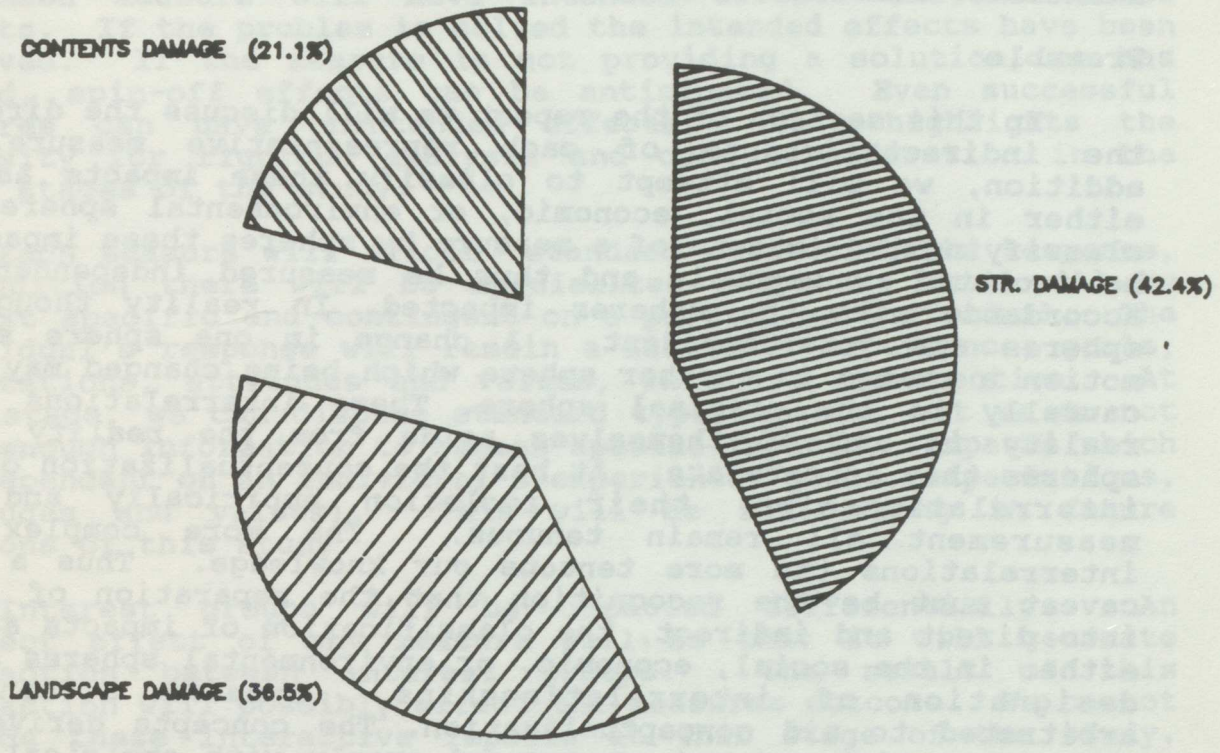

FIG # 9

ONTARIO CAN. $10,672,461 DAMAGES '72–73

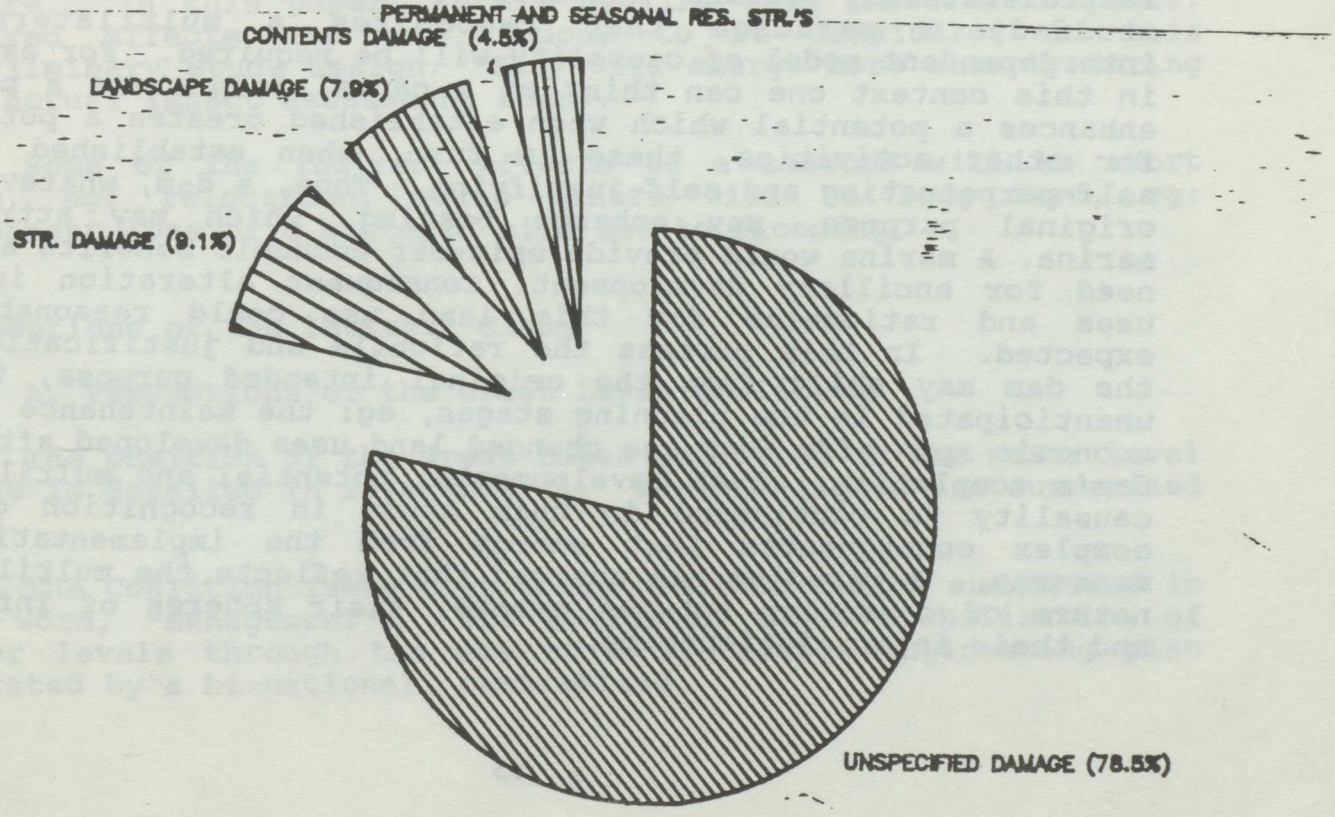

FIG # 10

IMPACTS OF MEASURES ON RESIDENTIAL PROPERTY OWNERS

Preamble

In this section of the report we will discuss the direct and the indirect impacts of each representative measure. In addition, we will attempt to classify these impacts as being either in the social, economic, or environmental spheres. By classifying the impacts of a measure by spheres these impacts may be isolated conceptualy and thus be measured independently in accordance with the spheres impacted. In reality though such spheres are interdependent. A change in one sphere sets in motion a change in another sphere which being changed may relate causally to the original sphere. These interrelations have a reality in and of themselves aside from the reality of the spheres they interrelate. At best the conceptualization of these interrelationships, their isolation empirically and their measurement all remain tenuous. The more complex these interrelations the more tenuous our knowledge. Thus a strong caveat must be the recognition that the separation of impacts into direct and indirect, the classification of impacts as being either in the social, economic, or environmental spheres and the designation of interrelationships remains a convention arbitrated to aid conceptualization. The concepts derived from this convention may not correspond evenly with empirical events or reflect their complexity.

