# Integrated Ecological Response Model (IERM) User's Manual

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**Limno-Tech, Inc.**
Excellence in Environmental Solutions Since 1975
Ann Arbor, MI

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# 1. INTRODUCTION

## 1.1 IERM FRAMEWORK OVERVIEW

The Integrated Ecological Response Model (IERM) was designed to analyze the ecological impacts of proposed regulation plans for the Lake Ontario – St. Lawrence River (LOSL) system. The IERM framework was developed as a collection of modules, class module, forms, and other objects in Microsoft Visual Basic 6.0 (VB6). The IERM application is comprised of two main components: a model simulation component and a visualization component consisting of a suite of graphical user interface (GUI) tools for viewing model results for hydraulics, ecological performance indicators, and hydrologic criteria.

This user's manual provides detailed information on how to:

- Run IERM simulations for various regulation plans and supply scenarios;
- Link the IERM to the Shared Vision Model (SVM);
- Visualize results for hydraulics, performance indicators, and hydrologic criteria in the IERM; and
- Review documentation for "key" performance indicators and hydrologic criteria.

The simulation component of the IERM utilizes a suite of databases to store and transfer raw model input/output data during the runtime sequence. Quarter monthly hydraulic results and annual performance indicator and criteria evaluation results are transferred from the simulation component to the main IERM database (IERM_v5.mdb). Following the completion of one or multiple IERM simulations, the results stored in the main IERM database can be accessed and reviewed by navigating through the IERM visualization tools. The simulation and visualization components are decoupled within the IERM framework so that results from one or many simulations can be stored in the main IERM database for access by the visualization tools without re-running the IERM. The linkage between the two components is illustrated in Figure 1-1.

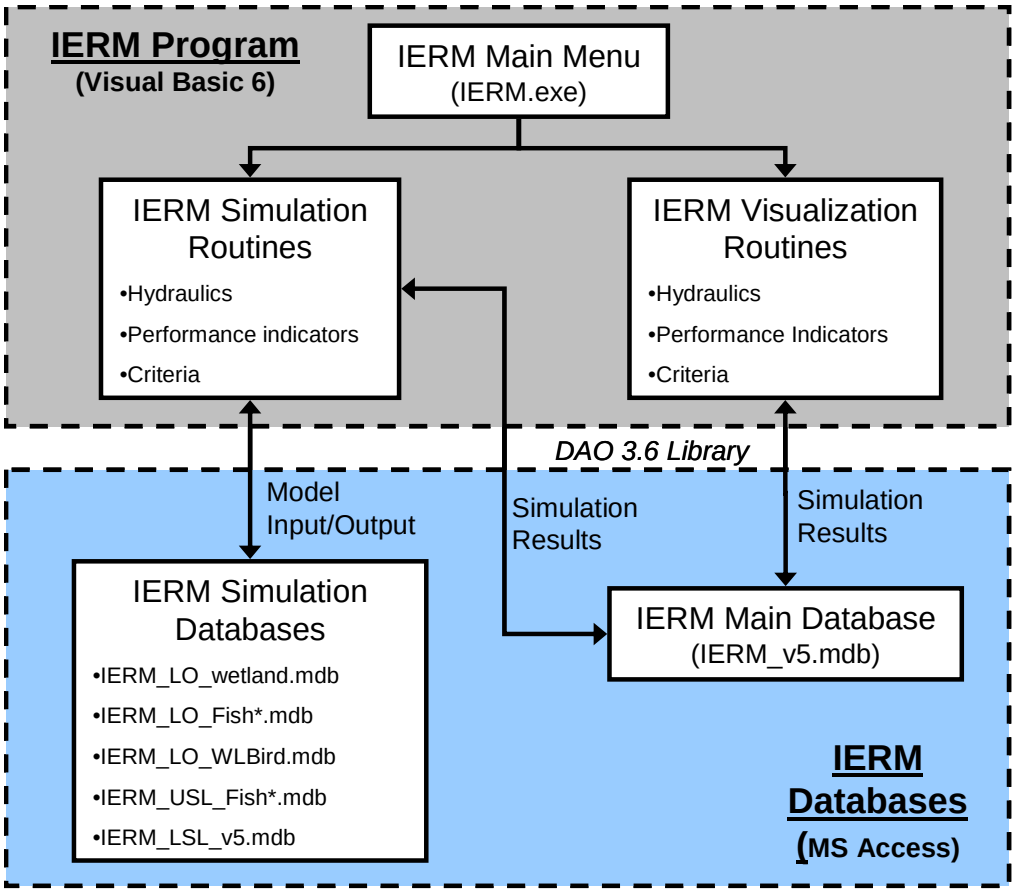


**Figure 1-1. IERM Framework Flow Chart**

## 1.2 INSTALLATION

The latest version of the IERM (version 4) is available for download at http://www.limno.com/ierm. The self-extracting zip file should be saved to the user's local hard drive, and its contents should be extracted to a local folder by double-clicking the executable and following the instructions. The IERM software setup package consists of 3 files: "IERM.cab", "setup.lst", and "setup.exe." Prior to installation, the user should ensure that the installation machine meets the system requirements described in Section 1.2.1. In addition, any previous versions of the IERM software should be uninstalled by following the steps in Section 1.2.2 prior to installing Version 4.

### 1.2.1 System Requirements

The IERM software should be installed in the "C:\Program Files" folder located on the local hard drive of a machine meeting the following minimum requirements:

- Operating System: Windows 2000 or XP;
- Processor: Pentium class – 300 Mhz or faster
- Available disk space: 500 MB

- Memory: 128 MB (256 MB recommended)

Note that the IERM software should never be installed on a machine running Windows 95 or 98; installing on either of these platforms could cause damage to the operating system.

### 1.2.2 Uninstalling Previous IERM Versions

Prior to installing the current IERM versions, the user should remove any existing IERM versions on the installation machine by following these steps:

1. Access the Windows Control Panel by clicking either: *Start* > *Settings* > *Control Panel* (Windows 2000) or: ; *Start* > *Control Panel* (Windows XP).

2. Double-click "Add/Remove Programs" and locate the "Integrated Ecosystem Response Model" item in the list;

3. Click "Change/Remove", and select "Yes" when prompted about whether you want to remove the IERM; and

4. During un-installation, select the "Keep" option when asked about keeping shared components.

### 1.2.3 IERM Software Installation

After uninstalling all previous IERM versions and confirming that the installation machine meets the minimum requirements described above, the user may begin the installation process for Version 4 by double-clicking the "setup.exe" file and following the on-screen prompts. During the installation process, several prompts may inquire about keeping an existing version of a system file that is newer than the file that the setup program is attempting to install. In all cases, the user should select "Yes" in response to these prompts to prevent any future operating system problems. The installation process may take 10-15 minutes due to the size of the files that must be copied to the installation folder. After installation has completed, an "Integrated Ecological Response Model" folder should be available.

### 1.2.4 Display Issues

The IERM software will currently not function properly if system display fonts are set to "Large" or "Extra Large." The setting for system fonts can be found by accessing the Windows Control Panel, clicking "Display", and then "Appearance options. The Scheme option should NOT be set to a large or extra large setting. In addition, the "Screen Area" setting under the Settings tab should not be less 1024 x 768.

## 1.3 MAIN MENU

All functionality provided within the IERM can be accessed from the IERM Main Menu (Figure 1-2), which is shown when the user executes the IERM program (IERM.exe). The IERM Main Menu provides the starting point for performing the following major tasks:

- Running IERM simulations ("Run IERM");
- Visualizing hydraulic results ("Visualize Hydraulics");
- Visualizing performance indicator results ("Visualize PI Results");
- Visualizing criteria results ("Visualize Criteria");
- Managing plan release input data ("Manage Plan Data"); and
- Reviewing performance indicator documentation ("View PI Information").

Detailed information regarding running an IERM simulation and using the visualization tools is provided in Sections 2 and 3, respectively. Additional features available from the IERM Main Menu include viewing a map of the LOSL study regions ("View Map"), exporting results to the Shared Vision Model ("SVM Export"), and viewing IERM version and contact information ("About IERM"). The "Exit IERM" button will close the IERM program and return the user to the Windows operating system.

