Living With The Lakes: Challenges and Opportunities

Annex F
Evaluation Instrument

A satellite view of the Great Lakes. Photo courtesy of the Atmospheric Environment Service, Environment Canada.

LIVING WITH THE LAKES:

CHALLENGES

AND

OPPORTUNITIES

ANNEX F

EVALUATION INSTRUMENT

PREPARED BY THE EVALUATION INSTRUMENT TASK GROUP
FOR THE PROJECT MANAGEMENT TEAM

International Joint Commission
Water Levels Reference Study

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PHASE 1 REPORT OUTLINE
IJC FLUCTUATING WATER LEVELS STUDY

MAIN REPORT

ANNEX A - PAST AND FUTURE WATER LEVEL FLUCTUATIONS

ANNEX B - ENVIRONMENTAL FEATURES, PROCESSES AND IMPACTS: AN ECOSYSTEM PERSPECTIVE ON THE GREAT LAKES - ST. LAWRENCE RIVER SYSTEM

ANNEX C - INTERESTS, POLICIES AND DECISION MAKING: PROSPECTS FOR MANAGING THE WATER LEVELS ISSUE IN THE GREAT LAKES - ST. LAWRENCE RIVER BASIN

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ANNEX F

EVALUATION INSTRUMENT
Development and Testing

EXECUTIVE SUMMARY

The development and testing of an evaluation instrument has been one of several significant activities undertaken during Phase I of the IJC Reference Study on fluctuating water levels in the Great Lakes-St. Lawrence River Basin. It was determined early in Phase I that an evaluation process going well beyond the conventional analytical procedures applied in previous Reference studies on this subject was required. The effort has been directed toward developing an ongoing analytical capability, for potential use by governments and others, that would not only enhance existing techniques for evaluating alternative courses of action, but also incorporate concerns of affected interests within the Basin.

The evaluation process described in this annex attempts to achieve these objectives through the creation of an analytical framework comprised of the following components: (1) development of an inventory of existing and potential problems related to fluctuating water levels and their extremes; (2) development of alternative courses of action, as organized into six types of measures and an inventory of over 100 measures; (3) the identification of the impacts of measures on affected interests, including the natural environment, in the form of an impacts matrix; (4) establishing a basis for assessing measures and their impacts through the development of six evaluative core criteria and 22 associated operational criteria; (5) assessing measures through the application of an evaluation instrument; and (6) compiling preliminary indications of possible courses of action.

The evaluation process was tested on two separate occasions by teams of three to five people, including engineers, economists, and environmental scientists, in completing initial assessments of 23 representative measures during Phase I. Work sheets were completed, consisting of the impacts matrix, evaluation instrument, and summary score sheets for each of the 23 measures. Scores in each case were assigned for the operational criteria and then aggregated for the six core criteria. The core criteria are economic sustainability; environmental integrity; social desirability; reduction of risk and uncertainty; implementability and political acceptability; and equitability. The primary intent of the test exercises at this point in the study was to gain experience using the components of the evaluation process and to assess their functional characteristics. Definitive findings on representative measures were not rendered at this time, in part because of the lack of detailed information on measures and their impacts, but also because the nature of the evaluation process requires that judgments be applied in

economic, social, environmental, and political matters where uncertainties in the context of water resources planning are often prevalent. The evaluation instrument does not remove these uncertainties, but it is positively viewed as a mechanism which organizes and structures the process of conducting an evaluation. It is useful in being able to explain the reasons for the results that are arrived at, and provides the documentation in a series of worksheets which comprise the evaluation instrument.

Examples of a completed impacts matrix, score sheets, and evaluation instrument are included in the Annex. Lessons learned and suggestions for improving the evaluation instrument and process are reported in the conclusion of the Annex.

The evaluation process developed in this Annex is found to:

. augment and expand past tools for evaluating potential measures by greatly broadening the evaluative scrutiny and criteria

. improve the capability to explicitly and simultaneously consider the interests; the physical and natural environment; possible measures; and the objectives, criteria, and values which shape and determine the outcome of an evaluation process

. have the potential for further application both as an analytical tool for governments and as a mechanism for engaging public participation and involvement directly in the Reference study at a subsequent stage in the determination of appropriate measures to respond to the consequences of fluctuating water levels.

It is recommended that the evaluation instrument and process should be refined and matured during Phase II, taking into account suggestions contained in the Annex and incorporating new data and information as it becomes available.

ANNEX F
EVALUATION INSTRUMENT
Development and Testing

FOREWORD

Annex F presents the products and results from efforts undertaken to develop an evaluation framework during the Phase I study. The objective was to establish a systematic process that could assist in analyzing the possible impacts of proposed measures to respond to the consequences of fluctuating water levels in the Great Lakes-St. Lawrence River Basin in a manner that would be thorough, comprehensive, and replicable. The evaluation framework responds to the charge established in this study to provide an ongoing analytical capability for use by governments in dealing with the consequences of fluctuating water levels.

Components of the evaluation framework are presented in this annex. They include the identification of representative measures used to test the evaluation instrument; the impacts matrix, where impacts to interest groups and the natural environment as the result of implementing a measure are identified, along with their units of measurement; the development of core criteria and operational criteria for purposes of evaluation; and the structure of an evaluation instrument for assessing the relative merits of possible measures. The process of testing the evaluation instrument through application of 23 representative measures is reported, with lessons learned and suggestions for further development and refinement of the instrument presented.

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INTRODUCTION

The evaluation instrument is intended as a tool to be used primarily by governments and agencies of government (especially U.S. and Canadian Federal governments) which have been given responsibility for deciding (or recommending) on the relative overall merit of courses of action (measures) available to governments to deal with the adverse consequences of fluctuating water levels.

This recognizes that agencies of governments ultimately need to decide which actions are in the general public interest - this is a fundamental responsibility of governments. This in no way excludes public participation, which may occur prior, during, and/or following the use of an evaluation instrument by government agencies (such matters as the means by which agencies act with or without the public and the role of various modes of evaluation are covered elsewhere - see Policies and Institutions).

For the purposes of this annex, it is sufficient to acknowledge:

* That government agencies do (and will continue to) evaluate measures because their mandates require that they develop or recommend measures to governments and/or they are obliged to consider the merit of measures with regard to all interests.

* That government agencies need explicit guidelines for these evaluations both to show the basis for judgments (i.e., not entirely arbitrary or vested interest) and to promote efficient and consistent evaluations (i.e., to avoid reinventing procedures) across measure types to improve upon personal opinion or professional judgments and to establish the longer term compilation of data necessary for well-founded evaluations.

Hence, this annex describes a set of procedures (data, analysis, interpretation, and rules for evaluation) which represent a tool to guide and assist personnel in agencies of government to judge the overall merit of any proposed measure.

The Evaluation Instrument is founded on the premise that the overall value of any measure can be judged by considering the performance of the measure against six broad principles or <u>core criteria</u>. In this case, we evaluate measures before they are implemented and implications observed; so performance scores or indices are really estimates or predictions of impacts <u>if</u> the measure were to be put in place when compared to the without measure condition. A superior measure would be one which scores well on all core criteria.

An ideal measure would:

a. Be economically efficient and sustainable,

b. Maintain or enhance environmental integrity,

c. Be socially beneficial or acceptable,

d. Avoid risk (or enhance certainty),

e. Be (politically) implementable,

f. Be fair and equitable.

A measure's overall evaluation is based on the degree to which the measure is expected to achieve or satisfy these core criteria.

In order to provide some justifiable and replicable basis for evaluating each core criterion, operational sub-criteria are defined for each core criterion. Performance scores on these sub-criteria, in turn, are based upon the application of specific ground rules to data or estimates of impacts of the measure.

Hence, an evaluation (score) on any core criterion requires evaluations on the sub-criteria, which usually require some specific impact analysis. Once the impacts have been assessed, the sub-criteria scored, and these scores aggregated to yield a score for each core criterion, then the overall evaluation of the measure can be presented.

It is possible to apply weights among the core criteria, or to establish scoring values indicative of minimum levels of acceptability, to ensure that critical concerns (such as environmental integrity) are identified and met in order for a measure to be considered acceptable in the evaluation process.

While the Evaluation Framework requires that an analytical process be systematically completed, there is considerable flexibility in the treatment of the components within the framework. The inventory of measures, for example, is able to be modified or expanded as new ideas or proposals are developed. The process is also subject to continual review as more detailed information becomes available after the completion of technical studies or as changing conditions create problems not previously considered. Finally, the criteria used for assessing the impacts of measures can be applied in a number of different ways depending on the underlying objectives, policies, and values which the study seeks to address. The essential focus is to proceed through the analytical process in an organized manner that identifies and explains the reasons for arriving at the findings that are developed.

This chapter describes the essential features of an instrument of this type, its design, and its testing on a small set of representative (example) measures, chosen to cover the wide range of options open to governments. The testing was undertaken at this stage in the development of an instrument to critique the utility and practicability of the approach and to identify the analytical and information needs for application of the tool.

Development of an evaluation instrument was undertaken to address a need identified in the study to provide an ongoing analytical capability by which Governments can collectively make decisions to deal with fluctuating water level conditions. In Phase I, efforts have been devoted to characterizing the fluctuating water levels and their consequences (Annexes A and B); developing a comprehensive inventory of measures (Annex E); and developing a systematic and comprehensive evaluation framework (this Annex). The evaluation framework, displayed in the next section (Figure F-2-1), is structured to ensure that the full range of measures, interests, and concerns, including the natural environment, will be considered, and that rigorous procedures for the evaluation of potential measures are established.

Both Federal Governments have procedural requirements in place to guide the review and implementation of water resources development. In the United States, legislative and administrative actions (Table F-1-1) have resulted in procedures for the conduct of Federal water resources planning which have evolved since 1936. Attention has been directed toward objectives such as national economic development, environmental quality, and social well-being with various degrees of emphasis over time. In Canada, the 1987 Federal Water Policy statement establishes that:

> "The overall objective of the federal water policy is to encourage the use of freshwater in an efficient and equitable manner consistent with the social, economic, and environmental needs of present and future generations."

The development of the evaluation instrument, presented in this annex, incorporates these objectives and procedures and attempts to expand upon them in building a more explicit process for documenting how these factors and others determine the methods by which the evaluation of potential measures can be conducted. It is clear that implementation of an IJC-recommended water project would be subject to the planning and regulatory rules and procedures of either or both countries, depending on the location and impact of the proposed measure. Based on the challenges presented by this Reference, however, and given its comprehensive nature and scope in covering the consequences of fluctuating levels and possible responses over the entire Great Lakes-St. Lawrence River Basin, it was determined early on that an

TABLE F-1-1

Selected Milestones in the Evolution of U.S. Federal Water Project Planning Guidelines

1936 Flood Control Act specifies, for the first time, that the federal government should pursue water projects if "benefits to whomsoever they accrue are in excess of the estimated costs."

1950 Subcommittee on Benefits and Costs, Federal Inter-Agency River Basin Committee issues the Green Book, which required that water projects be sized according to their incremental effects on national income.

1952 U.S. Bureau of the Budget Circular A-47 requires benefits of a project purpose to exceed economic costs attributable to that purpose.

1962 Senate Document 97 lists three objectives for water projects: development, preservation, and well-being of people, but provides guidance heavily weighted toward national economic analysis.

1970 Rivers and Harbors and Flood Control Act expresses Congressional preference for four objectives in water project development; regional development, environmental quality, well-being of people and national economic development.

1973 President approves Principles and Standards, which required that water project plans be formulated toward two objectives: national economic development (NED) and environmental quality (EQ), and that impacts of such plans be calculated on four "accounts": NED, EQ, regional development (RD) and social well-being (SWB).

1980 Principles and Standards undergo major revision, retaining objectives of national economic development and environmental quality, and adding a non-structural alternative.

1983 Water Resources Council approves Principles and Guidelines which contain a single objective (national economic development) with freedom to formulate other cost effective alternatives.

evaluation process going well beyond the conventional procedures applied in previous IJC Reference studies on this subject was required and in fact should be a significant item for initial development in Phase I. In exploring the potential of a new and more fitting evaluation paradigm in this annex, it is suggested at this time that the process presented herein:

a. augments and expands past tools for evaluating potential measures by greatly broadening the evaluative scrutiny and criteria;

b. improves the capability to explicitly and simultaneously consider the interests; the physical and natural environment; possible measures; and the objectives, criteria, and values which shape and determine the outcome of an evaluation process;

c. has the potential for further application both as an analytical tool for governments and as a mechanism for engaging public participation and involvement directly in the Reference study at a subsequent stage in the determination of appropriate measures to respond to the consequences of fluctuating water levels;

d. should be refined and matured during Phase II, taking into account suggestions covered in Section 4 of this annex and the incorporation of new data and information as it becomes available.

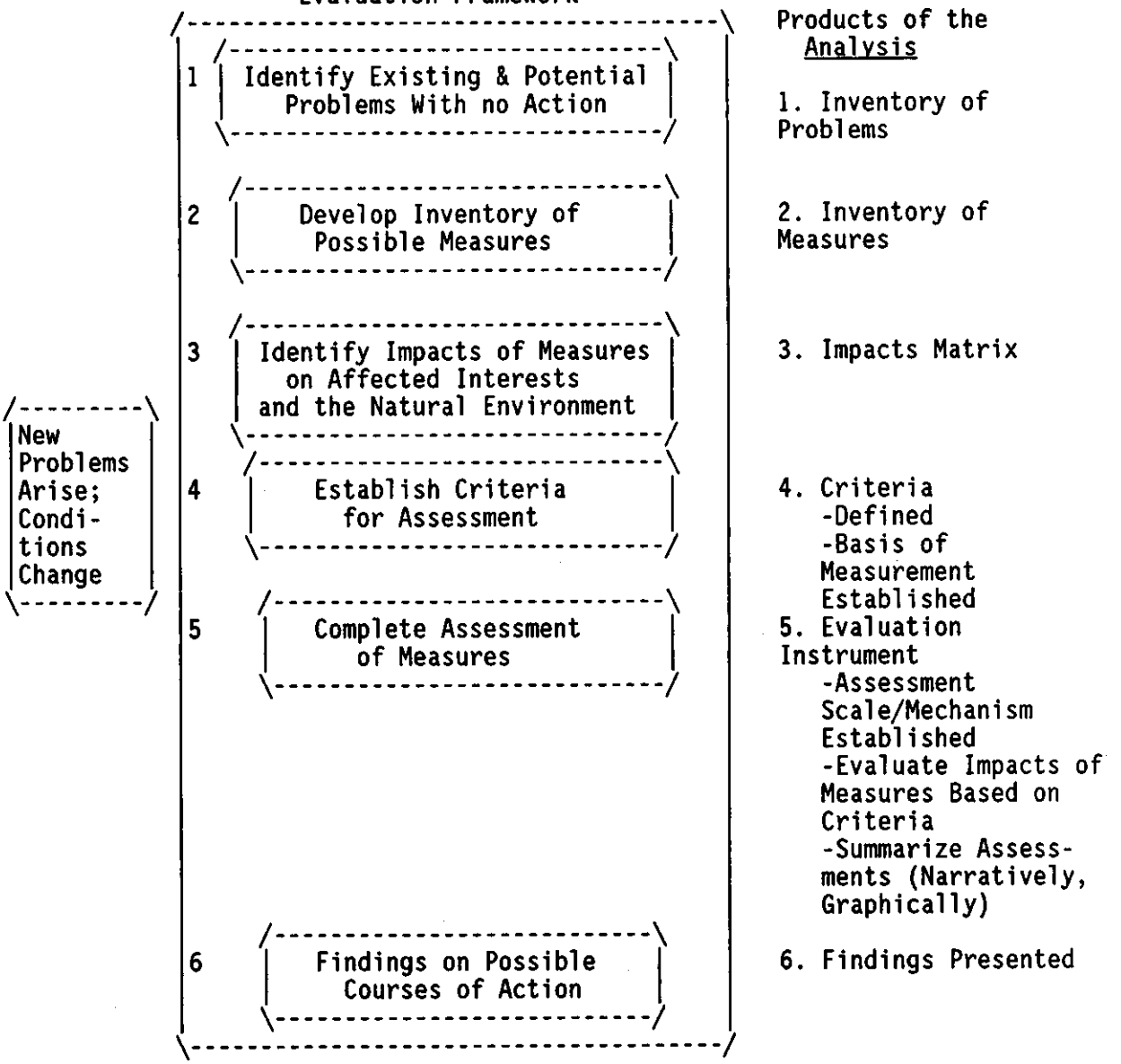
The annex has three main sections. Section 2 describes the instrument as developed to date; Section 3 reports on the testing exercise; and Section 4 indicates the lessons learned using the approach and its development needs.

SECTION 2

THE INSTRUMENT

An overview of the process and interactions of each component of the instrument is provided in Figure F-2-1. Problems and needs of interests within the Great Lakes have already been identified and an inventory of measures has been developed. The current effort is concentrating upon the impacts and overall evaluation of measures. This requires that criteria be estimated and applied consistently to each measure. A complete assessment and profile will be developed for each measure and this information will be the basis for possible future courses of action.

Figure F-2-1
Evaluation Framework



IMPACTS

Introduction

The identification and evaluation of consequences resulting from fluctuating water levels on the Great Lakes and St. Lawrence River are important elements of the Phase 1 study. There are significant problems caused by both extreme low and extreme high levels and by fluctuations in between. There are also benefits associated with natural fluctuations. The analysis of these problems is organized into two parts. The first is to develop procedures through which assessments may be made. The second is to locate information and data that indicate the nature and magnitude of the consequences.

Once these tasks are substantially underway, it is possible to consider various measures which respond to negative consequences. This is done by comparing the effects of applying measures against baseline conditions. The baseline conditions are established by assessment of the problems occurring over the extremes of a fluctuating range of levels. In this way, either quantitative measurements or qualitative evaluations of the impacts of measures can be developed with an established basis for comparison.

In essence, there are two stages of impact assessment taking place: the first concerns prevailing conditions when faced with extreme low and extreme high levels and the fluctuations in between. The second is what happens when a measure(s) is introduced.

Procedures for Impact Assessment

The following analytical steps are important in completing the impact assessment process:

a. Identify the interests and environments affected by the extremes of fluctuating water levels;

b. Identify the consequences of fluctuations, including extreme low and extreme high water levels on the interests and environments, and the possible consequences of fluctuations both within and outside these extremes;

c. Identify possible measures which may address negative impacts;

d. Assume the measure is applied and assess the possible impacts to interests and environments, with and without the measure in place.

e. Summarize the assessment of impacts given the best available information, either narratively or graphically.

The quality of the impact assessment process is continually enhanced by specific data that is obtained in the course of determining the nature and magnitude of impacts. If specific, quantifiable data are not available in problem areas that are positively identified, then qualitative assessments based on the best available information and judgments form the basis for completion of initial impact assessments. The initial assessments can also be of great assistance in highlighting those areas of concern where detailed data and information are required.

Phase 1 of this study has embarked on several avenues of inquiry to implement impact assessment procedures and to obtain data to document the nature and magnitude of impacts under prevailing baseline conditions. These include the following:

a. Functional Group 3, the Socio-Economic and Environmental Impact Assessment Functional Group, formed nine work groups, each devoted to a single interest, to ensure that affected interest groups were covered in the impact assessment process. Interest groups include transportation, riparians (including native peoples), electric power, commercial and industrial, agriculture, non-riparian recreation, environment, and commercial fishing.

b. Functional Group 2 organized three work groups to describe major Great Lakes environments; terrestrial, wetland and aquatic, and assess the impacts of fluctuating levels and flows and measures that governments could adopt to response to these fluctuations. An integrated coastal zone data base (Geographical Information System) is being developed by FG2 to aid an assessment of the sensitivity of various interest groups to fluctuations and the environmental impacts of various measures.

c. Public participation and involvement activities have been held to obtain views and concerns directly from affected groups. These include a series of 21 group depth interviews, a public workshop, a basin wide teleconference, distribution of a background paper and the Plan of Study for comment, and the creation of peer advisory groups. In some cases there has been direct participation by members of the public in Functional Group activities, either as experts on specific issues or in representative citizen capacities.

d. Functional Group tasks outlined in the Plan of Study have been directed toward the determination of impact assessments in such areas as hydrology, hydraulics, and climate; physical, biological, and water quality processes related to the coastal zone; and development of an aggregate visual situation model of the Great Lakes-St. Lawrence River Basin to highlight key cause and effect relationships.

Measurement of Impacts

An important aspect of the impact assessment process is to establish the kinds of effects associated with widely fluctuating lake levels and to determine methods of measuring these effects. Given the huge geographic area under consideration, and the number of interests potentially affected, a major task is simply to identify the range of sensitivities deserving of attention. The complexity of the natural biophysical system adds to the challenge, especially the spatial variation and sensitivity to impacts from lake to lake and from lake reach to lake reach. In this study, this task has been related to the development of criteria with which to assess the impacts of measures as part of an overall evaluation framework. The criteria for evaluation establish the categories in which impact assessments will be organized.

The six core criteria for the study, in random order, are identified below:

a. Economic Sustainability

b. Environmental Integrity

c. Social Desirability

d. Reduction of Uncertainty and Risk

e. Implementability and Political Acceptability

f. Equitability

In order to apply these core criteria for evaluation purposes, a number of operational criteria have been established to provide more definition in each case and one or several means of measurement.

Operational criteria constitute the level within the Evaluation Instrument where the assessment of impacts is translated into an evaluation of a measure. This is accomplished by comparing the anticipated consequences of a measure against the objectives defined by the core and operational criteria.

One characteristic of an operational criteria is that the mechanics of its measurement must be identified. This is important in order to specify the ways in which an impact assessment can be converted into a measurable effect.

It is also essential that the impacts themselves be assessed in as tangible a way as possible. The most effective means of achieving this objective, at least initially, has been to consider the affected interest groups and the natural environment as they relate to the areas of concern described by the operational criteria. This usually suggests a straightforward

means of measuring impacts that is compatible with the definitions of the operational criteria. Special care was taken in developing environmental components and parameters to assist in defining operational criteria appropriate to the concept of environmental integrity. An initial application of the impact assessment process, using a set of representative measures, will be covered later in this chapter and will clarify the relationships between measures, interests, impacts, and criteria for evaluation.

It should be noted that, in most cases during this Phase 1 study, detailed measurement of impacts in the various categories, via the operational criteria, are not yet possible. The objectives at this stage of the study are to organize existing information so that reasonable judgments on those measures most likely to be promising can be made during Phase 1, and to identify the types of measurements in the various impact categories that will be necessary to accomplish a detailed evaluation of the most promising measures during Phase 2.

Impacts Under Baseline Conditions

As the result of work completed during Phase I of this study, identification of types of impacts on interest groups and the natural environment can be made for low, high, and fluctuating water conditions. Table F-2-1 contains an inventory of positive and negative types of impacts potentially or actually experienced by interest groups under high, low, and fluctuating water level conditions. Table F-2-2 shows impacts to the natural environment. These types of impacts are indicative but should not be considered exhaustive.

In assessing the impacts identified in Table F-2-1, it is clear that both extreme (record) low and extreme (record) high water levels establish conditions that cause a number of problems. In the case of low levels, substantial negative impacts are identified for the transportation, electric power, commercial and industrial, non-riparian recreation, and environment interest groups. When extreme high water conditions prevail, problems are more narrowly targeted with the riparian interest group in particular suffering significant impacts along with members of other interest groups whose shoreline property and operations can be harmed by flooding and erosion. As for the natural environment, fluctuations are seen as desirable, with a mixture of beneficial and adverse impacts under extreme conditions.

Impacts Matrix

With problems in the base condition identified for interests and environments, the next step is to examine measures that have the potential to prevent or respond to the problems, and to evaluate the possible impacts of taking action. One method of organizing this process is in the form of an impacts matrix, where an initial characterization of a measure can be displayed by listing

the anticipated types of impacts of the measure along one axis of a graph and the interest groups and environment categories along a second axis. The objective is to develop a profile of the measure based on the distribution of its impacts across the interest groups and the environment categories.

An equally important challenge is to identify the means by which an impact is measured, and to develop the actual measurement, if possible. Impacts of measures must compare anticipated conditions with and without the measure in place. If data to complete a measurement is not yet available, then judgment based on available information and experience can be applied to represent an early indication of the expected type of impact in each case. This information is used in the subsequent stage of the evaluation process, where the measure is evaluated based on the core and operational criteria that describe and define the factors which establish whether a favorable or unfavorable assessment of the measure is rendered. Application of the evaluation instrument uses information from the impacts matrix along with other information in deriving assessments for the core and operational criteria.

Table F-2-3 displays the format of the impact matrix and the way in which the measurement information is organized. Application of the impacts matrix in the case of two representative test measures will be presented subsequently in this chapter. Documentation (file material) is available on the development of impacts matrices for all of the 23 measures applied to test the evaluation instrument during Phase I.