Because a paradigm utilizing a unilateral, or unidirectional model of causality fails to capture the essentially complex and multidirectional causal connections inherent in the reality studied, a paradigm that recognizes a multilateral or interdependent model of causality will be required. For example, in this context one can think of a causal loop where a measure enhances a potential which when established creates a potential for other activities, these in turn, when established become self-perpetuating and self-justifying. Thus, a dam, whatever its original purpose, may enhance boating, which may attract a marina. A marina would provide spin-off economic benefits and the need for ancillary development. Consequent alteration in land uses and rationales for this land use could reasonably be expected. In this process the rationale and justification for the dam may shift from the original intended purpose, to one unanticipated in the planning stages, eg: the maintenance of the economic spin-offs from the changed land uses developed after the dam's completion. Such developmental potential and multilateral causality is considered in this study in recognition of the complex consequences that emerge from the implementation of measures. A paradigm has emerged that reflects the multilateral nature of causation between events, their spheres of influence and their interrelationships.

Each measure will have intended effects and unintended effects. If the problem is solved the intended effects have been achieved. If the measure is not providing a solution, or has failed, spin-off effects can be anticipated. Even successful measures can have unintended effects. This highlights the necessity for rigorous analysis and open consideration in the early stages of the study.

Each measure will elicit standard or predictable respones, in addition there will be specialized responses that will be context specific and contingent on a particular individual. The individual's response will remain a factor of experience, goals, expectations, attitudes and values, in short, perspective. At this stage, we can discuss standard type impacts, but we do not have enough information to assess special impacts, (impacts which are dependent on an individual's experience, goals, expectations, attitudes and values). This will be forthcoming in future versions of this study.

Interest groups will be impacted differentially. An indirect effect of any measure will be that it will generate interaction between interest groups. The result of this interaction will possibly affect the measures outcome. We cannot include these interactive impacts at this stage of the study. Perhaps the coordinators can deal with these impacts.

Each measure will have immediate consequences but because of the complex web of interacting forces that a measure sets in motion there will be consequences that will only emerge in the future. In this paper, we are dealing with immediate impacts. Delayed effects are too tenuous to be considered in this prelilminary study design. They will emerge more clearly during the actual impact assessment study.

Some of the indirect effects of a measure will be short term, eg: relocation, while others will be long term, eg: permanent loss of a historic site due to flooding.

Perceptions of the Interest Class

a. Perceptions of the Great Lakes Coalition.

The position of the Great Lakes Coalition on the water level issue is detailed in reference 11. The highlights are summarized here.

The Coalition feels that their position can be summarized in one word, "management". The Coalition wants stabilization of water levels through the use of a systematic engineering plan operated by a bi-national, centralized,

management entity. They see this as a basic requirement for a reasonable and permanent solution to the flooding and erosion problems which they attribute to high water levels as well as the losses due to low water levels.

The coalition also wants to preserve and enhance the natural environment of the Great Lakes and the basin. Other objectives are to inform, cooperate with, and support governmental entities concerning matters of water levels, and to promote understanding and relief for private and public shoreline interests who have suffered or are threatened with property damage.

This is a strong, deeply held position. It stems from the emotional and economic lossses which many riparians suffered during the recent high water period. Coalition members feel that they are (unfairly) being expected to bear the loses or to do expensive things like relocate buildings and put in shore protection structures. They also feel that even these actions won't protect them if water levels become higher than they were in 1986.

Another tenet of their position is that decisions relating to water levels need to be fair and equitable. The Coalition feels that this hasn't always been the case in the past. They cite instances where, in earlier IJC studies, in the evaluation of measures, lakeshore property owners, communities, and municipalities were considered to be expendable. Profits to businessses using the lakes were used in the cost/benefit analysis to offset losses of their homes and life savings to riparians. The Coalition wants to ensure that future analyses include true shoreline values and human values.

The Coalition is critical of the existing government policy of "proper land use planning and public information." They view this as a poor and unacceptable substitute for water level controls.

The Coalition 's position on shore protection structures (Type II mesures) is that they have a place in the shoreline management process. However, they believe them to be futile and unacceptable in the absence of lake level management. These Type 11 measures offer no real and long term protection against erosion and flooding. They need constant attention and replenishment. They think that moving buildings back is even worse than building shore protection structures, and see this also as a temporary mesure if water levels go higher.

The Coalition is against diversion of Great Lakes water to other basins.

2. Water level fluctuations and ships have aggravated shoreline erosion on their property.

3. Long term water level increses and stabilization caused by the dam have changed water weeds, march plants, and fish species in some areas of the Akwesasne.

4. Scouring and depositional areas have changed with the practices of regulating the Seaway water levels. This has implications for toxic sediments and for fish spawning beds.

5. Actions by the governments to rectify the problems have been uneven and this is a problem for the Akwesasne who straddle the Canada/US border.

6. There is a risk of catastrophe for the Mohawk people if there were an oil or chemical spill, or an earthquake.

7. Property damage to docks and boathouses is a serious problem because these people use the river as a road for transportation.

8. Economic development project on Stanley Island and other Mohawk Islands would be seriously hurt by water level fluctuations, and this treatens their economic self-reliance.

This position paper also contains 5 recommendations:

1. A native representative should be included on the Taskforce to ensure that the native perspective is included.

2. All existing regulations regarding Great Lakes Water levels should be left alone, since we can only deal with minute sections of the system at a time. Any problems such as erosion and shoreline protection should be dealt with by the appropriate government agency since the Great Lakes system has been seriously modified by these governments. It is their responsibility to fix the damages, not destroy the whole system.

3. A long term effort to understand the whole aspects of water levels, flows, and live components of the Great Lakes Ecosystem must be seriously funded in order to regulate and maintain the system. At present, miniscule amounts of money are given to basin wide research effort. Each country duplicates scientific effort to the detriment of understanding the system.

4. Immediate action is necessary to identify areas susceptible to flooding and other forms of water level damage and where appropriate remove the offending activity. Public access areas to lake and river fronts susceptible to water level damage may enhance public appreciation of this resource.

5. Areas of Concern/Areas of Interest. The IJC has identified contaminated Areas of Concern which are to be fixed. The water levels task force should be identifying Areas of Interest that should be protected from unacceptable water level modifications. All the Great Lakes wetlands are seriously affected by water level changes. While Areas of Concern are reactive, Areas of Interest could be proactive.