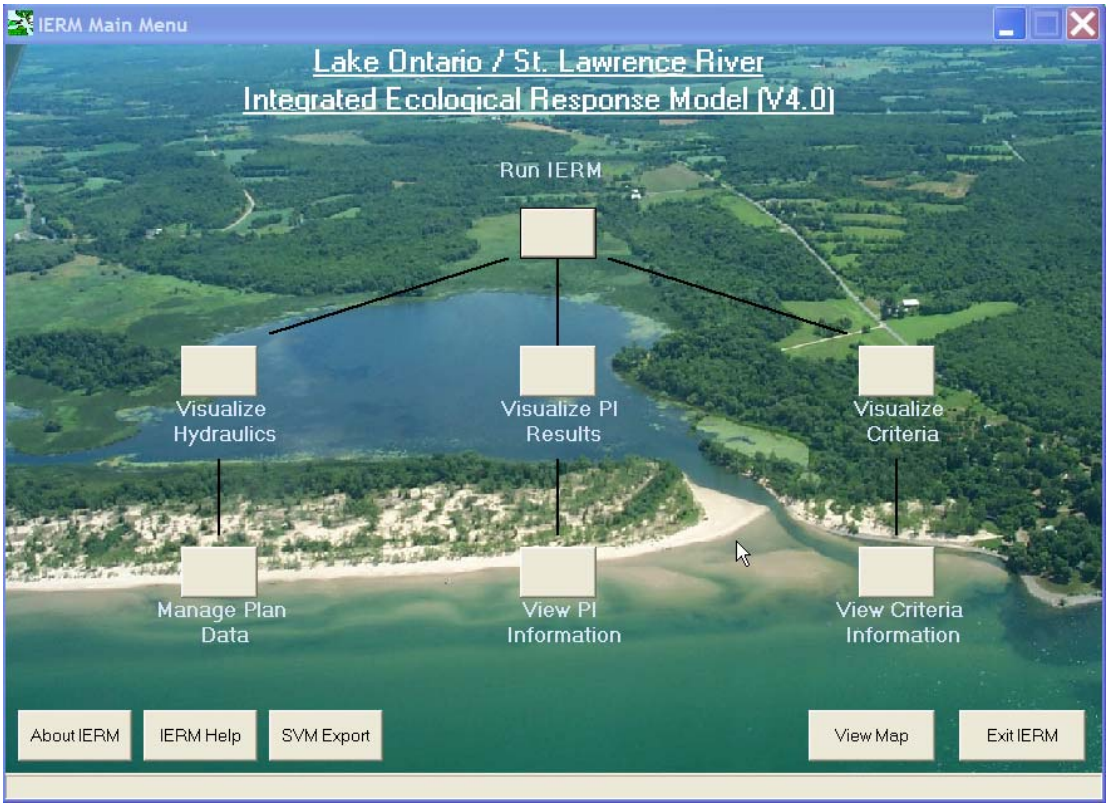


**Figure 1-2. IERM Main Menu**

# 2. IERM SIMULATION MODEL

The IERM simulation component contains all code relevant to the hydraulic simulation, ecological sub-models and associated performance indicators, and the hydrologic criteria evaluation. Ecological sub-models provided by the ETWG were coded into standalone modules or class modules that could be accessed from the main IERM calling sequence. This modularized approach provides a great deal of flexibility in terms of adding and modifying the various sub-models. The simulation code interacts with a series of Microsoft Access databases that provide efficient storage and transfer of model input/output data using Microsoft's Data Access Objects (DAO) library (Figure 1-1). The following sections provide detailed information on running an IERM simulation, including input data requirements and linking the IERM to the Shared Vision Model (SVM).

## 2.1 IMPORTING PLAN INPUT DATA

The IERM framework was designed to minimize the number of inputs required to run model simulations. This was accomplished by coding the SVM hydraulic algorithms directly into the IERM framework. Several different types of quarter-monthly input forcings are required to apply the regressions, including:

- Lake Ontario net total basin supply (NTS) rates;
- Tributary inflow rates for the Ottawa River and other major tributaries to the LSL;
- Ice factors at several locations in the USL and the LSL; and
- Releases at the Moses Saunders Dam associated with a given regulation plan.

Static quarter-monthly time series for total basin supply, tributary inflow rates, and ice factors are maintained within the main IERM database for 9 supply scenarios: historical, 4 stochastic scenarios, and 4 climate change scenarios. Because the SVM hydraulic algorithms are integrated directly into the IERM framework, the only "dynamic" input dataset required to run an IERM simulation is the quarter-monthly releases associated with the regulation plan of interest.

The IERM provides two options for importing quarter-monthly plan release data. First, the user may manually import release data manually from a spreadsheet using a plan import utility provided within the IERM. With this approach, plan releases are imported independently of launching an IERM simulation(s). Alternatively, the user may import plan releases from the Shared Vision Model (SVM) at runtime using a specially formatted worksheet in the SVM Post Processor file.

### 2.1.1 Importing Releases with the IERM Plan Utility

The IERM provides a plan import utility that allows the user to import plan releases directly from a Microsoft Excel spreadsheet. This utility can be accessed by clicking the "Manage Plan Data" button on the IERM Main Menu. The IERM plan utility interface provides an "Import Dam Release" tab (Figure 2-1), which allows the user to import releases for new regulation plan or overwrite releases currently stored in the IERM database for an existing regulation plan.

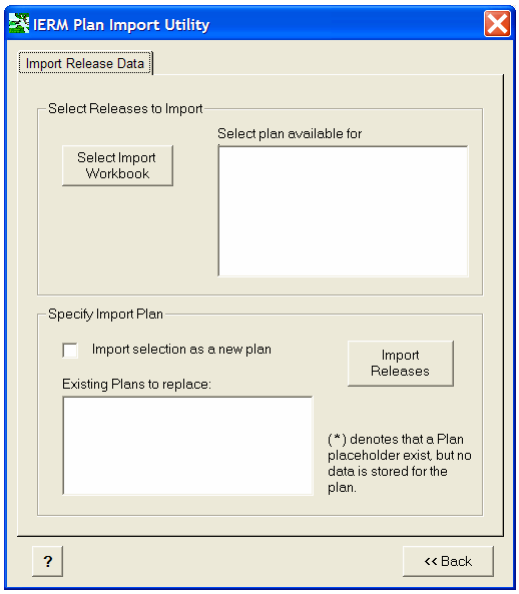


**Figure 2-1. IERM Plan Import Utility**

The plan release import process is initiated by clicking the "Import Release Data" button in the upper left corner of the form and selecting a Microsoft Excel workbook that contains quarter-monthly release data in the required format (Figure 2-2). The import workbook must contain a worksheet for each plan that includes the plan name (cell "B1"), the plan description (cell "B2"), and the one or two-digit identifier associated with the supply scenario (cell "B3"):

- Historical Scenario: "H";
- Stochastic #1-4: "S1", "S2", "S3", "S4"; or
- Climate Change #1-4: "C1", "C2", "C3", "C4"

The quarter-monthly plan release data, including year, month, quarter month (QM), and release rate ($m^3/s$) should be provided beginning in row 5, with column headers ("Year", "Month", "QM", "Release") provided in row 4. Because model simulations cover a full 101-year period, exactly 4848 (101 years X 48 QM) rows of data must be provided in the cell range "A5:D4852".

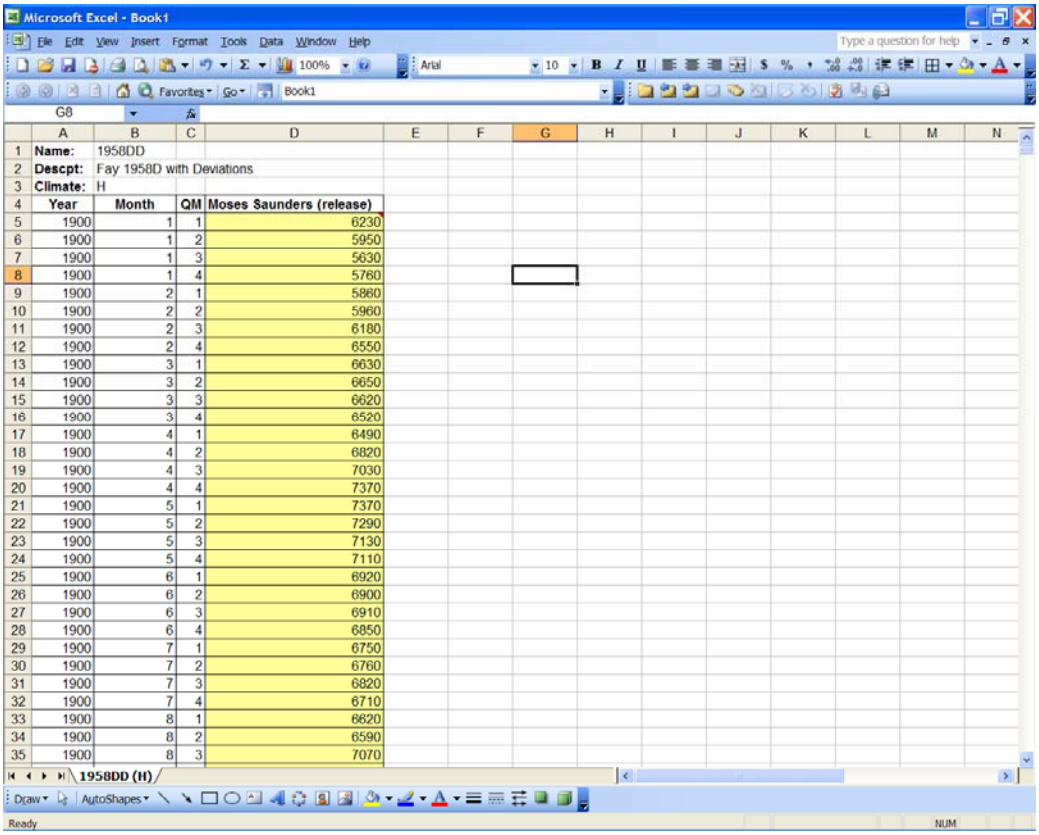


**Figure 2-2. Plan Release Import Workbook Template**

### 2.1.2 Importing Releases from Shared Vision Model

As an alternative to importing releases using the plan import utility, the IERM provides the user with the option of importing quarter-monthly release data directly from a SVM Post Processor workbook. The SVM import option is available as a "runtime" option on the "IERM Simulation Builder" form, which is discussed in detail in Section 2.2.

Once a SVM Post Processor workbook has been opened in Excel, the user should navigate to the "IERM Import" worksheet (Figure 2-3). The "pick list" near the top of the sheet should contain the names of all plans that have been run through the SVM framework and exported to the SVM Post Processor. When the plan of interest is selected, the release data (year, QM, and release rate) contained in the range "B9:D4856" will be updated based on the release data available in appropriate plan worksheet.