TABLE F-2-1

TYPES OF IMPACTS UNDER EXTREME HIGH, EXTREME LOW
AND FLUCTUATING WATER LEVEL BASELINE CONDITIONS, BY INTEREST GROUPS

Interest Group	Positive Impact Types	Negative Impact Types
1. Transportation/ Navigation		
a. High Levels	Less dredging of channels and docksides needed	More wake damage to shorelines along connecting channels
	Greater carrying capacities	Slower speeds through channels Reduced control with higher flows through channels can increase accident risk Greater flood damage risk to shoreside facilities Greater short-term erosion damage risk in some cases Loading at docks can be affected
b. Low Levels	Slower currents in narrow non-linear channels	Reduced carrying capacities More dredging required and disposal material volume increase Greater risk of groundings Greater rotting of exposed wooden docks and piers Draft restrictions at harbors, (e.g., Montreal, Quebec) and in connecting channels
c. Fluctuating Levels		Creates uncertainty for maintenance dredging needs
2. Riparians, including Native Peoples		
a. High Levels	Organized sense of community in face of shared threat	Greater risk of flood damages Greater risk, perhaps, of short-term erosion damages Greater risk of damage to docks and boathouses as well as residences Increased risk of social disruptions due to flooding and erosion Short-term loss of beaches Potential or actual decreases in property values Increased costs of shore protection Failure of septic systems Reduced enjoyment of property Increase in personal anxiety
b. Low Levels	Reduced risk, perhaps, of erosion losses	Restrictive conditions for recreational boating
	Reduced risk of flooding losses	Increased costs for keeping boat docks operational Possible negative aesthetics from near shore exposure of lake bottom Detrimental affects to living quality of Native Peoples through effects such as increased scouring of channels, negative impacts on fish and wildlife, and uncertain conditions for economic development

Table F-2-1 (cont'd)

Interest Group	Positive Impact Types	Negative Impact Types
c. Fluctuating Levels		Creates uncertainty in private uses of shorelines
3. Electric Power		
a. High Levels	Maximize hydroelectric production	Possible damage to shoreside facilities due to storm induced levels and erosion
	Plentiful cooling water for shoreside thermal plants	Reduced head for hydro generation if tailrace water levels are elevated
b. Low Levels	Easier maintenance of hydropower units, fewer generating losses while under repair	Reduced hydroelectric production
		Higher raw material shipping costs to thermal plants
		Utility interconnections may be strained, shortages possible
		Air and water quality problems with increased thermal plant discharges
		Increased pumping costs for cooling water to thermal plants
		Negative public reactions and regulatory reviews due to electricity cost increases
		Increased fly ash disposal problems
		Increased water withdrawals for thermal plants
c. Fluctuating Levels		Less than maximum production
4. Commercial and Industrial		
a. High Levels	Lower transportation costs	Increased flooding and short-term erosion risks at facilities, e.g., Thunder Bay grain elevators
	Less dredging required	
	Reduced pumping costs for water intakes	Drainage and sewer problems increased
		Increased costs to adapt dockage
	More marina business	
		Recreation-related beachfront commercial losses with temporary loss of beaches
b. Low Levels	More beach exposed leads to gains in recreation-related beachfront commerce	Recreational boating restrictions, confined areas, shorter seasons lead to losses of revenues
		Cruise boats suffer revenue reductions
		Higher transportation costs
		More hazardous navigation conditions, increasing congestion in harbors and channels between commercial and recreational boaters
		Water intakes need extending, higher pumping costs
		Increased dry rot of wooden mooring piers

Table F-2-1 (cont'd)

Interest Group	Positive Impact Types	Negative Impact Types
4. Commercial & Industrial (cont'd)		
c. Fluctuating Levels		Planning for facilities made difficult with widely ranging fluctuations
5. Agriculture		
a. High Levels		Greater risk of cropland being inundated, dikes overtopped Increased pumping costs Possible increase in erosion
b. Low Levels	Pumping costs reduced	
c. Fluctuating Levels		
6. Non-Riparian Recreation		
a. High Levels	Increase in recreational boating	Greater short-term risk of beaches eroded
	Increased safety for boaters	Greater short-term risk of property losses due to erosion
		Docks may require adaptation, increasing costs
		Shoreline hiking may be restricted
b. Low Levels	Expanded beach areas lead to increasing revenues for beachfront commerce	Shoaling problems for recreational boaters, increased grounding risk
		Forage and spawning beds for sports fish may be impacted
		Reduced boating opportunities especially large power boats and sailboats
		Loss of revenues to marinas, launch ramps and docks affected
		Potential harm to waterfowl, reduced hunting opportunities
		Water skiing may be restricted or more hazardous
c. Fluctuating Levels		Requires flexibility in recreational boating and other activities
7. Environment		
a. High Levels	Good for hypolimnion size (thermal stratification at lake bottom)	High flows increase flooding and erosion along connecting channels and St. Lawrence

Table F-2-1 (cont'd)

Interest Group	Positive Impact Types	Negative Impact Types
7. Environment (cont'd)		
	Water quality improves with better dilution of discharges	High flows detrimental to connecting channel wetlands
	Enhances fish production	Reduces opportunities for recovery and protection of cultural resources
	Improves embayment flushing	
	Good for water temperatures	
	Reduces cladophora abundance (algae)	
	Good for waterfowl and other wildlife	
b. Low Levels	Short term reduction in erosion in certain areas	Harm to beaches, vegetation encroaches
	Less flooding in nearshore/ onshore areas	Hypolimnion size affected
	Increases opportunities to locate cultural resources	Poorer fish production
	Low tributary flows (at times associated with low levels during extended periods of rainfall deficits) assist in sea lamprey control	Bad for water temperatures
		Reduces embayment flushing
		Increases cladophora (algae)
		Harms wetlands, waterfowl, and other wildlife
c. Fluctuating Levels	See Table F-2-2	See Table F-2-2
8. Governments		
a. High Levels		Increased risk of flooding and/or short-term erosion of government facilities and property
		Anticipating and responding to the impacts experienced by the other interest groups as guided by the objectives identified in the core criteria
b. Low Levels		Increased difficulty in providing services to constituents, e.g., water supply, recreation

Table F-2-1 (cont'd)

Interest Group	Positive Impact Types	Negative Impact Types
8. Governments (cont'd)		
		Anticipating and responding to the impacts experienced by the other interest groups as guided by the objectives identified in the core criteria
c. Fluctuating Levels		Same as above
9. Commercial Fishing		
a. High Levels		Damages to docks from storms and ice Damage to nets from debris
b. Low Levels		Restricts access to private harbors
c. Fluctuating Levels	Maintenance and rejuvenation of fish habitats	

TABLE F-2-2
IMPACTS UNDER EXTREME HIGH, EXTREME LOW AND FLUCTUATING
WATER LEVEL CONDITIONS, BY TYPE OF ENVIRONMENT

Environment and Water Level Condition	Positive Impacts	Negative Impacts
1. Terrestrial		
a. High Levels	Storm-induced overwash maintains width of barrier beaches and islands	Short-term increase in shore recession
		Shore-term loss of dune habitat
		Increased bank erosion along connecting channels
b. Low Levels	Short-term decrease in shore recession	Exposure of nearshore strata to subaerial weathering
	Rebuilding of dunes	
	Vegetation increases lakeward	
	Reduced bank erosion along connecting channels	
	Offshore sediment is entrained and moved onshore or alongshore	
c. Fluctuating Levels	Increased diversity of physical shore features (beaches, dunes, barrier islands)	
2. Wetland		
a. High Levels	Invasion of wetland species landward (and destruction of competing terrestrial species)	Destruction of emergent species
		Invasion of submergent species
b. Low Levels	Exposure of seed beds and germination	Invasion of woody (terrestrial) species
c. Fluctuating Levels	Maintenance of plant species diversity	
	Maintenance of diversity of wetland, wetland habitats (marshes, swamps, fens)	
	Increased opportunity of fires and release of nutrients and removal of organic accumulations	
	Enhanced fish and waterfowl habitat	
	Enhanced stability-resilience	
	Increased areal extent of wetland	

Table F-2-2 (cont'd)

Environment and Water Level Condition	Positive Impacts	Negative Impacts
3. Aquatic		
a. High Levels	Increased nutrient inputs from wetlands (detrital export)	Increased movement of contaminants from shore areas (e.g. septic beds)
	Increased hypolimnetic waters	Leaching of contaminants from newly submerged soils
	Increased channel flows and decreased entrainment of fish larvae in intakes	
	Increased dilution of contaminants	
	Increased flushing of nearshore areas	
	New habitat for nearshore fish created	
b. Low Levels	Cleansing of nearshore spawning beds	Decreased nutrient exchange (detrital export)
		Decreased shoulder (edge) habitat for fish in channels
		Decreased water quality
		Exposure of spawning beds
		Increased disturbance of bottom sediments (may contain pollutants)
c. Fluctuating Levels	Maintenance of genetic diversity (through changing habitat conditions)	
	Maintenance and rejuvenation of fish habitats	
	Enhance productivity of fish and other aquatic communities	

TABLE F-2-3
IMPACTS MATRIX FORMAT

Measure: _____
_____

Types of Impacts	Natural Environments				Interest Groups											Relevance to Operational Criteria
	(j) Terrestrial	(k) Wetland	(l) Aquatic		(a) Transportation	(b) Residents	(c) Elderly	(d) Income	(e) Agriculture	(f) Non-profit	(g) Environmental	(h) Governmental	(i) Economic			
Cost				1		x					x					1A
Damages Prevented				2		x		x		x		x				1A
Wetlands Affected		x	x	3						x	x					2A, 2C
Etc.				4												etc.
				5												
				6												
				7												
				8												
				9												
				10												
				11												
				12												

TABLE F-2-3 (cont'd)
IMPACTS MATRIX FORMAT

Measure: _____

_____

Impacts Matrix Location	Method/Unit of Measurement, with Actual Measurement, if Available
Box 1b, 1h	$ cost to implement the measure, (1b, $2 mil.est.; 1h, $10 mil. est.), e.g.
Box 2b, 2d	average annual property damage prevented due to reduction in flooding incidents (2b, $200,000, est.; 2d, $50,000, est.), e.g.
	average annual property damage prevented due to reduction in erosion losses (2b, $40,000 est.; 2d, $60,000 est.), e.g.
Box 2f	average annual cost reduction to adapt recreational boating docks and launch ramps ($25,000 est.), e.g.
Box 2h	average annual reduction in emergency response costs ($50,000 est.), e.g.
Box 3f	$ reduction in value of recreational user days for waterfowl hunting due to wetland habitat changes ($10,000 est.), e.g.
Box 3g, 3k, 3l	# of acres of wetland habitat lost (500 acres), e.g.
etc.	etc.

CRITERIA

In considering water level fluctuations and measures to address such fluctuations, various interest classes hold positions as to the perceived nature of the problem and desired solution. Underlying these positions, interest classes apply certain criteria to evaluate the effects and impacts of fluctuations and measures. These criteria are evaluative rules on some dimension of concern to interest classes and in turn to the governments who seek solutions to problems through a structured decision-making process. Criteria are conceptual but must have operational components that are measurable. These criteria were developed throughout the course of the study by the Criteria Work Group. One example of the effort expended in the criteria investigations was a Multi-Criteria Evaluation Workshop held in June 1988. Additional effort led to the finalization of the "core criteria" which are defined in the following paragraphs.

There are six core criteria identified in this study which provide the context for assessing the impacts of possible measures. They are, in random order; economic sustainability, environmental integrity, social desirability, reduction of uncertainty and risk, implementability and political acceptability, and equitability. Definitions for these core criteria follow:

a. Economic Sustainability - The objective of maintaining, at a minimum, the existing level of economic activity within the Great Lakes-St. Lawrence River Basin. Economic growth and development can be realized through greater productivity in the application of existing economic and natural resources so that these goals are not achieved at the expense of environmental, social, and cultural resources of significant value of society.

b. Environmental Integrity - The sustenance of important biophysical processes which support plant and animal life and which must be allowed to continue without significant change. The objective is to assure the continued health of essential life support systems of nature, including air, water, and soil, by protecting the resilience, diversity, and purity of natural communities (ecosystems) within the environment.

c. Social Desirability - The continued health and well-being of individuals and their organizations, businesses, and communities to be able to provide for the material, recreational, aesthetic, cultural, and other individual and collective needs that comprise a valued quality of life. The satisfaction of this objective includes a consideration of individual rights, community responsibilities and requirements, the distributional impacts of meeting these needs, and the determination of how these needs should be achieved (paid for) along with other competing requirements of society.

d. Reduction of Uncertainty and Risk - The evaluation of a proposed measure in terms of the unpredictability and magnitude of the consequences which may follow, the detectability of anticipated or unanticipated consequences, and the ability to reverse, adapt, or redirect the measure, depending on its effects.

e. Implementability and Political Acceptability - The coalescence of sufficient support to endorse a measure and the identification of a legal or institutional mechanism able to be applied to put the measure into effect. The greater the breadth of support, agreement, and consensus among affected interests, the more likely is the measure to be politically acceptable and implementable. The more demonstrable the feasibility of a measure, in its engineering, economic, environmental, social, and financial aspects, the more likely it is to be politically acceptable and implementable.

f. Equitability - The assessment of the fairness of a measure in its distribution of favorable or unfavorable impacts across the economic, environmental, social, and political interests that are affected.

While the core criteria provide the context for assessing the impacts of possible measures, an additional step is taken to facilitate the measurement and application of these six broad concepts in the assessment process. This is to establish operational criteria in each case which further explain and define the core criteria and which can be measured or otherwise evaluated. The operational criteria are listed in Table F-2-4 and definitions and measurement criteria, including methods of measurement, will be covered in the next section. A sample measures summary score sheet with the core criteria is shown in Table F-2-5. Twenty-three "Representative" measures were used to test the evaluation instrument during Phase I. These are found in Table F-3-1. Descriptions of these measures can be found in Annex E, Appendix E-4.

EVALUATION

The evaluation instrument has now been conceptually outlined by the definition of the core criteria. What remains is a detailed development (to the extent possible in Phase 1) of the operational criteria that provide the "measurements" of the essence of the core criteria. As with other components within the evaluation instrument there is flexibility in determining the number and type of operational criteria to be used in the assessment of measures. They may be modified, or changed in number, depending on whether these actions will contribute to the assessment. They will not all be applicable in each case, based on the nature of the measure under investigation. They will not

necessarily be judged as having equal value or importance in all cases. Formal weighting procedures can be established to ensure that those factors deemed to be most significant will have the greatest influence in determining the outcome of the assessment. Weighting is considered to be premature and inappropriate in the context of this Reference Study. It should be undertaken as a subsequent refinement by more extensive exercise when deemed appropriate by governments. Likewise, minimal scoring values can be established to ensure that critical, sensitive factors are achieved before a measure is rated "acceptable". This has not been done in this annex, but is a consideration for future applications.

Table F-2-4 - LISTING OF CORE AND OPERATIONAL CRITERIA

CORE CRITERIA	OPERATIONAL CRITERIA
1. Economic Sustainability	A. Aggregated Bi-National Net Benefits
	B. Regional Economic Development
2. Environmental Integrity	A. Environmental Diversity
	a) Plant & Animal Species
	b) Number of Habitats
	c) Physical Features
	B. Environmental Purity
	a) Toxic or Chemical Contamination
	b) Air, Water, Soil & Soil Substrate
	c) Introduction of Exotic Organisms
	C. Environmental Resilience
	D. Environmental Productivity
	a) Total Habitat Area
	b) Net Primary Productivity
3. Social Desirability	A. Human Health, Security, & Well-Being
	B. Private Property Rights
	C. Effects Across Social Strata
	D. Public Access to Natural & Cultural Resources
4. Reduction of Risk and Uncertainty	A. Flexibility
	B. Reversibility
	a) Residual Effect on the Man-Made Environment
	b) Residual Effects on the Natural Environment
	C. Predictability
	D. Responsiveness
5. Implementability & Political Acceptability	
	A. Technical Feasibility
	B. Legal & Policy Compatibility
	a) Within the U.S.
	b) Within Canada
	C. Cost-Sharing Acceptability
	D. Compatibility of Views
	E. Fiscal Acceptability
6. Equitability	A. Sectoral Equity
	B. Regional Equity
	C. Bi-National Equity

TABLE F-2-5 - SAMPLE MEASURES SUMMARY SCORE SHEET

CORE CRITERIA	M	E	A	S	U	R	E	S
Economic Sustainability								
Environmental Integrity								
Social Desirability								
Risk & Uncertainty								
Implementability & Political Acceptability								
Equitability								

SCORE SUMMARIES						

It is important that issues vital to the analysis be defined and capable of being measured and evaluated as operational criteria in the assessment process. In this way, systematic consideration of all important concerns can be achieved, and the most important factors in the outcome of an assessment can be identified. The identification and development of the operational criteria are contained in the paragraphs that follow. Their consideration within the evaluation instrument itself, in the form of worksheets, is shown in Appendix F-3.

Economic Sustainability - The economic sustainability criterion compares the expected economic consequence of measures at National and Regional economic levels. This core criterion is composed of two operational criteria; Aggregated Bi-National Net Benefits and Regional Economic Development.

a. Aggregated Bi-National Net Benefits are defined as the effect of a measure in terms of total net benefits (i.e., net combined total national economic impacts for the U.S. and Canada minus the total bi-national costs of the measure) it produces. Economic impacts (both positive and negative) measured in capitalized monetary terms are summed across all interests and both nations. Costs are the present value of the measure which includes all planning, design, administrative, construction, enforcement, maintenance, operation and replacements inclusive of all other resource costs necessary to make the measure fully operational. Therefore this operational criteria is simply measured by the net difference between economic benefits and economic resource costs.

The score range of "+3" to "-3" is based on the dollar magnitude of net benefits with "+3" for substantial positive net present value and "-3" for substantial negative net present values; a "0" score for no net aggregate gain or loss. * Once detailed costs are estimated for the array of measures, specific dollar ranges can be added to the narrative description of the magnitude (e.g., substantial).

b. The second operational criteria developed for economic sustainability is Regional Economic Development, defined as the net change in the natural or competitive potential of regions within the Great Lakes Basin relative to pre-measure existing conditions. The method selected for measuring this operational criteria is net changes in the levels of income or employment within the Great Lakes Basin. The scoring, "+3" for substantial increase, and "-3" for substantial decrease in levels of income and employment, and "0" score is for no net change.

*Note: A zero net score in any measure evaluation by any operational criteria should always be scrutinized as a possible result not of marginal relevance, but of offsetting positive and negative scoring of operational criteria.

Environmental Integrity - Environmental integrity is the ability of living things to interact and maintain their structure and function in the environment in some self-sustaining, stable fashion. The object is to ensure the quality and quantity of the terrestrial, wetland and aquatic environments of the Great Lakes Basin, at current levels as a minimum, by protecting and enhancing the productivity, diversity, purity and resilience of those environments. These four attributes are the operational criteria for this core criterion. A measuring technique has been devised which reflects some of the environmental factors that can be affected by actions (measures) introduced into the ecosystem. Most of these environmental factors relate to the concerns of the biological aspects of the physical environment.

a. Environmental Diversity is assessed in three ways. First, the changes in the number of plant and animal species are counted after the environment has adjusted to the impacts. A "+3" rating means there is an increase in species diversity without causing increased competition. A "+2" rating reflects no change in species diversity while "+1" and "0" ratings have no meaning. A "-3" rating indicates a potential for substantial increase or decrease in diversity.

The second way is to assess the changes in the number (variety) of habitats. A "+3" rating represents a substantial increase in habitats while a "-3" rating represents a substantial decrease. A score of "0" represents no net change.

The third way is to assess the change in number (variety) of physical features (i.e., dunes, bluffs, beaches, etc.). A "+3" rating represents no change in the number of features. A "+2", "+1", and "0" rating have no meaning. Ratings of "-1", "-2", and "-3" relate to minimal, moderate, and significant changes, respectively in the number of physical features.

b. Environmental Purity is defined as the desirability of minimizing chemical contamination, exotic organisms, thermal pollution and other human inputs harmful to environmental structure and function. There are three ways of measuring this, the first by the change in the levels of toxic or chemical contamination. A "+3" rating indicates a substantial decrease in toxicity or contamination of the environmental compared to the pre-measure environment, while a "-3" indicates a substantial increase. A "0" rating represents no change in toxicity when compared to the pre-measure condition.

The second way to measure environmental purity is to assess the air, water, soil and soil substrate quality. A "+3" rating represents a substantial improvement of air, water, soil and soil substrate quality, while "-3" represents a substantial degradation. A "0" rating indicates negligible change in quality inclusive of short-term inputs.

The third way is to assess the potential for introduction of exotic organisms. A "+3" rating represents introduction of a large number of beneficial organisms, while a "-3" rating represents the introduction of a large number of detrimental organisms. A "0" rating indicates no introductions.

c. Environmental Resilience is defined as the ability of an environment to maintain itself or recover from some disturbance, natural or human, and is measured by the technical judgment of the environment's ability to recover from the impacts. Concepts of elasticity, amplitude, hysteresis, and malleability may all be applicable here. A "+3" rating is assigned if the environment will recover to the pre-measure state, while a "-3" indicates that the environment will not recover. A "0" rating indicates the environment has the ability of recovering towards the pre-measure state, however, it is uncertain it will actually do so.

d. Environmental Productivity is defined as the ability of the environment to produce a variety of biotic and abiotic outputs essential to the maintenance of the environment. In a biotic context, plants convert solar energy into chemical energy necessary to the maintenance of all life. Primary productivity puts an upper limit on the size of animal populations. Abiotic environmental products, for example, indicate erosion of shores which produces sediment for redistribution. Changes in productivity (both biotic and abiotic) can result from increases or decreases in the productivity of a unit area of environment or from changes in the quantity of particular environments. For this exercise environmental productivity was measured in two ways. First, by weighing changes in the total habitat area. A "+3" rating represents a substantial gain in habitat area, while a "-3" is a substantial loss. A "0" rating is assigned if there is no net gain in habitat area for all types of habitat.

Environmental productivity was also assessed by changes in the net primary productivity of living matter produced by all habitats. A "+3" rating indicates a substantial gain in living matter produced, while a "-3" reflects a substantial loss. A "0" rating implies no net gain.

Social Desirability - Social desirability is society's perception of how a measure may influence or change the overall living conditions or lifestyles which are expected by individuals and groups. Due to the subjective nature of this criteria and the diversity of values and tastes that cut across the fabric of modern day society, defining good operational criteria which capture the essence of desires of the public is a difficult task.

Four operational criteria have been identified and defined. A measuring technique has been devised which reflects some of the social factors which can be affected by the types of measures introduced to the study. Most of these operational criteria relate to the concerns of the riparian interest group simply

because, from a social standpoint, they are the most affected interest group identified thus far.

a. Human Health, Security, and Well Being is defined as: "the exposure of shoreline property owners and users to adverse physical effects from natural phenomenon including lake storms and extreme high and low water levels." This operational criterion is measured by the technical judgment of the estimated degree to which a measure will change the incidence of disruptions, damages, including evacuations of individuals, families, communities at specific sites; adverse effects of extreme low waters and expected consequences upon water quality, dilution, etc. For the rating scale, a "+3" is scored for a substantial net decrease in the frequency, intensity, or reduced monetary losses associated with natural phenomenon while a "-3" is scored if it is judged that, as a result of the measure, there is a substantial inducement of future disaster potential and/or substantial increase in shoreline development susceptible to adverse effects from natural phenomenon. A score of "0" implies that there is no net change.

b. Private Property Rights are defined as legal guarantees and limitations of perceived and de facto property and water rights. It is simply measured by any change in private property rights. For this operational criterion a "+3" is scored if the measure does not alter private property rights or maintains the status quo. A "-3" is scored if there is a substantial change and/or restriction placed upon premeasure property rights. A "0" is scored for a moderate change in the level of premeasure property rights.

c. Effects Across Social Strata are defined as distribution effects of a measure. This operational criterion is designed to identify if a measure affects one income group differently from another and is measured by the incidence of impacts across income levels or intervals of property values. The highest rating, "+3", is scored if the distribution of impacts is equal and beneficial across the designated intervals of income or property values while a "-3" is scored if there is substantially uneven and detrimental distribution of the effects across social strata. Other intermediate ratings relate both to the distributional impacts of a measure and the direction (positive or negative) of the impacts.

d. Public Access to Natural and Cultural Resources is defined as the availability of active and passive recreational and cultural opportunities for public participation. This is measured by the net change of available opportunities for specialized or general recreational activities which exist in the basin. The rating scale for this operational criterion scores a "0" for no net change in opportunities and either a "+3" or a "-3" for the substantial creation of, or substantial loss of, annual activity occasions, respectively.

