

MAGAGUADAVIC RIVER WATERSHED MANAGEMENT PLAN

Prepared by Eastern Charlotte Waterways Inc.





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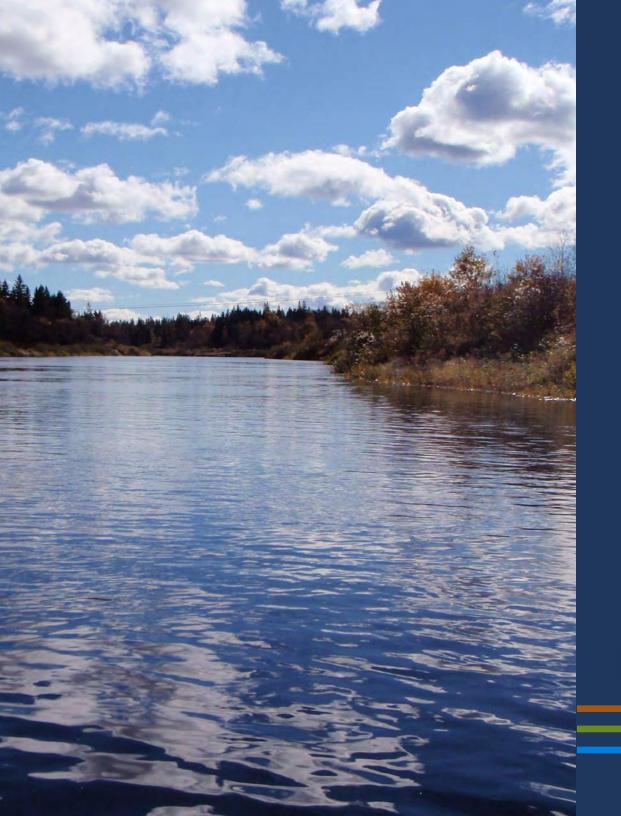
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- 1 Introduction
- 2 About the Author
- 3 The Watershed
- 4 History
- 5 Current Issues
- 6 Integrated Management
- 7 Participants
- 8 Issue #1: Storm Management
- 12 Issue #2: Fish Habitat
- 16 Issue #3: Fish Passage
- 19 Implementation



INTRODUCTION

About the Author



Since 1994, Eastern Charlotte Waterways (ECW) has provided environmental leadership in southwestern New Brunswick. The organization has collaborated with like-minded organizations to promote community well-being through sound environmental health. This has been accomplished by facilitating projects that integrate common social, economic, and environmental concerns. The organization has promoted the responsible stewardship of Eastern Charlotte County's natural resources, serving as an NGO partner in multi-disciplinary approaches towards the conservation of primary resources, ecosystems, and species of concern. This has included the creation of the Charlotte County Clam Harvesters Co-operative, the Chamcook Watershed Landowners' Association, the Lake Utopia Preservation Association, and the development of the New Brunswick Alliance of Lake Associations. Past stewardship efforts have also included ECW's efforts to develop best practice guidelines to maintain viable spawning habitats for the sympatric Rainbow Smelt of Lake Utopia.

Since its inception, the organization has worked closely with stakeholders in the Magaguadavic River Watershed to ensure a healthy habitat and high water quality. In 1997 the organization began working with the Department of Environment as part of the Outreach and Partnering Program. This program provided communities with the opportunity to contribute to the management of their own surface water resources. In 1999 Eastern Charlotte Waterways submitted its Water Classification report to the Department of Environment, which was used to create the Water Quality Index score for the watershed. Most recently, in 2010 the organization conducted a comprehensive assessment of the Magaguadavic River Watershed which included resident consultation and habitat assessments. In 2012 the organization completed its first integrated watershed management plan for the Chamcook Watershed and in 2013-2014, it undertook a similar planning initiative in the Magaguadavic River Watershed.