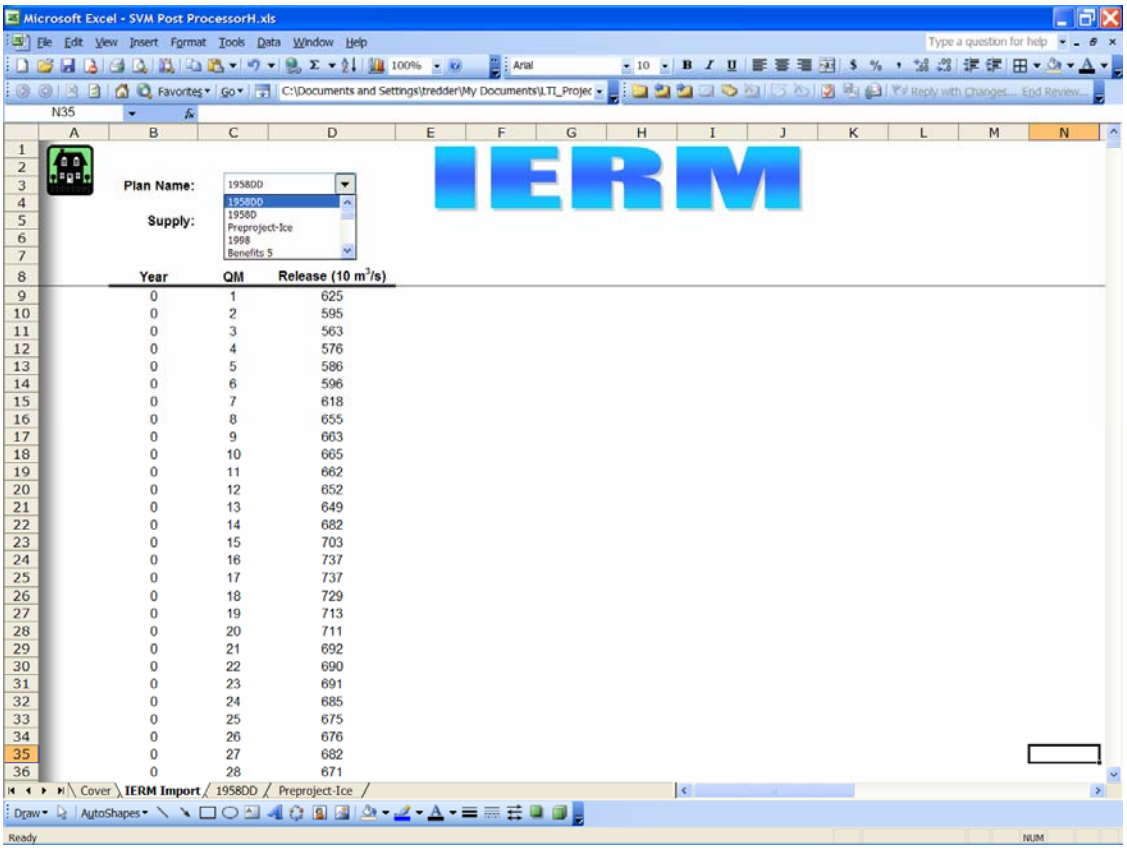


**Figure 2-3. "IERM Import" Worksheet in SVM Post Processor**

The name of the SVM Post Processor workbook should contain some combination of 1) "SVM", "Post", "Processor" or 2) "Board", "Room" so that the IERM can properly recognize the file during the import/export steps. These keywords are not case-sensitive, and they may occur anywhere within the filename. It should be noted that the plan selection procedure is identical regardless of the *supply scenario* that is being evaluated; however, it is important to remember that the appropriate scenario identifier ("H", "S*", or "C*") must be appended to the SVM Post Processor filename. The IERM will use the supply scenario identifier to determine which set of supplies and ice factors to apply to the selected plan. The supplies and ice factors for all 9 supply scenarios are maintained in the main IERM database, so it is not necessary to import this information when running IERM simulations. Only one SVM Post Processor file should be open when linking release data to the IERM to ensure that the correct set of releases is imported into the IERM.

## 2.2 RUNNING IERM SIMULATIONS

An IERM simulation, or a batch of simulations, can be launched from the "IERM Simulation Builder" form, which can be accessed by clicking the "Run IERM" button on the Main Menu (Figure 2-3). The IERM Simulation Builder provides two options for running a simulation. If the "Run Plan Stored in the IERM" option is checked, the user may select one or more plans to run simulations for. If multiple plans are

selected, the plans will be run in a batch sequence. Note that existing regulation plans may be permanently deleted from the main IERM database by selecting the plan(s) and clicking the "Delete Plans" button.

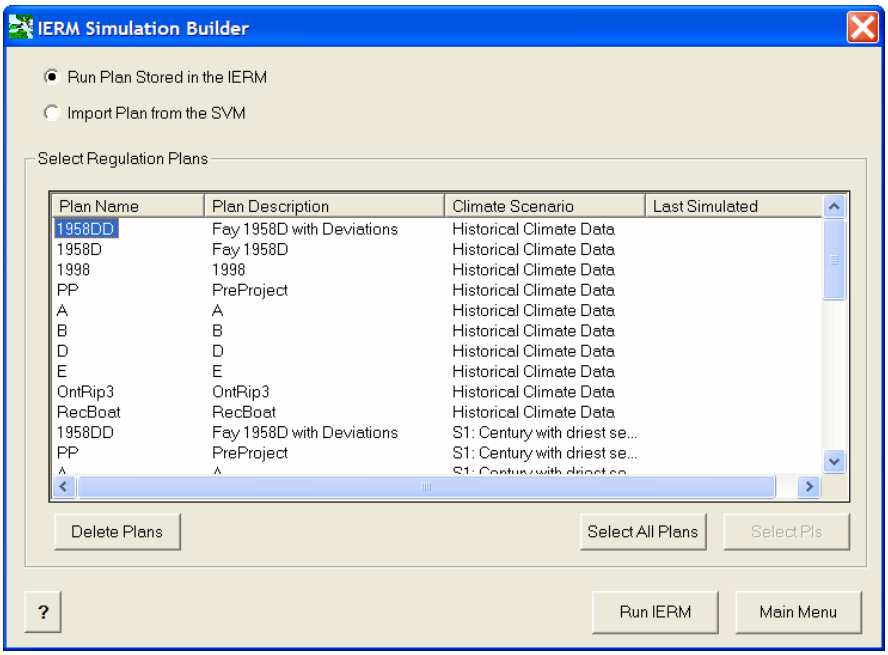


**Figure 2-4. IERM Simulation Builder**

Alternatively, the "Import Plan from the SVM" option allows the user to import releases and run a simulation for a new regulation plan from the SVM Post Processor. In order for the IERM to properly recognize the release series to be imported, the releases should be made available in the "IERM Import" worksheet in a single SVM Post Processor file. Specific requirements for this worksheet and the parent SVM Post Processor workbook are discussed in Section 2.1.2.

Regardless of whether the existing plan or SVM import option is selected on the "IERM Simulation Builder" form, the IERM simulation(s) can be launched by clicking the "Run IERM" and clicking "Yes" on the confirmation prompt. After the user confirms that the simulations should be launched, the IERM will import any necessary release data, launch a progress window, and initialize the simulation(s). The IERM progress form will provide updates for each sub-model and task as the simulation(s) progress. The total required simulation time for a regulation plan will be 1-2 hours depending on the specifications of the user's machine. After all simulations have been completed, a completion message will be displayed. Clicking "OK" will return the user to the IERM Main Menu.

A single IERM simulation generates a large quantity of output for the hydraulic, performance indicator, and criteria evaluations. During the course of an IERM sub-model simulation, these results are stored internally in arrayed variables. After a sub-model simulation has been completed, the simulation results are transferred to the appropriate tables in the main IERM database (IERM_v5.mdb), as illustrated in

Figure 1-1. Output datasets transferred from the simulation code to the main IERM database include:

- Hydraulics: Quarter-monthly water levels and/or flows for Lake Ontario, Thousand Islands area, Ogdensburg, Cardinal, Montreal Harbor, and Sorel are stored in the "Reg_Hydraulics" table.
- Performance Indicators: Annual scores for each performance indicator metric are stored in the "PI_Results" table.
- Hydrologic Criteria: Number of years each criterion is successfully met and total deviations for years where the criterion is not met are stored in the "Criteria_Results" table.

At the end of simulation, the IERM computes the aggregate scores for all performance indicators. These scores are later used to compute PI ratios for display in the PI visualization tools. It is important to note that plan "1958DD" must always be run and present in the IERM for a given supply scenario (historical, stochastic, climate change) prior to running any other plans for that particular supply scenario. This is important because a number of PIs are "scored" relative to the 101-year results for 1958DD.

## 2.3 EXPORTING RESULTS TO SHARED VISION MODEL

Running an IERM simulation generates a complete set of performance indicator and criteria results and stores those results in the IERM main database. In order to export the PI and criteria results to the SVM, the user must click the "SVM Export" button on the IERM Main Menu, which will display the "Export IERM Results to SVM" form (Figure 2-5). After selecting the supply scenario of interest, the user may select one or multiple sets of IERM plan results to export. Clicking the "Export Results" button will copy the key PI and criteria evaluation results to the appropriate plan worksheets in an open SVM Post Processor workbook.

It is important to note that the IERM will export results to the first SVM Post Processor (or "Board Room") workbook that meets the keyword criteria described in Section 2.1.2. If the user has multiple post-processing files open, the results may be exported to any one of the qualifying workbooks without the user knowing which file was used. Therefore, it is important that the user only have one SVM Post Processor (or "Board Room" workbook open when exporting IERM results to the SVM.