Reduction of Risk and Uncertainty - The interpretation of this core criterion has been divided into four operational criteria which relate the characteristics of any proposed measure to the uncertainty and risk that can accompany its implementation. These operational criteria are: flexibility, reversibility, predictability, and responsiveness. Assessments of these operational criteria are more judgmental and are not generally tied to information coming out of the impacts matrices. They relate more to the characteristics of the measures themselves rather than impacts sustained by interest groups or the environment. The paragraphs that follow explain the philosophical derivation and rating system developed to address them.

a. Flexibility is defined as its ability to adjust to changing physical and/or social conditions. That is, after implementation, it can be adjusted to regulate its effects in consonance with changing circumstances. One notable example of a changing natural condition is the potential impact the "greenhouse effect" could have on future lakes' levels. Man-made changes can relate to future shoreline use, occupancy, and rights. The measurement of this operational criterion is based upon a technical judgment of the operational range or implementation criteria of a measure. A measure receives a rating of "+3" if it is fully flexible and responds well to changing conditions such as high and low levels, and receives a rating of "-3" if it is totally inflexible and cannot adjust in any way to extremes of water level. A rating of "0" is assigned if the measure is partially flexible and can sometimes respond to a changing condition.

b. Reversibility is a technical judgment of the characteristic of a measure and its outputs that allows it to be liquidated or annulled. The ease with which a measure and its outputs can be liquidated gives governments some information on the ability to reverse its decision. This involves the risk or uncertainty associated with the commitment of resources and residual effects of the measure. This operational criterion is broken down into two measurements: the first assesses the degree of the residual effect of the measure on the man-made environment (the physical alterations required to implement the measure); and the second assesses the residual effect of the measure on the natural environment. These distinctions are important because, with some types of measures, there may be more at risk than the commitment of resources to implement the measures. The measure may alter the natural environment to the point where it may not be able to sustain its previous state, and it will evolve to a new equilibrium which may or may not be reversible even if the man-made environment is reversed. In general, a measure rates higher which is reversible to a greater degree. A rating of "+3" for both the man-made and natural suboperational criteria is associated with a full restoration to prior conditions, and a "-3" rating is applied where recovery is not possible and the

physical or natural effects are permanent. A measure may be assigned a rating of "0" if it is judged to have the partial ability to restore to premeasure conditions , but will have some residual effects.

c. Predictability is a technical judgment of the measure's ability to fulfill its intended objectives within the range of predicted impacts. The assessment points to the confidence that the effects and impacts evaluated elsewhere in the instrument are likely to occur. A higher score is assigned to a measure for which the estimated impacts/outputs have a high probability of occurring. The measurement of this operational criterion is based upon the extent of scientific or practical knowledge about a particular measure. A "+3" rating is associated with a substantial body of knowledge about a particular measure and a high degree of confidence about its characteristics, impacts, or expected outputs or function. A "-3" rating would indicate that the measure may be conceptual in nature, may never have been implemented within the region, or may have unpredictable outputs or impacts upon the man-made or natural environments. The "0" rating is assigned where limited information is available and/or few examples of the measure's application exist.

d. Responsiveness is the ability to respond to both high and low water conditions. The assessment of this operational criterion is based upon technical judgment of the operational range or implementation criteria of the measure. In general, a measure scores higher in responsiveness if it responds well to both high and low water level conditions. A "+3" rating is assigned to a measure that responds well to both conditions, and a "-3" rating is assigned if the measure is not responsive to either. A "0" rating is assigned to a measure that may respond to <u>either</u> high or low water conditions, but is marginal or has no effect on the other extreme.

<u>Implementability and Political Acceptability</u> - This core criterion is responsive to the characteristics of a measure, the nature of impacts or outputs and the expected reactions by governments, interest classes and the general public. There are five operational criteria associated with the core criterion: technical feasibility, legal and policy compatibility, cost-sharing acceptability, compatibility of views, and fiscal acceptability. Each of these operational criteria is discussed below.

a. Technical Feasibility is the characteristic of a measure which is evaluated relative to the existing technical body of knowledge in light of sound engineering principles. Implementation or construction of a measure may require application of simple techniques or passage of new legislative initiatives. On the other hand, there may be alternatives which push the limit of existing technical knowledge and/or abilities.

The more basic or demonstrable the measure is in light of accepted engineering procedures which have proven reliable from past field applications, the more general acceptance the measure will likely have by interest groups, governments, or the public. Also, widespread support for a measure is more likely if it is already part of the man-made environment. A "+3" rating is given if a measure uses technology that is sound, and/or well-known and similar measures have been successfully implemented elsewhere. A "-3" rating indicates that no technology is available or there is no past experience with the particular measure. A "0" rating is made if practical examples of similar measures have been applied in areas outside the Great Lakes Basin .

b. Legal and Policy Compatibility is the degree of fit between a measure relative to existing laws, rules, and policies. Measures which can be integrated within existing institutional frameworks are more likely to be accepted to resolve problems and needs within the Great Lakes-St. Lawrence River Basin. If many rules and regulations exist which create a complex regulatory structure within which the measure must be approved or evaluated (i.e.; public hearings, environmental studies including lengthy environmental impact statements, etc.), the less likely the measure will represent a timely measure to responded to short-term needs related to water level problems. The nature of the legal and administrative climate was specifically addressed within the United States and Canada. This operational criterion also provides insight into the nature of changes which may be required before a measure could be fully operational and respond to the specific problems and needs. A "+3" rating indicates substantial compliance with all rules, regulations, or policies while a "-3" indicates substantial conflicts. The "0" rating indicates minor changes at low levels of government may be necessary to implement a measure. All other rating values have no meaning for this operational criterion.

c. Cost-Sharing Acceptability is the extent of support for a measure by sponsors within the Great Lakes-St. Lawrence River Basin as affected by their perception of the "worth" of the measures and their expectation of the need to participate in a cost-sharing procedure. Various participants including levels of government may be involved in the recovery of costs for measures. The "measurement" of this operational criterion is an assessment of the perceived willingness of participants to successfully negotiate agreements necessary to cost-share a particular measure. A "+3" rating indicates a high probability of negotiating successful cost-sharing agreements. A "-3" rating is associated with a low probability. A "0" rating indicates moderate probability of negotiating successful cost-sharing agreement and/or experience with cost-sharing agreements for similar measures. Other intermediate ratings were not used.

d. Compatibility of Views is the extent of consensus in support of a measure by various beneficiaries as an indication of the practicality of pursuing a measure for implementation.

Widespread support for a measure across all interest groups would be ideal; however, this condition is not expected since there is a diversity of preference and problems to be resolved within the basin. Insight into the problems of each interest class, when combined with the expected outputs from a measure was evaluated using information obtained from the literature, group depth interviews, and personal interviews with representatives of the interest classes. A count of the number of interest groups who may oppose or support a particular measure was used to indicate the degree of compatibility of views. A consensus would be indicated by a majority of interest classes expected to support a measure, the maximum number of interests that support a measure would rate this measure above all others. This philosophy is reflected in the ratings where "+3" indicates all interest classes support. A "-3" rating indicates all interest classes oppose. A "0" indicates a relatively equal amount of support/opposition. The other ratings indicate intermediate levels of support or opposition for the measure under consideration.

e. Fiscal Acceptability attempts to address the relative costs of an expenditure by a particular level of government. Even small expenditures may have a large relative impact in light of other public priorities. Relative effects can only be evaluated when the level of government expected to participate in a measure can be identified and the overall fiscal resources available to that level of government can be quantified. This also presumes that reliable costs for measures can be developed and eventually compared to operating budgets at various levels of government. A "+3" rating indicates that the cost of the measure is not a burden and does not impact other priorities, while a "-3" rating indicates a substantial burden that will impact other priorities. A "0" rating is assigned where a moderate burden with some impacts on priorities will occur. The remaining rating values of "+2", "+1", "-1", and "-2" are not used.

Equitability has as its basis the philosophy that a measure should be fair and equitable to all. The impacts (both positive and negative) of a measure should then be spread out as much as possible amongst all interest classes (sectors), regions within the Great Lakes-St. Lawrence River Basin, and the two nations that "manage" the Great Lakes and St. Lawrence, the United States and Canada. The operational criteria that follow deal with the impacts of a measure across all the previous core criteria. Besides the three operational criteria described below to expand upon the concept of equitability, it has also been suggested that "intergenerational equity" would be worthy of consideration as another operational criterion in this category.

a. Sectoral Equity addresses the overall concept of equity of a measure across the interest classes that are identified as having some stake in Great Lakes-St. Lawrence River Basin water and related land resource management. It assesses the degree to which a measure is viewed as fair and responsive to the perceived needs of each sector in terms of the distribution of impacts. It

is measured by the magnitude and/or incidence of the benefits and costs between sectors. A "+3" rating indicates a perception of equal balance of impacts between all sectors from a measure, with a "-3" rating indicating a substantial imbalance. A "0" rating is assigned when it is not clear if any sector(s) will benefit more than other sectors from a particular measure. The other ratings scale the degree of balance or imbalance as appropriate.

b. Regional Equity is a component of "equitability" which addresses the overall concept of equity of a measure on specific regions. This specific measurement of fairness will be defined as the degree to which a region (states or provinces) within the Great Lakes-St. Lawrence River Basin shares the beneficial or adverse consequences of outputs from a measure. The judgment will be made over all categories of impacts both beneficial and adverse.

The net changes from a measure, including consideration of gains and losses, may be evaluated with complex regional models which attempt to measure tangible changes to levels of income or employment. In the absence of detailed data regarding a measure, technical judgment may also be used to address the more intangible effects such as environmental gains or losses or social changes associated with a measure.

The ratings for regional equity are similar to sectoral equity except the measurement statements apply to regions instead of sectors.

c. Bi-National Equity is a concept used to judge whether a measure provides reasonably equal or relatively equal aggregate impacts on both Canada and the United States. Bi-national equity is rated on a scale of "+3" to "-3", with highly equitable measures (rated "+3") resulting in the two nations incurring the same or relatively similar aggregate gains on the five core criteria. A rating of "0" would indicate one nation gains while the other nation is not impacted by the measure and experiences no gains or losses. A rating of "-3" would indicate one nation receives a disproportionate amount of aggregate gains (or losses) compared to the other, while both incur impacts.

Measure Worksheets and Summary Sheets

The output of the preceding sections is an evaluation instrument which consists of a package of worksheets and a summary sheet designed to "walk" someone through the evaluation of a measure. The complete evaluation instrument is shown in Appendix F-3 of this Annex.

It is intended to guide agencies of government (or other evaluators) through a systematic assessment of an individual measure. These worksheets generally consist of: a measure definition; the core criterion; the operational criterion and its definition; an "as measured by" statement; a rating system to assign values to a measure in the +3 to -3 range (in most cases);

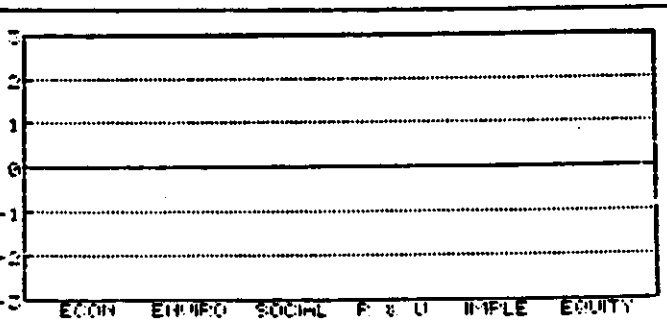
a rating for the measure; and a space to indicate the rationale or data source to support the rating given. Information from the impacts matrix assists in supporting this process. These worksheets are intended to backup the rating or score given each operational criterion so that any measure can be reviewed by anyone having a question about the scoring. These backup worksheets can also be added to as more data is developed with which to perform a more detailed evaluation of the measure. They may also be modified to provide a more "precise" evaluation as the amount of data about the measure and its consequences grows.

Figure F-2-2 is a measure score sheet that has been developed to combine all the ratings on the suboperational, operational, and core criteria to arrive at a measure's score. The sheet is set up to organize the ratings and allows spaces for weighting the various levels of criteria. This gives agencies of governments or others using the evaluation instrument the ability to assign weights to reflect "high priority" criteria which have greater implications than the others. The summary sheet assigns a measure "score" based upon combination of all the core criteria scores, and also provides a bar graph "fingerprint" of the measure's positive and negative outputs relative to the six core criteria.

MEASURE _____

Figure F-2-2 Measure Score Sheet

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
1. Economic Sustainability	A. Aggregated Bi-National Net Benefits				0.50			
	B. Regional Economic Development				0.50		0.167	
2. Environmental Integrity	A. Environmental Diversity		0.33					
	a) Plant & Animal Species							
	b) Number of Habitats		0.33					
	c) Physical Features		0.33		0.25			
	B. Environmental Purity							
	a) Toxic or Chemical Contamination		0.33					
	b) Air, Water, Soil & Soil Substrate		0.33					
	c) Introduction of Exotic Organisms		0.33		0.25			
	C. Environmental Resilience				0.25			
	D. Environmental Productivity							
	a) Total Habitat Area		0.50					
	b) Net Primary Productivity		0.50		0.25		0.167	
3. Social Desirability	A. Human Health, Security, & Well Being				0.25			
	B. Private Property Rights				0.25			
	C. Effects Across Social Strata				0.25			
	D. Public Access to Natural & Cultural Resources				0.25		0.167	
4. Risk & Uncertainty	A. Flexibility				0.25			
	B. Reversibility							
	a) Residual Effect on the Man-Made Environment		0.50					
	b) Residual Effect on the Natural Environment		0.50		0.25			
	C. Responsiveness				0.25			
	D. Predictibility				0.25		0.167	
5. Implementability & Political Acceptability	A. Technical Feasibility				0.20			
	B. Legal & Policy Compatability		0.50					
	a) Within the U. S.							
	b) Within Canada		0.50		0.20			
	C. Cost-Sharing Acceptability				0.20			
	D. Compatibility of Views				0.20			
	E. Fiscal Acceptibility				0.20		0.167	
6. Equitability	A. Sectoral Equity				0.33			
	B. Regional Equity				0.33			
	C. Bi-National Equity				0.33		0.167	



Graph A

* TOTAL MAY NOT ADD DUE TO ROUNDING

SECTION 3
TEST OF THE EVALUATION INSTRUMENT

The purpose of this section is to report on the initial test of the "Evaluation Instrument" that was conceptually developed in the previous section. The instrument was initially applied to six "representative measures" and subsequently to 17 more in an effort to determine if the instrument can be applied to the wide range of measures under consideration in this study. The test also served to point to changes or adjustments that may be necessary to develop a rating system across measure types. It is important to note that these initial tests were conducted using technical judgments and assessments based upon data available in January - March 1989. Part of the exercise will be to determine the additional data needs for these and other measures that will undergo similar evaluation procedures as the study progresses from Phase 1 to Phase 2.

TEST MEASURES

The measures selected for the test of the "Evaluation Instrument" were taken from the list of "Representative Measures" that was developed throughout the course of the Phase 1 investigation. The list of "Representative Measures" is an output of a PMT working session and additions by the Measures Sub-Group. "Representative" measures were selected to illustrate the groupings and ranges within measure types. No judgment as to the merit of the particular measure is implied by its selection for use in this exercise.

The selected measures and a brief description of their characteristics are found in Annex E, Appendix E-4. A list of the measures used to test the Evaluation Instrument is contained in Table F-3-1.

TABLE F-3-1

REPRESENTATIVE LIST OF MEASURES USED TO TEST THE EVALUATION INSTRUMENT

Type I - Public Investment in Control and Diversion Works

1.2.1 - Full Regulation of Lake Erie (50N)
1.3.1 - Manipulation of Interbasin Diversions such as Long Lac-Ogoki and Chicago
1.3.10 - A 50,000 cfs Diversion In and Out of the Great Lakes System
1.4.4 - Placement of Sills at Lakes' Outlets

Type 2 - Public Investment to Direct Land and Water Use to Adapt to Shore Fluctuating Levels

2.1.5 - Breakwater Construction
2.1.12 - Structural Floodproofing
2.2.4 - Fee Simple Property Rights Purchase with Possible Resale, with Restrictions on Development
2.3.1 - Navigation and Access Channel and Harbor Dredging/Deepening

Type 3 - Direct Public Regulation of Land and Water Use

3.1.1 - Mandatory Setback Zoning
3.1.6 - Mandatory Structure Relocation, with Subsidies
3.2.1 - Regulate Shore Protection Works and Navigation Structure Construction
3.3.1 - Regulation of Consumptive Uses (Management)

Type 4 - Public Programs to Indirectly Influence Land and Water or the Effects of Fluctuating Levels

4.1.7 - Interest Rate Subsidy Loan
4.2.9 - Tax Abatement to Cover Increased Operating Costs
4.3.1 - Public Information and Education Programs
4.3.5 - Real Estate Disclosure

Type 5 - Emergency Response Capability

5.2 - Sandbagging, Diking and Other Assistance
5.4 - Information Centers/Improved Communications/ Storm Forecasting
5.6 - Black Rock Lock Discharges

Table F-3-1 (cont'd)

Type 6 - Combinations

6.1 - Full Regulation of all the Great Lakes by combining Lake Erie Plan 50N (1.2.1) with Placement of a Sill in the St. Clair River (1.4.4), which is the outlet to Lakes Michigan-Huron, and Mandatory Setback Zoning (3.1.1)

6.4 - Full Regulation of Lake Erie (1.2.1) with Mandatory Setback Zoning (3.1.1)

6.5 - Protective Works for Structures (2.1.1-12) and Regulate the Use of Property in Hazard Areas (3.1.1-6)

6.6 - Mandatory Setback Zoning (3.1.1) with Public Information and Education Programs (4.3.1)

NOTE: All Type 6 Measures include Type 5 Measures as a Fallback Position in times of Emergency

APPLICATION OF THE IMPACTS MATRIX

In order to proceed with an initial test of the evaluation instrument, the selected "representative" measures were examined through an application of the impacts matrix. The sequence of steps in applying the impacts matrix is as follows: first, identify the potential types of impacts directly from the characteristics and the objective(s) of the measure itself; second, identify the interest groups and natural environments likely to be affected by the types of impacts being identified; third, establish the ways in which the effects on interests and the natural environment can be measured in each case, and the actual measurement of the impact if and when available; and fourth, identify the connection between type of impact and the relevant operational criteria. If specific data is unavailable, then the best available information and judgment is applied to indicate the anticipated nature (direction and magnitude) of the impacts.

Examples of initial results from the application of the impacts matrix are displayed in Tables F-3-2 and F-3-3, which illustrate their initial use for the evaluation instrument. Information from the impacts matrix assists in providing a basis for assigning values to the operational criteria in the subsequent stage of the evaluation process. Impacts matrices were completed for each of the 23 representative test measures and are maintained as file material documenting the initial use of the evaluation instrument.

In numerous cases, the impact categories are identified in ways to insure that as many of the relevant operational criteria as possible have a measurable way of being assessed. The impacts matrix is also structured to encourage the simultaneous consideration of impacts, interest groups, and the natural environments so that concerns of all kinds have the best possible chance of being explicitly identified. The impacts matrix can be used most effectively if technical specialists in the fields of engineering, economics, sociology, environmental sciences, risk analysis, and policy sciences have the opportunity to bring their knowledge together jointly in consideration of possible measures. This will also enhance the identification of ways in which possible impacts can be measured, and strategies for achieving their measurement.

The initial application of the impacts matrix for the representative measures, while not exhaustive in detail, illustrates a means by which likely interest-group and environmental concerns of the impacts of measures can be identified in a structured format.

TABLE F-3-2
IMPACTS MATRIX #1 - ANNEX DISPLAY

Measure: Setbacks for Structures in
3.1.1 Zoning Requirements

Types of Impacts	(j) terrestrial	(k) wetland	(l) aquatic		(a) transportation	(b) residential	(c) electric-power	(d) commercial industrial	(e) agriculture	(f) non-riparian recreation	(g) environment	(h) government	(i) commercial fishing	Relevance to Operational Criteria
	Natural Environment				Interest Groups									
Implementation Costs				1		x				x		x		1A, 5B, 5C
Flood Related Property Damage Impacts				2		x				x				1A
Erosion Related Property Damage Impacts				3		x				x				1A
Future Development Effects				4	x	x	x	x		x			x	1A, 1B, 3B
Habitat Effects	x	x	x	5							x			2A, 2D
Human Health, Security, & Well-Being				6		x				x		x		3A
Private Property Rights				7	x	x	x	x		x			x	3B
Effects Across Social Strata				8		x				x				3C
Public Access to Natural/Cultural Reso.				9						x		x		3D
Governance Arrangements				10								x		5B
Compatibility of Views				11	x	x	x	x	x	x	x	x	x	5D
				12										
				13										
				14										
				15										

TABLE F-3-2
IMPACTS MATRIX #1 (cont'd)

Measure: Setbacks for Structures in Zoning Requirements

Impacts Matrix Location	Method/Unit of Measurement, with Actual Measurement, if Available
Box 1b	$ cost incurred as part of the relocation program (based on participation rate, remains to be determined)

Box 1h	$ cost to complete delineation of erosion setback lines
	$ compliance and enforcement costs
	$ subsidies to support relocation program (costs fairly small but still to be determined)

Box 1f	$ cost incurred as part of the relocation program, for lakeshore rental cabins, motels (based on participation rate, remains to be determined)
Box 2b, 2f	Average annual property $ damages prevented due to reduced flood exposure (magnitude of benefits not yet known)
Box 3b, 3f	Average annual property $ damages prevented due to reduced erosion exposure (magnitude of benefits not yet known)
Box 4a, 4b, 4c, 4d, 4f, 4i	Increase in cost to pursue development among each interest group category in compliance with the measure, if any (magnitude of cost impact not yet known)
Box 5g, 5j, 5k 5l	Changes in # of acres of various habitat types Changes in numbers of plant and animal species (magnitude of impacts not yet known, but expected to be favorable)

TABLE F-3-2 (cont'd)

Measure: Setbacks for Structures in Zoning Requirements

Impacts Matrix Location	Method/Unit of Measurement, with Actual Measurement, if Available
Box 6b, 6f, 6h	Reduction in the frequency and intensity of monetary losses associated with flooding and erosion; reduction in emergency costs associated with responding to such events, on an average annual $ cost avoided basis (magnitude of impacts expected to be favorable, but not yet measured)
Box 7a, 7b, 7c, 7d, 7f, 7i	Change in legal guarantees and limitations related to private property rights (this measure significantly restricts private property rights in terms of future development)
Box 8b, 8f	Assessment of the distributional incidence of a measure across income levels or property values (magnitude of impacts, and their distribution, not yet known)
Box 9f, 9h	Increase in available recreational opportunities, as measured by unit day $ values on an average annual basis (impact expected to be positive, but not yet measured)
Box 10h	Assessment of the ease or difficulty of implementing a measure at all levels of government, in complying with applicable rules, regulations, and policies in both the U.S. and Canada. (Measure already implemented in certain jurisdictions; assessment of its effectiveness and further application remains to be made).
Box 11a, 11b, 11c, 11d, 11e, 11f, 11g, 11h, 11i	Assessment of the likely reaction of interest groups to the proposed measure. (Significant split in views anticipated over the idea of private right restrictions versus non-structural approach responding to high water level problems).

TABLE F-3-3
IMPACTS MATRIX #2 - ANNEX DISPLAY

Measure: Full Regulation of Lake Erie (Plan 50N)
1.2.1

Types of Impacts	Natural Environment (j) terrestrial	(k) wetland	(l) aquatic		Interest Groups (a) transportation	(b) residential	(c) electric-power	(d) commercial industrial	(e) agriculture	(f) non-riparian recreation	(g) environment	(h) government	(i) commercial fishing	Relevance to Operational Criteria
Project Costs				1								x		1A, 5E
Income & Employment Effects				2				x				x		1B
Flood Related Property Damage Impacts				3	x	x	x	x	x	x		x	x	1A
Erosion Related Property Damage Impacts				4	x	x	x	x	x	x		x	x	1A
Economic Impacts on Business Activities				5	x		x	x	x	x			x	1A
Habitat Effects	x	x	x	6						x	x			1A, 2A, 2C, 2D
Water Quality Effects		x	x	7							x	x		2B
Environmental Diversity Effects	x	x	x	8							x			2D
Effects of Environmental Purity		x	x	9							x	x		2B
Health, Security, & Well-Being Effects		x	x	10		x		x		x		x		3A
Effects Across Social Strata				11		x			x	x				3C
Public Access to Natural/Cultural Reso.				12						x		x		3D
Governance Arrangements				13								x		5B
Financing/Cost Arrangements				14	x	x	x	x	x	x		x		5C, 5E
Compatibility of Views				15	x	x	x	x	x	x	x	x	x	5D

TABLE F-3-3
IMPACTS MATRIX #2 (cont'd)

Measure: Full Regulation of Lake Erie (Plan 50N)

Impacts Matrix Location	Method/Unit of Measurement, with Actual Measurement, if Available
Box 1h	$ cost to implement the measure (rough estimate is $500 million to $1 billion)
Box 2d, 2h	$ increase in income and # of jobs increases resulting from project-related construction (positive impact in both categories, numbers not yet specified)
Box 3a, 3b, 3c, 3d, 3e, 3f, 3h, 3i	Net measurement of average annual property damages prevented due to reduction in flooding incidents in each interest group category on Lake Erie upstream versus anticipated increased damages on Lake Ontario downstream (magnitude of respective impacts not yet known)
Box 4a, 4b, 4c, 4d, 4e, 4f, 4f, 4i	Net measurement, same as above, as related to erosion incidence, both upstream and downstream effects (magnitude of respective impacts not yet known)
Box 5a	Net change in commercial navigation transportation costs, $/ton cost to ship cargoes, with slightly positive (?) impact on Lake Erie upstream due to better protection against low levels, versus increased costs downstream due to more hazardous and uncertain operating conditions on St. Lawrence River (magnitude of impacts not yet known)
Box 5c	Net change in hydropower generation, with slightly positive impact from Niagara River upstream due to more regulated levels and flows regime, versus significant negative downstream impact due to greater fluctuations in levels and flows (magnitude of impacts not yet known), measured by changes in ¢/kwh charges

TABLE F-3-3
IMPACTS MATRIX #2 (cont'd)

Measure: Full Regulation of Lake Erie (Plan 50N)

Impacts Matrix Location	Method/Unit of Measurement, with Actual Measurement, if Available
Box 5d	Net change in operational costs, average annual $ impact, in areas such as drainage and sewer maintenance, maintenance of wood mooring piers, water intake extensions, etc., with slightly positive impacts from Lake Erie upstream anticipated due to reduced range of fluctuating levels, versus increased costs from Lake Ontario downstream (magnitude of impacts not yet known)
Box 5e	Net change in pumping costs, average annual $ impact, favorable for Lake Erie upstream and unfavorable for Lake Ontario downstream (magnitude of impacts not yet known)
Box 5f	Net change, average annual $ impact, in cost and revenue areas such as adapting docks to fluctuating levels, and increases or losses of recreational boating business, with positive impacts anticipated for Lake Erie upstream and negative impacts for Lake Ontario downstream (magnitude of impacts not yet known)
Box 5i	Net change in commercial fishing income, if harvest potential in all parts of the system is affected by water level fluctuations (impact not yet known)
Box 6f	Net change in recreational opportunities, measured by user day $ values, due to potential waterfowl and recreational fishing effects associated with possible habitat changes resulting from adjustments to the existing fluctuating water level regime, both upstream and downstream areas (magnitude of impact not yet known)

TABLE F-3-3
IMPACTS MATRIX #2 (cont'd)

Measure: Full Regulation of Lake Erie (Plan 50N)

Impacts Matrix Location	Method/Unit of Measurement, with Actual Measurement, if Available
Box 6g, 6j, 6k, 6l	Net change in acres of various habitat types throughout the system (magnitude of impacts not yet known)
Box 7g, 7h, 7k, 7l	Changes in concentrations of chemicals, chloride, phosphorus in water, dissolved oxygen concentration, etc. (magnitude of impacts not yet known)
Box 8g, 8j, 8k, 8l	Changes in the number of plant and animal species after the environment has adjusted to the impacts associated with the measure (magnitude of impacts not yet known)
Box 9g, 9h, 9k, 9l	Changes in the level of toxic or chemical contamination; changes in air, water, and soil or soil substrate quality; and benefit or disbenefit to desirable and undesirable organisms (magnitude of impacts not yet known)
Box 10b, 10d, 10f, 10h	Net change in the frequency and intensity of monetary losses associated with fluctuating water levels, with slightly positive effects from Lake Erie upstream anticipated and negative effects from Lake Ontario downstream (magnitude of impacts not yet known)
Box 11b, 11e, 11f	Assessment of the distributional incidence of a measure across income levels or property values, considering both positive upstream and negative downstream effects (magnitude of impacts not yet known)
Box 12f, 12h	Net change in available opportunities for general and specialized recreational activities within the basin, expected to be somewhat favorable from Lake Erie upstream and unfavorable from Lake Ontario downstream (magnitude of impacts not yet known)

TABLE F-3-3
IMPACTS MATRIX #2 (cont'd)

Measure: Full Regulation of Lake Erie (Plan 50N)

Impacts Matrix Location	Method/Unit of Measurement, with Actual Measurement, if Available
Box 13h	Assessment of the ease or difficulty of implementing a measure, at all levels of government, in compliance with applicable rules, regulations, and policies in both the U.S. and Canada. As a major structural measure with widespread effects, this is viewed initially as a measure more difficult to implement, but a more considered assessment remains to be made.
Box 14a, 14b, 14c, 14d, 14e, 14f, 14h	Assessment of the likely responsiveness of potential sponsoring interests to finance and/or recover the cost of a measure. As an expensive measure, this is viewed initially as more difficult to implement, both from a fiscal budget/ taxpayer perspective and in terms of coordinating potential local sponsorship when so many of the interests are affected, both favorably and unfavorably. A more considered assessment remains to be made.
Box 15a, 15b, 15c, 15d, 15e, 15f, 15g, 15h, 15i	Assessment of the likely reaction of interest groups to the proposed measure. This measure splits interest groups internally because of its opposite effects upstream and downstream. There is likely to be considerably strong opposition to this measure as a result, especially from downstream interests and environmental interests.