At a Group Depth Interview on July 20, the Mohawk people of Akwesasne reacted positively to Types 11-V measures. Although not against Type 1 measures, they felt that the impacts of existing regulatory structutres and regulation of water levels needed to be better understood before man further modifies the water level regime of the Great Lakes system.

It has come to be realized by FG3 that the Native Peoples constitute a unique situation. Their culture, which predates history, relies essentially on an intimate oneness with Nature which includes, of course, rivers and lakes. Unlike our culture, based as it is on Judaic-Christian precepts, their culture does not make a distinction between Nature and the Sacred. Consequently their relationship with Nature has always been one of profound respect and intimacy. In a very real sense, then, they were the first conservationists and ecologists. Any issues pretaining to fluctuations and measures remains central to their intimate relationship with Nature. Thus, it has been decided to include them with the Governments work group rather than make them a sub-group within the riparian interest class. While being consistent with how they see themselves this should also insure that their unique situation is given a clear and fair elaboration.

c. Perceptions of a Random Sample of Cdn. Riparians.

A random sample of 222 shore property owners on the Canadian lower lakes was interviewed in December 1986 (Sudar, 87). The majority of this group (53%) supported water level regulation as the most effective action that governments could take to alleviatye the problems of fluctuating water levels. 21% suggested shore protection, and 6% suggested both water level regulation and shore protection. No property owners suggested shoreline management as an appropriate action.

PROFESSIONALS PERCEPTIONS OF MEASURES

Type I Measures.

Public investment in control and diversion works. Representative measures are: 1. full regulation of Lake Erie; and 2. Interbasin diversions. These measures are intended to reduce the range of water level fluctuations.

The two nations have had different patterns and densities of shoreline development and have had a different history of dealing with the "victims" of shoreline events. The U.S. has had the larger amount of shoreline development as well as a greater degree of urbanization associated with its this development. In addition, the U.S. has had one influential organization, the U.S. Army Corps of Engineers, associated with the building and maintenance of shoreline structures. Canada, and the two associated provinces, have had relatively less shoreline development with the building and maintenance of structures having been undertaken by a number of federal departments, (eg: Agriculture Canada & Environment Canada). Rather than being organizations with a mandate to build and maintain structures these departments deal with a wide range of factors under a central umbrella concern. Further because two nations and two distinct cultures are involved any control or diversion works that involves the two nations, or any analysis of such works, will involve two very different perspectives concerning the environment, the use of control structures and the responsibility of government to its citizens. Generalizing, we can say that the U.S. has historically favoured control structures combined with aid and insurance whereas Canada has tended to offer a minimum of aid and to favour prevention, (eg. the Flood Damage Reduction Program). (see Hartmann, Karsten, Shoots, "Type IV Measures" for a fuller treatment).

Compressing the range of water levels might reduce the impacts of both high and low water levels on riparians. It should be noted here that many of these impacts are not entirely attributable to fluctuating water levels. Therefore, even at constant water levels, some of these impacts would still occur. Potential and perceived impacts of high water levels which might be reduced by Type I measures are:

1. Shoreline erosion. This includes loss of land, loss of trees, shore protection structures, stairways, and in the extreme, loss of buildings as their foundations are undermined and they eventually fall into the lake. However, the relationship between water levels and erosion rates is not as simple as: lower water levels mean less erosion. In some cases, with particular shore types, this may be true, while in other cases erosion will continue over the long term regardless of whether the lake levels are high, low, or average. Forty percent

of the shoreline of the lower Great Lakes is classified as cohesive shorelines. These shorelines are formed in glacial, glacio-fluvial, and glacio-lacustrine sediments, and most of this is characterized by steep bluffs, narrow beaches of coarse sand and gravel, and rates of bluff recession that commonly range from 0.5 m.\yr to over 1.0 m/yr. And with this type of shoreline, erosion rates are independent of water level fluctuations (1,2,3,4). So the magnitude of this impact on residential property owners is uncertain.

We have had riparians and coalition members take exception to this viewpoint. Some believe that high water levels accelerate high erosion rates unnecessarily. Relatedly, some riparians believe that full-regulation of the lakes would maintain consistent water levels and hence mimimize erosion. These beliefs are often held with some conviction and are often supported by reference to observed examples. "Experts" are not often heeded. Experts are even, on occassion, looked upon as impractical and unnecessarily esoteric.

Under the auspices of FG2 the Canada Centre For Inland Waters hosted a Coastal Processes Workshop on October 27 & 28, 1988. Although generalization remains risky, the overwhelming consensus from this workshop, (except for Coalition members in attendance), would seem to suggest that erosion is a constant process in shoreline dynamics regardless of the lake levels. The shoreline experts suggest that after a drop in water levels erosion will cease for a very short period of time and then will begin anew at the lower level. Elsewhere, James K. Mitchell has captured the dynamic and potential of coastal erosion succinctly and clearly:

> Coastal erosion is essentialy a complex <u>class</u> of events whose chief common property is their tendency to promote loss of beach and dune sediments. The indifferent success of anti-erosion mesaures in this country is thus partly a response to the basic complexities inherent in the <u>dynamic</u> nature of the erosion processes. Beaches, dunes and cliffs are temporary geological features which respond to even small changes in the marine energy regime. Shoreline recessions and progradations form part of the normal pattern of coastal development. Considerable advances have been made in the creation and maintenance of artificial beaches, in the design of ingenious devices to dissipate wave energy and in the develpment of various other adjustments to erosion. Nevertheless, human ability to influence basic aspects of coastal energy systems, such as altering the dynamics of severe storms or controlling long term eustatic and tectonic movements, is either non-existent or at a very primitive level. Hence, there

> will continue to be definite natural constraints on man's attempts to create a static shoreline or permanently stabilize coastal landforms.
>
> Mitchell, P.12.

New ideas concerning erosion dynamics and governments' responsibility for flood damages are emerging. Concensus appears to be crystalizing around the idea that erosion will occur regardless of lake levels. Questions have emerged from this altered perspective concerning the effectiveness of past "solutions" to erosion dilemmas. Further, many factors, (eg. the emerging philosophy of "sustainable development"), are leading people to question the degree to which governments should be involved in assisting the "victims" of natural shoreline events given the widely-recognized option of prevention.

2. Shoreline flooding and Wave Attack. Residences can be flooded, damaging both the contents and the integrity of the structure. In addition to innundation, structures along the Great Lakes shoreline in low lying areas can be damaged due to the force of waves crashing against them, and in the spring, due to ice being pushed and thrown up against them by waves. Flooding has associated with it a wide range of both economic and social impacts, and even the risk of loss of life in some extreme situations. Some of the economic impacts of flooding are the costs of alternative accommodation while the house is uninhabitable, the costs of cleaning up the mess, and the costs of repairing or replacing damaged contents and structures. Some of the social impacts are trauma, disruption of people's lives if they have to evacuate, time spent cleaning up and fixing things, time when they could not use the dwelling, time and effort spent trying to fight the flood (sandbagging). If boathouses are flooded, or the water level in them is too high, boats cannot be put in or taken out. If the boat is already in the boathouse then it cannot be used. If it is out of the boathouse, it can be used but another place must be found to park it. Flooding of roads can also prevent access to residences, either marooning people on the shoreline or preventing them from reaching their house. Flooding of shore protection structures can make them ineffective and/or damage them.