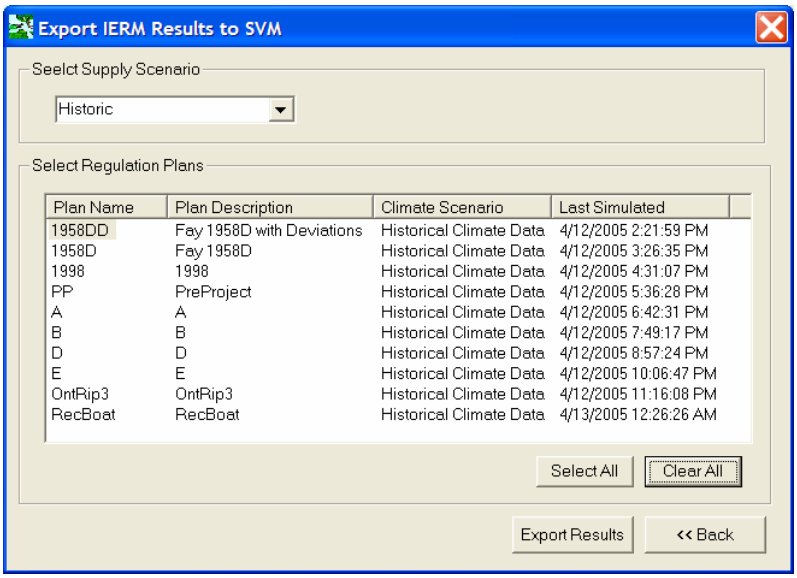


**Figure 2-5. IERM Export to SVM**

# 3. IERM VISUALIZATION TOOLS

The IERM visualization component contains all code relevant to graphical user interface (GUI) displays of the hydraulic, performance indicator, and criteria output generated by the simulation component. The IERM interface was designed using VB6 forms and controls and Giagsoft's ProEssentials v5 graphics library. The IERM visualization component was designed to provide the user with a variety of tools for reviewing the simulation results. These visualization tools can be accessed by clicking on the appropriate "Visualize…" buttons on the IERM Main Menu (Figure 1-2). The following sections provide an overview of the IERM visualization capabilities for hydraulic, performance indicator, and criteria evaluation results.

## 3.1 VISUALIZING HYDRAULIC RESULTS

The hydraulic time series visualization (Figure 3-1) can be accessed by clicking the "Visualize Hydraulics" button on the IERM Main Menu or the "Plot Hydraulics" button on the PI Target diagram. This visualization tool allows the user to view quarter-monthly water levels and/or flow for key locations in the LOSL region, including Lake Ontario, Thousand Islands area, Ogdensburg, Cardinal, Moses Saunders Dam (i.e., releases), Montreal Harbor, and Sorel. The baseline and alternative regulation plan selections can be modified using the "pick lists" in the upper left-hand corner. The user may zoom in and out of the plot by using the controls in the upper right hand corner of the window or by left clicking and dragging the mouse to create a window. After zooming in, the scrollbars may be used to scroll the plot vertically or horizontally. Quarter-monthly hydraulic data can be exported to Microsoft Excel spreadsheet format by clicking the "Export Data" button.

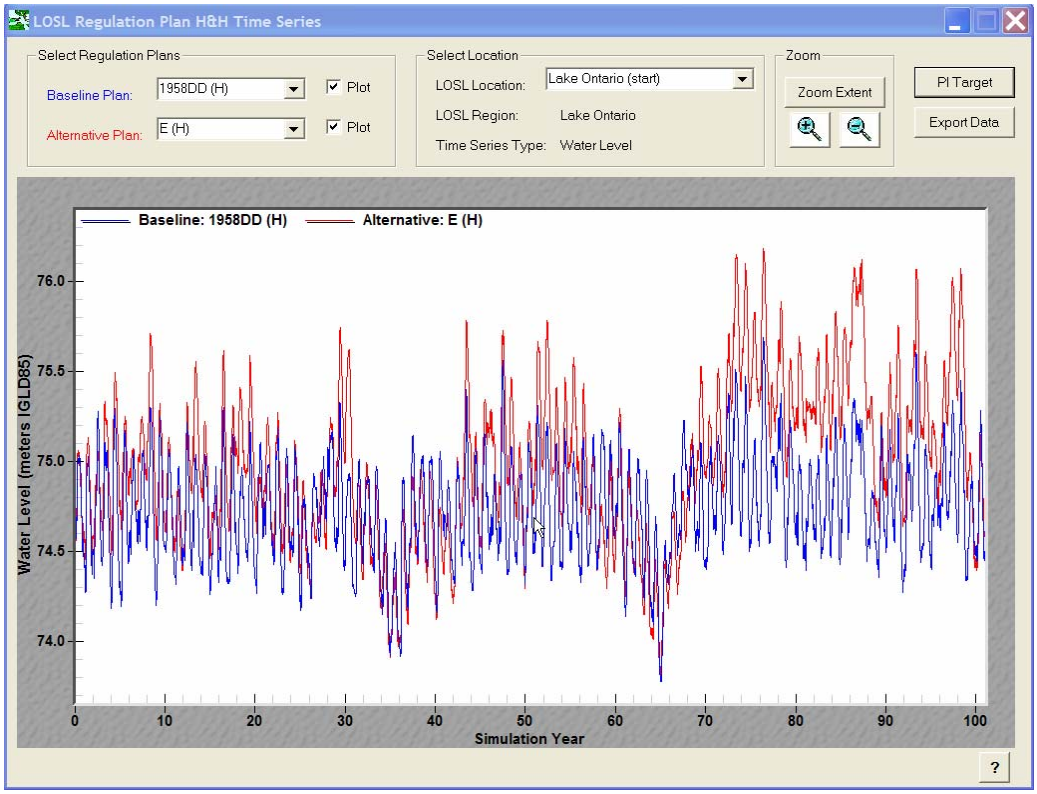


**Figure 3-1. IERM Hydraulic Time Series Visualization**

## 3.2 VISUALIZING PERFORMANCE INDICATOR RESULTS

The IERM provides a series of linked tools for visualizing performance indicator (PI) results. These tools provide a means for comparing the performance indicator responses to (user-defined) baseline and alternative plans at several levels of detail. At the top level, the PI target diagram provides an overview of the responses for all (or selected) PIs. The user may click on the individual PI points displayed on the target plot to "drill down" into more detail regarding the PI scores for the selected plans, including a plot of the annual PI scores. In addition, the IERM allows the user to plot PI results on a base map of the LOSL system, directly compare the response of a given PI for all regulation plans, and visualize weighted average ratios for the 3 PI regions and 6 PI groups. A schematic illustrating the various levels of PI evaluation and visualization is shown in Figure 3-1.

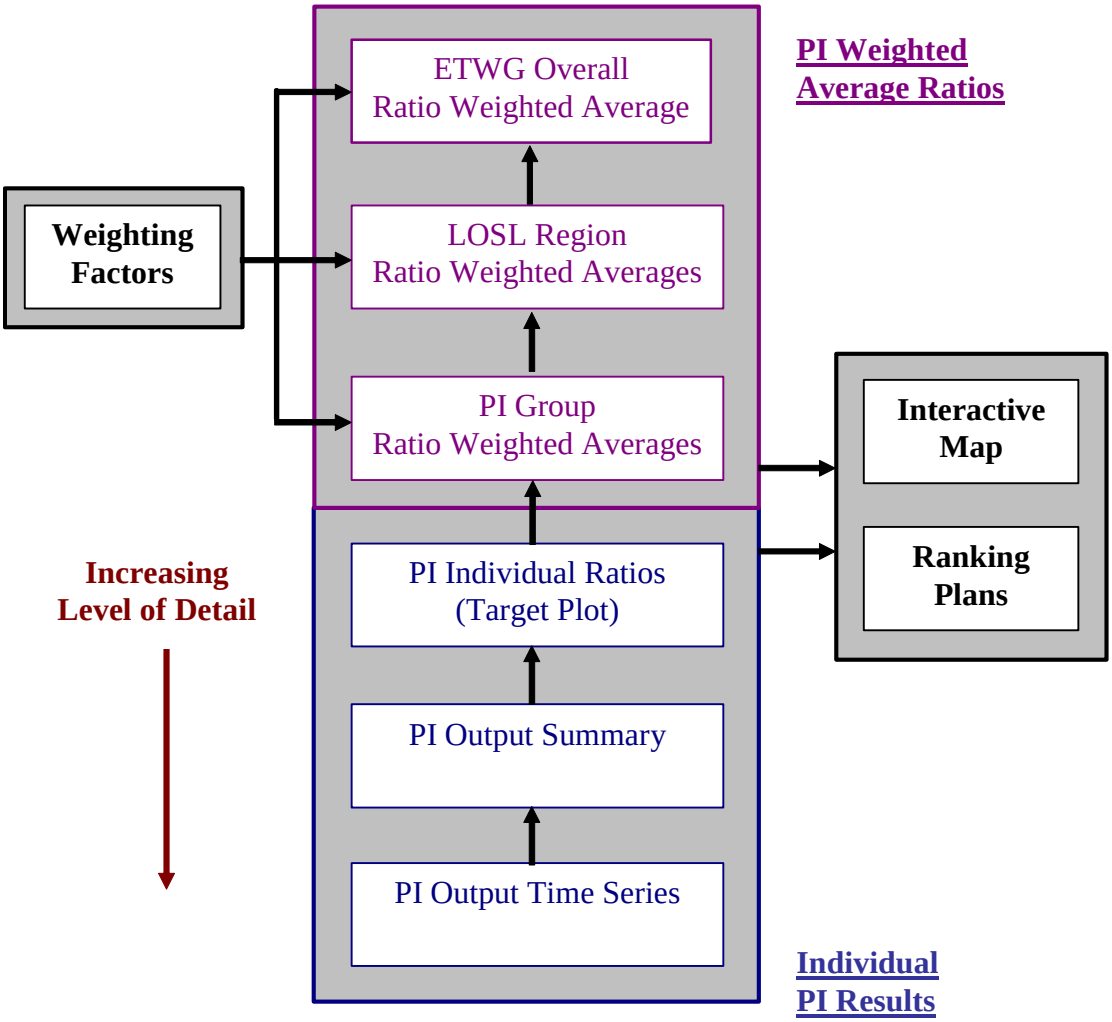


**Figure 3-2. IERM Performance Indicator Evaluation Schematic**

### 3.2.1 PI Target Diagram

The PI target diagram (Figure 3-3), which can be accessed by clicking the "Visualize PI Results" button on the Main Menu, provides the starting point for navigating to any of the PI visualization tools provided within the IERM.