CRITERIA SCORES & AGGREGATE EVALUATION

This sub-section will present tables containing the operational criteria and core criteria scores for each of the 23 measures used to test the Evaluation Instrument, and the overall score for each measure tested. The backup sheets which actually make up the written record of the measure evaluation are not included in this presentation, due to their length, but are maintained as supporting file material for this annex. A sample evaluation using the evaluation instrument is included as Appendix F-4.

The work sheets which make up the Evaluation Instrument provide a systematic means of completing an evaluation of a measure with consistent treatment of all measures used for testing. The testing process during Phase I entailed three to six people devoting up to a week on two separate occasions to complete the initial evaluations on the 23 test measures. An attempt was made to bring people from as many disciplines as possible (engineers, environmental scientists, and economists were participants) to the process to reflect the accumulated knowledge and expertise that has been developed during the course of Phase I of this study. Participants were asked jointly, as time permitted, to apply available information, knowledge, and insight in assessing the most significant factors identified by each of the operational criteria for each measure, and to reach agreement on assigning a score (+3 to -3) in each case. The process was extensive in the range of considerations feeding into the evaluation by means of the operational criteria, and intensive, as discussions often developed at a high level of detail in explaining the significance of relevant factors in the analysis. The process is time consuming and demanding, but succeeds in bringing to the surface the important linkages between the characteristics of a measure, the potential impacts on interest groups and the natural environment, and the judgments involved in assigning values for the operational criteria across the disciplines engaged in the process.

The work sheets provide space to indicate in writing the rationale leading to decisions concerning the assigned values for each of the operational criteria. The factors covered in the rationale may be as valuable as the assigned score itself in developing an appreciation for the thoroughness of the initial evaluation that takes place in working through the instrument. Obviously, the more background information, data, and knowledge of each of the measures that is available, the more substantial the quality of the evaluation becomes. However, the process succeeds even without a great amount of detailed information in developing a valuable sense of what the impacts of measures could be and the sensitivity of issues and concerns stemming from a proposed action. Working through the instrument is also of great benefit in refining the measures themselves, because the

questions that are raised in the evaluation process require that features such as cost sharing formulas, level of responsibility for implementation, and the technical aspects of the structural or non-structural proposal be specified so that a common understanding of what is being evaluated is developed.

Tables F-3-4 through F-3-26 contain the summary score sheets for each of the 23 representative measures that were used to conduct the initial testing of the evaluation instrument. Scores for each of the operational criteria are identified, then aggregated to obtain a score for the six core criteria. The six core criteria scores are then converted to a weighted measure score, in this case by applying an equal weight of 1/6 (.167), to arrive at the final measure score.

There are several ways of looking at the results to determine if there are any patterns that emerge from initial use of the evaluation instrument. One is to organize the raw scores on operational criteria by the six types of measures that were tested. Table F-3-27 contains such a display. Another is to compare the unweighted core criteria scores across the sample of 23 representative measures that were tested. Tables F-3-28A and F-3-28B provide such summaries, showing the two sets of representative measures for which initial evaluations were completed. It must be remembered that the selection of representative measures for testing and the results of the initial evaluations do not constitute considered preferences or determinations about the advisability of potential future courses of action. During Phase I of this study, the objective was to develop and test an evaluation process for potential application subsequently by governments or at a subsequent stage of this study.

Summary Score Sheets

Table F-3-4

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: -1.0

MEASURE: 1.2.1 - Full Regulation of Lake Erie (50N)

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			-3.0	0.5			
	Regional Economic Development			1.0	0.5	-1.0	0.167	-0.2
Environmental Integrity	Environmental Diversity	-3.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	-3.0	0.33					
	c) Physical Features							
		-1.0	0.33	-2.3	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	-1.0	0.33					
	b) Air, Water, Soil & Soil Substrate	-2.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	-1.0	0.25			
	Environmental Resilience			-3.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	-3.0	0.50					
	b) Net Primary Productivity	-2.0	0.50	-2.5	0.25	-2.2	0.167	-0.4
Social Desirability	Human Health, Security, & Well Being			-2.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			0.0	0.25			
	Public Access to Natural & Cultural Resources			-2.0	0.25	-0.3	0.167	-0.0
Risk & Uncertainty	Flexibility			2.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	0.0	0.5					
	b) Residual Effect on the Natural Environment	-3.0	0.5	-1.5	0.25			
	Responsiveness			2.0	0.25			
	Predictibility			2.0	0.25	1.1	0.167	0.2
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	-3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	-3.0	0.5	-3.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			-2.0	0.2			
	Fiscal Acceptibility			-3.0	0.2	-1.8	0.167	-0.3
Equitability	Sectoral Equity			-2.0	0.33			
	Regional Equity			-3.0	0.33			
	Bi-National Equity			-2.0	0.33	-2.3	0.167	-0.4

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

Table F-3-5

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: -0.6

MEASURE:1.3.1 Manipulation of Interbasin Diversions

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			-2.0	0.5			
	Regional Economic Development			0.0	0.5	-1.0	0.167	-0.2
Environmental Integrity	Environmental Diversity	-1.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	-1.0	0.33					
	c) Physical Features							
		-1.0	0.33	-1.0	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	-1.0	0.33					
	c) Introduction of Exotic Organisms	-1.0	0.33	-0.7	0.25			
	Environmental Resilience			-1.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	-1.0	0.50					
	b) Net Primary Productivity	-1.0	0.50	-1.0	0.25	-0.9	0.167	-0.2
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			0.0	0.25			
	Effects Across Social Strata			0.0	0.25			
	Public Access to Natural & Cultural Resources			1.0	0.25	0.5	0.167	0.1
Risk & Uncertainty	Flexibility			0.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	0.0	0.5					
	b) Residual Effect on the Natural Environment	-1.0	0.5	-0.5	0.25			
	Responsiveness			0.0	0.25			
	Predictibility			3.0	0.25	0.6	0.167	0.1
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	-3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	-3.0	0.5	-3.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			-2.0	0.2			
	Fiscal Acceptibility			0.0	0.2	-1.0	0.167	-0.2
Equitability	Sectoral Equity			-1.0	0.33			
	Regional Equity			-3.0	0.33			
	Bi-National Equity			-1.0	0.33	-1.7	0.167	-0.3

Table F-3-6

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: -1.1

MEASURE: 1.3.10 - A 50,000 cfs Diversion

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			-3.0	0.5			
	Regional Economic Development			2.0	0.5	-0.5	0.167	-0.1
Environmental Integrity	Environmental Diversity	-3.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	-3.0	0.33					
	c) Physical Features							
		-1.0	0.33	-2.3	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	-3.0	0.33					
	c) Introduction of Exotic Organisms	-3.0	0.33	-2.0	0.25			
	Environmental Resilience			-3.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	-3.0	0.50					
	b) Net Primary Productivity	-2.0	0.50	-2.5	0.25	-2.5	0.167	-0.4
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			3.0	0.25			
	Public Access to Natural & Cultural Resources			1.0	0.25	2.0	0.167	0.3
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	-3.0	0.5					
	b) Residual Effect on the Natural Environment	-3.0	0.5	-3.0	0.25			
	Responsiveness			3.0	0.25			
	Predictibility			-3.0	0.25	0.0	0.167	0.0
Implementability & Political Acceptability	Technical Feasibility			-2.0	0.2			
	Legal & Policy Compatability	-3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	-3.0	0.5	-3.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			-3.0	0.2			
	Fiscal Acceptibility			-3.0	0.2	-2.8	0.167	-0.5
Equitability	Sectoral Equity			-2.0	0.33			
	Regional Equity			-3.0	0.33			
	Bi-National Equity			-3.0	0.33	-2.7	0.167	-0.4

Table F-3-7

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

								MEASURE SCORE	-0.2

MEASURE:1.4.4 Placement of Sills at Lakes' Outlets

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			0.0	0.5			
	Regional Economic Development			0.0	0.5	0.0	0.167	0.0
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	3.0	0.33					
	b) Number of Habitats	1.0	0.33					
	c) Physical Features							
		-2.0	0.33	0.7	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	1.0	0.33					
	b) Air, Water, Soil & Soil Substrate	1.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.7	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	1.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.5	0.25	0.5	0.167	0.1
Social Desirability	Human Health, Security, & Well Being			-1.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			0.0	0.25			
	Public Access to Natural & Cultural Resources			-1.0	0.25	0.3	0.167	0.0
Risk & Uncertainty	Flexibility			-3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	0.0	0.5					
	b) Residual Effect on the Natural Environment	-1.0	0.5	-0.5	0.25			
	Responsiveness			-1.0	0.25			
	Predictibility			3.0	0.25	-0.4	0.167	-0.1
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	0.0	0.5					
	a) Within the U. S.							
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			-2.0	0.2			
	Fiscal Acceptibility			0.0	0.2	-0.4	0.167	-0.1
Equitability	Sectoral Equity			-2.0	0.33			
	Regional Equity			-1.0	0.33			
	Bi-National Equity			-1.0	0.33	-1.3	0.167	-0.2

Table F-3-8

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

									MEASURE SCORE	0.1
MEASURE: 2.1.5 - Breakwater Construction										
SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE		
Economic Sustainability	Aggregated Bi-National Net Benefits			0.0	0.5					
	Regional Economic Development			1.0	0.5	0.5	0.167	0.1		
Environmental Integrity	Environmental Diversity	2.0	0.33							
	a) Plant & Animal Species									
	b) Number of Habitats	0.0	0.33							
	c) Physical Features									
		-2.0	0.33	0.0	0.25					
	Environmental Purity									
	a) Toxic or Chemical Contamination	0.0	0.33							
	b) Air, Water, Soil & Soil Substrate	-1.0	0.33							
	c) Introduction of Exotic Organisms	0.0	0.33	-0.3	0.25					
	Environmental Resilience			0.0	0.25					
	Environmental Productivity									
	a) Total Habitat Area	0.0	0.50							
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	-0.1	0.167	-0.0		
Social Desirability	Human Health, Security, & Well Being			1.0	0.25					
	Private Property Rights			3.0	0.25					
	Effects Across Social Strata			-3.0	0.25					
	Public Access to Natural & Cultural Resources			1.0	0.25	0.5	0.167	0.1		
Risk & Uncertainty	Flexibility			-2.0	0.25					
	Reversibility									
	a) Residual Effect on the Man-Made Environment	0.0	0.5							
	b) Residual Effect on the Natural Environment	-1.0	0.5	-0.5	0.25					
	Responsiveness			0.0	0.25					
	Predictibility			3.0	0.25	0.1	0.167	0.0		
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2					
	Legal & Policy Compatability	3.0	0.5							
	a) Within the U. S.									
	b) Within Canada	3.0	0.5	3.0	0.2					
	Cost-Sharing Acceptability			0.0	0.2					
	Compatibility of Views			-1.0	0.2					
	Fiscal Acceptibility			-2.0	0.2	0.6	0.167	0.1		
Equitability	Sectoral Equity			-2.0	0.33					
	Regional Equity			-1.0	0.33					
	Bi-National Equity			-1.0	0.33	-1.3	0.167	-0.2		

Table F-3-9

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 0.1

MEASURE: 2.1.12 - Structural Floodproofing

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			1.0	0.5	1.0	0.167	0.2
Environmental Integrity	Environmental Diversity	0.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	0.0	0.33					
	c) Physical Features							
		0.0	0.33	0.0	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	0.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.0	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	0.0	0.167	0.0
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			0.0	0.25			
	Effects Across Social Strata			-3.0	0.25			
	Public Access to Natural & Cultural Resources			0.0	0.25	-0.5	0.167	-0.1
Risk & Uncertainty	Flexibility			0.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	0.0	0.5					
	b) Residual Effect on the Natural Environment	0.0	0.5	0.0	0.25			
	Responsiveness			0.0	0.25			
	Predictibility			2.0	0.25	0.5	0.167	0.1
Implementability & Political Acceptability	Technical Feasibility			2.0	0.2			
	Legal & Policy Compatability	0.0	0.5					
	a) Within the U. S.							
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			1.0	0.2			
	Fiscal Acceptibility			-3.0	0.2	-0.6	0.167	-0.1
Equitability	Sectoral Equity			-1.0	0.33			
	Regional Equity			0.0	0.33			
	Bi-National Equity			1.0	0.33	0.0	0.167	0.0

Table F-3-10

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 1.3

MEASURE: 2.2.4 - Fee Simple Prop. Rights Purchase..

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			1.0	0.5	1.0	0.167	0.2
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	3.0	0.33					
	b) Number of Habitats	2.0	0.33					
	c) Physical Features							
		0.0	0.33	1.7	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	2.0	0.33					
	b) Air, Water, Soil & Soil Substrate	2.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	1.3	0.25			
	Environmental Resilience			3.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	2.0	0.50	1.0	0.25	1.8	0.167	0.3
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			2.0	0.25			
	Public Access to Natural & Cultural Resources			2.0	0.25	2.0	0.167	0.3
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	2.0	0.5					
	b) Residual Effect on the Natural Environment	0.0	0.5	1.0	0.25			
	Responsiveness			0.0	0.25			
	Predictibility			2.0	0.25	1.5	0.167	0.3
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	0.0	0.5					
	a) Within the U. S.							
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			1.0	0.2			
	Fiscal Acceptibility			-3.0	0.2	-0.4	0.167	-0.1
Equitability	Sectoral Equity			2.0	0.33			
	Regional Equity			1.0	0.33			
	Bi-National Equity			3.0	0.33	2.0	0.167	0.3

Table F-3-11

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: -0.4

MEASURE: 2.3.1 Dredging of Nav. Channels & Harbors

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			0.0	0.5			
	Regional Economic Development			1.0	0.5	0.5	0.167	0.1
Environmental Integrity	Environmental Diversity	-3.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	-3.0	0.33					
	c) Physical Features							
		-1.0	0.33	-2.3	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	-3.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33					
				-1.0	0.25			
	Environmental Resilience			-2.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	-3.0	0.50					
	b) Net Primary Productivity	-3.0	0.50	-3.0	0.25	-2.1	0.167	-0.3
Social Desirability	Human Health, Security, & Well Being			-2.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			-1.0	0.25			
	Public Access to Natural & Cultural Resources			1.0	0.25	0.3	0.167	0.0
Risk & Uncertainty	Flexibility			-1.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	0.0	0.5					
	b) Residual Effect on the Natural Environment	-3.0	0.5	-1.5	0.25			
	Responsiveness			0.0	0.25			
	Predictibility			2.0	0.25	-0.1	0.167	-0.0
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	0.0	0.5					
	a) Within the U. S.							
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			0.0	0.2			
	Compatibility of Views			0.0	0.2			
	Fiscal Acceptibility			-3.0	0.2	0.0	0.167	0.0
Equitability	Sectoral Equity			-2.0	0.33			
	Regional Equity			0.0	0.33			
	Bi-National Equity			0.0	0.33	-0.7	0.167	-0.1

Table F-3-12

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 0.8

MEASURE: 3.1.1 - Mandatory Setback Zoning

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			1.0	0.5	1.0	0.167	0.2
Environmental Integrity	Environmental Diversity	-1.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	0.0	0.33					
	c) Physical Features							
		-2.0	0.33	-1.0	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	0.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.0	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	-0.3	0.167	-0.0
Social Desirability	Human Health, Security, & Well Being			2.0	0.25			
	Private Property Rights			-3.0	0.25			
	Effects Across Social Strata			3.0	0.25			
	Public Access to Natural & Cultural Resources			0.0	0.25	0.5	0.167	0.1
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	3.0	0.5					
	b) Residual Effect on the Natural Environment	2.0	0.5	2.5	0.25			
	Responsiveness			1.0	0.25			
	Predictibility			2.0	0.25	2.1	0.167	0.4
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	0.0	0.5					
	a) Within the U. S.							
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			-2.0	0.2			
	Fiscal Acceptibility			3.0	0.2	0.2	0.167	0.0
Equitability	Sectoral Equity			-2.0	0.33			
	Regional Equity			2.0	0.33			
	Bi-National Equity			3.0	0.33	1.0	0.167	0.2

Table F-3-13

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

								MEASURE SCORE	0.0

MEASURE: 3.1.6 - Subsidized Structure Relocation

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			0.0	0.5			
	Regional Economic Development			0.0	0.5	0.0	0.167	0.0
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	3.0	0.33					
	b) Number of Habitats	1.0	0.33					
	c) Physical Features	-1.0	0.33	1.0	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	1.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.3	0.25			
	Environmental Resilience			1.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	1.0	0.50					
	b) Net Primary Productivity	1.0	0.50	1.0	0.25	0.8	0.167	0.1
Social Desirability	Human Health, Security, & Well Being			2.0	0.25			
	Private Property Rights			-3.0	0.25			
	Effects Across Social Strata			-2.0	0.25			
	Public Access to Natural & Cultural Resources			1.0	0.25	-0.5	0.167	-0.1
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	-2.0	0.5					
	b) Residual Effect on the Natural Environment	0.0	0.5	-1.0	0.25			
	Responsiveness			0.0	0.25			
	Predictibility			0.0	0.25	0.5	0.167	0.1
Implementability & Political Acceptability	Technical Feasibility			1.0	0.2			
	Legal & Policy Compatability	-3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	0.0	0.5	-1.5	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			-2.0	0.2			
	Fiscal Acceptibility			0.0	0.2	-1.1	0.167	-0.2
Equitability	Sectoral Equity			-2.0	0.33			
	Regional Equity			2.0	0.33			
	Bi-National Equity			0.0	0.33	0.0	0.167	0.0

Table F-3-14

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

		MEASURE SCORE	1.0

MEASURE: 3.2.1 - Regulate Shore Prot.& Nav. Constr.

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			0.0	0.5	0.5	0.167	0.1
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	3.0	0.33					
	b) Number of Habitats	2.0	0.33					
	c) Physical Features							
		-3.0	0.33	0.7	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	0.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.0	0.25			
	Environmental Resilience			-3.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	2.0	0.50					
	b) Net Primary Productivity	1.0	0.50	1.5	0.25	-0.2	0.167	-0.0
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			0.0	0.25			
	Effects Across Social Strata			3.0	0.25			
	Public Access to Natural & Cultural Resources			0.0	0.25	1.0	0.167	0.2
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	-2.0	0.5					
	b) Residual Effect on the Natural Environment	-2.0	0.5	-2.0	0.25			
	Responsiveness			2.0	0.25			
	Predictibility			3.0	0.25	1.5	0.167	0.3
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	0.0	0.5	1.5	0.2			
	Cost-Sharing Acceptability			3.0	0.2			
	Compatibility of Views			-2.0	0.2			
	Fiscal Acceptibility			3.0	0.2	1.7	0.167	0.3
Equitability	Sectoral Equity			-1.0	0.33			
	Regional Equity			2.0	0.33			
	Bi-National Equity			3.0	0.33	1.3	0.167	0.2

Table F-3-15

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 1.0

MEASURE: 3.3.1 Reg. of Consumptive Uses -Management

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			0.0	0.5	0.5	0.167	0.1
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	2.0	0.33					
	b) Number of Habitats	0.0	0.33					
	c) Physical Features							
		0.0	0.33	0.7	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	2.0	0.33					
	b) Air, Water, Soil & Soil Substrate	2.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	1.3	0.25			
	Environmental Resilience			3.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	1.3	0.167	0.2
Social Desirability	Human Health, Security, & Well Being			3.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			3.0	0.25			
	Public Access to Natural & Cultural Resources			0.0	0.25	2.3	0.167	0.4
Risk & Uncertainty	Flexibility			0.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	2.0	0.5					
	b) Residual Effect on the Natural Environment	0.0	0.5	1.0	0.25			
	Responsiveness			2.0	0.25			
	Predictibility			0.0	0.25	0.8	0.167	0.1
Implementability & Political Acceptability	Technical Feasibility			2.0	0.2			
	Legal & Policy Compatability							
	a) Within the U. S.	0.0	0.5					
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			0.0	0.2			
	Compatibility of Views			0.0	0.2			
	Fiscal Acceptibility			0.0	0.2	0.4	0.167	0.1
Equitability	Sectoral Equity			-1.0	0.33			
	Regional Equity			1.0	0.33			
	Bi-National Equity			2.0	0.33	0.7	0.167	0.1

Table F-3-16

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 0.2

MEASURE: 4.1.7 - Interest Rate Subsidy Loan

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			2.0	0.5			
	Regional Economic Development			1.0	0.5	1.5	0.167	0.3
Environmental Integrity	Environmental Diversity	-2.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	-2.0	0.33					
	c) Physical Features							
		-1.0	0.33	-1.7	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	-1.0	0.33					
	c) Introduction of Exotic Organisms	1.0	0.33					
				0.0	0.25			
	Environmental Resilience			-1.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	-2.0	0.50					
	b) Net Primary Productivity	-2.0	0.50	-2.0	0.25	-1.2	0.167	-0.2
Social Desirability	Human Health, Security, & Well Being			2.0	0.25			
	Private Property Rights			0.0	0.25			
	Effects Across Social Strata			-3.0	0.25			
	Public Access to Natural & Cultural Resources			1.0	0.25	0.0	0.167	0.0
Risk & Uncertainty	Flexibility			-2.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	2.0	0.5					
	b) Residual Effect on the Natural Environment	-1.0	0.5	0.5	0.25			
	Responsiveness			1.0	0.25			
	Predictibility			1.0	0.25	0.1	0.167	0.0
Implementability & Political Acceptability	Technical Feasibility			2.0	0.2			
	Legal & Policy Compatability	3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	3.0	0.5	3.0	0.2			
	Cost-Sharing Acceptability			0.0	0.2			
	Compatibility of Views			2.0	0.2			
	Fiscal Acceptibility			2.0	0.2	1.8	0.167	0.3
Equitability	Sectoral Equity			-1.0	0.33			
	Regional Equity			-1.0	0.33			
	Bi-National Equity			-2.0	0.33	-1.3	0.167	-0.2

Table F-3-17

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

		MEASURE SCORE	1.0

MEASURE: 4.2.9 - Tax Abatement to Cover Oper. Costs

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			1.0	0.5	1.0	0.167	0.2
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	2.0	0.33					
	b) Number of Habitats	-1.0	0.33					
	c) Physical Features							
		0.0	0.33	0.3	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	1.0	0.33					
	b) Air, Water, Soil & Soil Substrate	-1.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.0	0.25			
	Environmental Resilience			-1.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	-1.0	0.50					
	b) Net Primary Productivity	-1.0	0.50	-1.0	0.25	-0.4	0.167	-0.1
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			-1.0	0.25			
	Public Access to Natural & Cultural Resources			1.0	0.25	1.0	0.167	0.2
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	1.0	0.5					
	b) Residual Effect on the Natural Environment	0.0	0.5	0.5	0.25			
	Responsiveness			3.0	0.25			
	Predictibility			-2.0	0.25	1.1	0.167	0.2
Implementability & Political Acceptability	Technical Feasibility			0.0	0.2			
	Legal & Policy Compatability							
	a) Within the U. S.	0.0	0.5					
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			0.0	0.2			
	Compatibility of Views			2.0	0.2			
	Fiscal Acceptibility			0.0	0.2	0.4	0.167	0.1
Equitability	Sectoral Equity			2.0	0.33			
	Regional Equity			3.0	0.33			
	Bi-National Equity			3.0	0.33	2.7	0.167	0.4

Table F-3-18

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 1.8

MEASURE: 4.3.1 - Public Info. & Education Programs

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			0.0	0.5	0.5	0.167	0.1
Environmental Integrity	Environmental Diversity	0.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	0.0	0.33					
	c) Physical Features							
		0.0	0.33	0.0	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	0.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.0	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	0.0	0.167	0.0
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			3.0	0.25			
	Public Access to Natural & Cultural Resources			0.0	0.25	1.8	0.167	0.3
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	3.0	0.5					
	b) Residual Effect on the Natural Environment	0.0	0.5	1.5	0.25			
	Responsiveness			3.0	0.25			
	Predictibility			2.0	0.25	2.4	0.167	0.4
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	3.0	0.5	3.0	0.2			
	Cost-Sharing Acceptability			3.0	0.2			
	Compatibility of Views			3.0	0.2			
	Fiscal Acceptibility			3.0	0.2	3.0	0.167	0.5
Equitability	Sectoral Equity			3.0	0.33			
	Regional Equity			3.0	0.33			
	Bi-National Equity			3.0	0.33	3.0	0.167	0.5

*Table F-3-19 IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 0.8

MEASURE: 4.3.5 - Real Estate Disclosure

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			-1.0	0.5			
	Regional Economic Development			0.0	0.5	-0.5	0.167	-0.1
Environmental Integrity	Environmental Diversity	0.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	0.0	0.33					
	c) Physical Features							
		0.0	0.33	0.0	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	0.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.0	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	0.0	0.167	0.0
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			0.0	0.25			
	Effects Across Social Strata			0.0	0.25			
	Public Access to Natural & Cultural Resources			0.0	0.25	0.3	0.167	0.0
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	3.0	0.5					
	b) Residual Effect on the Natural Environment	0.0	0.5	1.5	0.25			
	Responsiveness			3.0	0.25			
	Predictibility			2.0	0.25	2.4	0.167	0.4
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	0.0	0.5					
	a) Within the U. S.							
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			3.0	0.2			
	Compatibility of Views			-1.0	0.2			
	Fiscal Acceptibility			3.0	0.2	1.6	0.167	0.3
Equitability	Sectoral Equity			-1.0	0.33			
	Regional Equity			2.0	0.33			
	Bi-National Equity			3.0	0.33	1.3	0.167	0.2

Table F-3-20

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 1.8

MEASURE: 5.2 - Sandbagging, Diking, & Other Assist.