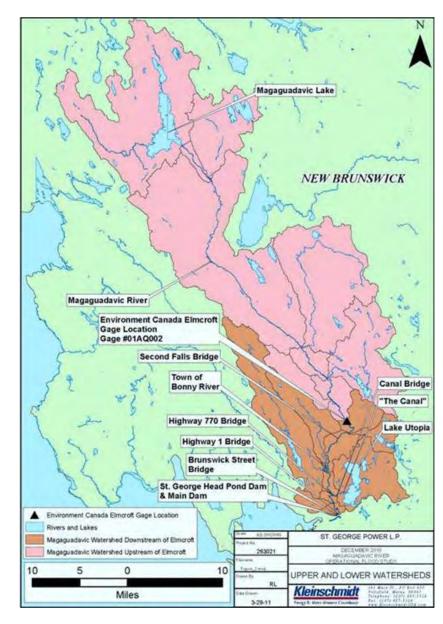






The The Magaguadavic River Watershed is located in the central southwest drainage area of New Brunswick, draining 1,812 square kilometers. With 103 named tributaries and 55 lakes, the Magaguadavic stretches across York and Charlotte counties. The Magaguadavic River has a meander length of 129 km, the sixth largest river in New Brunswick. Rising out of Magaguadavic Lake, the river passes through the St. Croix Highlands and into the Town of St. George where it plunges into a basin at the head of the tide through a narrow gorge, flowing another 8.4 kilometers before emptying into the Passamaquoddy Bay, a sub-basin of the Bay of Fundy.

The average summer temperatures in the watershed range from 13 to 16°C, while average winter temperatures range from -4 to -7°C. The Magaguadavic watershed receives about 1400 mm of precipitation annually. The watershed is made up of igneous and sedimentary rock, with 83.7% of the land forested, 8.8% wetlands, and 4.7% water. Sixteen fish species are found within the Magaguadavic. These include the Atlantic salmon, brook trout, smallmouth bass, American eel, burbot, sculpin, smelt, spiny stickleback, dace, creek chub, common shiner, sunfish, yellow perch, fallfish & white sucker. It is a very popular area for outdoor recreation, hunting, and fishing.



History



First Nations people were the first documented residents of the watershed area. A division of the Maliseets, called the Passamaquoddys, occupied the area between the Passamaquoddy Bay and Point Lepreau. Magaguadavic is a Passamaquoddy term that means "River of Eels". The first non-native settlers in the area were the French of the Saint Croix Seigniory. In 1691, the French government granted Jean Meusniev land in the lower Magaguadavic. The English arrived in the mid-1760's, and, following the end of the American Revolution, the American and British governments surveyed the land to establish the international boundary. The Town of St. George was laid out on Frye Island in 1786, and in 1790 after a fire destroyed that town, the settlers moved to the present day location of St. George.

The first saw mill was built at this time, and by 1833 there were 10 sawmills in the gully of the St. George Falls. Sawmills were also established up river at Second Falls and in Linton Stream, as well as on Lake Utopia. It was the lumber industry that brought settlements to these areas. In 1872 the granite industry was born with "The Bay of Fundy Red Granite Company", and by 1912 there were six firms quarrying "St. George Red" and "Black Granite". The granite industry persisted until the 1930s. At the turn of the 19th century a pulp mill was built below St. George Falls by The New York World Company. They were the first to construct a hydroelectric dam at the mouth of the river, agreeing to supply power to the granite shacks for 99 years. The company passed through different ownerships until it was purchased by J.D. Irving Ltd. in 1967. The dam has been upgraded through the years, with the most recent renovation taking place in 2002, when 2 new turbines were installed. The pulp and paper industry remains a strong part of the Magaguadavic economy and was joined by salmon aquaculture in the 1970s. Today Cooke Aquaculture operates salmon hatcheries on Linton Stream, at Thompson Corner, and until recently, on Lake Utopia. Much of the company's operation and the secondary industries that support it are located in and around St. George, serving as the area's main economic force.







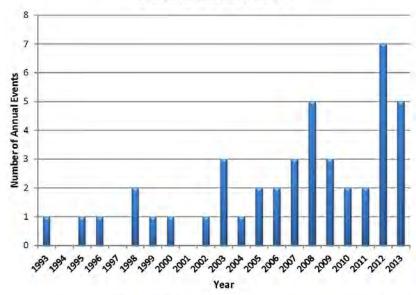
Current Issues

The watershed has two issues that have moved to the forefront in recent time. The first is storm management. Precipitation data for Charlotte County indicates an increase in deluge rain events. While total precipitation has not increased, warmer air, holding more moisture, has resulted in an increase in precipitation events greater than 50mm. In December of 2010, one such event, totalling as much as 185 mm in some areas, caused severe flooding throughout the lower Magaguadavic. The storm washed out as many as 100 roads, and dozens of people had to be rescued from their homes. In the aftermath of the flood the community raised questions that persist to this day, including how the storm was prepared for and how the disaster response was organized. In July of 2013 another serious rain event totalling as much as 155mm once again flooded the homes of Magaguadavic residents. Managing preparation and adaptation to these extreme weather events is a primary concern of watershed stakeholders.