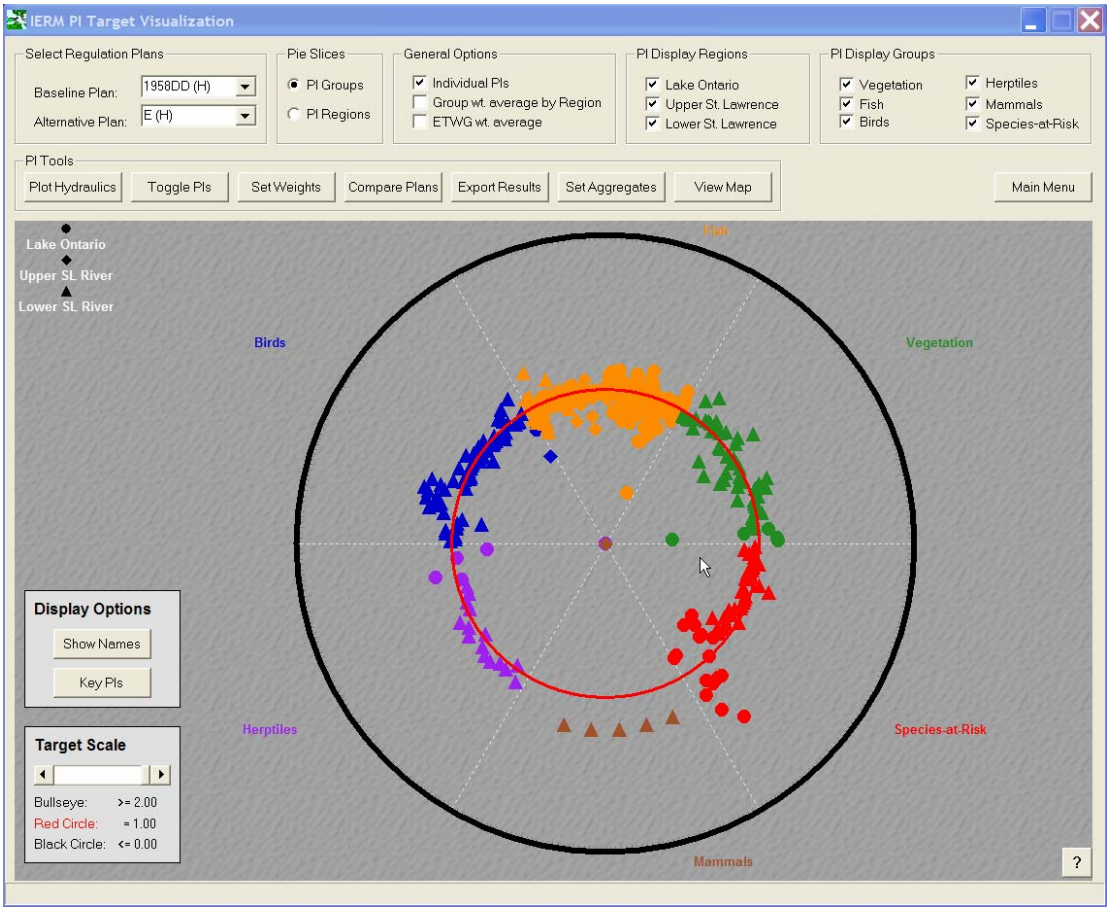


**Figure 3-3. PI Target Visualization**

The target diagram is designed to allow the user to rapidly assess the relative response of a large number of PIs for the selected baseline and alternative plans. The red circle is always associated with a ratio of unity (1.0), which is indicative of zero change for the alternative plan relative to the baseline plan. The outer black circle is associated with the minimum PI ratio score, while the "bullseye" is associated with the maximum PI ratio score. Therefore, ratio points that fall inside the red circle score better for the alternative plan relative to the baseline plan, while ratio points that fall outside the red circle (inside the outer black circle) score worse. By default, the ratio values associated with the black circle and the bullseye are 0.0 and 2.0, respectively; however, these values can be adjusted by adjusting the slider bar in the "Target Scale" frame. In some cases, one or more PI ratios may fall below/above the minimum/maximum ratio values specified in the "Target Scale" frame. In these cases, the ratio points are plotted on the outer black circle or the bullseye point.

The target diagram is organized into multiple "slices", which represent either the 3 LOSL regions or the 6 PI groups, depending on the option selected in the "Pie Slices" frame. The shape and color of a given PI ratio point indicates which LOSL region and PI group that particular PI belongs to. The 3 regions include Lake Ontario (circle), the upper St. Lawrence River (diamond), and the lower St. Lawrence River (triangle). The PI groups include vegetation (green), fish (orange), birds (blue),

herptiles (purple), mammals (brown), and species-at-risk (red). Slices and associated PIs can be added or removed from the diagram by toggling the checkboxes provided in the "PI Display Regions" and "Display PI Groups" frames. Finally, the target plot can be limited to displaying only "key" PI ratios ("Key PIs" button) and/or the short PI names can be displayed ("Show Names" button). When an individual PI ratio point is single-clicked, a short description of the PI will be displayed in the status bar. Double-clicking the PI allows the user to "drill down" into more detail regarding the PI results for the selected plans (see Section 3.2.2 for more details).

In addition to modifying the display options for the 3 LOSL regions and 6 PI groups, the IERM provides the option of toggling the display on/off for individual PIs. The PI toggle display (Figure 3-4) can be accessed by clicking the "Toggle PIs" button on the PI target diagram. The display status of individual PIs can be viewed by selecting the appropriate region and group at the top of the form. A checked box for a given PI indicates that the display is toggled "on" for that indicator. The user can save changes to the PI display selections and return to the PI target form by clicking the "Save Changes" button. Alternatively, the user can discard any display changes and return to the PI target diagram by clicking the "Cancel" button.

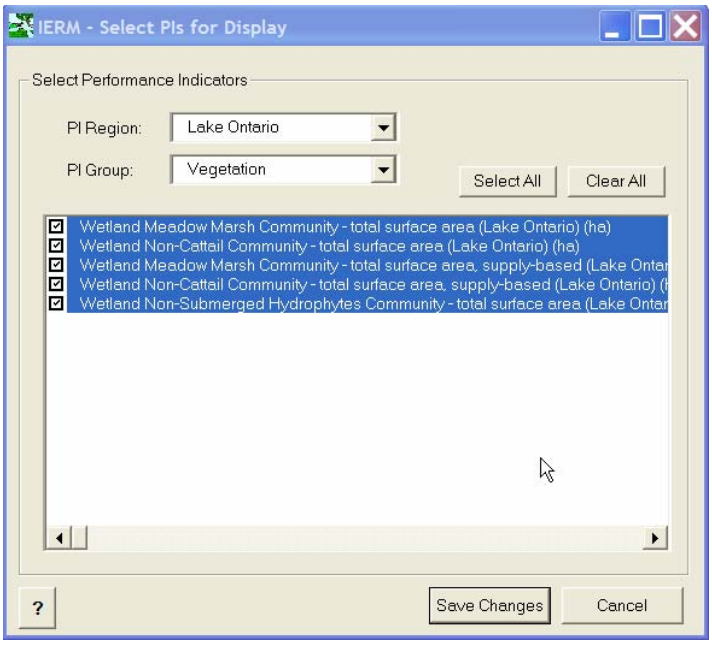


**Figure 3-4. PI Toggle Display**

### 3.2.2 PI Output Summary & Time Series

The "IERM PI Output Summary" (Figure 3-5) provides a more detailed view of the PI aggregate and ratio results for the selected baseline and alternative regulation plans. This display can be accessed by double-clicking on a PI ratio point in the PI

target display. The PI output summary provides general information on the selected PI, including a short description and the region/group that the PI belongs to. The PI's weight factor and weight percentage area also displayed; these values are associated with the weighting scheme described in Section 3.2.3. The "PI Aggregate Scores" frame provides the ratio score and the associated aggregate scores for the selected baseline and alternative regulation plans. In addition, this frame provides a description of the aggregation method that was applied to obtain the aggregate scores. (It should be noted that the aggregate scores are not actually used to compute the ratio when the aggregation method used for a given PI is the "average of annual ratios." This only applies to fish habitat supply and population PIs for Lake Ontario and the upper St. Lawrence River.)