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			2.0	0.5			
	Regional Economic Development			1.0	0.5	1.5	0.167	0.3
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	-1.0	0.33					
	b) Number of Habitats	-1.0	0.33					
	c) Physical Features							
		3.0	0.33	0.3	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	0.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33					
				0.0	0.25			
	Environmental Resilience			2.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	0.6	0.167	0.1
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			0.0	0.25			
	Effects Across Social Strata			3.0	0.25			
	Public Access to Natural & Cultural Resources			2.0	0.25	1.5	0.167	0.3
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	3.0	0.5					
	b) Residual Effect on the Natural Environment	2.0	0.5	2.5	0.25			
	Responsiveness			2.0	0.25			
	Predictibility			3.0	0.25	2.6	0.167	0.4
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	3.0	0.5	3.0	0.2			
	Cost-Sharing Acceptability			3.0	0.2			
	Compatibility of Views			3.0	0.2			
	Fiscal Acceptibility			3.0	0.2	3.0	0.167	0.5
Equitability	Sectoral Equity			-2.0	0.33			
	Regional Equity			3.0	0.33			
	Bi-National Equity			3.0	0.33	1.3	0.167	0.2

Table F-3-21

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 1.4

MEASURE: 5.4 -Info. Centers / Storm Forecasting

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			0.0	0.5	0.5	0.167	0.1
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	0.0	0.33					
	b) Number of Habitats	0.0	0.33					
	c) Physical Features	0.0	0.33	0.0	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	0.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.0	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	0.0	0.167	0.0
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			0.0	0.25			
	Effects Across Social Strata			3.0	0.25			
	Public Access to Natural & Cultural Resources			0.0	0.25	1.0	0.167	0.2
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	3.0	0.5					
	b) Residual Effect on the Natural Environment	0.0	0.5	1.5	0.25			
	Responsiveness			3.0	0.25			
	Predictibility			3.0	0.25	2.6	0.167	0.4
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability							
	a) Within the U. S.	3.0	0.5					
	b) Within Canada			3.0	0.2			
	Cost-Sharing Acceptability			0.0	0.2			
	Compatibility of Views			3.0	0.2			
	Fiscal Acceptibility			3.0	0.2	2.4	0.167	0.4
Equitability	Sectoral Equity			1.0	0.33			
	Regional Equity			1.0	0.33			
	Bi-National Equity			3.0	0.33	1.7	0.167	0.3

Table F-3-22

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 0.3

MEASURE: 5.6 - Black Rock Lock Discharges

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			-1.0	0.5			
	Regional Economic Development			-1.0	0.5	-1.0	0.167	-0.2
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	2.0	0.33					
	b) Number of Habitats	0.0	0.33					
	c) Physical Features							
		3.0	0.33	1.7	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	-1.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	-0.3	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	0.3	0.167	0.1
Social Desirability	Human Health, Security, & Well Being			0.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			0.0	0.25			
	Public Access to Natural & Cultural Resources			-1.0	0.25	0.5	0.167	0.1
Risk & Uncertainty	Flexibility			-2.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	1.0	0.5					
	b) Residual Effect on the Natural Environment	2.0	0.5	1.5	0.25			
	Responsiveness			0.0	0.25			
	Predictibility			2.0	0.25	0.4	0.167	0.1
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	3.0	0.5	3.0	0.2			
	Cost-Sharing Acceptability			3.0	0.2			
	Compatibility of Views			-1.0	0.2			
	Fiscal Acceptibility			3.0	0.2	2.2	0.167	0.4
Equitability	Sectoral Equity			0.0	0.33			
	Regional Equity			-1.0	0.33			
	Bi-National Equity			-1.0	0.33	-0.7	0.167	-0.1

Table F-3-23

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: -0.7

MEASURE: 6.1 - Full Reg (50N, Sills,& Mand. Setback

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			-2.0	0.5			
	Regional Economic Development			1.0	0.5	-0.5	0.167	-0.1
Environmental Integrity	Environmental Diversity	-3.0	0.33					
	a) Plant & Animal Species							
	b) Number of Habitats	-3.0	0.33					
	c) Physical Features							
		-1.0	0.33	-2.3	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	-2.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33					
				-0.7	0.25			
	Environmental Resilience			-3.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	-3.0	0.50					
	b) Net Primary Productivity	-1.0	0.50	-2.0	0.25	-2.0	0.167	-0.3
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			-3.0	0.25			
	Effects Across Social Strata			2.0	0.25			
	Public Access to Natural & Cultural Resources			0.0	0.25	0.0	0.167	0.0
Risk & Uncertainty	Flexibility			2.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	0.0	0.5					
	b) Residual Effect on the Natural Environment	-2.0	0.5	-1.0	0.25			
	Responsiveness			1.0	0.25			
	Predictibility			2.0	0.25	1.0	0.167	0.2
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	-3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	-3.0	0.5	-3.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			-2.0	0.2			
	Fiscal Acceptibility			-3.0	0.2	-116	0.167	-0.3
Equitability	Sectoral Equity			-2.0	0.33			
	Regional Equity			-1.0	0.33			
	Bi-National Equity			-1.0	0.33	-1.3	0.167	-0.2

Table F-3-24

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 0.8

MEASURE: 6.4 Offshore brkwtrs & pub info/education

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			1.0	0.5	1.0	0.167	0.2
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	3.0	0.33					
	b) Number of Habitats	1.0	0.33					
	c) Physical Features	-1.0	0.33	1.0	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	1.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.3	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	1.0	0.50					
	b) Net Primary Productivity	1.0	0.50	1.0	0.25	0.6	0.167	0.1
Social Desirability	Human Health, Security, & Well Being			1.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			0.0	0.25			
	Public Access to Natural & Cultural Resources			1.0	0.25	1.3	0.167	0.2
Risk & Uncertainty	Flexibility			-1.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	0.0	0.5					
	b) Residual Effect on the Natural Environment	-1.0	0.5	-0.5	0.25			
	Responsiveness			0.0	0.25			
	Predictibility			3.0	0.25	0.4	0.167	0.1
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	3.0	0.5	3.0	0.2			
	Cost-Sharing Acceptability			0.0	0.2			
	Compatibility of Views			1.0	0.2			
	Fiscal Acceptibility			-3.0	0.2	0.8	0.167	0.1
Equitability	Sectoral Equity			0.0	0.33			
	Regional Equity			1.0	0.33			
	Bi-National Equity			1.0	0.33	0.7	0.167	0.1

Table F-3-25

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

MEASURE SCORE: 1.3

MEASURE: 6.5 Optim. Use of Exist. Reg Struc, Mapping

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			1.0	0.5	1.0	0.167	0.2
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	2.0	0.33					
	b) Number of Habitats	0.0	0.33					
	c) Physical Features	-1.0	0.33	0.3	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	1.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33	0.3	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	0.0	0.50					
	b) Net Primary Productivity	0.0	0.50	0.0	0.25	0.2	0.167	0.0
Social Desirability	Human Health, Security, & Well Being			2.0	0.25			
	Private Property Rights			3.0	0.25			
	Effects Across Social Strata			0.0	0.25			
	Public Access to Natural & Cultural Resources			1.0	0.25	1.5	0.167	0.3
Risk & Uncertainty	Flexibility			0.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	2.0	0.5					
	b) Residual Effect on the Natural Environment	1.0	0.5	1.5	0.25			
	Responsiveness			2.0	0.25			
	Predictibility			2.0	0.25	1.4	0.167	0.2
Implementability & Political Acceptability	Technical Feasibility			3.0	0.2			
	Legal & Policy Compatability	3.0	0.5					
	a) Within the U. S.							
	b) Within Canada	3.0	0.5	3.0	0.2			
	Cost-Sharing Acceptability			3.0	0.2			
	Compatibility of Views			2.0	0.2			
	Fiscal Acceptibility			3.0	0.2	2.8	0.167	0.5
Equitability	Sectoral Equity			2.0	0.33			
	Regional Equity			0.0	0.33			
	Bi-National Equity			1.0	0.33	1.0	0.167	0.2

Table F-3-26

IJC REFERENCE STUDY ON FLUCTUATING WATER LEVELS

TEST OF THE EVALUATION INSTRUMENT

								MEASURE SCORE	1.1

MEASURE:6.6 Public Acquis. of Hazard Lands &Reg Use

SCORE CRITERIA	OPERATIONAL CRITERIA	SUB OPERATIONAL CRITERIA SCORE	SUB OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	OPERATIONAL CRITERIA SCORE	OPERATIONAL CRITERIA WEIGHT (OPTIONAL)	CORE CRITERIA SCORE	CORE CRITERIA WEIGHT (OPTIONAL)	WEIGHTED MEASURE SCORE
Economic Sustainability	Aggregated Bi-National Net Benefits			1.0	0.5			
	Regional Economic Development			1.0	0.5	1.0	0.167	0.2
Environmental Integrity	Environmental Diversity							
	a) Plant & Animal Species	3.0	0.33					
	b) Number of Habitats	2.0	0.33					
	c) Physical Features							
		3.0	0.33	2.7	0.25			
	Environmental Purity							
	a) Toxic or Chemical Contamination	0.0	0.33					
	b) Air, Water, Soil & Soil Substrate	1.0	0.33					
	c) Introduction of Exotic Organisms	0.0	0.33					
				0.3	0.25			
	Environmental Resilience			0.0	0.25			
	Environmental Productivity							
	a) Total Habitat Area	2.0	0.50					
	b) Net Primary Productivity	3.0	0.50	2.5	0.25	1.4	0.167	0.2
Social Desirability	Human Health, Security, & Well Being			2.0	0.25			
	Private Property Rights			0.0	0.25			
	Effects Across Social Strata			2.0	0.25			
	Public Access to Natural & Cultural Resources			2.0	0.25	1.5	0.167	0.3
Risk & Uncertainty	Flexibility			3.0	0.25			
	Reversibility							
	a) Residual Effect on the Man-Made Environment	3.0	0.5					
	b) Residual Effect on the Natural Environment	2.0	0.5	2.5	0.25			
	Responsiveness			0.0	0.25			
	Predictibility			2.0	0.25	1.9	0.167	0.3
Implementability & Political Acceptability	Technical Feasibility			2.0	0.2			
	Legal & Policy Compatability							
	a) Within the U. S.	0.0	0.5					
	b) Within Canada	0.0	0.5	0.0	0.2			
	Cost-Sharing Acceptability			-3.0	0.2			
	Compatibility of Views			0.0	0.2			
	Fiscal Acceptibility			0.0	0.2	-0.2	0.167	-0.0
Equitability	Sectoral Equity			-1.0	0.33			
	Regional Equity			2.0	0.33			
	Bi-National Equity			2.0	0.33	1.0	0.167	0.2

Table F-3-27
RAW SCORES OF REPRESENTATIVE MEASURES

OPERATIONAL CRITERIA	TYPE 1				TYPE 2				TYPE 3			
	1.2.1	1.3.1	1.3.10	1.4.4	2.1.5	2.1.12	2.2.4	2.3.1	3.1.1	3.1.6	3.2.1	3.3.1
Aggregated Bi-National Net Benefits	-3	-2	-3	0	0	1	1	0	1	0	1	1
Regional Economic Benefits	1	0	2	0	1	1	1	1	1	0	0	0
Environmental Diversity												
a) Plant & Animal Species	-3	-1	-3	3	2	0	3	-3	-1	3	3	2
b) Number of Habitats	-3	-1	-3	1	0	0	2	-3	0	1	2	0
c) Physical Features	-1	-1	-1	-2	-2	0	0	-1	-2	-1	-3	0
Environmental Purity												
a) Toxic or Chemical Contamination	-1	0	0	1	0	0	2	0	0	0	0	2
b) Air, Water, Soil & Soil Substrate	-2	-1	-3	1	-1	0	2	-3	0	1	0	2
c) Introduction of Exotic Organisms	0	-1	-3	0	0	0	0	0	0	0	0	0
Environmental Resilience	-3	-1	-3	0	0	0	3	-2	0	1	-3	3
Environmental Productivity												
a) Total Habitat Area	-3	-1	-3	1	0	0	0	-3	0	1	2	0
b) Net Primary Productivity	-2	-1	-2	0	0	0	2	-3	0	1	1	0
Human Health, Security, & Well Being	-2	1	1	-1	1	1	1	-2	2	2	1	3
Private Property Rights	3	0	3	3	3	0	3	3	-3	-3	0	3
Effects Across Social Strata	0	0	3	0	-3	-3	2	-1	3	-2	3	3
Public Access to Natural & Cultural Resources	-2	1	1	-1	1	0	2	1	0	1	0	0
Flexibility	2	0	3	-3	-2	0	3	-1	3	3	3	0
Reversibility												
a) Residual Effect on the Man-Made Environment	0	0	-3	0	0	0	2	0	3	-2	-2	2
b) Residual Effect on the Natural Environment	-3	-1	-3	-1	-1	0	0	-3	2	0	-2	0
Predictability	2	3	-3	3	3	2	2	2	2	0	3	2
Responsiveness	2	0	3	-1	0	0	0	0	1	0	2	0
Technical Feasibility	3	3	-2	3	3	2	3	3	3	1	3	2
Legal and Policy Compatibility:												
a) Within the U.S.	-3	-3	-3	0	3	0	0	0	0	-3	3	0
b) Within Canada	-3	-3	-3	0	3	0	0	0	0	0	0	0
Cost-Sharing Acceptability	-3	-3	-3	-3	0	-3	-3	0	-3	-3	3	0
Compatibility of Views	-2	-2	-3	-2	-1	1	1	0	-2	-2	-2	0
Fiscal Acceptability	-3	0	-3	0	-2	-3	-3	-3	3	0	3	0
Sectoral Equity	-2	-1	-2	-2	-2	-1	2	-2	-2	-2	-1	-1
Regional Equity	-3	-3	-3	-1	-1	0	1	0	2	2	2	1
Bi-National Equity	-2	-1	-3	-1	-1	1	3	0	3	0	3	2

Table F-3-27 (cont'd)

RAW SCORES OF REPRESENTATIVE MEASURES

OPERATIONAL CRITERIA	TYPE 4				TYPE 5			TYPE 6			
	4.1.7	4.2.9	4.3.1	4.3.5	5.2	5.4	5.6	6.1	6.4	6.5	6.6
Aggregated Bi-National Net Benefits	2	1	1	-1	2	1	-1	-2	1	1	1
Regional Economic Benefits	1	1	0	0	1	0	-1	1	1	1	1
Environmental Diversity											
a) Plant & Animal Species	-2	2	0	0	-1	0	2	-3	3	2	3
b) Number of Habitats	-2	-1	0	0	-1	0	0	-3	1	0	2
c) Physical Features	-1	0	0	0	3	0	3	-1	-1	-1	3
Environmental Purity											
a) Toxic or Chemical Contamination	0	1	0	0	0	0	0	0	0	0	0
b) Air, Water, Soil & Soil Substrate	-1	-1	0	0	0	0	-1	-2	1	1	1
c) Introduction of Exotic Organisms	1	0	0	0	0	0	0	0	0	0	0
Environmental Resilience	-1	-1	0	0	2	0	0	-3	0	0	0
Environmental Productivity											
a) Total Habitat Area	-2	-1	0	0	0	0	0	-3	1	0	2
b) Net Primary Productivity	-2	-1	0	0	0	0	0	-1	1	0	3
Human Health, Security, & Well Being	2	1	1	1	1	1	0	1	1	2	2
Private Property Rights	0	3	3	0	0	0	3	-3	3	3	0
Effects Across Social Strata	-3	-1	3	0	3	3	0	2	0	0	2
Public Access to Natural & Cultural Resources	1	1	0	0	2	0	-1	0	1	1	2
Flexibility	-2	3	3	3	3	3	-2	2	-1	0	3
Reversibility											
a) Residual Effect on the Man-Made Environment	2	1	3	3	3	3	1	0	0	2	3
b) Residual Effect on the Natural Environment	-1	0	0	0	2	0	2	-2	-1	1	2
Predictability	1	-2	2	2	3	3	2	2	3	2	2
Responsiveness	1	3	3	3	2	3	0	1	0	2	0
Technical Feasibility	2	0	3	3	3	3	3	3	3	3	2
Legal and Policy Compatibility:											
a) Within the U.S.	3	0	3	0	3	3	3	-3	3	3	0
b) Within Canada	3	0	3	0	3	3	3	-3	3	3	0
Cost-Sharing Acceptability	0	0	3	3	3	0	3	-3	0	3	-3
Compatibility of Views	2	2	3	-1	3	3	-1	-2	1	2	0
Fiscal Acceptability	2	0	3	3	3	3	3	-3	-3	3	0
Sectoral Equity	-1	2	3	-1	-2	1	0	-2	0	2	-1
Regional Equity	-1	3	3	2	3	1	-1	-1	1	0	2
Bi-National Equity	-2	3	3	3	3	3	-1	-1	1	1	2

TABLE F-3-28A - UNWEIGHTED CORE CRITERIA SCORES - INITIAL TESTING

UNWEIGHTED CORE CRITERIA SCORES	PLAN 1.2.1	PLAN 6.8	PLAN 2.1.5	PLAN 3.1.1	PLAN 4.1.7	PLAN 5.2
Economic Sustainability	-1.0	-0.5	0.5	1.0	1.5	1.5
Environmental Integrity	-2.2	-2.0	-0.1	-0.3	-1.2	0.6
Social Desirability	-0.3	1.3	0.5	0.5	0.0	1.5
Risk & Uncertainty	1.1	1.8	0.1	2.1	0.1	2.6
Implementability & Political Acceptability	-1.6	1.2	0.6	0.2	1.8	3.0
Equitability	-2.3	-0.7	-1.3	1.0	-1.3	1.3
SCORE SUMMARIES	-1.0	0.2	0.1	0.8	0.2	1.8

Plan 1.2.1 - Full Regulation of Lake Erie (50N), without downstream mitigation
Plan 6.8 - Full Regulation of Lake Erie (50N), with downstream mitigation
Plan 2.1.5 - Breakwater Construction
Plan 3.1.1 - Mandatory Setback Zoning
Plan 4.1.7 - Interest Rate Subsidy Loan
Plan 5.2 - Sandbagging, Diking, Drought and Other Assistance

TABLE F-3-28B - UNWEIGHTED CORE CRITERIA SCORES

UNWEIGHTED CORE CRITERIA SCORES	TYPE 1			TYPE 2			TYPE 3			TYPE 4			TYPE 5		TYPE 6			
	Plan 1.3.1	Plan 1.3.10	Plan 1.4.4	Plan 2.1.12	Plan 2.2.4	Plan 2.3.1	Plan 3.1.6	Plan 3.2.1	Plan 3.3.1	Plan 4.2.9	Plan 4.3.1	Plan 4.3.5	Plan 5.4	Plan 5.6	Plan 6.1	Plan 6.4	Plan 6.5	Plan 6.6
Economic Sustainability	-1.0	-0.5	0.0	1.0	1.0	0.5	0.0	0.5	0.5	1.0	0.5	-0.5	0.5	-1.0	-0.5	1.0	1.0	1.0
Environmental Integrity	-0.9	-2.5	0.5	0.0	1.8	-2.1	0.8	-0.2	1.3	-0.4	0.0	0.0	0.0	0.3	-2.0	0.6	0.2	1.4
Social Desirability	0.5	2.0	0.3	-0.5	2.0	0.3	-0.5	1.0	2.3	1.0	1.8	0.3	1.0	0.5	0.0	1.3	1.5	1.5
Risk & Uncertainty	0.6	0.0	-0.4	0.5	1.5	-0.1	0.5	1.5	0.8	1.1	2.4	2.4	2.6	0.4	1.0	0.4	1.4	1.9
Implementability & Political Acceptability	-1.0	-2.8	-0.4	-0.6	-0.4	0.0	-1.1	1.7	0.4	0.4	3.0	1.6	2.4	2.2	-1.6	0.8	2.8	-0.2
Equitability	-1.7	-2.7	-1.3	0.0	2.0	-0.7	0.0	1.3	0.7	2.7	3.0	1.3	1.7	-0.7	-1.3	0.7	1.0	1.0
Score Summaries	-0.6	-1.1	-0.2	0.1	1.3	-0.4	0.0	1.0	1.0	1.0	1.8	0.8	1.4	0.3	-0.7	0.8	1.3	1.1

Plan

1.3.1 - Manipulation of Interbasin Diversions
1.3.10 - A 50,000 cfs Diversion
1.4.4 - Placement of Sills at Lakes' Outlets
2.1.12 - Structural Floodproofing
2.2.4 - Fee Simple Property Rights Purchase
2.3.1 - Dredging of Nav. Channels and Harbors
3.1.6 - Subsidized Structure Relocation
3.2.1 - Regulate Shore Protection & Nav. Construction
3.3.1 - Regulate/Manage Consumptive Uses
4.2.9 - Tax Abatement to Cover Operating Costs
4.3.1 - Public Info. & Education Programs
4.3.5 - Real Estate Disclosure
5.4 - Information Centers/Storm Forecasting
5.6 - Black Rock Lock Discharges
6.1 - Combination - (SON, Sills, & Setback)
6.4 - Combination - (Offshore Breakwaters & Public Information/Education)
6.5 - Combination - (Optimize Use of Existing Regulatory Structures/Hazard Mapping)
6.6 - Combination - (Public Acquisition of Hazard Lands and Regulate Land Use)

SUMMARY OF THE MEASURES TESTED

In all, five measures were initially tested using the evaluation instrument. As a consequence of the negative assessment which resulted in initially analyzing "Full Regulation of Lake Erie (Plan 50N)" in isolation, it was tested for both cases of no mitigation downstream (Plan 1.2.1) and extensive mitigation downstream (Plan 6.8), which was assumed to bring the adverse impacts on Plan 50N downstream interests down to negligible levels (excepting the environmental aspects). The scores, shown in Table F-3-28A, ranged from a low of **"-1.0"** for full regulation of Lake Erie-Plan 50N (with no downstream mitigation) to **"+1.8"** for sandbagging, diking and other assistance. The initial testing of the instrument demonstrated possibilities for its use as a learning device and as a tool for organizing an evaluation process.

After refinements to a few of the "as measured by" statements and the scale (+3 to -3) descriptors contained within the evaluation instrument, a more extensive series of test measures was preliminarily evaluated, as shown in Table F-3-28B. The scores in these cases ranged from a **"-1.1"** for a 50,000 cfs diversion into and out of the Great Lakes-St. Lawrence River Basin to **"+1.8"** for public information and education programs.

