

Reviewing the Rule Curves: Study Board Methods and Tools



Overview

Since 1949 Canada and the United States, through the International Joint Commission (IJC), have established formal rules for regulating water levels and flows for the Namakan and Rainy lakes. These “rule curves” (RCs) guide decisions and are intended to benefit and protect interests in both lakes and the Rainy River Basin as a whole. Benefits and protections include protecting shoreline properties, communities and archeological sites from flooding and erosion; protecting the natural environment of the basin and its water quality; maintaining seasonal water levels to allow for recreational and tourism uses and ensuring sufficient water levels for hydroelectricity generation while conforming to the requirements of the International Treaty.

To ensure that the RCs keep current with the most recent scientific information, the IJC reviews the rule curves every 15 years. The most recent comprehensive review was conducted between 2015 and 2017 and examined the socio-economic and ecological impacts of water levels management decisions. The 2017 Study Report resulted in the adoption of updated RCs in 2018. In addition, it was recommended that this work be overseen by a new Adaptive Management Committee (AMC) that would assist in identifying and responding to emerging climate change conditions. With the adoption of the updated RCs and establishment of the AMC in 2018, the stage has been set for the next study to commence in 2033.

2015-2017 Rule Curve Review

The 2015-2017 RC study sought to address concerns about flooding, particularly on Rainy Lake, and investigate whether there were options for improving ecological outcomes from previous studies. The study was led by the RC Study Board which included a 32-member RC Public Advisory Group representing a range of perspectives in the basin. These included: lake/property owners' associations; navigation interests; environmental organizations; First Nations and Tribes; tourism and recreation interests; and hydroelectric companies. The Study Board also established a separate advisory group, the Resources Advisory Group (RAG), for federal, state and provincial agencies in the watershed that are responsible for natural resource management or environmental protection.



The Board reviewed the study findings and concluded that the existing RCs, provided the intended ecological benefits and recommended minimal changes. Accordingly, the 2018 RCs were designed to maintain previous objectives while adding new benefits based on study findings and input from stakeholders. Some of the new benefits in the recommended Operational Guidelines for the 2018 RCs included efforts to optimize benefits to high value resources such as wild rice and lake sturgeon by making small adjustments to water level management at critical times. Following the completion of the 2018 study, and the establishment of the AMC, the focus of RC work is to support continued improvement of lake level management and to adapt to changing conditions in the system.

Methods and Tools Used by the Study Board

Integrated Ecosystem Response Model (IERM)

Between 2015 and 2018, the IJC engaged Environment and Climate Change Canada (ECCC) to develop an Integrated Ecosystem Response Models (IERM) for the Namakan Rainy Lakes system and the Rainy River. These models incorporate information from a wide array of sources to assess impacts of using different rule curve scenarios to ecological outcomes on more than a dozen high priority performance indicators.

Performance Indicators of the IERM Rainy River		Rainy and Namakan Lakes	
<i>1-dimensional model</i>	<i>2-dimensional model</i>	<i>1-dimensional model</i>	<i>2-dimensional model</i>
Walleye egg survival probability	Suitable spawning and egg incubation habitat for walleye	Probability of wild rice survival	Submerged aquatic vegetation
Egg survival probability for lake sturgeon	Suitable spawning and egg incubation habitat for lake sturgeon	Water level suitability index for cattails	Wetland class distribution
		Winter lodge viability for muskrat	Suitable habitat for wild rice
		Probability of loon nest viability	Suitable habitat for cattails
		Walleye egg survival probability	Suitable spawning and egg incubation habitat for walleye
		Egg survival probability of lake whitefish	Suitable spawning and egg incubation habitat for lake whitefish
			Suitable habitat for the reproduction of northern pike

Note: the 1-dimensional model only takes into account water depth, whereas the 2-dimensional model considers both water depth and surface area.



Shared Vision Model

Next, the Shared Vision Model (SVM) that simulates water levels and flows interpreted results from the IERM, integrating these with results from other sources to develop evaluation metrics that were used to compare rule curve alternatives. Each individual SVM simulation generated level and flow information in mean quarter-monthly values for a specified number of years for a particular rule curve alternative and climate scenario. The SVM was used to evaluate the performance of existing and historical rule curves, as well as more than two dozen alternative scenarios, including state of nature.



Weight of Evidence Analysis

In an approach called a Weight of Evidence Analysis (WEA), the Study Board evaluated results of the IERM and SVM modelling studies as well as other studies to assess whether specific issues in the basin under consideration had improved, worsened or not been affected by the current RC. These results were brought together and analysed to assess the full range of effects of the RCs. Following the WEA analysis, the SVM process provided a framework for comprehensive evaluation of alternative scenarios, in which participants engaged in practice decision-making workshops, supported by computer modelling, to reach decisions on best management scenarios.

The evaluation process resulting from the SVM considered the existing RC model and four new RC potential alternatives. Based on a review of the different models the recommended approach focussed on retaining the benefits of the previous RCs, reducing the potential for flooding on Rainy Lake and enhancing ecological conditions for fish and mammals. This model also revised the RC targets in fall and winter to reduce winter drawdown and included a flood reduction option for Rainy Lake during high-risk flood conditions in spring. This recommended approach became the basis for the RCs adopted in 2018 and it continues to be in use.



Looking Forward to the 2033 Rule Curve Review

The modelling team at ECCC is working to transition the IERM model to a new Integrated Socio-Economic and Environmental model (ISEE) for the 2033 RC review. The ISEE model will combine the existing utilities of the IERM model for impacts to environmental indicators with additional modelling of the economic and social impact of flooding. At the mid-point of the review process, in 2025, the AMC will host a workshop to gather feedback on any additional performance indicators that should be modelled during the review process. A new study board will then be created in 2031 to start the RC review process.

For over 75 years the rule curves on the Namakan Rainy Lake system have provided broad ecological benefits to the lands and waters and many interests that enjoy the benefits offered within the system. These include ecological, economic and recreational benefits for residents and visitors who have come to depend on and enjoy all that the area has to offer.

It is recognized that the rule curves must continually be improved, and this includes advancing engagement processes with Indigenous people including First Nations, Tribes and Metis people who have stewarded these lands and waters for millennia. Through continuous improvement, use of adaptive management, regular studies and analysis the rule curves and shared information amongst partners will help to ensure that the boundary waters of the Rainy River basin are well managed for years to come.



For more information, please visit:

International Rainy and Namakan Lakes Rule Curve Study Board (June 2017).

Managing Water Levels and Flows in the Rainy River Basin.

https://www.ijc.org/sites/default/files/IRNLRCSB_Final_Report_2017I.pdf