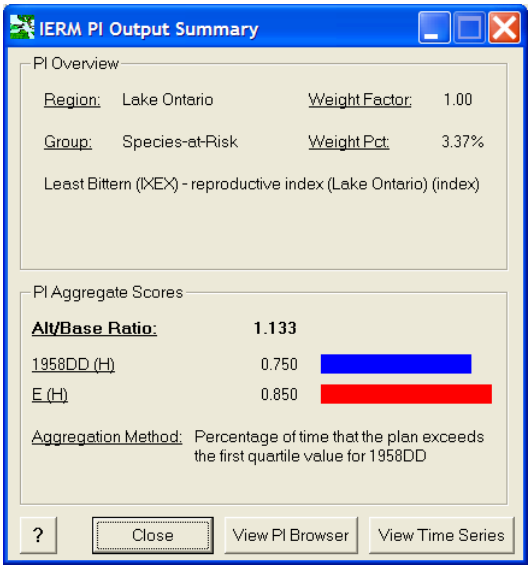


**Figure 3-5. PI Output Summary**

The complete PI time series output (Figure 3-6) can be accessed by clicking the "View Time Series" button on the PI output summary display. The PI time series visualization displays the selected regulation plans, a short description of the PI, and the ratio/aggregate scores at the top of the form. The time series graphic contains two separate plots. The upper plot displays the annual PI results for the selected baseline and alternative plans, while the lower plot displays the quarter-monthly hydraulic time series (water level or flow) that serves as the primary hydrologic/hydraulic forcing function for the PI. Similar to the hydraulic visualization, the tools available in the "Zoom" frame allow the user to zoom in/out of the two plots. Scrollbars can be used to navigate horizontally and vertically after zooming in on the plot(s). The "Export Results" button available in the "PI Tools" frame directs the user to the PI export interface, which is discussed in Section 3.2.6. The "PI Browser" button in this frame directs the user to the IERM PI Browser display, which is discussed in Section 4.

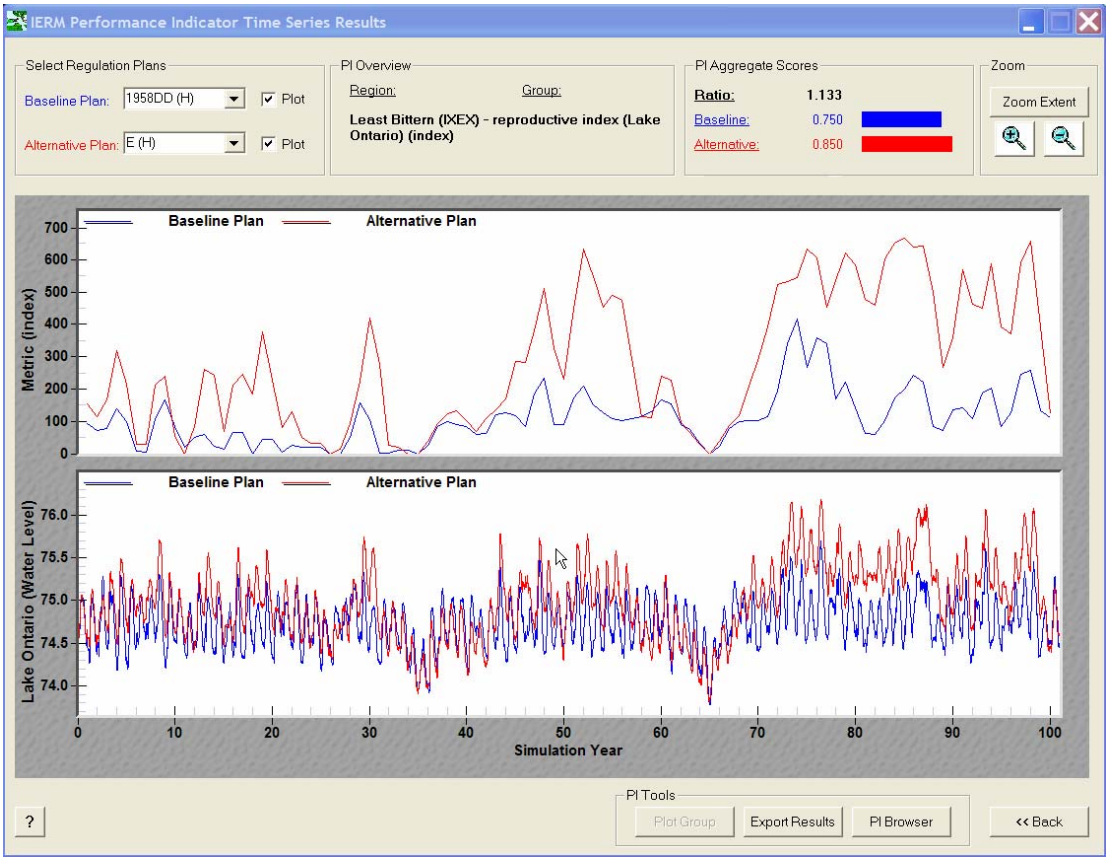


**Figure 3-6. PI Time Series Visualization**

### 3.2.3 PI Weighted Averages

The IERM includes a feature that allows the user to visualize weighted average PI ratios for individual PIs, PI groups, and LOSL regions based on a user-defined weighting scheme. The user can review and modify the weighting scheme on the "PI Weighting Factors" display (Figure 3-7), which can be accessed by clicking the "Set Weights" button on the PI target form. The controls at the top of this display can be used to display different PIs, PI groups, and regions. Weighting factors can be adjusted in 0.05 increments on a scale of 0.00-1.00 by selecting a single bar and by adjusting the scrollbar in the "Modify Selected Weight" frame, or by using the up/down keyboard arrows. Pie charts that provide summary distributions for the various weighting factor can be displayed by clicking on the "View Summary" button.

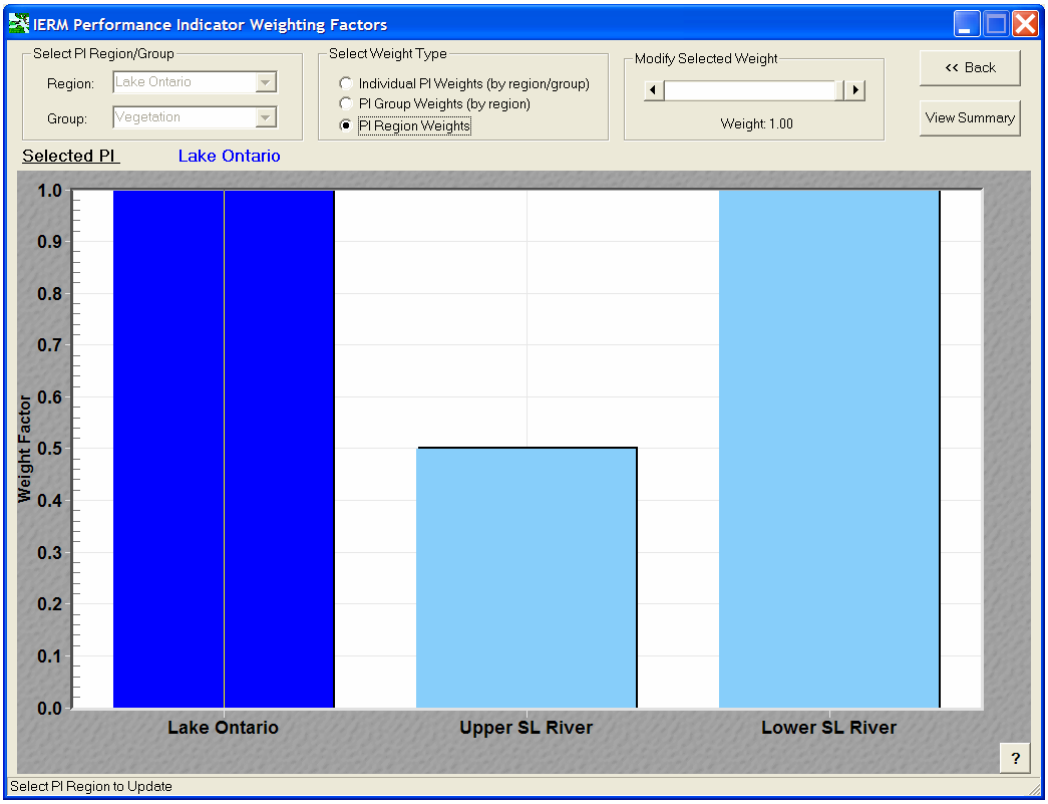


**Figure 3-7. IERM PI Weighting Factor Display**

Once the PI weighting scheme has been established, the user can view weighted average ratios by PI group (within the 3 LOSL regions), by LOSL region, or as an ETWG weighted average ratio. These various points can be displayed as white symbols on the PI target diagram (Figure 3-3) by selecting the 2nd and 3rd checkboxes found in the "General Options" frame. Similar to the individual PI ratios, these weighted ratio points can be single-clicked to obtain a brief description of the ratio, and double-clicked to view additional details regarding the ratio value. In the case of the weighted average ratios, double-clicking individual points displays the "EWTG Weighted Average Summary" (Figure 3-8) and highlights the ratio of interest. The weighted average summary provides an interactive "tree view", which allows the user to explore the ratios and weighting factors that were used to calculate the weighted average ratios at the 3 levels: PI group averages, LOSL region averages, and the overall ETWG average.

The PI weighting scheme provided in the IERM (version 4) mirrors the weighting scheme used in the March/April 2005 version of the SVM Board Room to compute an overall index of ecological integrity for each plan.