It should be noted here that although the risk of flooding and wave attack is higher when static water levels of the Great Lakes are high, these problems can also occur during average or low water times due to storm surges and seiches (short term fluctuations in water levels caused by extreme weather events).

There emerges essentially two ideas surrounding the utility of Type I measures to control flooding and erosion. This utility will be assigned a different value within each of the two nations. Many riparians, including the coalitions, advocate full regulation as a means to control flood and erosion damage.

Other individuals, including many experts and riparians, maintain that erosion will occur regardless of the water levels and that the possible reduction in flooding gained by control will be minimized by the inevitable occurance of severe and/or surprise storm events. Severe and/or surprise storm events are essentially uncontrollable and account for most, if not all, devastation on the shorelines. A source of conflict could emerge, therefore, if these two opposite views of the utility of Type 1 measures become polarized into opposing power factions.

3. Loss of beaches. High water levels reduce the size of beaches, and for riparians who have beaches, this hinders their use and aesthetic and recreational enjoyment of the property. As the beach shrinks, certain activities are no longer possible. The first activities to go would be games which require a certain amount of space, such as baseball, football, frisbe, volleyball. As the beach gets narrower, other activities are eliminated, such as picnics and bonfires, sunbathing, building sand castles, until the beach disappears altogether and all beach activities are impossible. The loss of beaches would reduce the ability of riparians to enjoy their property. Loss of beaches also means loss of protection from wave action and storms, and can lead to more erosion.

4. Apparent decreases in property values. There is a perception that during high water periods, the value of shoreline property drops because of the risk of flooding and erosion and the uncertainty about how much higher water levels might go. This hurts riparians if they want or need to move, because they may not get enough money for the shoreline residence to buy a similar house without these risks. However, for property owners who do not wish to sell their property, this drop in value during high water periods is only a paper loss. For older riparians who die during high water times, this loss in property value would be transferred to their children, or their estate.

It is not known whether or not this impact has actually occurred on the Great Lakes, nor what the magnitude of if might be at various stages of water levels, nor how significant this loss in value might be to property owners.

5. Increased Costs of protective works . When water levels are high, living on the shoreline becomes more expensive for some residential property owners. We do not know how many property owners or what proportion of them are affected in this way in the entire Great Lakes Basin. A survey done on the Canadian side of the basin in 1986 found that approximately half of the riparians on the lower lakes had installed some form of shore protection, and thereby suffered increased costs during the high water period of 1985-86. Depending on the individual's financial status, this may mean severe hardship, or an expense that can be easily absorbed.

6. Problems and increased costs associated with septic systems. During high water periods, in low lying areas, some riparians have experienced failure of their septic systems. These private waste disposal systems do not work effectively when the soil is saturated. Ground and surface water becomes contaminated, drinking water supplies are threatened, severe odor problems arise. This situation impacts riparians financially by requiring costly alternative disposal systems. If not corrected, the situation is a health hazard to those living in the area.

7. Reduced enjoyment of the property. High water levels may increase the anxiety level of riparians to the extent that they do not enjoy being there, or are even afraid to be there. High water levels can also cause people to spend a lot of the time that they would otherwise spend relaxing and enjoying the lake on activities such as sandbagging and building seawalls.

8. The emergence of riparian interest groups. This is also a social impact of the recent high water level period. Riparians have organized themselves and as such are much more effective in lobbying governments to do something about high water levels than they could have been individually. There is a sense of comradarie in these organizations and they provide an outlet for people's frustrations and a mechanism through which riparians can learn more about the water level issue. They also strengthen the sense of community among riparians.

Specifically, the high water levels of 1985 and 1986 gave rise to local coalition groups (most prevalent on Lake Erie). These local coalitions form a network around the Great Lakes , with an umbrella organization for each nation (the Canadian Great Lakes Coalition and the U.S. Great Lakes Coalition), and an international organization that ties together the entire group (the International Great Lakes Coalition).

The coalitions are well organized and have a clearly articulated position paper, "Position Paper in Reference to the Great Lakes Water Level Crisis: Opportunities for Lake Level Regulation and Management." The details of this position will be described in a later section of this report.

One coalition leader told us that while their ability to fill a meeting hall has diminished since the levels have fallen, they still receive constant monetary support from their members. We have witnessed the dynamism and dedication of the executive. Coalition leaders are articulate, educated, and astute. They continuously express their desire to work with us in harmonious cooperation. None-the-less, they see their position as potentially adversarial and are prepared to be both vociferous and political if need be. They view themselves as proactive rather than reactive. They have been disenchanted with government efforts to help them to date, but recognize that

change entails cooperation. They express the fear that the current IJC water levels reference study may be just another in a host of quickly-forgotten studies.

Impacts of low water levels on residential property owners which may (or may not) be reduced by Type I measures

1. Restrictions on recreational boating. Low levels force some property owners to rent boat dockage space elsewhere if their docks are high and dry, and to put their boats in winter storage long before the end of the normal fall season. This situation reduces the recreational benefits of owning shoreline property.

2. Increased costs. Low water levels may require some property owners to extend their docks or to modify them in other ways in order to be able to tie up their boats near their dwellings. Low water levels can also interfere with water supply systems and require riparians to extend their water intake pipes or install an alternative water supply system (well or cistern).

3. Recreation and Aesthetics. As water levels go down, the water line moves, exposing in some cases more beautiful beach, and in other cases exposing ugly dried up lake bottom. This impact can be positive or negative, depending on the particular shore type. We cannot estimate the numbers of property owners who would be either positively or negatively affected by this consequence of low lake levels, nor do we know which group is likely to be the largest.

Summary . It should be noted here that there are differing views on the impacts of lake level regulation on residential property interests. Some property owners on Lake Ontario feel that their problems began when the lake became regulated and that regulation of the lake has exascerbated shoreline erosion. Property owners on the other regulated lake, Lake Superior, also have complaints about regulation, and many still suffer severe erosion problems. Significant numbers of property owners on the middle, unregulated lakes, Lakes Michigan, Huron, St. Clair, and Erie, believe that regulation will reduce their erosion and flooding problems. In the minds of many riparians, eg: some of those on Lake Ontario, regulation efforts to date have not been successful. The feeling exists here, among some riparians, that regulation has not been managed in a fair and equitable manner. At this time, and based on current available information, we do not know whether regulation helps or hurts residential property owners when considered as a group.

Type II Measures:

Public investment to direct land and water use to adapt to shore fluctuating levels.

