

## **APPENDIX G**

### **DFO Correspondence and Questions/Answers**

**DFO Request for Additional Information (1) and NSMDC Response**



Fisheries and Oceans    Pêches et Océans  
Canada                            Canada

Aquatic Invasive Species National Core Program  
343 Université Avenue  
P.O. Box 5030  
Moncton, New Brunswick  
E1C 9B6

June 24, 2019

Your file            Votre référence  
19-IGLF-00001

Jim Ward  
North Shore Micmac District Council Inc.  
38 MicMac Road  
Eel Ground, New Brunswick  
E1V 4B1

Dear M. Ward

**Subject:    Additional information is required for the review of your request.**

The Aquatic Invasive Species National Core Program (the Program) of Fisheries and Oceans Canada received your proposal on April 9, 2019.

Your proposal is being reviewed to determine whether an authorization should be issued under Section 19 of the *Aquatic Invasive Species Regulations* to deposit a deleterious substance for the purpose of controlling / eradicating an aquatic invasive species (AIS). Your proposal is also being reviewed to determine if it has the potential to result in prohibited effects to species at risk listed under the *Species at Risk Act* as well as serious harm to fish under subsection 35(1) of the *Fisheries Act*.

In order for us to complete the review of your proposal and to determine if an authorization should be issued for the deposit of a deleterious substance to control AIS, we ask that you provide the following additional information:

Requirements under subsection 28(1)(a) of the *Aquatic Invasive Species Regulations* compel the consideration of public safety. Provide the following additional information:

1. Section 4.4 of the project application mentions “treatment will not impact groundwater, riparian areas, or other fish habitat outside of the project site”. Provide references to support this statement.
2. Section 4.1 of the project application mentions “unavoidable temporary water quality impacts will occur”. Provide information on potential impacts to drinking water in the area. Additionally, provide information on the source of drinking water for cottage owners in the project area (i.e. drawn from the lake or surrounding surface water).
3. Section 5.1 of the project application mentions that the public is prohibited to come into contact with the treated water during application, as well as for three days post application (a total of five days). These timelines apply only to contact with water. Provide timelines/guidelines in relation drinking water being safe for consumption after

application. If drinking water is affected, provide a detailed plan to provide cottage owners access to clean water during project duration and post-treatment.

Requirements under subsection 28(2)(a) of the *Aquatic Invasive Species Regulations* compel the consideration of impacts on fish, fish habitat or the use of fish. Provide the following additional information which pertains to the pesticide treatment:

1. Section 4.2 of the project application mentions that the lake contains organic-rich mud as well as tea colored water due to leaching from humic matter and surrounding bogs. It is also later mentioned in section 5.2 that this high organic content “sequesters rotenone toxicity”. Provide context around this sequestration. How does this sequestration impact the Rotenone degradation rate? Is the sequestration by organic content permanent? Can it be released back into the environment? Provide references to support information provided.
2. Section 5.2 of the project application describes treatment rates. DFO’s understanding of the information provided is that the recommended treatment rate for NoxFish is 0.0186 mg/L rotenone. However, tests conducted using CFT Legumine with Miramichi Lake water showed an LC50 value of 0.0065mg/L rotenone. This would suggest a recommended treatment rate of 0.026 mg/L rotenone. The proposed treatment rate in this project is 0.075 mg/L rotenone, which is three times the recommended rate based on the LC50 using Miramichi Lake water. Those calculations include the doubling of the minimum effective dose (MED), as suggested by the Standard Operating Procedures cited in your proposed project. Does this doubling of the effective dose already account for some environmental variability, such as temperature, sediment sequestration and biological Smallmouth Bass variability? At what temperature were the laboratory toxicity tests conducted? Provide evidence to justify the proposed substantial increase in the treatment rate.
3. Section 5.2 of the project application also indicates that treatment rate may be modified based on additional on-site toxicity tests. The assessment of the proposed project will be performed on the information provided during the regulatory review. Changing the treatment rate post regulatory review may require a re-evaluation of the proposed project. To avoid potential delays, provide sufficient details surrounding potential changes to the treatment rate.
4. Section 4.1 states “Habitat in several intermittent inlet tributaries (< 500 m) and Lake Brook (riverine), and adjacent peripheral wetlands around the lake (palustrine) will be affected by the proposed project” and section 5.2 states “rotenone will be applied to at least the first 100 m upstream of the lake using drip stations”. Provide clear and exact location of all product application and affected areas.
5. In section 4.3 of your application, it is mentioned “Rotenone will be deactivated with potassium permanganate near the outlet of Lake Brook to prevent impacts to surface water in the Southwest Miramichi River”. Section 4.5 provides details on the proposed deactivation using Potassium Permanganate. The Safety Data Sheet for Potassium Permanganate lists this chemical as having “acute aquatic toxicity” and “chronic aquatic toxicity” meaning it is very toxic to aquatic life and it has long lasting effects. DFO is concerned that the use of this deactivation product for rotenone could potentially have negative impact on Fish and Fish Habitat. Provide details of deactivation protocol that ensures the product will not have any negative impacts caused by the chemical itself.