The second is the Magaguadavic's fish population. Species at risk in the river include Outer Bay of Fundy Atlantic salmon (Salmo salar), Lake Utopia Rainbow Smelt (Osmerus sp.), and the American eel (Anguilla rostrata). The salmon and eel are diadromous fish, who must contend with the hydroelectric dam at the mouth of the river, while the smelt are a sympatric pair of species in distinct body forms, the dwarf and long-bodied, which breed in the ephemeral tributaries of Lake Utopia. The Atlantic salmon are of particular concern to stakeholders, as they have been a part of the Magaguadavic lifestyle in the final half of the 20th century. In the last fifteen years the species has declined 80-92% depending on the statistical model used. This is the most severe decline of adult salmon abundance in any of the Outer Bay of Fundy complex of rivers. The Atlantic Salmon Federation headquarters is in nearby Chamcook, and one of the world's largest salmon aquaculture companies is located in the area. These two stakeholders continue to work together to try and bring salmon back to the river.

Annual Number 1-Day 50+ Events - St Stephen

■ Annual Number 1-Day 50+ Events





Prepared by R.J. Daigle Enviro using Leading Edge Geomatics LiDAR (Dec 2011) and NB Orthophoto (1996). LiDAR Vertical Accuracy tested at 11cm

Integrated Management



Integrated Watershed Management (IWM) is a multidisciplinary process that seeks to optimize the contribution of aquatic resources to the social, environmental, and economic welfare of humans while maintaining the integrity of aquatic ecosystems, both now and in the future. Traditionally, water management has been based on water allocation issues, but this did not account for the other values associated with water systems, or the biological integrity of the systems themselves. Watershed management can ensure the comprehensive protection of water supplies through the integration of land conservation principles, across various sectors. The goal of IWM is to bring together the work of federal and provincial government, Aboriginal peoples, municipalities, industry, agriculture, non-governmental organizations, community groups, and research teams into full partnership in the process of planning, decision-making, management, and implementation of watershed based management plans.

This Integrated Watershed Management Plan (IWMP) lays out actions to be undertaken in the Magaguadavic River Watershed to address the major issues in the watershed. The plan primarily serves as a communication tool for all watershed stakeholders to ensure each is aware of the actions taking place in the watershed, which can inform future decision making in their respective areas of responsibility and interest. It identifies specific actions that will be implemented, describes the reasoning for doing so, and presents a timeline based on realistic estimates from the proponent. The recommendations address issues identified by stakeholders and the public through the extensive engagement and discussion processes that Eastern Charlotte Waterways has conducted throughout the process. To the extent possible, the recommendations in this plan are an accurate representation of the input received from stakeholders and their shared interests concerning the future management of the Magaguadavic River Watershed.





Participants



This project has been developed in concert with the Magaguadavic River Salmon Recover Group. This multi-stakeholder committee features representatives from the Department of Fisheries and Oceans, the provincial Department of Agriculture, Aquaculture, and Fisheries, J.D. Irving, Cooke Aquaculture, the Atlantic Salmon Federation, and concerned residents. ECW has developed this watershed plan in full consultation with the members of this group. Their input, along with Environment Canada, the Town of St. George, the New Brunswick Department of Environment and Local Government, and the Lake Utopia Preservation Association, makes up the bulk of the actions held within.