Type II A. Community protection works for existing property along selected shoreline reaches. The impacts of this measure would be:

1. Reduced Erosion and Flooding Hazard in the protected areas. Usually shore protection works which are planned and built on a reach basis are more effective than those built on an individual basis. If these structures were effective, then the risk of flooding and erosion would probably be significantly reduced, at least in the short term, and this would likely result in more peace of mind for the owners and perhaps higher property values during high water periods.

2. Reduced Aesthetics and Access. These impacts are likely to be most significant during low water periods. Most shore protection structures impede access to the beach and in general, mar the natural beauty of the shoreline. Sometimes they even block the view of the water from the residence, severely reducing the aesthetic benefits of living by the water.

3. Reduced Costs for Riparians in the protected areas. There would be direct financial benefits for riparians located in the protected areas in terms of money saved that they would otherwise have spent on individual protective works. For owners of undeveloped land , there could be a windfall if sections of vacant land were protected along with developed shoreline.

4. Local Conflicts. This type of measure could have negative social implications for the riparians whose property is not protected. They may feel that the measure is unfair and that certain property owners are being given preferential treatment and government assistance while they are left to fend for themselves. Even more serious conflicts may arise if the community protection works are seen as increasing erosion on adjacent, unprotected properties.

Another type of conflict could arise if some property owners are unwilling participants in the program. These riparians may prefer their shoreline left in its natural state, and if forced to participate in community protection works, may take the matter to court.

5. More shoreline development in protected areas. This measure may encourage riparians to invest more in their property, by making improvements or additions to their homes, and even building new structures. If the works fail or if they are overtopped due to extreme conditions in the future, then more property is at risk.

Type III Measures:

Direct public regulation of land and water use

Representative measure #2: Erosion setback zoning.

The impacts of this measure are:

1. Changes in property values. Setback zoning might have either positive or negative impacts on property values depending on the circumstances. For owners of undeveloped land, if the setback line does not allow enough room for any buildings on the property, then the value of that property will be less. If, however, there is enough room to construct buildings with a generous setback from the water, there should be no reduction in property values.

If substantial amounts of shoreline are rendered undevelopable by setback zoning, then the value of existing shoreline residences might go up due to the laws of supply and demand.

2. Reduced property damages in the future. This impact would be limited to owners of undeveloped shoreline, where development occurs behind the erosion setback line.

3. Reduced need for shore protection structures. This impact would also be limited to owners of undeveloped shoreline, who develop their property after the erosion setback zoning measure is implemented.

4. Fears and anxieties for owners of existing buildings which fall in the erosion hazard zone. These riparians may feel that the erosion hazard designation will affect their ability to get a mortgage on their home, to get adequate fire insurance, and to sell the property in the future. They may also feel that this measure interferes with their private property rights.

Type IV Measures:

Public programs to indirectly influence land and water or the effects of fluctuating levels

Representative measure #1: Interest Rate Subsidy Loan

Impacts on riparians who decide to take advantage of this program would be:

1. Convenience. It would probably be easier to obtain a loan through this program than from a conventional financial institution.

2. Lower Costs. Some of the cost of taking action to protect their property will be absorbed by the government, resulting in a dollar savings for the riparian.

3. Reduced property damages in the short term. Depending on the effectiveness of the action taken, short term erosion and flooding damages might be lessened. If the money is spent for relocation, property damages would be reduced in the longer term as well.

4. Increased property damages in the longer term. Since most shore protection structures provide only temporary protection, long term property damages may be higher as a result of this measure. The subsidized loans may provide an incentive for riparians to persist in occupying dangerous locations, and to invest more time and money in perpetuating what really is a hopeless situation.

5. Short term relief of anxieties and frustrations. This measure will make property owners feel better in the short term.

Representative Measure #2: Real Estate Disclosure

For this measure, a clear distinction must be made between existing owners of shoreline property and future owners of shoreline property. For present owners the impacts are:

1. Apparent property value depreciation. There is no empirical evidence on this impact, but many property owners believe it to be real.

2. Anxiety. Property owners may be afraid that they will not be able to sell their property if they must disclose flooding or erosion hazards. They may also worry about being sued by future owners.

For future owners, the impacts would be:

3. No surprises. Knowledge of the flooding and/or erosion hazards at the beginning will enable future owners to cope much better with fluctuating lake levels and the related phenomena of erosion and flooding.

Type V Measures:

Emergency Response Capacity

Representative Measure: Emergency sand bag and dyking assistance to affected riparians during high water times and providing emergency water supplies from other sources (trucking, pipeline) during low water times.

The impacts of this measure would be:

1. Reduced costs. These programs would have direct and immediate economic benefits for riparians.

2. Reduced anxiety. These programs would ease anxiety in the short term by alleviating some of the most obvious and acute effects of fluctuating water levels. People would feel better because steps were being taken to control the situation.

3. Similar impacts as with the interest rate subsidy loan.

Representative measure #2: Information centres for Great Lakes Levels/flows and forecasting data/information to apprise the public and interested and or affected agencies.

The impacts of this measure would be:

1. Increased awareness of the erosion and flooding hazards associated with Great Lakes shoreline property.

2. Increased understanding of the factors determining Great Lakes levels and flows.

3. Increased warning for severe storms, and time to take action to protect property.

SUMMARY AND CONCLUSIONS.

PUBLIC PARTICIPATION & PERCEPTION.

PROBLEM.

In the context of this paper special consideration has been given to public participation and perception because of its crucial importance to the riparian's experience of flucuating water levels and the measures used to ameliorate these flucuations.

Both the government and a commercial enterprise have a problem with citizen/customer satisfaction and citizen/customer allegiance. The government remains much different than the commercial enterprise in terms of accountability and motive. Ultimately the government is there to serve the people and is accountable to them. Given vastly differing perceptions and wants by the people and given differing accesses to the decision-making process government is constantly strained to make wise and equitable decisions. A problem for government, then, is to gain an accurate perception of the public and then to assess implementation of the public will in terms of feasibility and equity. A problem for the citizen, then, is to make her/his needs known to the government and to posture politically in a

manner that insures that these needs are met. In theory the government is the people and the people are the government. In practice this theory of a unity represents an ideal to be targeted. The closer this ideal is approximated the less problematic becomes the question of citizen satisfaction and allegiance.

A threat to the unity between government and the people is the constant possibility radical polarization will develop. Unfortunately, in a less than ideal world perceptions of events, (fluctuations & measures), will be different between the parties involved. The government has its perception of the event and the citizen has her/his perception of the event. Participation in the decision-making process tends to gravitate toward the governmental pole. The modern civil service being populated by an array of bureaucrats and informed experts tends to confound and frustrate the most intelligent and stalwart of citizens. If government is to serve the public good it must address the interrelated, twin-problems of both the public's participation in decision-making processes and the public's perception of the governments' endeavors that have emerged from such decicion-making processes. This paper maintains that both parties in the equation must be considered and analysed if impediments to communication are to be reduced and understanding enhanced. This section of the paper, being social in scope, will consider values, perceptions, tactics and frustrations encountered by both parties in the process and make recommendations accordingly.