Requirements under subsection 28(2)(a) of the *Aquatic Invasive Species Regulations* compel the consideration of impacts on fish, fish habitat or the use of fish. Provide the following additional information which pertains to species at risk:

1. In section 4.3 of your application, it is mentioned that a survey for Yellowlamp Mussel and Brook Floater was conducted. In order for DFO to fully assess project implications on aquatic species at risk, provide a report for the mentioned mussel bed investigations, including survey protocol, locations surveyed and findings.
2. In section 4.3 and 5.1 of your application, it is mentioned that toxic effects to mussels are not expected with the proposed rotenone treatment levels. Provide specific evidence related to any effects on Brook floater.
3. Additional concerns in relation to species at risk is the uncertainty around host species for Brook Floater to complete their life cycle. Currently, host species for Brook Floater have not been identified for NB populations. Some studies (see page 22 of the attached document) have identified potential host fish and six of these species are present in Miramichi Lake. These include the Common shiner (*Luxilus cornutus*); Golden shiner (*Notemigonus crysoleucas*); Fallfish (*Semotilus corporalis*); Brown bullhead (*Ameiurus nebulosus*); White sucker (*Catostomus commersonii*); and Yellow perch (*Perca flavescens*). Of these species, laboratory studies indicated that the Common shiner, Golden shiner and White sucker showed the highest frequency of Brook Floater life cycle completion. Only two of these three species were included as high priority in the re-introduction plan. Additionally, other species in the lake could also serve as potential host species. Provide any additional measures that could address these concerns.
4. How will the suggested temporary effects of treatment on plankton impact the survival of dependent species such as freshwater mussels (including Brook Floater)? How will a reduced food source impact overwintering of these species? Provide references to support information provided.

Requirements under subsection 28(2)(a) of the *Aquatic Invasive Species Regulations* compel the consideration of impacts on fish, fish habitat or the use of fish. Provide the following additional information:

1. In section 4.3 of your application, it is mentioned a fall treatment will also enhance the recovery of planktonic organisms such as cladoceran, copepod, and rotifer populations. Although the provided references suggest that plankton will recover in the spring, what are the expected timelines for populations to fully recover to pre-treatment levels? How will young-of-the-year alewife be affected if plankton populations have not fully recovered? Provide further information on impacts to plankton and more specifically as it relates to alewife.

Provide the following additional information on the proposed re-establishment strategy:

1. In section 7.1 of your application, it is mentioned that "Species that may survive the rotenone exposure are also be given low priority for re-introduction such as brown bullhead and golden shiner." Provide information on any documented effects on fish which have survived rotenone treatments, including changes in feeding and reproduction behavior.