In attempting to identify any patterns that present themselves from use of the evaluation instrument to this point, one can look to apparent characteristics of the instrument itself or traits of the types of measures that have been preliminarily examined. In the treatment of the six core criteria there appears to be a reasonably good spread of positive and negative assessments in the areas of economic sustainability, environmental integrity, implementability and political acceptability, and equitability. In the areas of social desirability and risk and uncertainty, however, the overwhelming majority of measures are rated positively. Such a result may give reason to question whether the instrument is adequately structured in these areas to be able to satisfactorily discriminate between measures of different types and characteristics. The criteria themselves may need to be further evaluated or reconsidered.

Table F-3-29 displays a summary of the core criteria ratings (positive, neutral, or negative) for the complete set of representative measures that have been initially evaluated. Of course an even greater degree of discrimination is available with reference to the magnitude of the positive and negative ratings that were assigned.

TABLE F-3-29
DISTRIBUTION OF CORE CRITERIA SCORES

Core Criteria	Rating for Representative Measures		
	Positive	Neutral	Negative
Economic Sustainability	14	2	8
Environmental Integrity	8	5	11
Social Desirability	19	2	3
Risk & Uncertainty	21	1	2
Implementability & Political Acceptability	14	1	9
Equitability	12	2	10

In assessing the ratings by the types of measures evaluated, other broad (and still tentative) patterns emerge. For Type I measures, public investment in control and diversion works, there appear to be difficulties in obtaining favorable assessments in the areas of economic sustainability, environmental integrity, implementability and political acceptability, and equitability. Type II measures, structural protection or adaptations, rated favorably in economics but more mixed to negative in the environmental, implementability, and equitability categories. Fee simple property rights purchase was clearly the outstanding Type II measure in this set of preliminary evaluations. Type III measures, direct public regulation of land and water use, scored quite favorably across the board except for a mixed result in the environmental category (based on individual environmental characteristics of two of the Type III representative measures examined). Mandatory setback zoning, regulating shore protection works and navigation structure construction, and regulation of consumptive uses were measures which received favorable assessments during the initial tests. Type IV measures, public programs to indirectly influence land and water use to minimize the effects of fluctuating levels, also scored generally positive in all categories except for neutral to negative scores in the environmental area. (In this case, many of the incentives themselves are environmentally neutral, but the type of activity being encouraged, such as construction of shore protection works, may be environmentally detrimental). Tax abatements to cover increased operating costs, public information and education programs, and real estate disclosure requirements were favorably assessed. Emergency response test measures (Type V) scored well in all cases except for localized economic and equity problems involved with increasing discharges through the Black Rock Lock along the Niagara River at Buffalo, New York. Combination measures are more difficult to characterize, with mixed (both positive and negative) results in almost all categories based on attributes of the individual measures which made up the combinations.

SECTION 4
CONCLUSIONS

LESSONS LEARNED

The testing of the evaluation instrument was a considerable undertaking by a relatively large group of study participants. This section will provide some insights as to what worked well, what limitations are apparent, and what may be improved as the instrument is refined and as data gathering on the measures takes place. The following paragraphs each focus on one "lesson learned" which may require consideration in further refinement of the instrument as the study progresses into Phase 2.

* The evaluation instrument has proven to be a good way to organize what is important to know about a measure. Because of its worksheet-like format it enhances the documentation of the evaluation process. These worksheets can be used by others to see how a rating was arrived at.

* The evaluation instrument forces the evaluator to be as specific as possible when identifying the measure to be evaluated. This specification process helps to clear up any misunderstandings as to what the measure is and what it is not. In this respect the instrument functions as a learning tool.

* The evaluation instrument provides a final score which gives general direction rather than a hard number. The point is that comparing two very different types of measures by the "bottom line" number is inappropriate, rather the two measures should be compared side-by-side, criteria by criteria, when we try to learn more about them.

* It is difficult to score operational criteria in many instances because the impacts being assessed are site-dependent and scale dependent while the measures at this point in the study are less well defined concerning size, location, scale, and environmental content.

* The combination of devising and fine tuning the evaluation instrument, along with applying it to measures is: time consuming; challenging; and requires sufficient resources to do a credible job.

* The "weighting" of the criteria may become an important part of the process, to be applied as one aspect to assist "decision-makers" in evaluating alternatives, once the instrument has been reviewed and refined.

* The current evaluation instrument rating system tends to obscure what may be significant observations on the operational criteria, either positive or negative, when these scores are aggregated to arrive at single scores for the core criteria.

* At this point, the evaluation instrument is more of an organizing tool than a technical tool because the criteria and ratings are highly subjective due in part to the lack of the detailed data desired to do a proper assessment. The evaluation process making use of this instrument, and the instrument itself, will always require technical and subjective judgments. It enhances the process by providing a means through which such judgments can be documented and made explicit.

* The instrument has perhaps more potential value in refining individual measures by addressing or responding to their negative components rather than by attempting to combine disparate measures.

* Trade-offs within combinations of measures are difficult to assess. Often the direction and magnitudes of impacts are not additive, or are not able to be netted out.

* Non-structural measures in particular need to be more clearly defined so that a common understanding of what a measure entails in all its nuances is achieved.

* It is important to target the objective in putting together workable combinations of measures. Otherwise the structural measure characteristics tend to predominate.

* The scale of application for measures, or within a combination of measures, needs consideration. Putting similar scale measures together, for instance, appears to lead to more effective use of the instrument.

* Measures combinations put together simply to mix the various measures types did not yield very effective evaluations.

* The core criterion "equitability" does not handle combination measures very well. The synergism of impacts under measures combinations is often difficult to evaluate unless an objective is established toward which all of the components of the combination are directed.

* There remains a need to achieve greater agreement on the selection of core and operational criteria, through reference to existing public policy or public preference. The conceptual basis for scoring operational criteria needs more development.

Among the lessons learned during the development and testing of the instrument was the realization that, even if complete and accurate data were available, the evaluation exercise requires a series of subjective judgments to be made. These choices, which are arbitrary by nature and which are in many cases independent of the quality and quantity of data available, must be made either by those developing the instrument or by those using it. It is a strength of the approach outlined herein that these

choices are explicit. They are readily apparent and can be changed, but they cannot be unequivocally substantiated (or denied) by data or analysis. The points in the development and/or use of the instrument at which these judgments are made include the following:

a. selection and definition of core criteria;
b. selection and definition of operational criteria;
c. "scoring" of operational criteria with respect to measures;
d. aggregation over operational criteria to "score" on core criteria;
e. aggregation over core criteria to get a "score summary" for a measure.

Selection and Definition of Core Criteria

At the heart of the Evaluation Instrument are 6 core criteria. They evolved from discussions within and beyond the Study team, some of them related to stated policies of governments, and some of them are consistent with principles espoused by interests. However, there is no way to confirm or deny that these are the "only" set of core criteria. Another group or study could come up with a different set. It is also worth noting that selection of core criteria represents the ultimate weighting; namely the criterion is either in (selected) or out (not selected). The instrument is flexible enough to allow for any desired changes in the selection of core criteria.

Selection and Definition of Operational (and Suboperational) Criteria

As with core criteria there is no objective way to choose these operational criteria. While it is possible that evaluations will differ depending on the definitions, there is no analytical basis for judging the appropriateness of a selection or a definition. They are inherently arbitrary decisions. Again, operational criteria can be added to or modified within the instrument if changes are desired.

Scoring of Operational (and Suboperational) Criteria

While it might be accepted via the selection and definition of Criteria that greater economic benefits are better than lesser benefits and that more species diversity is superior to lesser diversity, the scoring on these criteria is another matter. The instrument uses a -3 to +3 scale, which requires establishing thresholds (either numerical or qualitative) for each criterion. It remains an arbitrary decision that at $X the economic score goes from +1 to +2 or that at Y species the diversity score goes from -2 to -3.

Aggregation and Scoring on Core Criteria

The score on the core criteria are derived directly from the scores on the relevant operational criteria. This derivation involves two important judgments:

a. How are the operational criteria to be weighted, one relative to another? What is our basis for assigning different or equivalent weights?

b. Given the operational scores (weighted or otherwise), how are these combined to arrive at a score for the core criterion? It is a subjective decision to add them rather than take their product or some other function.

These are not trivial choices - the evaluation of a measure on a core criterion can be changed fundamentally simply by choosing a different set of weights or a different aggregation procedure.

Aggregation and "Score Summary"

The Evaluation Instrument allows for the calculation of an overall evaluation score for each measure. This calculation requires two subjective judgments to be made (comparable to those in the preceding section):

a. The scores on the core criteria need to be weighted (either equally or unequally). There is no universal basis for deciding on the relative contribution of the core criteria to the overall score. Different governments, interests, groups, etc., and all at different times will prefer different weights.

b. Given the scores on the core criteria, these are to be combined to generate an overall Score. In this illustration and development we have simply summed the scores. Other aggregation functions, such as multiplying the scores, are no less legitimate. The choice of aggregation rule is an arbitrary one.

Interpretation

Because of these subjective components of the Evaluation Instrument, it should not be considered as a sole means of deciding on which measures are the best. A different choice on any of the five points of arbitrariness (a-e) could dramatically alter the score for a measure and hence its relative evaluation.

However, the Instrument has already served some very useful purposes in the study and can play a valuable role beyond the Study.

ENHANCING THE INSTRUMENT

Based on the experience gained throughout the instrument testing period, a number of ideas have been introduced which would enhance the functionality of the instrument.

Though the instrument has undergone significant improvements, there is still a need for further refinement in all areas of the evaluation process. Experts representing a variety of disciplines could especially sharpen the definition, measurement, and application of the operational criteria in the evaluation instrument. Refinement should evolve over the continual testing of all types of measures to ensure broad applicability. There is also a need to collect relevant data to assist in establishing the relative rankings from measure to measure so that judgments can be made on a more substantive basis.

One idea for improvement stemmed from the problems encountered with the +3 to -3 scoring range not properly fitting the data type for particular operational criteria. A possibility is to bifurcate the instrument in such a way that positive and negative assessments on operational criteria are separately treated rather than netted out. Under an evaluation of the Base Case or No Action Alternative, the appropriate score of "0" would be assigned for both the positive and negative branches of the instrument.

This would assist with the problem associated with certain operational criteria not having either a positive side or a negative side. To illustrate, consider the operational criteria "Environmental Diversity (c) change in the number of physical features." The highest score (+3) is obtained for no change. There are no other applicable positive scores, in other words, any change is viewed as negative, hence +1, +2 or 0 are not applicable here. In this case, the No Action Plan scores a +3 in Environmental Diversity for not doing anything. Under this new proposed enhancement, this operational criteria would be relevant for the negative branch of the instrument only.

The improvement cited in the previous paragraph would also solve the problem associated with the degree of severity associated with the negatively scored values not being equivalent to the degree of improvement associated with the positive side of the scale. As it stands, the instrument implicitly weights negative and positive scores equally. With two branches of the instrument, appropriate weights can be applied which are commensurate with the tradeoffs associated with gains and losses which are deemed appropriate for each operational criteria.

Another idea for enhancing the instrument arises from the problem associated with weighting core criteria. It was suggested that certain operational criteria (particularly from the Environmental Integrity operational criteria) are critical. The problem is that if a measure scored a -3 on one of the critical operational

criteria, the strong negative rating loses its significance if other criteria scored highly positive, counter balancing the affect of the critical one. The solution offered is to set up a dichotomous scale for the critical operational criteria by simply identifying passing or failure. With this, along with the measure's score there would be the pass/fail record of the critical elements.

DATA NEEDS

1. Economic Sustainability

a. Aggregated Bi-National Net Benefits

A measure may have tangible benefits (or costs) for an interest group relative to existing fluctuating water levels conditions. Navigation interests may experience higher efficiencies or reduced damages or lost income. Riparian interests may have less flooding or erosion and reduced levels of damages or lost income if extreme high levels can be reduced. Power interests may be able to spill less water or utilize existing water levels or flows more efficiently. Recreation use may be sustained at seasonal peak levels during periods of the year when water levels may have been insufficient under the pre-measure condition. Commercial and industrial developments may experience greater net returns under a particular measure. The threat of flood damage, erosion or wave attack at selected shoreline areas may be reduced.

Commercial fishing interests may find harvestable stocks changing, and the commercial fishing entities more or less productive. Agricultural interests may have reduced flood damages or less erosion losses due to the effects of a measure. Native peoples located in close proximity to the shoreline may also experience beneficial effects from a measure. Disruption of their activities which might otherwise result in loss of income might be eliminated.

In all cases, tangible benefits or changed conditions must be estimated for U.S. and Canadian Great Lakes-St. Lawrence River interests using comparable monetary units. Measurement over future time periods must reflect the appropriate adjustments for the time value of money and price levels. These procedures are likely to rely upon a structured analysis of the consequences of a measure or its outputs. The evaluation may be in the form of a model, a procedure or an algorithm. The relevant activity of each interest group should be incorporated into the measurement methodology to estimate the tangible gains or losses.

A separate investigation into the resource costs to implement a measure will also be required. For those measures which have traditional engineering features, this requirement should provide an estimate of the construction, operation and maintenance costs.

More theoretical or conceptual measures, or those which are administrative in nature may be less cost specific. In general, the resource costs associated with a measure must be identified.

The present value of all existing and future costs must be developed to compare with the estimate of benefits from a measure.

b. Regional Economic Development

Regional impact models, sensitive to changes in income or employment levels which might result from a measure, may be developed. Complex relationships exist between individual interest classes and regional economic activity. These relationships need to be identified and the consequences or outputs of a measure traced through the economic linkages within specific regions.

2. Environmental Integrity

A large body of information is needed about the various physical and biological components of the environment (see Annex B). Environmental process models are needed that will realistically reflect environmental conditions and inter-relationships.

Some pilot computer and field studies should be undertaken in Phase 2 to test and improve our knowledge on the impacts of measures. This approach seems to be the only viable means of assessing the impacts of combination measures. Computer scenarios having some spatial significance can be undertaken using the GIS's of FG2. Potential Phase 2 field studies and sites are being identified by FG2.

3. Social Desirability

a. Human Health, Security and Well-Being

Shoreline interests have the greatest exposure to adverse physical effects by high and low water levels. Lake storms typically aggravate erosion and flood damages. Riparians, commercial and industrial, and recreational facilities may all sustain economic losses.

Physical inventory and land use classification data bases will assist in establishing damage estimates for the affected interests over future time periods. Monetary damages for tangible losses for structures, contents, equipment or public utilities could be developed for high potential damage areas. Technical studies which can relate the lake levels, wave characteristics, economic values and losses (or damages prevented) expected over future time periods may be required. A data intensive procedure is likely to require a geographic information system (GIS) approach to the measurement problem. The GIS under development in this study will contain a physical inventory of land use, including types of structures.

b. Private Property Rights

Implementation of a specific measure may alter, restrict or produce a legal taking of existing real property or water rights. Local governments typically administer zoning ordinances and provide enforcement and appeal procedures. The extent of impacts upon existing property rights will vary by state or province. A search into the legal nature and extent of existing rights is required in each particular case before a clear assessment of losses or restrictions may be determined for shoreline property owners. Changes in market value may result from increases or decreases in property and water rights. Market value statistics should be obtained for shoreline areas and predictive methods developed to measure changes attributed to a measure.

c. Effects Across Social Strata

If the outputs from a measure produce positive consequences for all property owners, as opposed to either the upper or lower strata of income or property value intervals, the social effects are expected to be neutral. Socio-economic profiles of existing shoreline occupants would be useful in order to classify them into income and property value intervals.

Census tract data, also available at the block group level, may be useful in developing profiles of property owners. Sampling techniques will be necessary to develop profiles of land owners over large areas at reasonable costs. Stratification of owner and property characteristics can then be completed so that the differential effects of measure outputs can be evaluated.

d. Public Access to National and Cultural Resources

Preparation of an inventory of existing recreational and cultural resources located in close proximity to the Great Lakes shoreline is necessary to evaluate the changes in public access. Extensive inventories of local, state/provincial or Federal sites exist. A profile of existing information can be developed. Measurement of the net change in available opportunities can be assessed for each measure.

4. Risk & Uncertainty

Future extremes of physical and social changes may exceed the effective design capacity of a measure or alter the expected levels of outputs. How well a measure can respond to the extent of need within a region or the concerns of an interest group requires application of technical judgment. However, development of climatic scenarios or forecasts of population shifts or land use changes will provide the necessary background data to interpret the overall feasibility, reversibility or predictability of a measure.

5. Implementability and Political Acceptability

a. Technical Feasibility and Legal & Policy Compatibility

Successful implementation of a measure in light of existing technology will be based upon technical judgment. How well a measure fits into the institutional framework of national, state/provincial and local governments will require an understanding of existing zoning, land use controls within programs similar to the Coastal Zone Management program, and the legal procedures or requirements which exist at various levels of government. Study participants need access to legal skills and land use controls information within the region or at local levels.

b. Cost-Sharing Acceptability

Cost-sharing acceptability is evaluated as the willingness of various parties to participate in the negotiation process. Except for the existence of similar measures elsewhere which may have related outputs or effects, the degree of support for a measure will rely upon the relationship between adverse effects that will otherwise continue and the remedial effects attributed to the measure.

c. Comparability of Views

A broad general knowledge of the relationships between interest groups is necessary to estimate how an interest group may be affected by a measure. Information from technical journals, past studies, conferences or professional associations is useful to interpret the viewpoints of interests. This information, in combination with technical judgment, will be required to evaluate measures.

d. Fiscal Acceptability

Fiscal impacts are relative to the size of governments. Large capital intensive measures at the level of national government may effect other Federal budgetary priorities. Localized measures at specific problem areas, although lower in cost, may have relatively severe effects on local budgets. A determination of the relative fiscal impacts requires basic information about the level of government which will implement a measure. The next step is to relate available fiscal resources with the cost of a measure. If a budgetary constraint is anticipated, a trade-off procedure may be developed to support decisions between public priorities.

6. Equitability

Decisions regarding the equity of a measure must integrate all of the data obtained from the above core criteria across all interest groups. Once the data requirements from core criteria #1 thru #5 are provided, the degree of equity at the sectoral,

regional and bi-national levels can be made. Quantitative values for all outputs or effects from a measure, for the tangible aspects of benefits and costs, will be an important variable in the determination of equity.

THE INSTRUMENT WITHIN THE STUDY CONTEXT

Within the study, the development and testing of the evaluation instrument has forced a consideration of the broad principles upon which the merit of alternative measures might be addressed. This consideration is far from complete. The core criteria represent a set of concepts which this study has proposed as a basis for evaluating options. The exercise has also ensured that a broad range of impacts and implications are addressed. The instrument provides a structure which has aided in directing detailed analyses of the interests and components of the environment. The testing of the instrument has also contributed to the study by showing some implications of measures which are not always expected.

Beyond the study, the instrument has considerable potential to aid government agencies with their in-house evaluations and to assist with informing and involving the public. The instrument provides a framework which obliges the user (government agency or member of public) to consider all economic and social interests and the natural environment. It provides a means of indicating what we know (and don't know) about implications of fluctuating water levels with and without measures. It encourages description of how impacts of measures are and might be estimated or measured. It suggests criteria which might be used in an evaluation process, and more importantly, forces the user to make explicit whatever criteria are to be used and their relative weights. The instrument might also be used to show, in a most general fashion, how certain types of measures perform on the criteria (as defined).

The main utility of the evaluation instrument is as an organizational tool and a heuristic device. It is an aid in helping to develop and compare measures which respond to conditions associated with fluctuating water levels in the Basin. It should not be considered the sole basis of determining which courses of action should be pursued.

Other avenues of inquiry and possible action have been explored in other annexes of the report. These include a consideration of the systemic context in which the conditions associated with fluctuating water levels reside; analyses of public policy and institutional developments for responding to these conditions; and the importance of substantial public participation and involvement in the consideration of these conditions. The development and testing of the evaluation instrument, and its future refinement and use, is viewed as a mechanism which complements significant developments in each of these other areas.

LIST OF CREDITS

Development of an Evaluation Framework and its components for this study has been an ongoing process throughout much of Phase I. Its conceptual elements were developed under auspices of the Functional Group 3 Co-Chairs, Dr. Leonard Shabman of Virginia Tech and Dr. Barry Smit of the University of Guelph. A multi-criteria work group of FG3, co-chaired by Mr. Ray Rivers of Environment Canada and Mr. Curt Meeder of the U.S. Army Corps of Engineers, was responsible for much of the work leading to identification and definition of the core criteria and operational criteria. Some 20 invited participants to a multi-criteria workshop, held in Buffalo, New York on 16 June 1988, provided substantial assistance in this effort.

A task group, headed by Mr. Robert MacLauchlin of the U.S. Army Corps of Engineers and Mr. Tony Wagner of Environment Canada, was assigned responsibility for assembling the components of the Evaluation Framework into a integrated whole. Barry Smit, Ray Rivers, Curt Meeder, and Mr. Jim Karsten of the U.S. Army Corps of Engineers also participated in the initial stage of "product development". Substantial development, improvement and refinement to the Evaluation Instrument was accomplished by a group comprised of Jim Karsten, Mr. Ron Guido, Mr. Mike Pelone, and Mr. Jonathan Brown of the U.S. Army Corps of Engineers and Mr. Mark Law of Environment Canada. Initial estimates of impacts on interests were drawn from the Interest Work Group reports of Functional Group 3. Refinement of the Impacts Matrix was undertaken by Curt Meeder with assistance from Ray Rivers. Valuable suggestions on this component were received from the FG2 Co-Chairs, Mr. Robert Roden of the Wisconsin Department of Natural Resources and Dr. Reid Kreutzwiser of the University of Guelph. Participants in the second set of test evaluations included Jim Karsten, Mike Pelone, Curt Meeder, and Mr. Steve Patch of the U.S. Fish and Wildlife Service, with assistance from Reid Kreutzwiser. Valuable suggestions on the first draft of this document were received from the IJC Lead Staff for this study, Dr. Murray Clamen of Canada and Mr. Don Parsons of the U.S.

Narrative and tabular materials for this annex were developed in a first draft by Jim Karsten, Mike Pelone, Jonathan Brown, and Barry Smit, while Curt Meeder is primarily responsible for subsequent changes and editing of Annex F. Ms. Lueretta Jones of the U.S. Army Corps of Engineers has provided indispensable typing and editing support. Bob MacLauchlin and Tony Wagner maintain supervisory control and responsibility for this product.

A challenging venture such as this is not undertaken without some "risk and uncertainty". Those who have participated substantially in this process will be the first to acknowledge that the product presented herein represents only a beginning step in an effort to develop an ongoing analytical capability to

assess the consequences of fluctuating water levels in the Great Lakes-St. Lawrence River Basin and to assess the impacts of possible measures. Continuing efforts are needed to further refine and enhance this evaluation process and to pursue its subsequent application during Phase II of this study and perhaps even in other contexts.

ANNEX F

APPENDIX F-1

CONSOLIDATED GLOSSARY

GLOSSARY OF TERMS

Accretion: Accretion may be either natural or artificial. Natural accretion is the build-up of land, solely by the action of the forces of nature, on a beach by deposition of water or redistribution of material by wind. Artificial accretion is a similar build-up of land by reasons of an act of man, such as the accretion formed by a groin, breakwater, or beach fill deposited by mechanical means.

Action: see "Measures"

Adverse Consequence (a common usage): Some negative implication of fluctuating water levels for a social, economic, environmental or political investment.

Aggregate Sensitivity Model: The link between the visual situation model(s) and the "what if" modelling capability, this step in the analytical process will describe those factors most sensitive or critical in resolving problems caused by fluctuating water levels in the Great Lakes, taking into account the range of measures and stakeholder interests under consideration.

Aggregate Visual Situation Model: A pictorial display linked to an automated information/geographic information system(s) which connects the problems associated with fluctuating water levels with the stakeholders and their interests that are impacted by the problems, with an emphasis on overlapping or interacting relationships.

Agreements: Joint statements among two or more governmental units on (i) criteria (purposes and goals) which should guide basin decision making, (ii) processes of decision making and (iii) authorities of governments to act. Agreements must be formalized in charters, treaties, letters of understanding, etc. Agreements serve to define the boundaries and constraints on choice of measures.

Agricultural Interests: These interests benefit from the services of shore location (fertility and climate), water supply, and indirectly from the transport of grains. This interest class includes all types of farming and production agriculture.

Alternative Dispute Resolution (ADR): Decision making guided by professional experts and based on scientific management principles, but includes interest groups in developing and assessing alternatives and in making tradeoffs between alternatives.

Associated Costs: Costs incurred as a result of implementing a measure. There are two types of associated costs. (1) Cash costs are expenditures required of an interest in order to take advantage of a measure. (2) Opportunity costs are a change in the welfare of an interest as a result of a measure.

Bathymetry: The topography or relief of the lake bottom, as in the measurement of depths of water in oceans, seas and lakes; also information derived from such measurements.

Beneficial Consequence: Some positive implication of fluctuating water levels for a social, economic, environmental or political investment.

Commercial Fishing: Commercial fishing interests use the Great Lakes habitat and shore access services to earn income and sustain a lifestyle from sale of fish and fish products.

Commercial/Industrial: Commercial and industrial interests are those firms whose activities are tied into having a fixed point location along the shoreline and whose net income position is potentially affected by fluctuating lake levels. The interest is made up of a number of diverse businesses that are often represented by specialized trade associations and because of diversity of activities and geographic dispersion may not be uniformly affected by lake level fluctuations.

Compensation: Any expenditure received by an interest to mitigate costs imposed by a measure. Compensation may be in the form of money paid to those affected by an action, or it may involve creating similar conditions to the pre-project state to mitigate effects of the measure.

Connecting Channels: A natural or artificial waterway of perceptible extent, which either periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. The Detroit River, Lake St. Clair and the St. Clair River comprise the connecting channel between Lake Huron and Lake Erie. Between Lake Superior and Lake Huron, the connecting channel is the St. Marys River.