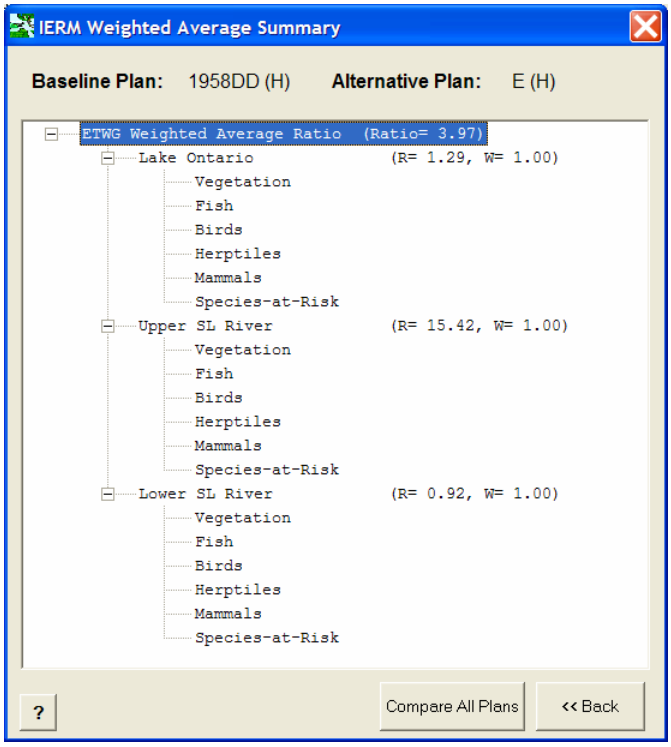


**Figure 3-8. IERM Weighted Average Summary**

### 3.2.4 PI Map-Based Display

A geographic display of the PI results can be accessed by clicking the "View Map" button on the PI target diagram. This display allows the user to overlay individual PI ratio or group/region weighted average ratios on a base map of the LOSL system for the selected baseline and alternative plans (Figure 3-9). Individual PI results may be viewed by first selecting the associated LOSL region and PI group in the "Select Result" frame, and then selecting the PI of interest. Regardless of whether the PI or weighted average option is selected, the IERM will display two bars representing the ratios calculated for the baseline and alternative plans. The relative height of these bars will be proportional to the ratio values. When a bar is clicked, the actual ratio values will be displayed in the status bar at the bottom of the form. Text annotations shown on the map display (e.g., "Ottawa River") can be toggled on or off using the check box in the lower left hand corner of the form.

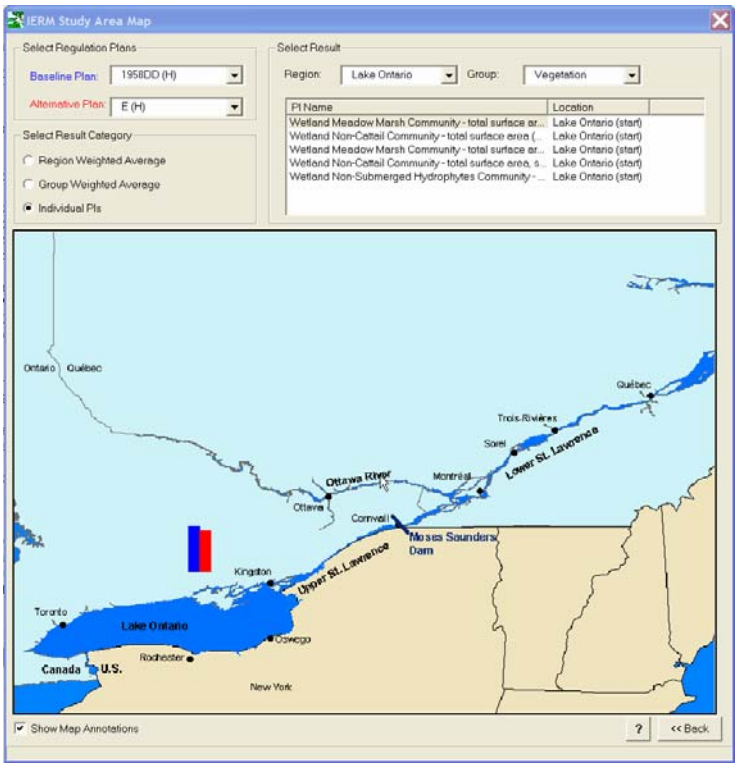


**Figure 3-9. PI Map-Based Visualization**

### 3.2.5 Plan Ranking

A majority of the visualization tools provided in the IERM are designed to compare just two plans (baseline and alterative) at a time. However, the "Compare Plans" button provided on the PI target diagram generates a bar chart (Figure 3-10) that compares the response of the selected performance indicator (PI) or region/group weighted average to all regulation plans that have been evaluated within the IERM framework. The Y-axis shows either the PI aggregate score or the ratio relative to the baseline plan (as specified on the target plot) depending on the radio button settings in the upper right-hand corner of the interface. The plans can be "ranked" from highest ratio (at the left side) to lowest ratio (at the right side) by selecting the "" option at the bottom of the form.

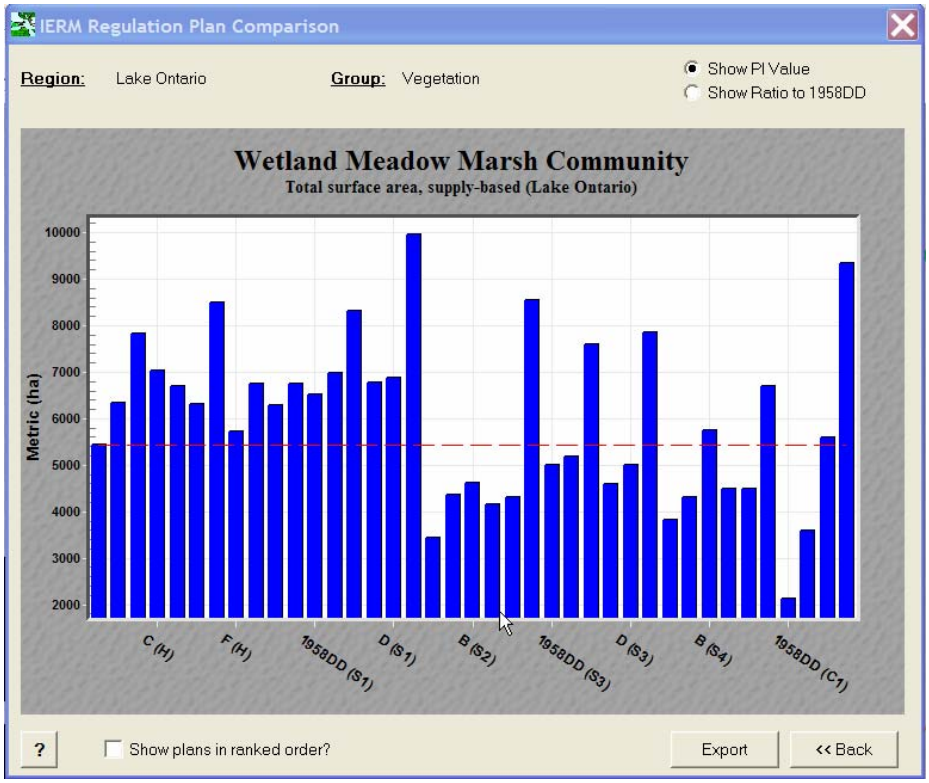


**Figure 3-10. Plan Comparison Visualization**

### 3.2.6 Exporting PI Results

The IERM provides options to export the annual, aggregate, and ratio results one or more PIs. The "IERM PI Result Export" (Figure 3-11) can be accessed by clicking the "Export Results" button, which is available on the PI target diagram and the PI time series visualization. The user has the option of exporting IERM results to a Microsoft Excel spreadsheet for any combination of regulation plans and PIs. The "Organize worksheets…" checkboxes can be used to define the format of the export workbook. The "organize by plan" option will produce a workbook with a worksheet for each selected regulation plan, while the "organize by PIs" option will produce a workbook with one worksheet per PI. The results for the selected plan(s) and PI(s) can be exported as raw annual scores ("Export Scores" button) or PI ratios ("Export Ratios" button).

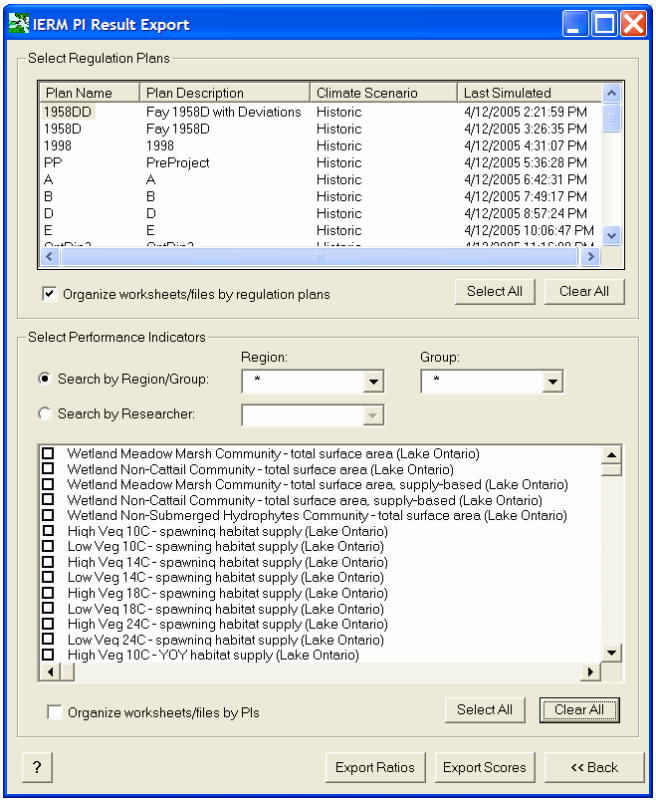


**Figure 3-11. IERM PI Result Export**

## 3.3 VISUALIZING CRITERIA RESULTS

The IERM criteria visualization (Figure 3-12) can be accessed by clicking the "Visualize Criteria" button on the IERM Main Menu. Similar to the PI visualizations, this display allows the user to visualize the criteria evaluation results for selected baseline and alternative regulation plans. Three different graphics can be generated by modifying the selection in the "General Options" frame:

- Number of Violations – a bar chart displaying the number of years that each criterion was successfully met;
- Deviation from Criteria – a bar chart displaying the total deviation (i.e., sum of absolute deviations from target water level for 101-year simulation) for each criterion; and
- Quadrant Comparison – a two-dimensional plot combining the results displayed in the "violations" and "deviations" bar charts.