2. Point of clarification: your application indicates that Golden shiner is considered a tolerant species that is likely to survive treatment and thus will be given a low priority for re-introduction (section 5.1 and 7.1). However, Table 4 in section 7.1 identifies Golden shiner as a high priority. Please clarify this discrepancy.
3. In section 7.1 of your application, it is mentioned that “Anadromous or highly migratory species will colonize the lake on their own within a year, which makes them a lower priority for collection/re-establishment”. Provide evidence to support the anticipated timeline for re-establishment of migratory species.
4. The goal of the proposed re-establishment strategy in this project application is focused on “restoring the existing fish community with the exception of SMB”. In the application document there is no mention of quantities (or relative proportions) of each fish species to be re-introduced. Re-introduction quantities and sequence of fish species may ultimately affect the resulting fish community structure. Provide details around your re-introduction strategy to achieve your goal of re-establishing the existing community structure (minus SMB).
5. Keeping in mind the above re-establishment goal, the project application also mentions “Miramichi Lake has a highly diverse fish community for a post-glacial Appalachian Lake. This greatly increases the challenges and complexity of restocking from nearby lakes as multiple systems would be required to restore the diversity” and “Rare species are also a low priority as the likelihood of capture for recolonization may require exhaustive fishing effort”. Provide clarification on achieving the proposed re-establishment goal if “rare species” are not re-introduced due to the given low priority status.
6. Does the “highly diverse fish community for a post-glacial Appalachian Lake” make Miramichi Lake a unique environment? Provide context around the importance of the fish diversity present in Lake Miramichi as it relates to other lakes in New Brunswick.
7. Provide details around proposed water source for temporary containment of native fish species. More precisely, plans for temporarily diverting a section of spring-fed stream (i.e. water withdrawal).
8. During temporary containment of the fish species, how will fish survival be assured? Are the fish going to be fed during containment? Provide details on protocols that will be used to maintain healthy fish while in containment.
9. Section 7.1 of your application suggests that re-introduction of captured fish could take place as early as 10 days post-treatment. Provide evidence to support the likelihood that re-introduced fish will survive into the next season (i.e. sufficient available food sources prior to overwintering).

Provide the following additional information on the proposed monitoring plan:

1. In section 8.1 of your application, a description of a monitoring plan was provided. The description mostly provides information around what could or may be done for monitoring. Please provide DFO a definitive monitoring protocol for assessment.

2. In section 8.1 of your application, the use of eDNA was mentioned. Although eDNA might be useful to monitor native species recovery, it will not be able to demonstrate the absence of SMB post treatment (i.e. minimum detection levels). Current SMB population levels are barely detectable by eDNA techniques. Provide details around protocols to monitor the treatment effectiveness.

Other topics to be addressed. Provide the following additional information:

1. In section 7.1 of your application, it is also mentioned that Brook trout, although highly migratory, should be considered as a high priority because of it is highly valued for recreational fishing. It is also mentioned that this will appease camp owners along the lake and serve as risk mitigation against future invasive species introductions. Explain how re-establishing existing trout populations will mitigate against other invasive species introductions.
2. Provide information around the risk of Smallmouth Bass being re-introduced into the lake post-treatment. Include the locations of the closest established Smallmouth Bass populations, information on waterbody connectivity and potential vectors that could lead to re-introduction.
3. Section 5.2 of the project application indicates that the Province will likely apply the pesticide. The Province is not listed as the proponent nor a project partner. The legal responsibility of the Province in the proposed activity is not clear. Please clarify the role of the Province in this project proposal.
4. Section 4.5 of the project application indicates the dead fish be collected and buried in a landfill post treatment. How will the dead fish be collected? Provide the protocol for removing the dead fish.
5. In section 7.1 of your application, it is also mentioned that a Wetland and Watercourse Alteration (WAWA) permit will be required from NB Department of Environment and Local Government (NB DELG) for temporary containment. Has a request been made to the WAWA program?
6. Consult the NB DELG's Environmental Impact Assessment (EIA) program to confirm whether the project might trigger an EIA or not.

To determine whether the proposed project site preparation contains works, undertakings or activities that could result in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery which is prohibited under subsection 35(1) of the Fisheries Act, provide detailed information if any of the following apply:

1. Watercourse crossing construction (permanent or temporary);
2. Shoreline alteration (e.g. dredging, infilling, boat slip construction, etc.);
3. Reductions in water flow (e.g. withdrawals);
4. Habitat alteration associated to fish removal;
5. Fording sites

As previously mentioned, we have engaged with Aboriginal communities and First Nations. The following concerns were raised:

1. Impacts to native fish communities. As requested above, please provide the necessary information on the proposed re-establishment strategy to address this concern.
2. Long term effects of using Rotenone, especially in relations to invertebrate species, including zooplankton and insect populations. It was mentioned that some studies show that it can take 2-5 years for populations to recover. Some populations never do recover. Please provide more information on the potential recovery of invertebrate populations.
3. The risk level of Smallmouth Bass being re-introduced post-treatment. As requested above, please provide information on the risk of reintroduction.
4. Have less destructive and more targeted means of eliminating Smallmouth Bass been fully considered?