Although exceptions exist, one feels safe in saying that a large measure of misunderstanding, miscommunication and mistrust often exists between the riparians and those in the government service who believe that they are helping the riparians.

In this vein, there are three key ideas that can be considered:

First, riparians are resourceful, thoughtful and adaptable both individually and as a group. Most are reasonable, realize that the dynamics of flucuating water levels are complex and want feasible solutions to their dilemmas.

Secondly, often what riparians believe government to be doing and what government believes it is doing are two different things.

Thirdly, a huge gap often exists between what riparians believe shoreline dynamics to be and what the academic, engineering and governmental community believe shoreline dynamics to be. One has intimate knowledge of specific reaches, while the other is steeped in the consensus of a professional overview.

Riparians often possess unnecessarily negative perceptions of government, eg:

-"govt. is in conspiracy with commercial enterprise (shipping & hydro) to artificially alter lake levels"
-"govt. doesn't care about riparians"
-"govt. experts don't understand the situation"
-"govt. can perform omnipotent feats, but they just don't".

Any human communication remains susceptible to distortion. Predictions of a tenuous and qualified nature are particularly susceptible to distortion. Given the often erratic character of the natural phenomena that influence fluctuating water levels, and given the extreme complexity of the causal links occuring among natural phenomena, predictions concerning water levels must remain highly qualified as must considerations of measures. Riparians have a variety of theories and various degrees of quality in the information that they utilize to consider fluctuating water levels and measures. Government information may be couched in qualifications and scientific rationality. This is necessary to insure confidence and reliability in the information. However, the interpretation and application of this information may be open to distortion or misunderstanding and may eventuate in sorrow if crucial decisions are based on distorted information. Journalists, although generally responsible professionals, may through inadvertence present less than reliable information. This information may gain an unwarranted credibility and validity. Hence its usage may lack the safety gained when considerations are rigorously circumscribed by qualification. (The above discussion raises anew the question: "What is governments' role in riparian education and what are the impediments to such education?")

Thus individuals often make crucial decisions with confounding bits of information and sometimes with problem-solving skills that could utilize enhancement or input.

In addition to the problem of the quality of general information and its distribution, there exists uneven dissemination of specific types of information vital to riparians, eg: availabililty of various aid programs.

Riparians and/or coalition groups sometimes, <u>although not always</u>, insist on measures that lack feasiblity in governments view: this may be because they have unique, and possibly viable, criteria for feasibility which government has failed to recognize or accept, or that they lack the quality or scope of information required to recognize feasibility and would "see" the feasible if this information were available, or that they decide to avoid consideration of the feasible in deference to another consideration.

Governments may be culpable, but there exists no direct route for riparians to redress wrongs, indeed their grievances may be lost in a morass of governmental bureaucracy.

We have two groups: government and the public. One group makes decisions that dramatically effects the other. The decision making party, the government, includes participation of the other party, the public, in the decision-making process. Government has the problem of how best to include the public in this process. In the past, the mutual perception of these parties has been less than perfect, even disharmonious. This disharmony has been exacerbated by poor communication and variations in the quality of information utilized. A device to facililtate harmony between government and the public is clearly indicated.

SOLUTION:

This paper suggests the implementation of a new measure as a means of lessening the potential for disharmony between government and the public. Each measure will have an acceptability quotient. For example, 50N will impact property owners along the Lake Erie shore-line. Society's willingness to see 50N as a legitimate expenditure of scarce public funds remains a contingent factor in 50N's implementaion. The general public's perception of a "measure", its sense of the measure as being part of the common good and, more importantly, its willingness to support the measure economically and spiritually is not itself a measure. However, the concerted efforts made by the I.J.C. and the respective governing bodies to incorporate any given measure into the social realm in an ongoing, interactive and dialectical process must itself be considered as a "measure".

Such a measure would consist of the active involvement of all parties in the emergence of a consensus concerning perspective and a consensus concerning the implementation of that perspective. Such a measure could be considered as a project comparable to a dam or a canal in so far as it follows definite stages in development and has a specific technology. The implementation of 50N as a measure, the perception the public has of it and the public's willingness to support it remain very much a factor impacted by society's perception, understanding and consequent labelling of "50N". The "measure" that would be concerned with public involvement to enhance perception and understanding of any specific measure, although intimately tied to public relations, (and the work of FG4), remains much more than a public relations endeavor.

The Lake Erie property owner, for example, will be directly impacted by the efforts undertaken to enhance sociey's participation, perception and understanding of 50N. If 50N is to be pereceived as achieving maximum effectiveness and alienation from it is to be minimized, the public must have a sense of

participation in the project from its inception. This paper argues that a new "measure" should be mandated which would directly involve itself with the complexities involved in the public's participation, perception and adaptation to any given, specific measure. The perception and adaptation to innovation and the facilitation of equitable compromize would be the daily task of this "measure". The final expectation for this new "measure" would be the lessening of disharmony and disenchantment between government and the public.

This measure recognizes the fundamental human quality of adaptability.

This measure recognizes that the individual belongs to a complex web of associations of varying degrees of influence and intimacy through which the individual constructs definitions and perceptions of situations.

This measure suggests that people move through stages in the process of translating problems into grievances and gaining societal support for their resolution. This process remains amenable to enrichment and demands the active involvement of the individual in the solution rather than having the problem of resolution being transposed to government. Such a methodology avoids some of the pitfalls inherent in closed planning, eg: lengthy legal battles, lengthy delays, reduced appropriations following delays.

This measure recognizes that the political climate and the ethos of the planning profession influence planning outcomes eg: the type of resources made available, the projects chosen to be undertaken and the types of efforts made to ameliorate unavoidable negative consequences are contingent on the belief system in predominance at that specific time.

This measure recognizes that the adoption of any measure assumes a specific theory of government and assumes a specific stance toward the resolution of the inherent tension between concepts of public costs and private benefits.

This measure recognizes and rests on the social technology available for implementing change in perceptions and definitions through an interactive interchange that minimizes power and status differentials in favour of equity.

This measure favors a processs by which the public is actively involved from the outset rather than presenting the public with a full-blown plan and then asking for either their acceptance or their rejection of that plan.

This measure believes that when consensus emerges in open-ended flexible debate then public accord emerges and rests on a solid

foundation that will provide the political will necessary for a measures acceptance and completion.

SOCIAL FACILITATOR ROLE:

This measure would be enhanced by the introduction of a "community worker" or "social facilitator" role within its structural dynamic:

The "facilitator" would work in the "community" on a variety of levels with private, public and commercial individuals and groups. The "facilitator" would necessarily have exceptional people and group skills in order to effect change, compromise and conciliation.

The "facilitator", ideally, would be funded by the government but would be essentially free, (and be seen by riparians as being free), of the bureaucratic restrictions enjoined on many civil servants.