Full list of participants

- Department of Fisheries and Oceans (DFO)
- Environment Canada (EC)
- New Brunswick Department of Environment and Local Government (NBDFLG)
- New Brunswick Department of Natural Resources (NBDNR)
- Town of St. George
- J.D. Irving Ltd. (JDI)
- · Cooke Aquaculture Ltd.
- Atlantic Salmon Federation (ASF)
- Magaguadavic Salmon Recovery Group (MSRG)
- Dr. Brian Glebe







ISSUE #1: STORM MANAGEMENT



Action 1.1 Action 1.2 Action 1.3

Annual review of the St. George Power storm management plan

The operation of the St. George Power hydroelectric dam in response to forecasted storm events has remained under intense scrutiny since the flooding of December 2010. In response, its role in storm management on the Magaguadavic system has become increasingly well understood. A comprehensive hydrological study was completed in 2011 by a third party engineering firm. The hydrological models created by that study have been utilized to increase the effectiveness of the dam operation in response to heavy precipitation. The models benefit from the collection and incorporation of additional data, ensuring they are properly tuned to the hydrological realities of the Magaguadavic. By continuing to review storm management on an annual basis, the data gained during each rainfall event can be incorporated ensuring the most responsive and effective management of the dam possible.

Proponent: J.D. Irving

Timeline: Annual

Develop a virtual tool to demonstrate Magaguadavic hydrology

There remains tension amonast stakeholders in the Magaguadavic River Watershed when considering the role of the St. George Power hydroelectric dam. The dam owners. J.D. Irvina Ltd. continue to work towards communicating the hydrology of the watershed, and the dam's role within it. The company will partner with the Natural Resource Council of Canada to create an online modelling tool that allows users to observe the hydrology in any chosen scenario. This is similar to a project completed by the NRCC for the Rainy River Watershed, which can be found here: http://www.lwcb.ca/rlwwb-temp/gateanim/ index.php

Proponent: J.D. Irving
Timeline: Summer 2016

Develop physical model to demonstrated Magaguadavic hydrology

There remains tension amonast stakeholders in the Magaguadavic River Watershed when considering the role of the St. George Power hydroelectric dam. The dam owners. J.D. Irvina Ltd. continue to work towards communicating the hydrology of the watershed, and the dam's role within it. The company will partner with the University of New Brunswick to create a scaled physical model of the Magaguadavic River Watershed. This tool will allow users to visualize the hydrology of the area in a chosen scenario. The physical model will be used to assist stakeholders with understanding the hydrology of the Maaaauadavic.

Proponent: J.D. Irving
Timeline: Summer 2016





Action 1.4 Action 1.5 Action 1.6

Share third party reviews of Magaguadavic River Watershed hydrology study

After the devastating floods that took place on the Magaguadavic in December 2010. the owners of the St. George Power hydroelectric dam, J.D. Irving, commissioned a hydrological study of the watershed. Upon the completion of that study, a number of third parties were asked to verify the process and conclusions of the study. Currently, the residents of the watershed remain hesitant to accept the conclusions of the commissioned study. In an effort to increase confidence in the hydrological models, J.D. Irving will share the third party verifications with the concerned residents. While there is no avarantee that other stakeholders will accept the conclusions of the commissioned report, every effort should be made.

Proponent: J.D. Irving
Timeline: Summer 2014

Provide real-time flow data from the Elmcroft monitoring station

Environment Canada maintains a monitorina station at Elmcroft in the Magaguadavic River Watershed (Station 01A0002). The equipment is capable of providing data in real-time on the water flow and depth of the river. This station provides the primary data used by lower Magaguadavic stakeholders to prepare for the management of storm water. This includes the operation of the St. George Power hydroelectric dam, and flood predictions on Lake Utopia. Currently, the water flow, which can be used to predict water levels in the lower reaches of the river. is only available as archived data. The water level data can be converted to flow values, but that is an inexact conversion. and predictions would be more accurate if real-time flow data was available.

Proponent: Environment Canada

Timeline: Summer 2015

Increase storm management data collection

The effort to manage storm water is dependent on the accuracy of hydrology models, which in turn is dependent on the amount and quality of data inputted. Currently, one monitoring station, operated by Environment Canada, provides real time water depth data and archived flow data at Elmcroft on the Magaguadavic River. Eastern Charlotte Waterways has secured funding for an additional station to provide real time depth and flow data, as well as rainfall data, above Elmcroft at Thompson Corner. J.D. Irving is committed to installing an additional station at Canal, in the lower Magaguadavic. Linking these new stations to the Environment Canada system will be crucial in strenathenina mitigation and response to flood threats in the watershed. The New Brunswick Department of Environment and Local Government will liase between parties to ensure the monitoring of conditions on the Magaguadavic is effectively expanded.