If you have any questions, please contact me directly at our Moncton office at 506-851-7244, or by email at [XGLFInvaders@dfo-mpo.gc.ca](mailto:XGLFInvaders@dfo-mpo.gc.ca). Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,



Daniel Bourque  
Aquatic Invasive Species Regional Coordinator Biologist

Cc. Terry Melanson (DFO), Guy Robichaud (DFO)

**Response to Aquatic Invasive Species National Core Program of DFO (dated June 24, 2019) Regarding Additional Information for the Application to Eradicate Smallmouth Bass from Miramichi Lake (19-IGLF-00001)**

Submitted by: North Shore Micmac District Council Inc.

Submitted to: Fisheries and Oceans Canada (Gulf Region)

Date: Sept 13, 2019

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**I. *Aquatic Invasive Species Regulations* Section 28(1)(a) Requirements**

1. *Impact on Groundwater and Aquatic Areas* – Sediment adsorption and desorption studies by Dawson (1986)<sup>1</sup> using native sediments from USA determined sediment coefficient ( $k_d$ ) values of <10 (sand) to >100 (high silt and organic sediment) with the average sorption constant  $K_{oc}$  >2000, suggesting that the mobility of rotenone in soil is low to slight. Rotenone was most tightly bound to those sediments that had a high silt and organic content, similar to sediments in Miramichi Lake. He found desorption of rotenone was only 3.7% for silty sediments and concluded that the expected leaching distance for most soils would be 0 to 2 cm, suggesting that rotenone is unlikely to be a groundwater contaminant. Several agencies have monitored wells in the vicinity of rotenone treatments since the 1980s. There is no known instance of rotenone being found in those associated groundwaters (Finlayson et al. 2001<sup>2</sup>; Finlayson et al. 2014<sup>3</sup>). Rotenone will be confined to the project site by deactivating rotenone leaving the project area before it enters the Southwest Miramichi River.

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<sup>1</sup> Dawson, V. 1986. Adsorption-desorption of [6a-<sup>14</sup>C] rotenone by bottom sediments. U.S. Fish and Wildlife Service, National Fishery Research Laboratory, La Crosse, Wisconsin. Report ROT-84-988.02, 136 pp.

<sup>2</sup> Finlayson, B., J. Trumbo, and S. Siepmann. 2001. Chemical residues in surface and ground waters following rotenone application to California lakes and streams. Pages 37-53 in R. Cailteux, L. DeMong, F. Finlayson, W. Horton, W. McClay, R. Schnick, and C. Thompson, editors. Rotenone in fisheries: are rewards worth the risks? American Fisheries Society, Trends in Fisheries Science and Management I, Bethesda, Maryland.

<sup>3</sup> Finlayson, B., Eilers, J. and H. Huchko. 2014. Fate and behavior of rotenone in Diamond Lake, Oregon, USA, following invasive tui chub eradication. *Environmental Toxicology and Chemistry* 33(6):1630-1655.

2. *Drinking Water Impacts* – No drinking water is taken from Miramichi Lake. The cottages on the lake take their drinking water from a small reservoir located upslope from the cottages that will not be treated.
3. *Public Health and Safety* – The water in Miramichi Lake is not a source of drinking and therefore, no plan has been provided for supplying drinking water to the residences. Given the expected half-life (2.5 d) of rotenone in Miramichi Lake during the proposed treatment scenario based on data from Finlayson et al. 2001; Finlayson et al. 2014), the initial 0.075 mg/L rotenone is expected to degrade to 0.0375 mg/L rotenone in 2.5 d, a level below the suggested safe drinking water level of 0.040 mg/L rotenone proposed by EPA (2007)<sup>4</sup>.