Because of the large geographic magnitude of the Great Lake's Basin and because it entails two nations a number of individual facilitators would be necessary. This would entail co-ordination and communication between the various individual facilitators. Such co-ordination suggests management, organization and strategy as well as liaison with a variety of governments and the IJC. Indeed, the organizational aspect of the recommendation approaches something that approximates a bureau. Large organizations can be cumbersome, unresponsive to client needs and impersonal. The social facilitator, envisaged as being a community worker, would represent the antithesis of the bureaucrat as has been depicted in sterotype. The managerial skill involved would entail the delivery of the organization and communication efficiency required to umbrella the basin while preserving the possibility for personable and flexible interaction of the facilitator with riparians and the coalitions.

Physically the facilitator should have a high profile in the riparian community. As a general rule riparians are a group that have severe misapprehensions about bureaucracies. If the facilitator role is to attain and maintain credibility with this group every effort must be expended to reduce bureaucratic trappings. The facilitator must be easily accessible, perhaps ensconced in a "store-front" facility, and should actively work at securing credibility.

The "facilitator" would provide input or "counselling" to riparians experiencing problems associated with flucuating water levels:

This "counselling" might be of a simple information sharing and information clarification type. Similarly, the facilitator might

act as a sounding board for problem solving throughout the duration of a riparian project.

This "counselling" might be to point riparians toward certain "experts" or be undertaken in conjuction with such "experts".

This "counselling" might be a guiding through the maze of bureaucratic, legal and technical considerations that accompany riparian problems and projects.

This "counselling" might be, but not necessarily, of a stress relieving sort - a "talking-through" of a problem as an exercise in individual or group catharsis.

This "counselling" might be of a quasi-political nature that would be a working with coalition groups, planning professionals local governments and/or ad hoc groups to arrive at the best possible solutions to a dilemma given the negotiated nature of reality.

This "counselling" might be in the form of that of an ombudsman, or in conjunction with the existing ombudsman's office.

This "counselling" would provide an information vehicle but more importantly would provide a cross-fertilization of ideas and a facilitation of their consideration, synthesis and final adoption with a goal to minimizing fiction and maxamizing fact.

This "counselling" would provide a consolidation of ideas and perspectives that would, in part at least, bridge the vast geographic distances in the Great Lakes Basin with consensus in perspectives.

This approach is used in the social work field when new facilities and/or programs are introduced into the community.

The Ontario Ministry of Agriculture has field workers, ("Ag. Reps"), as an institutionalized role in its structure - they provide farmers with an array of technical and innovational advice.

Because highly developed people skills, rather than scientific expertise, represents the central requirement of the facilitator the field of social work might provide the best recruits for the position although not necessarily.

FUTURE OF GREAT LAKES BASIN.

The nature and quality of shoreline residence remains contextual as does the impact of measures impinging on it. Aside from matters of climate, water levels and water quality, factors of a geographic, demographic, economic, social and political character impinge as active determinants of the riparian experience. A reasonable speculation would suggest that in a century, indeed perhaps in fifty years, the nature of human settlement in the Great Lakes basin and the hierarchy of land uses will undergo a significant reconfiguration, perhaps of a dramatic type. Further, as the nature of work, of leisure and the distribution of wealth shifts, the use and abuse, of shoreline property will alter including its residential aspects. The availability, accessibility and use of shorefront property remains contingent on the future economic development of the basin. Among the indirect intervening variables operating would be: the emerging interdependent urban systems and their complexity; the resolution of transportation dilemmas; the debate of decentralization versus urban renewal; the demographic compostion of the population and its size; altered intricacies of social stratification; the consequent redistributions of power; increased levels of affluence; scarcity of crucial materials; social resolution of pollution problems; and increased levels of free time.

These variables will shape the land use patterns and cultural values associated with land use. One might reasonably predict that the Great Lakes basin may, through a host of cumulative factors, become a favored place to live. Indeed it would not be unreasonable to consider a Great Lakes megalopolis and to tailor thinking accordingly. The dominant sector of the megalopolitan population would be one with a relatively high level of education and affluence, one that is informed, politically aware, environmentally conscious and health orientated. It remains highly probable that such a population would make intensive use of the Great Lakes recreationally and residentially considering this to be their natural right. Thus what emerges as a possible future scenario for the Great Lakes Basin is a densely populated area consisting of a system of urban networks, where the distinction between "urban" and "rural" remains blurred, where enhanced transportation capabilities enable large separations in distance between residence and work, where alterations in time demands and affluence make two residences feasible for some, where the population in general enjoys an unprecedented level of free-time combined with affluence and where a society intensely utilizes the shore lines. Further, it can be anticipated that the amount of utilizable shore property will diminish in the future while the demand for it will increase. Therefore, because of the essentially contextual nature of shoreline residency the assessment of a measure's value and the anticipation of its impact will be confounded by consideration of the above factors. Indeed the assessment may be invalid if these factors are not considered.

ONGOING WORK EFFORTS - CENSUS & SURVEY

The riparian work group has analysed a heterogeneous interest class with a large number of members. This is unlike some of the other working groups whose interest class is homogeneous or contains a relatively small number of members. Having a large heterogeneous group with members experiencing a wide range of geographic circumstances significantly increases the possibility that distorted results might have emerged. Some sub-categories of the group may have been underepresented, or not represented at all, while others may have been over represented.

Riparians perceive their properties in a variety of ways. Variables influencing riparian perceptions and associated actions are: age, family size, income, education, occupational status, property location, property characteristics etc. Social and demographic variables, in conjunction with locational specifics, represent significant predictors of perceptions. The incidence of types of riparians and their relative locations have not been know to date.

Budgetary and time considerations prevent most complex sociological variables necessary for social impact assessment from being studied by means of a census. A scientifically defensible alternative to doing a census is to analyse a selected sample of the population and generalize from that sample. For this to provide valid results the sample must be assembled through a process that insures that the sample is unbiased. A "random" sample can only be drawn when a population list can be established to draw that sample from. Although lists of riparians exist for some areas no such population list has been compiled for the entire riparian population of the Great Lakes Basin to date.

There is no way of knowing how representative the perceptions of riparians gathered in this report are or how much weight to assign to the incidence of the various types of perceptions. Early in the study we came to suspect that riparian's perceptions concerning levels and measures are polarized. Now we know that a wider variety of circumstances, (and hence perceptions), exist than had been initially imagined. Because of the wide variation in locational circumstances, reach types, population densities, governmental influence, property value, and property use a wide range in types of perceptions do exist. Because, up until now, we have had no comprehensive population list we have compiled the perceptions of those riparians who have made themselves known to government or those whose names we have encountered in an ad hoc fashion. We cannot guarantee representativeness.

RECOMMENDATIONS OF EARLIER REPORTS

The earlier drafts of this report noted that a profile of the study area quite clearly highlights the lack of any reasonable data base from which to formulate even a superficial overview. This lack existed despite the fact that the residential interest group of riparians is a highly vocal and important segment to be considered when any study of lake levels is undertaken.