Proponent: ECW, NBDELG, JDI, EC



Action 1.7

Action 1.8



Climate change adaptation

In 2013, Eastern Charlotte Waterways began the climate change adaptation process in the lower Magaguadavic. The area has felt severe effects of anthropogenic climate change, suffering from an increase in deluge rain events which has led to destructive flood events. A community vulnerability assessment was conducted with a volunteer working group from the community. The working group met five times to discuss the effects of climate change and the potential effects on the infrastructure, social and economic systems, and governance of the community. This vulnerability assessment will help inform an assessment of risk, completed in consultation with industry and government. Appropriate adaptive measures will be proposed to increase the resilience of the Magaguadavic communities to the effects of anthropogenic climate change.

Proponent: ECW
Timeline: Ongoing

Flood-proof vulnerable water wells

During the flooding event of December 2010, the Town of St. George came dangerously close to losing function in well fields #2 & #3. These two well fields provide over 70% of the town's potable water. Access to safe drinking water must be assured in future flooding events. These infrastructure needs should be considered dire. Addressing this issue will be a priority to ensure future flooding events do not lead to a disruption in access to fresh water for town residents.

Proponent: Town of St. George

Timeline: Winter 2015







ISSUE # 2: FISH HABITAT



Action 2.1 Action 2.2 Action 2.3

Monitor for Spruce budworm

A Spruce budworm outbreak is currently occurring in the province of Ouebec. Experts agree that an outbreak is imminent in New Brunswick. The Spruce budworm historically experiences a population explosion every 35 to 40 years, leading to widespread defoliation in evergreen forests. The eastern version of the Spruce budworm is Choristoneura fumiferana, which is one of the most destructive native insects in the northern spruce and fir forests of the Eastern United States and Canada. According to one common theory, popularized in the 1970s, periodic outbreaks of the spruce budworm are a part of the natural cycle of events associated with the maturing of balsam fir. The pest could have a profound effect on the forests of the Magaguadavic River Watershed and JDI will monitor the area for sians of outbreak.

Proponent: J.D. Irving
Timeline: Ongoing

Tree planting in riparian zone

In the summer of 2013, and again in 2014, Eastern Charlotte Waterways is planting native tree species in the riparian zone of the Magaguadavic River Watershed. Degraded riparian zones are found primarily in the lower reaches of the river. Working with landowners, the ECW team is planting over 6000 trees during the two summer seasons. These riparian zones are responsible for providing shade in the river, lowering water temperatures. They also increase water quality by limiting sedimentation and filtering out contaminants from the shoreline.

Proponent: ECW

Timeline: Summer 2014

Monitor temperature and water levels in Lake Utopia tributaries

The Lake Utopia Rainbow Smelt is a sympatric pair consisting of a dwarf bodied and long bodied form. Both species are considered threatened by COSEWIC and the dwarf bodied form is protected under the Species at Risk Act. The pair is known to spawn in five tributaries of Lake Utopia. Since 2012, Eastern Charlotte Waterways has monitored the water depth and temperature in these critical habitats. The organization will continue to monitor the streams to ensure the suitability of the habitat for smelt spawning.

Proponent: ECW

Timeline: Ongoing





Action 2.4 Action 2.5 Action 2.6

Conduct study of Chain pickerel diet

In a relatively short period of time, Chain pickerel (Esox niger) has made its way from Magaguadavic Lake to Lake Utopia. By establishing itself throughout the Magaguadavic system, the invasive fish has quickly become an issue of concern for natural resource managers. Understanding the effects of this exotic species on the watershed's ecology will be crucial in managing its impact. Eastern Charlotte Waterways will complete a study of the fish's diet, by capturing samples and analyzing stomach contents. The analysis will be concerned primarily with Atlantic salmon smolt and Lake Utopia Rainbow Smelt. however a full accounting of the diet will take place.

Proponent: ECW

Timeline: Summer 2015

Diligent monitoring for Largemouth bass

Objective: While not yet an issue, the arrival of a Largemouth bass (*Micropterus salmoides*) population in the Magaguadavic River system would be devastating to the established ecology. Thus far, there has been only one observation of Largemouth bass in the river. The Atlantic Salmon Federation will continue to monitor the system for Largemouth bass individuals, and rapid action will be necessary if they are identified in order to maintain the status quo.