## II. *Aquatic Invasive Species Regulations Section 28(2)(a) Requirements*

1. *Impact of Organics on Treatment Rates* – Section 5.2 states that “*The high organic content of the water (evidenced by its brown color) will likely sequester some of rotenone’s toxicity*”. This is certainly a possibility, supported by a recent unpublished study in Montana (Skaar and Selch 2018) which found that a pond with tea-colored water and high levels of DOC had LC50 values 70-140% higher than four other unstained and low DOC waters; similar results were obtained in the test recently completed on Smallmouth Bass with water from Miramichi Lake (see below). This phenomenon is also recognized on the labels for rotenone products: the rate table on page 4 of the Noxfish Fish Toxicant II label (PRMA Registration No. 3327) allows the dose for ponds high in organics to be twice that allowed in pond waters not high in organics. Similar adjustments are found on the USA labels. The difference in toxicity values between the test done in Miramichi Lake water and the data of Marking and Bills (1976) may suggest lower rotenone toxicity in Miramichi Lake water (see page 21 of application). We are not aware of any studies looking specifically at the effect of organic loading on rotenone degradation rates. However, Finlayson et al. (2014) suspected that blue-green algae removed rotenone from the water during a bloom in Diamond Lake, Oregon and later released some of the rotenone back into the water when the bloom subsided, likely decreasing the dissipation of rotenone from the water body. The degradation of rotenone is increased by higher water temperatures, greater sunlight penetration, alkaline pH and higher metabolic activity.
2. *Justification of Treatment Rate* – The data of Marking and Bills (1976)<sup>5</sup> suggest a minimum treatment rate for Smallmouth Bass of 0.0186 mg/L rotenone (4 x LC50

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<sup>4</sup> EPA, 2007. Registration eligibility decision for rotenone, EPA 38-R-07-005. U.S. Environmental Protection Agency, Prevention, Pesticides and Toxic Substances, Special Review and Registration Division, March 2007.

<sup>5</sup> Marking, L and T. Bills. 1976. Toxicity of rotenone to fish in standardized laboratory tests. *Investigations in Fish Control* 72. U.S. Fish and Wildlife Service, Washington, D.C.

value). You are correct that the toxicity test data using Miramichi Lake water suggest a minimum treatment rate of 0.026 mg/L rotenone, suggesting a 44% reduction in toxicity. The water temperatures averaged 12 °C for the Marking and Bills (1976) tests and 13 °C for those using Miramichi Lake water. The LC100 value is doubled (e.g., 4 x LC50 value) to account solely for biological variability which is why this is the minimum recommended rate. Variability caused by environmental conditions is accounted for in increasing the minimum treatment rate. For example, a deep lake with cool water and low in organics, submerged vegetation and turbidity will require less rotenone than a shallow lake with warm water high in organics, submerged vegetation and turbidity. The minimum treatment rate was increased to 0.075 mg/L rotenone to account for likely possibility that the shallow lake depth will increase the rate of photolysis, the warm water conditions will increase the rate of hydrolysis, and the abundant submerged aquatic vegetation containing high sediment and silt loads will sequester the rotenone, all of which will lower the rotenone concentration and increase the dissipation of rotenone from the water column. Additionally, lethal levels of rotenone must persist long enough to penetrate low water circulation shoreline areas favored by young Smallmouth Bass.

3. *Change in Treatment Rate* – Based on ongoing baseline data collection, if it is deemed necessary to increase the treatment rate, sufficient details will be provided to DFO.
4. *Intermittent Inlet Tributaries* (**UPDATE in APPENDIX B with criteria for drip station placement on 5 inlets and electrofishing protocol**) – There are 4 inlets to Miramichi Lake (see map in Figure 3 of the AIS application). They will be electro-fished prior to treatment for presence of Smallmouth Bass. In mid-September these are expected to be at or near base-flow conditions if not dry. If no Smallmouth Bass are detected, each tributary will be treated only 100 m upstream from its confluence with the lake to eliminate any refugia for the bass and prevent the intrusion of rotenone-free water into the lake. Coordinates for the drip stations are:

- 1) 46°27'32.76"N, 66°57'30.24"W
- 2) 46°27'3.46"N, 66°57'25.94"W
- 3) 46°27'22.90"N, 66°58'53.36"W
- 4) 46°27'49.88"N, 66°59'29.97"W

*Lake Brook* – (**UPDATE: Given the known presence of SMB in Lake Brook, the brook will also be treated. Drip stations located along Lake Brook and the east branch of Lake Brook for rotenone treatment (placement TBD based on flows immediately prior to treatment to ensure target concentration of 0.075 mg/L**