The earlier drafts recommended that a detailed investigation of this interest component be made, using current techniques and professionally derived study methodology. The data then available did not answer the questions that we needed to answer. Data that included:

1. A simple enumeration of housing units, by reach, which is encoded such that shore risk type can be crosstabulated.

2. Information on flood/erosion incidence (not damage at this point); the reaction to events: modifications in living pattern as a result.

3. An investigation between length of residence and flood/erosion experience and reaction to same.

4. An investigation of the perceptions of risk as related to the decision to purchase the property.

It was noted that if the above were available it would aid in defining the problem, in the same way that the problem is being defined for all other impact categories which benefit from an abundance of available data. It will also make the analysis of measures less clinical and more realisitic.

In addition, one of the major problems is the lack of tracking data which would allow for an appropriate assessment of changes through time, response to flood/erosion, etc. The temporal element of fluctuation dynamics, heretofore missing from lake level studies, can provide the best information on measures and impacts because it tracks events in time. Quantification of the high incidence areas would allow for development of an ongoing tracking system for those areas. In this way changes could be monitered through time providing insights into planning and initiatives.

In the draft of this report dated November 30, 1989 we recommended that a census of all shore-line properties be conducted and that a survey follow the census. We maintained that a census would provide baseline information for any individual or organization thinking seriously about the complexities associated with fluctuations. The conduct of most forms of inquiry including survey research would be made possible by such a census. Now, (Spring 1989), a comprehensive census of

shoreline property owners, their contact addresses, their phone numbers the location of their properties, attributes of their properties and the structures on their properties is being assembeled. The census will fullfill the basic need to know the magnitude of the riparian population, the location of its members, and the means to contact them. It will contain a designation as to shore-line type. The census will be invaluable to researchers as well as those involved in the public involvement aspects of the study.

Similarly, a survey was designed during the Winter of 1989. It was a collaborative effort between the U.S. Army Corps of Engineers and Environment Canada. Information needs were appraised, a questionnaire was constructed, a methodology formulated, a population targeted, sampling proceedures devised, confidence intervals and precision levels set, administration details decided upon, funding negotiated, contractor requirements assessed, and an agenda for completion outlined. This survey will be of shore-front property owners. It seeks to understand the demographic features of this group, to assess their perceptions of various events and measures, and to gage their acceptance of the alternatives available.

We are now tying up the lose ends and fine details of the survey itself. We are essentially ready to go to the field with our survey and require but little refinement in our present instrument. (Indeed, we may be in the field before this report reaches the stage of general circulation). The census, must necessarily proceed the actual administration of the survey because the "random" sample must be derived from a complete population list. Thus, the survey waits for completion of the census. There should be virtually no time lag between the completion of the census and the start of the survey.

Both the U.S. Army Corps of Engineers and Environment Canada have made the commitment to gathering a census of shoreline property owners and to conduct a survey of shore-front property owners. Because different funding and contracting proceedures exist between the U.S. Army Corps of Engineers and Environment Canada the completion of the phases of the project(s) between the two countries do not match exactly in time. Further, whereas the Corps of Engineers is treating the census and the survey as one project Environment Canada has chosen to break the work into two seperate segments keeping the census distinct from the survey in administration, contracting, and funding. Because radical differences exist in the formatting assumptions between the U.S. and Canadian GIS data organization will be different between the two endeavors. However, the IJC has strongly insisted on the need for compatibility between the output from each countries output. This will insure that the results between the two endeavors will be homogeneous allowing comparable analysis to be undertaken between both countries and throughout the Basin.

COMPATIBILITY WITH GEOGRAPHIC INFROMATION SYSTEM (GIS) - US & CAN

The information from both the census and the survey will be amalgamated with the computer-formated information modules contained in the Geographic Information System (GIS) that has been developed by Functional Group 2. When ideal conditions exist the GIS allows for universal and instantaneous access to the information gathered: an electronic atlas.

In constructing the GIS, FG2 will be taking aerial photographs of the shorelines. These photographs will be converted to a digital format. When input of the census data has been completed it will be possible to generate maps that portray the lots that are listed in the municipal registries. In other words, the numbering scheme of the records will allow for the coordination of the tax registry information with the aerial photographs. Further, shore-line type and coastal dynamics can be matched with the information on the municipal tax records. Hence a link will exist for the coordination of shore-line events with the sociological dynamics profiled in our research. This coordination of the two types of phenomena, (geographic and social), will allow for the correlation of specific shore-line events with the social responses that emerge from these events. Additionaly, the GIS will allow for the modelling of probable shoreline scenarios allowing for a pretesting of planned measures. The GIS has the capability of easily formating maps on an ad hoc basis in reponse to specific infromation needs. Among the long term results of incorporating the census and survey information into the GIS will be a more profound understanding of the social patterns that emerge from fluctuations and measures.

IMPORTANCE OF SURVEY

The Survey will:

-fill the need for a comprehensive overview of entire basin which will be similar for both countries.

-tell us how the riparians really feel toward fluctuations, various measures and the damages they have incurred to date.

-give policy and decision makers solid information to base their judgments on.

-provide public-relations people, (Functional Group 4), with a description of their audience and the information needs of that audience.

-allow for a basin wide assessment of the damages that have occurred, the actions that people have taken, and the threat they perceive.

perceptions of riparians on:
-water-levels communication
-insurance
-emergency measures
-causes of fluctuations

-# who belong to Coalitions
-the support Coalitions really have

-value of properties in monetary terms & non-monetary terms.

SUMMARY:

People occupying vastly different shoreline configurations will be impacted by fluctuations in vastly different ways. Their perceptions of fluctuations, their subsequent actions and their reaction to measures will be directly related to three factors: the type of shoreline they occupy, its relative location, and their social profile, (as described above). If wise policy decisions are to be made, basic reliable information is required. Fundamental to any information gathering is a comprehensive list of the riparian population. Such a list is being assembeled during the spring and summer of 1989 on both sides of the border. Further, a survey designed to ascertain information about the experience of shore-property residences will be administered in the Summer and Fall of 1989. The census and survey results will be amalgamated with FG2's Geographic Information System to provide highly specific detail on fluctuations and coastal dynamics, as well as the locations, demographics, perceptions and experiences of riparians.

The riparian experience remains a highly variable one. Complexities of a cultural, political, social, and psychological nature overlay the complexities of geography, hydrology, and ecology to create the potential for varied interpretations of the experience of being a riparian. These varied interpretations have the potential to create misunderstandings. Misunderstandings, in turn, enhance the inherent tension both between riparians themselves, and between riparians and other groups who have an interest in aspects of the Great Lakes/St. Lawrence Basin. Ideally the resolutions of fluctuation and levels dilemmas will be seen as equitable by all groups who have a stake in their outcomes. A necessary prerequisite of clear thinking and equity in the political process remains accurate, reliable, information.

This report has attempted to capture the variability of the riparian experience and the complexities that impinge on it. It does not pretend to be definitive. If, however, it paves the way to a clearer understanding of the riparian experience and leads toward an equitable resolution of the dilemmas created by water-level fluctuations then it will have been a success.

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