Consumptive Use: The quantity of water withdrawn or withheld from the Great Lakes and assumed to be lost or otherwise not returned to them, due to evaporation during use, leakage, incorporation into manufactured products or otherwise consumed in various processes.

Control Works: Hydraulic structures (channel improvements, locks, powerhouses, or dams) built to control outflows and levels of a lake or lake system.

Convergent Shores: The phenomena of converging shorelines; such as Saginaw Bay. Water-level fluctuations are exaggerated as shorelines converge.

Criteria: These are evaluative rules on some dimension of concern to one or more interests in the decision making process. Criteria are conceptual but must have operational (measurable in principle) components. Any single criterion can be used to judge the merits of a measure or policy along the dimensions encompassed by the criterion. Criteria are used to judge measures and criteria are used to judge the decision making process (for example, group access to the decision making bodies).

Crustal Movement: The change in level of the earth's surface at a location with respect to another location. Crustal movement is expressed as a differential rate of the change in level over time. This process is still continuing and effects differences in elevations.

Decision by Governments: A choice by government to spend money or to change laws and regulations to implement measures.

Distribution: An assessment of the effectiveness and efficiency of a measure, or combinations of measures, on a basis which considers all of the interests affected by a problem associated with fluctuating water levels. (For consideration within the evaluation framework).

Diurnal Tide: A tide with one high water and one low water in a tidal day.

Diversions: A transfer of water either into the Great Lakes watershed from an adjacent watershed, or vice versa, or from the watershed of one of the Great Lakes into that of another.

Drainage Basin: That part of the surface of the earth that is occupied by a drainage system of rivers and lakes.

Economic Sustainability: The objective of maintaining, at a minimum, the existing level of economic activity within the Great Lakes-St. Lawrence River Basin. Economic growth and development can be realized through greater productivity in the application of existing economic and natural resources so that these goals are not achieved at the expense of environmental, social, and cultural resources of significant value of society.

Ecosystem: The interacting complex of living organisms and their non-living environment. In the context of this IJC study, these concerns relate primarily to biophysical impacts within the coastal zone as a consequence of fluctuating water levels.

Educational and Learning Activities: Activities undertaken through the formal education system, in post-secondary settings, for the media, and in informal, public meetings. Example: supplemental curricular lessons and activities for secondary school students.

Effectiveness: The degree to which a problem associated with fluctuating water levels is resolved or made worse by implementation of a measure. (For consideration within the evaluation framework.)

Efficiency: A comparison of the benefits gained and the costs incurred in implementing a measure in response to a problem associated with fluctuating water levels. (For consideration within the evaluation framework.)

Electric Power Interest: Power interests are composed of all forms of electrical generation that depend on water as an integral part of power production process. The interest uses the Great Lakes and the St. Lawrence River for shore access service and water supply for hydro power head, cooling water and steam power and therefore includes hydro power, nuclear power, and fossil fuel-fired electric power.

Empirical: Relying or based solely on experiment and observation rather than theory.

Environment: The natural conditions and resources fundamental to sustaining life and the well-being of mankind and wildlife. In the context of this IJC study, these concerns relate to the ways in which fluctuating water levels affect such interests as domestic water supply and sanitation, agriculture, recreation and tourism, use of shore property, both public and private, flood control, and wildlife habitats.

Environmental Integrity: The sustenance of important biophysical processes which support plant and animal life and which must be allowed to continue without significant change. The objective is to assure the continued health of essential life support systems of nature, including air, water, and soil, by protecting the resilience, diversity, and purity of natural communities (ecosystems) within the environment.

Environmental Interests: This class of interest is primarily concerned with the environment in its own right and not with any specific use or exploitation from the Great Lakes Ecosystem. The class is represented primarily by naturalist and conservation groups and government agencies with a mandate of preserving the environment.

Equitability: The assessment of the fairness of a measure in its distribution of favorable or unfavorable impacts across the economic, environmental, social, and political interests that are affected.

Erosion: The wearing away of the shoreline and lake or riverbed by the action of waves and currents. Shoreline erosion on the Great Lakes is most often a result of the combined action of waves and currents.

Evaluation: The application of data, analytical procedures and judgment related to criteria to establish a judgment on the merit of a measure, policy or institution. Evaluation is a process which is conducted both within formal studies and by separate interests, although different data, procedures and criteria may be employed in the evaluation by different interests.

Evaluation Framework: A systematic accounting of the criteria considered and methodologies applied in determining the impact of measures on lake levels, components of the environment, stakeholders, and stakeholder interests.

Evapotranspiration: The loss of water from the soil by evaporation and transpiration (the passage of water from plants through membranes or pores).

Governance System: The complex of interest, policy and institutions which result in decisions on measures that are adopted over time.

Government Interests: These interest include all levels of government, local, regional, state/provincial and federal.

Groundwater: Subsurface water occupying the zone of saturation. In a strict sense, the term is applied only to water below the water table.

Group Depth Interviews (GDI's): A technique used in the field of marketing to gather perceptual data from a small group of representatives of local interests and governments on the following: the problems caused by different lake levels; the opportunities presented by different Measures; the factors involved in decision making about adopting Measures; and the consequences of Measures. It should be noted the GDI's reflect accurately the perceptions of the attendees but do not necessarily reflect the perceptions of all individuals within an interest.

Hanging Dam: A form of ice jam.

Hydrodynamics: A branch of science that deals with the motion of fluids and the forces acting on solid bodies immersed in fluids and in motion relative to them.

Hydrometeorology: A branch of science concerned with the study of the atmospheric and land phases of the hydrological cycle, with emphasis on the interrelationships involved.

Ice Boom: A structure installed to aid in the formation and maintenance of an ice arch at the head of a river, and thus reduce the adverse effects of ice on river levels and flows.

Ice Jam: An accumulation of river ice, in any form, which obstructs the normal river flow.

Ice Retardation: The difference between the amount of water discharged at given lake and river stages under open water conditions and under ice conditions.

Impact Matrix: A display which contains across-the-board assessments of how the various measures analyzed impact on the natural environment and all identified stakeholders and their interests, using the criteria agreed upon in the evaluation framework.

Implementation Cost: There are three costs that governments must assume when implementing any action; the initial or capital cost of implementation, costs associated with operation and maintenance of an action, and any compensatory costs.

Implementability: The ability to put into effect a measure considering factors of engineering, economic, environmental, social and institutional feasibility. (For consideration within the evaluation framework).

Implementability and Political Acceptability: The coalescence of sufficient support to endorse a measure and the identification of a legal or institutional mechanism able to be applied to put the measure into effect. The greater the breadth of support, agreement, and consensus among affected interests, the more likely is the measure to be politically acceptable and implementable. The more demonstrable the feasibility of a measure, in its engineering, economic, environmental, social, and financial aspects, the more likely it is to be politically acceptable and implementable.

Implementing Authority: Any governmental agency at any level having appropriate authority to authorize and execute the implementation of any particular action and the jurisdiction to enforce an action.

Infiltration: Movement of water through the soil surface and into the soil

Institution: An organization of governmental units which have the authority and ability to facilitate and/or make decisions affecting the implementation of measures.

Interests: Any identifiable group, including specialized mission agencies of governments which perceive that their constituents/ members welfare is influenced by lake level fluctuation or policies and measures to address lake level fluctuation, and are willing and able to enter the decision making process to protect the welfare of their constituents/members.

Interest Classification System: A categorization of the different types of impacts caused by fluctuating water levels. Envisioned as part of an Impacts Matrix whereby the affects of introducing various measures on each area of impact can be displayed.

Investment: Expenditure made by an interest in one time period to capture benefits in another period. The investment decision presumes knowledge and understanding of future risks and uncertainty.

Lake Outflow: The amount of water flowing out of a lake.

Lake Years: A hydrologic year considered to begin in August.

Location Benefit: Positive effect on the welfare of an interest derived from shore location and water level situation.

Location Cost: Negative effect on the welfare of an interest derived from shore location and water level situation.

Low Water Datum: The plane on each lake to which navigation chart depths and Federal navigation improvement depths are referred. Also referred to as Chart Datum.

Marsh: see "Wetlands".

Mass Transfer Relationship for Evaporation: An application of Dalton's Law, where evaporation is considered to be a function of the wind speed and the difference between the vapor pressure of saturated air at the water surface and the vapor pressure of the air above.

Measures: Any action, initiated by a level(s) of government to address the issue of lake level fluctuations, including the decision to do nothing. Measures are defined by three elements. The first element is the specific investment or action intended to affect the land and water resource and/or the human use of the land and water resource. The second element is the manner in which the socio-economic cost burden for an action is distributed (i.e. who pays?). And the third element refers to the implementing authority (i.e. who is responsible for executing and enforcing the action). Actions have been classified into six types:

Type 1 - Regulation and Diversions: Any engineering action which can alter Great Lakes water supplies, water levels and flows.

Type 2 - Land and Water Adaptations: Actions which involve government investment to adapt to or modify local land and water use in an effort to adapt to water level fluctuations and natural shore processes.

Type 3 - Restrictions on Land and Water Use: Actions whereby governments restrict how interests may use the land and water of the Great Lakes Basin.

Type 4 - Programs to Influence Use: Public programs and policies to provide information and alter financial incentives to influence the ways in which interests make decisions about the use of the land and water.

Type 5 - Emergency Response: Actions by governments to emergency situations. These are short-term measures to ease immediate problems.

Type 6 - Combinations: Two or more of the above types of actions combined to address the issue of fluctuating water levels.

Meteorological: Pertaining to the atmosphere or atmospheric phenomena; of weather or climate.

Negotiation: The process of seeking accommodation and agreement on measures and policies among two or more interests having initially conflicting positions by a "voluntary" or "non-legal" approach.

Net Basin Supply: Represents the supply of water a lake receives from its own basin less the losses by evaporation from the lake surface and loss or gain due to seepage, and the inflows to the lake and the outflows from it.

Physiography: A descriptive study of the earth's surface.

Policy: Policy may cause certain positions to be taken by the governments without evaluation, and may result in positions of other interests to be discarded or accepted without evaluation.

Position of Interests: The perceptions, beliefs and preferences of interests regarding fluctuating water levels, implications of those levels, and acceptability of a measure or policy to an interest. Positions are based upon an evaluation process. Positions may be directly stated or may be inferred by supporting or opposing activities taken by the interest in the decision making process.

Public Communications: Activities where the purpose, design, and plan intends for two-way communication for a defined period of time between Study personnel and the public or various publics. Examples: the Toledo Public Information Meeting and the Public Comment Process on the Task Force Report and Background Paper.

Public Information: Activities where the purpose, design, and plan intends to deliver information to the public or various publics. Examples: press releases and articles in the IJC's Focus Newsletter.

Public Involvement: Activities where the purpose, design, and plan is such that members of the public or various publics are engaged in the Study on a continuing basis with other "expert" resources. Example: a member of an interest group serving as a functional group member.

Public Participation: Activities where purpose, design, and plan intends that members of the public have an opportunity to participate for a defined period of time in a Study activity. Example: input into a portion of the work activities of a functional group through a workshop.

Recreational Interests: Non-riparian recreation interests include individuals, some of which are represented by specialized associations, which are located both inside and outside the Great Lakes Basin. This interest does not include those who own shoreline property. These interests seek access to the lakeshore and to some extent depends upon the habitat services of the lakes for serving its interests. Recreation interests benefit from angling, hunting, non-consumptive recreation, boating, swimming, and camping.

Regression Equation: A mathematical expression which statistically relates two or more variables.

Regulation: In accordance with a rule designed to accomplish certain goals. In this study, the term applies both to controls of water levels and controls of land and water use.

Riparian: The interest group is comprised of very many individuals, some of which are represented by various coalitions and associations with a wide range of organization and political strength.

Riparians: Persons residing on the banks of a body of water.

Robustness: The breadth or depth across fluctuation effects or across stakeholders of the effectiveness of a measure in resolving a problem associated with fluctuating water levels under a variety of changing conditions. (For consideration within the evaluation framework).

Runoff: The portion of precipitation on the land that ultimately reaches streams and lakes.

Seiche: A standing wave oscillation of a body of water that continues, pendulum fashion, after the cessation of the originating force.

Sensitivity: The degree to which an interest is effected by, receives benefits from, or suffers consequences of, water level fluctuations. Sensitivity is related to the preparedness of the interest to the effects of levels and the ability of the interest to adapt. (see also "Adverse Consequence - FG3 Operational Definition).

Snowpack Water: The depth of water which would result from the melting snow cover of a given area.

Social Desirability: The continued health and well-being of individuals and their organizations, businesses, and communities to be able to provide for the material, recreational, aesthetic, cultural, and other individual and collective needs that comprise a valued quality of life. The satisfaction of this objective includes a consideration of individual rights, community responsibilities and requirements, the distributional impacts of meeting these needs, and the determination of how these needs should be achieved (paid for) along with other competing requirements of society.

Socio-economic Conditions: Pertaining to the demographics of a region.

Stakeholder: An individual, group, or institution with an interest or concern, either economic, societal or environmental, that is affected by fluctuating water levels or by measures proposed to respond to fluctuating water levels within the Great Lakes-St. Lawrence River Basin.

Steady-state: No change over time.

Systems Approach: An analysis which is structured in such a way as to identify the many interrelated problems and interests affected by fluctuating water levels in the Great Lakes-St. Lawrence River Basin. This means an overriding concern that all aspects of the problems associated with fluctuating water levels be analyzed and evaluated, and their linkages be identified and weighted as to the degree of sensitivity in the system.

Transportation Interests: Transportation includes movement of goods in Great Lakes-St. Lawrence shipping channels and into and out of Great Lakes-St. Lawrence ports. Transportation interests are comprised of two major sub-classes: ocean going and lake carrier shipping companies, often represented by shipping associations, and ports, often represented by port associations. Associated with the lake transportation interests are other interests within the regional transportation infrastructure, including truck and rail interests.

Uncertainty and Risk: The evaluation of a proposed measure in terms of the unpredictability and magnitude of the consequence which may follow, the detectability of anticipated or unanticipated consequences, and the ability to reverse, adapt, or redirect the measure, depending on its effects.

Urbanization: The change of character of land from rural to urban.

Water Supply: Water reaching the Great Lakes as a direct result of precipitation, less evaporation from land and lake surfaces.

Watershed The area drained by a river or lake system.

Wetlands: "Lands where the water table is at, near or above the land surface long enough each year to support the growth of hydrophytes (plants which prefer wet conditions), as long as other environmental variables are favorable." (Cowardin, et.al., 1977) Along the Great Lakes shoreline they include marshes, swamps and other lands generally considered to be potential havens for fish and wildlife areas.

"What If" Modelling Capability: The ability to simultaneously determine the impacts of many different stakeholders and their interests in response to the implementation of a wide range of measures to deal with problems associated with fluctuating water levels in the Great Lakes-St. Lawrence River Basin.

ANNEX F

BIBLIOGRAPHY

APPENDIX F-2

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ANNEX F

APPENDIX F-3

EVALUATION INSTRUMENT TEMPLATE

MEASURE:

ECONOMIC SUSTAINABILITY

Operational Criteria: Aggregated Bi-National Net Benefits

Definition: The effect of a measure in terms of the total net benefits (i.e., net combined total national economic impacts for the USA and Canada minus the total bi-national costs of the measure) it produces

TABLE OF ECONOMIC IMPACTS

	Nav	Riparian	Power	Recreat	Com/Ind	Com/Fish	Agy	Nat Peoples
US								
CAN								
Total								

Costs are the present value of the measure which includes all planning, design, administrative, construction, enforcement, maintenance, replacements inclusive of all other resource costs necessary to make the measure fully operational

ESTIMATE OF ECONOMIC COSTS:

ESTIMATE OF NET ECONOMIC BENEFITS: (+)/(-) $

As measured by: The net difference between economic benefits and economic resource costs

+ 3 SUBSTANTIAL positive net present values
+ 2 MODERATE . .
+ 1 MINIMAL . . .

0 No net aggregate gain or loss

- 1 MINIMAL . .
- 2 MODERATE . . .
- 3 SUBSTANTIAL negative net present values

1. ECONOMIC SUSTAINABILITY (Continued)

Operational Criteria: Aggregated Bi-National Net Benefits (cont'd)

Rating:

Rationale:

Operational Criteria: Regional Economic Development

Definition: Net change in the natural or competitive potential of regions within the Great Lakes Basin relative to pre-measure existing conditions

As measured by: The net changes in the levels of income or employment within the Great Lakes Basin

+ 3 SUBSTANTIAL net increase in levels of income and employment

+ 2 MODERATE . . . .
+ 1 MINIMAL . . . .

0 No net change in levels of income and employment

- 1 MINIMAL . . . .
- 2 MODERATE . . . . .

- 3 SUBSTANTIAL net decrease in levels of income and employment

Rating:

Rationale:

2. ENVIRONMENTAL INTEGRITY

Operational Criteria: Environmental Diversity

Definition: The (a) richness of plant and animal species; (b) number of habitats, and; (c) number of physical features (eg., bluffs, dunes, beaches, etc)

As measured by: (a) changes in the number of plant and animal species after the environment has adjusted to the impacts

Aquatic
Assessment:_____

_____

Wetland
Assessment:_____

_____

Terrestrial
Assessment:_____

_____

+ 3 MINIMAL increase in diversity (assuming no negative competition)

+ 2 No change
+ 1 This value not used for this operational criteria

0 Not Applicable

- 1 MINIMAL decrease
- 2 MODERATE increase or decrease

- 3 SUBSTANTIAL increase or decrease

Rating:

Rationale:

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Diversity (Continued)

As measured by: (b) changes in the number of all habitats

Aquatic
Assessment:_____

_____

Wetland
Assessment:_____

_____

Terrestrial
Assessment:_____

_____

+ 3 SUBSTANTIAL increase. . .

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No net changes or not applicable

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . .

- 3 SUBSTANTIAL decrease. . .

Rating:

Rationale:

2. Environmental INTEGRITY (Continued)

Operational Criteria: Environmental Diversity (Continued)

As measured by: (c) the change in the number of physical features
(e.g., number of dunes ,bluffs, beaches, etc.)

Aquatic
Assessment:_____

_____

Wetland
Assessment:_____

_____

Terrestrial
Assessment:_____

_____

+ 3 No change

+ 2 This value not used for this operational criteria
+ 1 This value not used for this operational criteria

0 Not Applicable

- 1 MINIMAL changes
- 2 MODERATE changes

- 3 SUBSTANTIAL changes

Rating:

Rationale:

2. Environmental INTEGRITY (Continued)

Operational Criteria: Environmental Purity

Definition: Maintenance of pre-measure conditions or characteristics of the aquatic, terrestrial and wetland environments

As measured by: The change in the level of toxic or chemical contamination; either direct and/or indirect (e.g., dilution)

+ 3 SUBSTANTIAL decrease in toxicity or contamination
+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No change in existing toxicity or not applicable

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .
- 3 SUBSTANTIAL increase in toxicity or contamination

Rating:

Rationale:

As measured by: Air, water and soil and soil substrate quality

+ 3 SUBSTANTIAL improvements to existing air, water and soil & substrate quality

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Negligible change in air, water, and soil or soil substrate quality inclusive of short term impacts or not applicable

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 SUBSTANTIAL degradations to existing air, water and soil substrate quality

Rating:

Rationale:

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Purity (Continued)

As measured by: The introduction of exotic organisms
(+) is beneficial to the environment,
(-) is detrimental to the environment

+ 3 Large number of beneficial organisms

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No introductions or not applicable

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . .

- 3 Large number of detrimental organisms

Rating:

Rationale:

Operational Criteria: Environmental Resilience

Definition: Ability of any environment to recover from some disturbance, natural or human

As measured by: Technical judgment of an environment's ability to recover from the impacts

+ 3 Environment will recover to pre-measure state

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .
0 Environment can recover towards pre-measure state or not applicable
- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . .

- 3 Environment will not recover to pre-measure state

Rating:

Rationale:

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Productivity

Definition: The ability of an environment to produce a variety of (a) physical and (b) biological outputs essential to the maintenance of the existing environment

As measured by: (a) The total habitat area (abiotic)

Aquatic
Assessment:_____

_____

Wetland
Assessment:_____

_____

Terrestrial
Assessment:_____

_____

+ 3 SUBSTANTIAL gain . . .

+ 2 MODERATE . . .
+ 1 MINIMAL . . .

0 No Gain or not applicable

- 1 MINIMAL . . . . .
- 2 MODERATE . . . . .

- 3 SUBSTANTIAL loss . . .

Rating:

Rationale:

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Productivity (Continued)

As measured by: (b) The net primary productivity (mg/m2/day) of living matter produced

Aquatic
Assessment:_____

_____

Wetland
Assessment:_____

_____

Terrestrial
Assessment:_____

_____

+ 3 SUBSTANTIAL gain . . .

+ 2 MODERATE . . . .
+ 1 MINIMAL . . . .

0 No gain or not applicable

- 1 MINIMAL . . . .
- 2 MODERATE . . . .

- 3 SUBSTANTIAL loss . . .

Rating:

Rationale:

3. SOCIAL DESIRABILITY

Operational Criteria: Human Health, Security and Well-Being

Definition: The exposure of shoreline property owners and users to adverse physical effects from natural phenomenon including lake storms and extreme high and low water levels

As measured by: The technical judgment of the estimated degree to which a measure will change the incidence of disruptions, damages, including evacuations of individuals, families, communities at specific sites; adverse effects of extreme low waters and expected consequences upon water quality, dilution, etc.

+ 3 SUBSTANTIAL net decrease in the frequency, intensity or reduced monetary losses associated with extreme natural phenomenon

+ 2 MODERATE . . .
+ 1 MINIMAL . . .

0 No net change

- 1 MINIMAL . . . .
- 2 MODERATE . . . .

- 3 SUBSTANTIAL inducement for future potential disasters and/or substantial increase in shoreline development susceptible to adverse effects from natural phenomenon

Rating:

Rationale:

3. SOCIAL DESIRABILITY (Continued)

Operational Criteria: Private Property Rights

Definition: Legal guarantees and limitations of perceived and de facto property and water rights

As measured by: Changes in private property rights

+ 3 NO CHANGE to pre-measure property rights (status quo)

+ 2 This value not used for this operational criteria
+ 1 This value not used for this operational criteria

0 MODERATE change to pre-measure property rights or not applicable

- 1 These values not used for this operational criteria
- 2 These values not used for this operational criteria

- 3 SUBSTANTIAL change and/or restriction to pre-measure property rights

Rating:

Rationale:

3. SOCIAL DESIRABILITY (Continued)

Operational Criteria: Effects Across Social Strata

Definition: Distributional effects of a measure

As measured by: The incidence of impacts across income levels or intervals of property values and the beneficial/detrimental effects on interests

+ 3 Distribution of impacts is equal within various interest classes across the designated intervals of income or property values; and the effect of the measure to most interests is beneficial

+ 2 Distribution of impacts is equal; and the overall net effect of the measure on interests is beneficial

+ 1 Distribution of impacts is equal; and the overall net effect of the measure on interests is neutral

0 Distribution of impacts is equal; and the overall net effect of the measure on interests is slightly detrimental

- 1 Uneven distribution of impacts; and the overall net effect of the measure on interests is moderately beneficial

- 2 Uneven distribution of impacts; and the overall net effect of the measure on interests is neutral

- 3 Uneven distribution of impacts across income levels or property value intervals; and the effects of the measure on most interests is detrimental

Rating:

Rationale:

3. SOCIAL DESIRABILITY (Continued)

Operational Criteria: Public access to natural and cultural resources

Definition: Availability of active and passive recreational and cultural opportunities for public participation

As measured by: The net change of available opportunities for cultural opportunities and general or specialized recreational activities which exist within the Basin

+ 3 SUBSTANTIAL creation of additional user days or annual activity occasions

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No net change or not applicable

- 1 MINIMAL . . . . .
- 2 MODERATE . . . . .

- 3 SUBSTANTIAL loss of existing user days or annual activity occasions

Rating:

Rationale:

4. RISK AND UNCERTAINTY

Operational Criteria: Flexibility

Definition: Ability of a measure to adjust to conditions outside the expected range of physical and/or social conditions. (e.g., extreme climatic scenarios, population shifts, etc)

As measured by: Technical judgment of the operational range or implementation criteria of a measure

+ 3 Fully flexible (responds well to changes outside the expected range)

+ 2 MODERATELY . . . .
+ 1 MINIMALLY . . . . .

0 Partially flexible and can possibly respond to a changed condition

- 1 MINIMALLY . . . . .
- 2 MODERATELY . . . . .

- 3 Totally inflexible (no response is possible)

Rating:

Rationale:

4. RISK AND UNCERTAINTY (Continued)

Operational Criteria: Reversibility

Definition: The characteristic of a measure and its outputs that allows it to be removed, liquidated or annulled.

As measured by: (a) Degree of residual effect of the measure on the man-made environment

+ 3 Full restoration to pre-measure conditions possible

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Ability to restore to pre-measure conditions; partial recovery of pre-measure conditions but with some residual effects

- 1 MINIMAL . . . . .
- 2 MODERATE . . . .

- 3 Recovery not possible; natural or physical effects are permanent

Rating:

Rationale:

As measured by: (b) degree of residual effect of the measure on the natural environment

+ 3 Full restoration to pre-measure conditions possible

+ 2 MODERATE . . . . .
+ 1 MINIMAL . . . . . .