The quadrant comparison displays the criteria evaluation results using a "normalized ratio" approach. A normalized ratio is defined as the ratio of the alternative score to the baseline score minus a value of one. A normalized ratio of zero indicates that the scores for the two plans are identical, while a positive normalized ratio indicates that the alternative plan scores better than the baseline plan. In Figure 3-12, the X-axis is

associated with the number of times a criterion was successfully met, while the Y-axis is associated with the inverse of the total deviations calculated for the criterion. Therefore, each quadrant in the plot represents a specific condition, with the first quadrant representing the optimal condition:

- Quadrant #1 – criteria are met more often, failures (i.e., deviations) are less severe;
- Quadrant #2 – criteria are met less often, failures are less severe;
- Quadrant #3 – criteria are met less often, failures are more severe; and
- Quadrant #4 – criteria are met more often, failures are less severe.

It should be noted that total deviations/failures are not calculated for several criteria for which success/failure in meeting a water level condition is evaluated over a multi-year period.

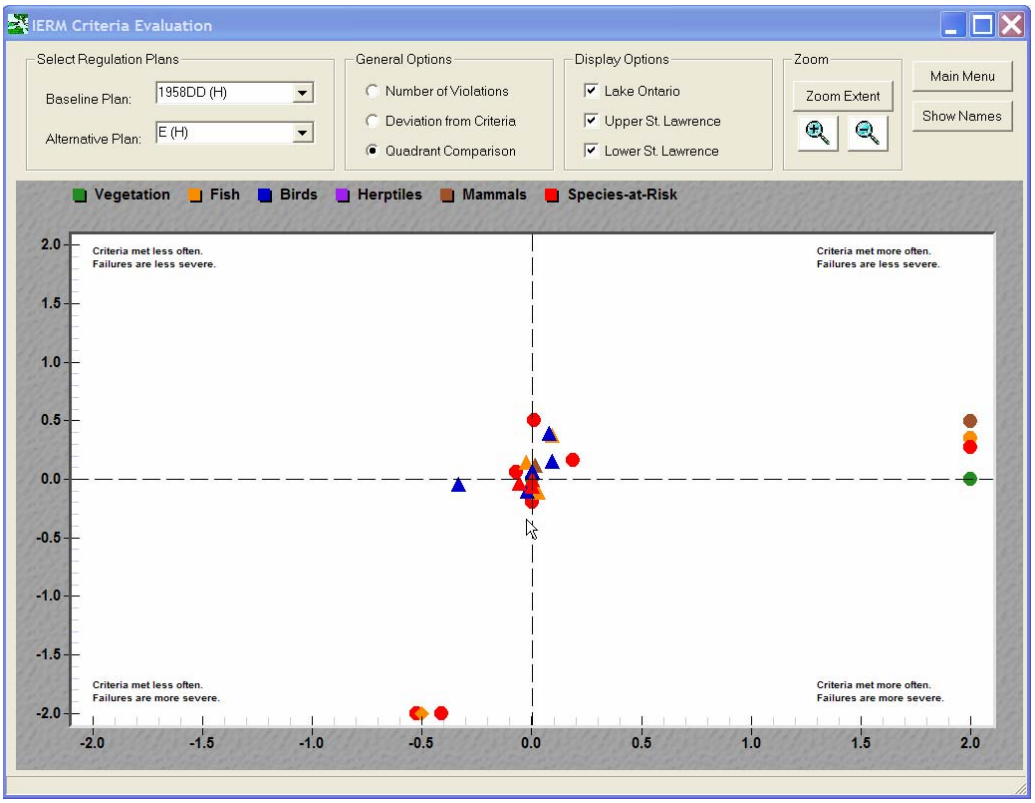


**Figure 3-12. IERM Visualization for Hydrologic Criteria**

# 4. IERM DOCUMENTATION

The IERM provides an abbreviated online HTML-based user's manual to compliment this comprehensive user's manual. The online IERM help can be accessed by clicking the "IERM Help" button on the Main Menu, or by clicking the "?" buttons provided on a majority of the IERM form displays. In addition, the IERM provides limited built-in documentation for performance indicators (and associated ecological sub-models) and hydrologic criteria. The following sections describe how to browse this built-in documentation.

## 4.1 PI DOCUMENTATION

The IERM includes a "PI Browser" display, which allows the user to view a full description for each PI (Figure 4-1). This display can be accessed by clicking the "View PI Information" button on the IERM Main Menu. In addition to these descriptions, the PI browser display provides links to external files that provide documentation for the key ecological PIs included in the final SVM analysis. The key PI documents are available in either Microsoft Word or Adobe PDF format, and can be accessed by selecting the key PI of interest and clicking the "View Docs" button located near the bottom of the display.

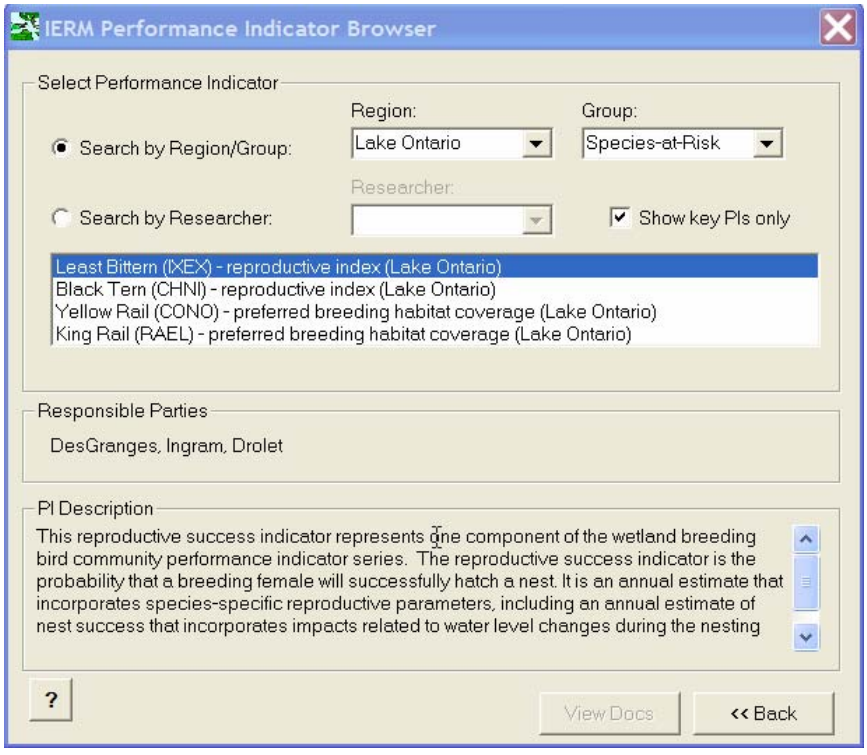


**Figure 4-1. IERM Performance Indicator Browser**

## 4.2 CRITERIA DOCUMENTATION

The IERM includes a "Criteria Browser" display (Figure 4-2), which allows the user to view a full description for each hydrologic criterion. This display can be accessed by clicking the "View Criteria Information" button on the IERM Main Menu.

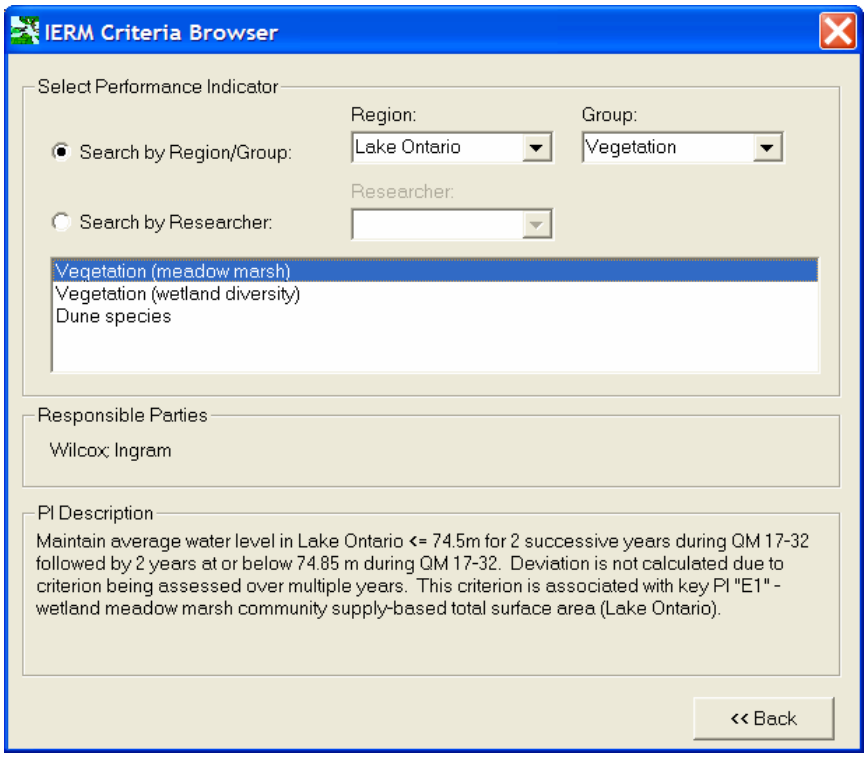


**Figure 4-2. IERM Criteria Browser**