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rotenone is sustained in the brook during treatment. The rotenone will be deactivated in Lake Brook prior to reaching the SW Miramichi River; the deactivation station will be located at least 30 minutes water travel time upstream from the brook's confluence with the SW Miramichi River. Maintaining 4 ppm residual of  $\text{KMnO}_4$  in the deactivation zone will ensure that rotenone is deactivated by the time it reaches the SW Miramichi River, and that lethal conditions are sustained in the lower reach of the brook given that SMB distribution includes the brook. Upon flowing into the SW Miramichi River, the 4 ppm  $\text{KMnO}_4$  will be immediately diluted to non-lethal levels, and the rotenone will have been deactivated. Please see monitoring detail and map locations in APPENDIX E.)

Lake Brook will be treated and will also contain rotenone-containing water leaving Miramichi Lake. As a precaution to ensure that rotenone does not affect aquatic life in the Southwest Miramichi River, rotenone will be deactivated with potassium permanganate at least 30-minutes water travel time upstream of the confluence of the two streams until rotenone subsides below 0.0375 mg/L in Miramichi Lake. The 35:1 dilution with the Southwest Miramichi River will further lower rotenone concentrations below biological effect and detection levels (< 0.002 mg/L).

*Wetlands* – Only wetlands that are contiguous with Miramichi Lake will be affected by the treatment, and there are no Provincially Significant Wetlands in the project vicinity.

5. *Deactivation Procedures* – The deactivation procedures are described in detail in SOP 7.1 of the Rotenone SOP Manual (Finlayson 2018)<sup>6</sup> and are based on the rotenone-permanganate kinetic studies of by Engstrom-Heg (1972)<sup>7</sup>. The objective is to keep the oxidation/reduction reaction in balance by maintaining 1 mg/L permanganate residual at a point, 30-minutes downstream of the permanganate injection site (UPDATE in APPENDIX E: residual will be maintained at 4 ppm in the deactivation zone in lower Lake Brook to maintain lethal levels for fish while deactivating rotenone; SMB are now known to be in the brook and lethal conditions are needed throughout its entirety; 4 ppm  $\text{KNO}_4$  will be immediately diluted in the SW Miramichi River to non-lethal levels).

Adjustments to the injection of permanganate are accomplished through a feedback loop of directly or indirectly measuring the permanganate residual using a spectrophotometer and relaying the results via radio to the operator of the

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<sup>6</sup> Finlayson, B., D. Skaar, J. Anderson, J. Carter, D. Duffield, M. Flammang, C. Jackson, J. Overlock, J. Steinkjer, and R. Wilson. 2018. Planning and Standard Operating Procedures for the Use of Rotenone in Fish Management – Rotenone SOP Manual, 2<sup>nd</sup> edition. American Fisheries Society, Bethesda, Maryland.

<sup>7</sup> Engstrom-Heg, R. 1972. Kinetics of rotenone-potassium permanganate reactions as applied to the protection of trout streams. New York Fish and Game Journal 19(1):47-58.

deactivation station. Potassium permanganate is toxic to aquatic life at relatively low concentrations in clean laboratory water free of permanganate demand, but the toxicity decreases an order of magnitude in natural water sources (Hobbs et al. 2006<sup>8</sup>; Marking and Bills 1975<sup>9</sup>). Toxic levels of permanganate are reduced through the oxidation of organic components and rotenone when permanganate is in balance with rotenone. When rotenone concentrations subside below 0.0375 mg/l (likely 2-3 days after application) in Miramichi Lake, the deactivation station will be turned off since the expected dilution in the Southwest Miramichi River will eliminate rotenone residues downstream of the confluence. There is an approximate 35:1 dilution of Lake Brook in the Southwest Miramichi River, also lowering the 1.0 mg/L permanganate residual to 0.028 mg/L permanganate, a level far below known aquatic toxicity levels even in clean water (Hobbs et al. 2006). We are unaware of long-lasting effects of using potassium permanganate as described above beyond those already caused by rotenone.