Proponent: Atlantic Salmon Federation

Timeline: Ongoing

Promote best land management practices amongst residents

Providing residents in the lower Magaguadavic with accessible information to the best land management practices (BMPs) will be valuable to the health of the watershed and important in its long term maintenance. The Lake Utopia Preservation Association, a citizen-led stewardship group, will incorporate BMPs into their literature, their website, and their annual general meeting. Eastern Charlotte Waterways will assist with the delivery and implementation of the BMPs.

Proponent: LUPA

Timeline: Summer 2014



Action 2.7

Action 2.8



Continue water quality monitoring program

The New Brunswick Department of Environment and Local Government will continue its water quality monitoring program in the Magaguadavic River system. The program is made up of the following components:

Department staff will monitor sites in the Magaguadavic vulnerable to industry. These include three sites each on Linton Stream and at Thompson Corner, each home to a Cooke Aquaculture facility. These sites are monitored monthly throughout the summer season.

Department staff will continue to regularly monitor Magaguadavic River surface water quality at the monitoring site in St. George. Readings will be taken four times per year.

The water quality of Lake Utopia and Magaguadavic Lake will each be monitored twice annually to ensure the historical data set is maintained and any environmental change is identified.

Proponent: NBDELG
Timeline: Ongoing

Manage Magaguadavic Lake dam to keep water temperature in upper Magaguadavic below 30 degrees Celsius

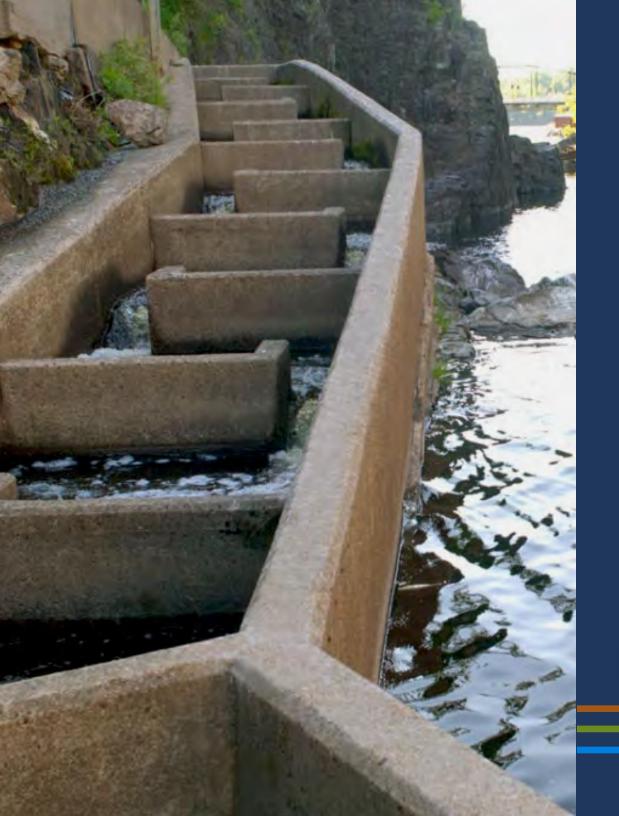
At the warmest time of the year, the water temperature in the upper Magaguadavic can surpass 30 degrees Celsius. This is a crucial threshold for fish habitat. The dam on Magaguadavic Lake, owned and operated by J.D. Irving has not been an issue for landowners, however, it may be used to mitigate these high temperatures. When managing the water levels on Magaguadavic Lake, J.D. Irving will make every effort to ensure there is water available to be released during periods of high temperature. This is the best hope to keep water temperatures below the critical threshold.

Proponent: J.D. Irving

Timeline: Ongoing







ISSUE # 3: FISH PASSAGE



Action 3.1 Action 3.2 Action 3.3

Count and test Atlantic salmon at the Magaguadavic dam fish ladder

The fish ladder at the head of the Magaguadavic River facilitates fish passage around the St. George Power hydroelectric dam. The structure is owner by the Department of Fisheries and Oceans and monitored by the Atlantic Salmon Federation. The ASF will continue to count the number of diadromous Atlantic salmon that utilize the ladder and ensure that aquaculture escapees do not gain entrance to the river.