0 Ability to restore to pre-measure conditions; partial recovery of pre-measure conditions with some residual effects or not applicable

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 Recovery not possible; natural or physical effects are permanent; no recovery possible

Rating:

Rationale:

4. RISK AND UNCERTAINTY (Continued)

Operational Criteria: Predictability

Definition: Ability of a measure to fulfill its intended objectives within the range of predicted impacts

As measured by: The extent of scientific or practical knowledge about a particular measure

+ 3 There is substantial body of knowledge about a particular measure and a high degree of confidence about its characteristics, impacts or expected outputs or function

+ 2 MODERATE . . . . .
+ 1 MINIMAL . . . . . .

0 Limited information available and/or few examples exist

- 1 MINIMAL . . . . .
- 2 MODERATE . . . . .

- 3 Measure is conceptual in nature, has never been implemented within the region or may have unpredictable outputs or impacts upon the man-made or natural environments

Rating:

Rationale:

4. RISK AND UNCERTAINTY (Continued)

Operational Criteria: Responsiveness

Definition: Ability of a measure to respond to both high and low water conditions

As measured by: The technical judgment of the operational range or implementation criteria of a measure

+ 3 Responds extremely well to both high and low water conditions

+ 2 MODERATELY . . . . .
+ 1 MINIMALLY . . . . .

0 Responsive to either one, but is marginal or has no effect on the other extreme

-1 MINIMALLY . . . . .
-2 MODERATELY . . . . .

- 3 Not substantially responsive to either extreme

Rating:

Rationale:

5. Implementability & Political Acceptability

Operational Criteria: Technical Feasibility

Definition: The degree to which a measure can be successfully implemented

As measured by: The application of existing technology or past experience

+3 Technology to be used is sound; substantially well known and similar measures have been successfully implemented elsewhere

+ 2 MODERATELY . . . . . .
+ 1 MINIMALLY . . . . . .

0 Practical examples may exist but at locations outside the Great Lakes Basin

- 1 MINIMALLY . . . . .
- 2 MODERATELY . . . . .

- 3 No technology available and or no past experience with the specific measure exists

Rating:

Rationale:

5. Implementability & Political Acceptability (Continued)

Operational Criteria: Legal and Policy Compatibility

Definition: Degree of complexity of the administrative process required by existing laws and policies across all levels of government

As measured by: The ease of implementing a measure across all levels of governmental rules, regulations or policies within (a) the United States and, (b) Canada

+ 3 SUBSTANTIAL compliance with all rules, regulations or policies

+ 2 This value not used for this operational criteria
+ 1 This value not used for this operational criteria

0 Minor changes at low levels of government may be necessary to implement a measure

- 1 This value not used for this operational criteria
- 2 This value not used for this operational criteria

- 3 SUBSTANTIAL conflicts are known to exist at international or national levels of government

(a) within the United States

Rating:

Rationale:

(b) within Canada

Rating:

Rationale:

5. Implementability & Political Acceptability (Continued)

Operational Criteria: Cost-Sharing Acceptability

Definition: The willingness of responsible parties to participate in cost-sharing

As measured by: The perceived willingness of participants (including governments, direct beneficiaries, and/or other interests) to successfully negotiate the agreements necessary to cost share a particular measure

+ 3 High probability of negotiating a cost-sharing agreement and/or past support for cost-sharing of this particular measure

+ 2 This value not used for this operational criteria
+ 1 This value not used for this operational criteria

0 Moderate probability of negotiating cost-sharing agreements and/or some experience for similar measures

- 1 This value not used for this operational criteria
- 2 This value not used for this operational criteria

- 3 Low probability of negotiating cost-sharing agreements and/or no past experience or acceptance of cost-sharing for similar measures

Rating:

Rationale:

5. Implementability & Political Acceptability (Continued)

Operational Criteria: Compatibility of Views

Definition: The concurrence, or lack thereof, by interest classes for a specific measure

As measured by: Technical judgment of the extent of support by interest classes for a proposed measure

	Nav	Riparian	Power	Recreat	Com/Ind	Com/Fish	Agy	Nat. People
Support								
Oppose								
Indiff								

+ 3 Almost all interest classes support, none opposed

+ 2 Majority support, remainder are indifferent
+ 1 Minimal support, some opposition

0 Equal distribution of support/opposition

- 1 Minimal opposition, remainder indifferent
- 2 Majority oppose, few support

- 3 Almost all interest classes oppose

Rating:

Rationale:

5. Implementability & Political Acceptability (Continued)

Operational Criteria: Fiscal Acceptability

Definition: The monetary resources, from whatever level of government, necessary to implement a proposed measure relative to other public priorities

As measured by: The impact of the cost of a measure on a sponsors' other public priorities

+ 3 Cost of the measure is not a burden and does not impact other priorities

+ 2 This value not used for this operational criteria
+ 1 This value not used for this operational criteria

0 Cost of the measure is no more than a moderate burden on the sponsor and may have some impact upon other priorities

- 1 This value not used for this operational criteria
- 2 This value not used for this operational criteria

- 3 Cost of the measure is a substantial burden on the sponsor and impacts on other spending priorities

Rating:

Rationale:

6. Equitability

Operational Criteria: Sectoral Equity

Definition: The degree to which a measure is viewed as fair and responsive to the perceived needs of each sector within the Great Lakes Basin in terms of the distribution of all impacts

As Measured by: The magnitude and/or incidence of the gains and losses between sectors

\+ 3 There is a substantially equal balance of positive impacts between all sectors from a measure with no negative impacts to any sector

\+ 2 MODERATELY . . . . . .
\+ 1 MINIMALLY . . . . . .

0 Relatively few positive or negative impacts for most sectors

\- 1 MINIMAL . . . . . .
\- 2 MODERATE . . . . . .

\- 3 There will be a substantial imbalance of gains or losses among sectors

Rating:

Rationale:

6. Equitability (Continued)

Operational Criteria: Regional Equity

Definition: The degree to which a measure is viewed as fair and responsive to the perceived needs of each region in terms of the distribution of all impacts

As measured by: The magnitude and/or incidence of the gains and losses between regions

+ 3 There is a substantially equal balance of positive impacts among almost all regions and no negative impacts for any region

+ 2 MODERATELY . . . . .
+ 1 MINIMALLY . . . . . .

0 Relatively few positive or negative impacts for most regions

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . .

- 3 There is a substantial imbalance of gains or losses among regions

Rating:

Rationale:

6. Equitability (Continued)

Operational Criteria: Bi-National Equity

Definition: The degree to which a measure is viewed as fair and responsive in terms of the distribution of all impacts between the USA and Canada

As measured by: The magnitude and/or incidence of all gains and losses between nations

+ 3 There is a substantially equal balance of positive impacts between nations from a measure

+ 2 MODERATELY . . . .
+ 1 MINIMALLY . . . . .

0 Either nation will have positive impacts while the other nation has no negative impacts

- 1 MINIMAL . . . . .
- 2 MODERATE . . . . .

- 3 There is a substantial imbalance of gains and losses between nations from a measure

Rating:

Rationale:

ANNEX F

APPENDIX F-4

SAMPLE OF A COMPLETED EVALUATION INSTRUMENT

MEASURE: 3.1.1 Setbacks for Structures in Zoning

ECONOMIC SUSTAINABILITY

Operational Criteria: Aggregated Bi-National Net Benefits

Definition: The effect of a measure in terms of the total net benefits (i.e., net combined total national economic impacts for the USA and Canada minus the total bi-national costs of the measure) it produces

TABLE OF ECONOMIC IMPACTS

	Nav	Riparian	Power	Recreat	Com/Ind	Com Fish	Agy	Nat Peop
USA	*	*	*	*	*	*	*	*
CAN	*	*	*	*	*	*	*	*
Total	0	+1	0	+1	+1	0	+1	+1

+.6

Costs are the present value of the measure which includes all planning, design, administrative, construction, enforcement, maintenance, replacements inclusive of all other resource costs necessary to make the measure fully operational

ESTIMATE OF ECONOMIC COSTS: — $ MINIMAL COST

ESTIMATE OF NET ECONOMIC BENEFITS: (+)/(−) $ MINIMAL POSITIVE

As measured by: The net difference between economic benefits and economic resource costs

+ 3 SUBSTANTIAL positive net present values
+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No net aggregate gain or loss

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .
- 3 SUBSTANTIAL negative net present values

1. ECONOMIC SUSTAINABILITY (Continued)

Operational Criteria: Aggregated Bi-National Net Benefits (cont'd)

Rating: [+1]

Rationale: Minimal costs and some degree of long term economic gain across a number of shoreline interests: - Reduction in future damages, future cleanup, future evacuations, and utility relocations. Assumes: No compensation for short change in market value of negatively affected properties - There will be stabilization of property values over the long-ter

Operational Criteria: Regional Economic Development

Definition: Net change in the natural or competitive potential of regions within the Great Lakes Basin relative to pre-measure existing conditions

As measured by: The net changes in the levels of income or employment within the Great Lakes Basin

+ 3 SUBSTANTIAL net increase in levels of income and employment

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No net change in levels of income and employment

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 SUBSTANTIAL net decrease in levels of income and employment

Rating: [+1]

Rationale: Although slight decrease in regional development in short term as a result of lessened construction, because of the stabilization of values over the long term; regional income/employment will be stimulated due to improved business climate and general physical conditions of properties.

2. ENVIRONMENTAL INTEGRITY

Operational Criteria: Environmental Diversity

Definition: The richness of (a) plant and animal species, (b) number of habitats and (c) number of physical features (eg., bluffs, dunes, beaches, etc)

As measured by: (a) changes in the number of plant and animal species after the environment has adjusted to the impacts

Aquatic

Assessment: Could be lost with increased dumping infront of existing/remaining properties.

Wetland

Assessment: no gain because of preferential erosion (new properties, no structures / protection (of existing properties.

Terrestrial

Assessment: Anthropogenic presence still exists and therefore in parts still occur. No net gain, some loss! With increased protection around properties.

+ 3 minimal increase in diversity (assuming no negative competition)

+ 2 No change
+ 1 N/A

0 N/A

- 1 MINIMAL decrease
- 2 MODERATE increase or decrease

- 3 SUBSTANTIAL increase or decrease

Rating: [-1]

Rationale: The implementation of revetments and shore protection could cause more damage to habitat and therefore decrease the number of species.

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Diversity (Continued)

As measured by: (b) changes in the number of all habitats

Aquatic

Assessment: _____

_____

Wetland

Assessment: _____

_____

Terrestrial

Assessment: _____

_____

+ 3 SUBSTANTIAL increase...

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No net changes

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 SUBSTANTIAL decrease...

Rating: [0]

Rationale: Should be no gain/loss in "number" of habitats just areal extent, unless habitat is already small. Some creation of habitat if preferential erosion occurs along sites where structures no longer exist. 100 year setback alone does very little to enhance. environment or even degrade!

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Diversity (Continued)

As measured by: (c) the change in the number of physical features (e.g., number of dunes, bluffs, beaches, etc.)

Aquatic

Assessment: _____

_____

Wetland

Assessment: _____

_____

Terrestrial

Assessment: Could create an accelerated loss of bluffs / beaches where structures are removed. Increased protection can create larger changes to the features.

+ 3 No change

+ 2 N/A
+ 1 N/A

0 N/A

- 1 MINIMAL changes
- 2 MODERATE changes

- 3 SUBSTANTIAL changes

Rating: [-2]

Rationale: Not sure because of the nature of the measure. Finding it difficult to assess a measure that may or may not remove structures incidently. Will be detrimental in that change will occur because preferential changes along the shoreline will take place.

"Preferential" defined: Where people reside shore protection will occur therefore no erosion. No people or structures means erosion.

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Purity

Definition: Maintenance of pre-measure conditions or characteristics of the aquatic, terrestrial and wetland environment

As measured by: The change in the level of toxic or chemical contamination; either direct and/or indirect (e.g., dilution)

+ 3 SUBSTANTIAL decrease in toxicity or contamination
+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No change in existing toxicity

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .
- 3 SUBSTANTIAL increase in toxicity or contamination

Rating: [0]

Rationale: because structures will remain / no change in base case.

As measured by: Air, water and soil and soil substrate quality

+ 3 SUBSTANTIAL improvements to existing air, water and soil & substrate quality

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Negligible change in air, water, and soil or soil substrate quality inclusive of short term impacts

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 SUBSTANTIAL degradations to existing air, water and soil & substrate quality

Rating: [0]

Rationale: _____

_____

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Purity (Continued)

As measured by: The introduction of exotic organisms
(+) is beneficial to the environment,
(-) is detrimental to the environment

+ 3 Large number of beneficial organisms
+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No introductions

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .
- 3 Large number of detrimental organisms

Rating: [0]

Rationale: Don't know

Operational Criteria: Environmental Resilience

Definition: Ability of any environment to recover from some disturbance, natural or human

As measured by: Technical judgment of an environment's ability to recover from the impacts

+ 3 Environment will recover to pre-measure state
+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Environment can recover towards pre-measure state

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .
- 3 Environment will not recover to pre-measure state

Rating: [0]

Rationale: Environment in 30 yrs. (assuming lifetime of structures is 30 yrs.) will begin to reestablish once all shore protection is removed.

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Productivity

Definition: The ability of an environment to produce a variety of (a) physical and (b) botanical outputs essential to the maintenance of the existing environment

As measured by: (a) The total habitat area (abiotic)

Aquatic

Assessment: _____

_____

Wetland

Assessment: _____

_____

Terrestrial

Assessment: _____

_____

+ 3 SUBSTANTIAL gain ...
+ 2 Moderate gain...
+ 1 Minimal gain...

0 No gain

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .
- 3 SUBSTANTIAL loss...

Rating: [0]

Rationale: Balanced in the longterm. Once setback is uniform along the shore line, the environment can develop naturally. In the natural case all factors considered the environment should develop towards an equilibrium state which is "environmentally" the preferred alternative.

2. ENVIRONMENTAL INTEGRITY (Continued)

Operational Criteria: Environmental Productivity (Continued)

As measured by: (b) The net primary productivity ($mg/m^2/day$) of living matter produced

Aquatic

Assessment: _____

_____

Wetland

Assessment: _____

_____

Terrestrial

Assessment: _____

_____

+ 3 SUBSTANTIAL gain ...
+ 2 Moderate gain...
+ 1 Minimal gain...

0 No gain

- 1 Minimal loss...
- 2 Moderate loss..
- 3 SUBSTANTIAL loss...

Rating: [0]

Rationale: Balanced over long term.

_____

3. SOCIAL DESIRABILITY

Operational Criteria: Human Health, Security and Well-Being

Definition: The exposure of shoreline property owners and users to adverse physical effects from natural phenomenon including lake storms and extreme high and low water levels

As measured by: The technical judgment of the estimated degree to which a measure will change the incidence of disruptions, damages, including evacuations of individuals, families, communities at specific sites; adverse effects of extreme low waters and expected consequences upon water quality, dilution, etc.

+ 3 Substantial net decrease in the frequency, intensity or reduced monetary losses associated with extreme natural phenomenon

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No net change

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 Substantial inducement for future potential disasters and/or substantial increase in shoreline development susceptible to adverse effects from natural phenomenon

Rating: +2

Rationale: This measure provides absolute control over future damages. There would be substantial decrease in the frequency, intensity and dollar damages to future structures. However, there would be no change for existing development.

3. SOCIAL DESIRABILITY (Continued)

Operational Criteria: Private Property Rights

Definition: Legal guarantees and limitations of perceived and de facto property and water rights

As measured by: Changes in private property rights

+ 3 No change to pre-measure property rights (status quo)

+ 2
+ 1

0 Moderate change to pre-measure property rights

- 1
- 2

- 3 Substantial change and/or restriction to pre-measure property rights

Rating: [-3]

Rationale: A federal mandate which causes absolute restrictions of future construction would cause a substantial change in property rights.

3. SOCIAL DESIRABILITY (Continued)

Operational Criteria: Effects Across Social Strata

Definition: Distributional effects of a measure

As measured by: The incidence of impacts across income levels or intervals of property values

+ 3 Distribution of impacts is equal across the designated intervals of income or property values

+ 2
+ 1

0

- 1
- 2

- 3 Substantially uneven distribution of impacts across income levels or property value intervals

Rating: +3

Rationale: Distribution of undeveloped parcels and future additions cuts across all social strata of existing owners. In other words, the measure has no hidden biases which impact one shoreline property owner from a particular social strata and not another.

Note: The measurement scale for this operational criteria was refined between the two sets of measures applied in testing the evaluation instrument. This explains any differences between the template shown in Appendix H-3 and use of the original instrument as shown in this Appendix.

3. SOCIAL DESIRABILITY (Continued)

Operational Criteria: Public access to natural and cultural resources

Definition: Availability of active and passive recreational and cultural opportunities for public participation

As measured by: The net change of available opportunities for cultural opportunities and general or specialized recreational activities which exist within the Basin

+ 3 SUBSTANTIAL creation of additional user days or annual activity occasions

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 No net change

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 SUBSTANTIAL loss of existing user days or annual activity occasions

Rating: [0]

Rationale: Though one impact of setback zoning may provide recreational access and hence activity occasions on lands which otherwise would have been developed restricting public access, it is also possible that certain lands may be impacted preventing the development of structures which provide recreational opportunities (eg. publicly accessible summer rental cottages).

4. RISK AND UNCERTAINTY

Operational Criteria: **Flexibility**

Definition: Ability of a measure to adjust to conditions outside the expected range of physical and/or social conditions. (e.g., extreme climatic scenarios, population shifts, etc)

As measured by: Technical judgment of the operational range or implementation criteria of a measure

+ 3 Fully flexible (responds well to changes outside the expected range)

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Partially flexible and can possibly respond to a changed condition

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 Totally inflexible (no response is possible)

Rating: +3

Rationale: Set back zoning is fully flexible, in that setback requirement can be easily modified through legislative actions hence adapting to changing conditions.

4. RISK AND UNCERTAINTY (Continued)

Operational Criteria: Reversibility

Definition: The characteristic of a measure and its outputs that allows it to be removed, liquidated or annulled.

As measured by: (a) Degree of residual effect of the measure on the man-made environment

+ 3 Full restoration to pre-measure conditions possible
+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Ability to restore to pre-measure conditions; partial recovery of pre-measure conditions but with some residual effects

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .
- 3 Recovery not possible; natural or physical effects are permanent

Rating: +3

Rationale: Full reversibility possible thru legislatative action.

As measured by: (b) degree of residual effect of the measure on the natural environment

+ 3 Full restoration to pre-measure conditions possible
+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Ability to restore to pre-measure conditions; partial recovery of pre-measure conditions with some residual effects

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .
- 3 Recovery not possible; natural or physical effects are permanent; no recovery possible

Rating: +2

Rationale: Although full reversibility is possible thru legislative action, the changes in the natural environment which occur through a reduction in future development (eg. Preferential erosion) would only recover minimally.

4. RISK AND UNCERTAINTY (Continued)

Operational Criteria: **Predictability**

Definition: Ability of a measure to fulfill its intended objectives within the range of predicted impacts

As measured by: The extent of scientific or practical knowledge about a particular measure

+ 3 There is substantial body of knowledge about a particular measure and a high degree of confidence about its characteristics, impacts or expected outputs or function

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Limited information available and/or few examples exist

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 Measure is conceptual in nature, has never been implemented within the region or may have unpredictable outputs or impacts upon the man-made or natural environments

Rating: [+2]

Rationale: There is some degree of uncertainty regarding requirements for effective setbacks over long periods (i.e. 100 yrs.) However long term historical erosion rates provide reasonable confidence in prescribed setback distances.

4. RISK AND UNCERTAINTY (Continued)

Operational Criteria: Responsiveness

Definition: Ability of a measure to respond to both high and low water conditions

As measured by: The technical judgment of the operational range or implementation criteria of a measure

+ 3 Responds well to both high and low water conditions

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Responsive to either one, but is marginal or has no effect on the other extreme

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 Not responsive to either extreme

Rating: [+ 1]

Rationale: Assumes: Erosion continues during low water periods. Setback zoning will reduce damages to future structures for erosion during highs and lows.

5. Implementability & Political Acceptability

Operational Criteria: Technical Feasibility

Definition: The degree to which a measure can be successfully implemented

As measured by: The application of existing technology or past experience

+ 3 Technology to be used is sound; well known and similar measures have been successfully implemented elsewhere

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 Practical examples may exist but at locations outside the Great Lakes Basin

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 No technology available and no past experience with the specific measure exists

Rating: [+3]

Rationale: Many jurisdictions currently have set back zoning that have been successfully implemented

5. Implementability & Political Acceptability (Continued)

Operational Criteria: Legal and Policy Compatibility

Definition: Degree of complexity of the administrative process required by existing laws and policies across all levels of government

As measured by: The ease of implementing a measure across all levels of governmental rules, regulations or policies within
(a) the United States and,
(b) Canada

+ 3 SUBSTANTIAL compliance with all rules, regulations or policies

+ 2 N/A . . . . . .
+ 1 N/A . . . . . .

0 Minor changes at low levels of government may be necessary to implement a measure

- 1 N/A . . . . .
- 2 N/A . . . . .

- 3 SUBSTANTIAL conflicts are known to exist at international or national levels of government

(a) within the United States

Rating: [-1]

Rationale: _____

_____

(a) within Canada

Rating: [-1]

Rationale: Potential problems regarding legal challenges from changes in property rights and the number of local government administraters and enforcement with regards to existing local rules and ordinances.

5. Implementability & Political Acceptability (Continued)

Operational Criteria: Cost-Sharing Acceptability

Definition: The willingness of responsible parties to participate in cost-sharing

As measured by: The number of participants, or levels of government, required to negotiate agreements, and/or experience with acceptance or rejection of cost sharing for similar measures

+ 3 Negotiations will be necessary between national governments only; or there has been widespread success with cost-sharing for similar measures

+ 2 N/A . . . . . .
+ 1 N/A . . . . . .

0 Requires involvement of state/provincial governments, or limited success with cost-sharing agreements at some areas within the Basin

- 1 N/A . . . . . .
- 2 N/A . . . . . .

- 3 Many levels of government will be involved, or there is no past experience regarding cost-sharing for this particular measure

Rating: [-3]

Rationale: Widespread geographic implementation required though federal mandate and minimal admin./overhead cost (assumes federal mandate similar to FIA).

5. Implementability & Political Acceptability (Continued)

Operational Criteria: Compatibility of Views

Definition: The concurrence, or lack thereof, by interest classes for a specific measure

As measured by: Technical judgment of the extent of support by interest classes for a proposed measure

	Nav	Riparian	Power	Recreat	Com/Ind	Com Fish	Agy	Nat Peop
Supprt	✓			✓				
Oppose		✓		✓	✓			
Indiff			✓			✓	✓	✓

+ 3 All interest classes support

+ 2 Majority support, few oppose
+ 1 Minimal support, remainder are indifferent

0 Equal distribution of support/opposition

- 1 Minimal oppose, remainder indifferent
- 2 Majority oppose, few support

- 3 All interest classes oppose

Rating: -2

Rationale: Because of the significant restrictions to land use and changes in property rights there would be widespread opposition from affected riparians and commercial/industrial interests, yet support from environment and recreation groups.

5. Implementability & Political Acceptability (Continued)

Operational Criteria: Fiscal Acceptability

Definition: The monetary resources, from whatever level of government, necessary to implement a proposed measure relative to other public priorities

As measured by: The impact of the cost of a measure on a sponsors' other public priorities

+3 Cost of the measure is not a burden and does not impact other priorities

+2 N/A . . . . . .
+1 N/A . . . . . .

0 Cost of the measure is no more than a moderate burden on the sponsor and may have some impact upon other priorities

-1 N/A . . . . .
-2 N/A . . . . .

-3 Cost of the measure is a substantial burden on the sponsor and impacts on other spending priorities

Rating: [+3]

Rationale: Because of the low cost of the measure there would be no more than a minor burden even though costs may be spread across many locales.

6. Equitability

Operational Criteria: Sectoral Equity

Definition: The degree to which a measure is viewed as fair and responsive to the perceived needs of each sector within the Great Lakes Basin in terms of the distribution of all impacts

As measured by: The magnitude and/or incidence of the benefits and costs between sectors

+ 3 There is an equal balance of impacts between all sectors from a measure

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 It is not clear if any sector(s) will benefit more than other sectors from a particular measure

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 There will be a substantial imbalance of gains or losses among sectors

Rating: [-2]

Rationale: The measure does not address the needs of the majority of interests.

6. **Equitability (Continued)**

Operational Criteria: **Regional Equity**

Definition: The degree to which a measure is viewed as fair and responsive to the perceived needs of each region in terms of the distribution of all impacts

As measured by: The magnitude and/or incidence of the benefits and costs between regions

+ 3 There is an equal balance of impacts among all regions from a measure

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 It is not clear if any region will benefit more than others from a particular measure

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 There is a substantial imbalance of gains or losses among regions

Rating: [+2]

Rationale: Subregions in the basin close to the shoreline receive greater impacts (reduced damages, environmental gains) than outside regions within the Great Lakes basin.

6. Equitability (Continued)

Operational Criteria: Bi-National Equity

Definition: The degree to which a measure is viewed as fair and responsive in terms of the distribution of all impacts between the USA and Canada

As measured by: The magnitude and/or incidence of all gains and losses between nations

+ 3 There is an equal balance of impacts between nations from a measure

+ 2 MODERATE . . . . . .
+ 1 MINIMAL . . . . . .

0 It is not clear if either nation will benefit more than the other from a particular measure

- 1 MINIMAL . . . . . .
- 2 MODERATE . . . . . .

- 3 There is a substantial imbalance of gains and losses between nations from a measure

Rating: +3

Rationale: Both nations share equal proportions of impacts.

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Living with the lakes,

DATE	ISSUED TO