Proponent: Atlantic Salmon Federation

Timeline: Ongoing

Annual review of St. George Power's Fisheries Management Plan

The Fisheries Management Plan is the key document in the effective operation of the hydroelectric dam at the head of the Magaguadavic River. Diadromous fish hoping to utilize the Magaguadavic River depend on this document to ensure their safe and efficient passage upstream and downstream. As part of the continuing effort to improve the document, J.D. Irving and DFO will review its contents annually and incorporate any new information that becomes available. This process will be ongoing, with annual results being approved and appropriate changes made to standard operating procedures.

Proponent: J.D. Iriving, DFO

Timeline: Autumn 2014

Identify NB DNR contact person for Magaguadavic dam file

The New Brunswick Department of Natural Resources currently does not have a staff member appointed to the St. George Power hydroelectric dam file. It is important that all regulatory bodies are represented in the process. J.D. Irving and NB DNR will work together to identify a suitable staff member to oversee the file moving forward.

Proponent: NB DNR

Timeline: Immediately





Action 3.4 Action 3.5 Action 3.6

Monitor fish passage at Magaguadavic Lake fish ladder

The dam at Magaguadavic Lake, the head of the Magaguadavic River, has a fish ladder in place but its operation is not regularly monitored. Staff at Cooke Aquaculture's Thompson Corner facility will make regular trips to the fish ladder at Magaguadavic Lake to ensure the safe and efficient passage of fish.

Proponent: Cooke Aquaculture

Timeline: Ongoing

Stock Magaguadavic River with Atlantic salmon

In recent years, Cooke Aquaculture and the Atlantic Salmon Federation have worked together to stock the Magaguadavic River with Atlantic salmon smolt that have been bred from Magaguadavic genetics. However, this program has not resulted in these fish successfully returning to the river. The stocking program must evolve to identify a genetic makeup that can successfully negotiate the salmon's diadromous lifecycle. Using stock from the Magaguadavic River, the Hammond River, and the Cairns River the Atlantic Salmon Federation and Cooke Aquaculture will systematically cross the genetics, breeding the fish and then stocking them strategically in various tributaries of the Magaguadavic that are suitable for salmon smolt. This program should help identify which aenotypes are best suited to the Magaguadavic, and hopefully lead to an improved population of Atlantic salmon in the Magaguadavic River.

Proponent: ASF, Cooke Aquaculture

Timeline: 2014-2017

Monitor water quality in Atlantic salmon spawning streams

Eastern Charlotte Waterways will assist ASF and Cooke Aquaculture with their Atlantic salmon restocking program. The organization will provide water quality monitoring in the salmon spawning streams used in their restocking program. This will ensure that those streams being utilized feature the necessary water quality to support growing Atlantic salmon. The goal of the program is to ensure that genetics is the deciding factor in survival, not habitat quality.

Proponent: ECW

Timeline: 2014-2017





Long-term collaboration will be required to implement the recommended actions of this watershed management plan. Eastern Charlotte Waterways will act as the bridging organization to bring together the stakeholders, monitor the progress of the report, and assist where possible the implementation of initiatives. All stakeholders must work to identify knowledge gaps and research needs, develop detailed work plans, review pertinent legislation and policy, identify best management practices, and consult as required. To enable the work to proceed, each participant will be expected to continue sharing resources such as information, in-kind support, and funding.

Implementation of certain recommendations will be achieved through the voluntary choices and actions of individual decision makers in government, industry, municipalities, non-government organizations and other stakeholders. The value of the plan will only be realized to the extent that stakeholders, individually and in collaboration, act on the recommendations as there is no specific statutory framework that requires adoption and implementation of the document. The plan will be adaptive in that the occurrence and timing of implementation initiatives by stakeholders will vary according to their own priorities, resources and capacities.

A large effort has been undertaken in the past few years to facilitate understanding of issues in the Magaguadavic River Watershed. The watershed faces increasing challenges in the face of a changing climate and the effect of province-wide economic realities. The complexity of issues and diversity of stakeholder interests make for a formidable challenge. Watershed planning and management represents a continuum of work, and ongoing efforts will be required. All parties must continue to participate with good will and prudent efforts to sustain the Magaguadavic River Watershed and all natural resources in southwestern New Brunswick.