## **II. Aquatic Invasive Species Requirements Section 28(2)(a)**

1. *Mussel Bed Investigations* – Mussel beds were investigated in several shallow areas of the lake and samples submitted to provincial specialist for identification. Sites included: 46°27'6.88"N, 66°57'32.06"W; 46°27'45.25"N, 66°59'21.77"W; 46°27'46.67"N, 66°57'59.76"W. No Yellow Lampmussel or Brook Floater were identified. For a more comprehensive approach, a team from Anqotum Resource Management will conduct a systematic mussel survey of the lake, supplemented by eDNA sampling, to identify mussel species in the lake. The survey map has been provided to DFO AIS staff. The work will be completed during the week of September 15, 2019, and results communicated to DFO when finalized. (UPDATE: survey provided in APPENDIX C).
2. *Brook Floater Studies* – There are no tests or evidence on the toxic effects of rotenone specifically to the Brook Floater. Tests and studies have been completed on other freshwater mollusk species and are referenced in the application. We have no evidence that suggests the Brook Floater would respond any differently than the mollusk species previously tested. Furthermore, eradication of invasive Smallmouth Bass eliminates a threat to Brook Floater and

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<sup>8</sup> Hobbs, M., R. Grippo, J. Farris, B. Griffin, and L. Harding. 2006. Comparative acute toxicity of potassium permanganate to nontarget aquatic organisms. *Environmental Toxicology and Chemistry* 25(11):3046-3052.

<sup>9</sup> Marking, I., and T. Bills. 1975. Toxicity of potassium permanganate to fish and its effectiveness for detoxifying antimycin. *Transactions of American Fisheries Society* 104:579-583.

is in-keeping with the broad strategies outlined in the DFO's Management Plan for the species (DFO 2018)<sup>10</sup>.

3. *Brook Floater Host Fish Species* – The Brook Floater mussel has been assessed by COSEWIC (2009)<sup>11</sup> as Special Concern and DFO has developed a Management Plan (DFO 2018) to identify broad strategies for addressing threats. Invasive species such as Smallmouth Bass pose a threat to the Brook Floater primarily through impacts to its host fish species. A persisting Smallmouth Bass population in Miramichi Lake and the risk of its escape into the Southwest Miramichi River poses a threat to existing known assemblages of Brook Floater downriver. The distribution of the mussel in Miramichi Lake is not known. Therefore, surveys will help identify presence/absence and distribution in the area, and eradication of Smallmouth Bass will eliminate the threat to Brook Floater and its host species. A permanent eradication plan will contribute to the protection of the Brook Floater in the Lake (if present) and in the Southwest Miramichi River (known assemblages).

Host species including Golden Shiner and Brown Bullhead will likely survive the treatment and White Sucker and Yellow Perch are high priorities for re-establishment in Miramichi Lake. If Brook Floater are found to be present in the Lake, known host fish species will be given priority status for reintroduction.

4. *Effects on Plankton* – Freshwater mussels filter feed on algae, detritus, and bacteria. Rotenone at the dosage prescribed for treatment in Miramichi Lake is not toxic to phytoplankton, and no decrease in phytoplankton abundance is expected following the treatment. Two studies suggest that algae as a group are tolerant of rotenone: Maione and Gibbs (1985)<sup>12</sup> exposed alga *Chlamydomonas reinhardi* chloroplasts to 59 mg/L rotenone with no effect on photosynthesis, and van Leeuwen et al. (1992)<sup>13</sup> proposed a QSAR equation for the alga *Selenastrum capricornutum* that results in an estimated 96-h EC50 value of 1.8 mg/L rotenone. To the contrary, there will likely be an increase in phytoplankton

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<sup>10</sup> Department of Fisheries and Oceans Canada (DFO). 2018. Management Plan for the Brook Floater (*Alasmidonta varicosa*) in Canada. Species at Risk Act Management Plan Series. Department of Fisheries and Oceans Canada, Ottawa. iv + 42 pp.

<sup>11</sup> COSEWIC. 2009. COSEWIC assessment and status report on the Brook Floater *Alasmidonta varicosa* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 79 pp. ([www.sararegistry.gc.ca/status/status\\_e.cfm](http://www.sararegistry.gc.ca/status/status_e.cfm)).

<sup>12</sup> Maione, T., and M. Gibbs. 1986. Association of the chloroplastic respiratory and photosynthetic electron transport chains of *Chlamydomonas reinhardi* with photoreduction and the oxyhydrogen reaction. *Plant Physiology* 80:364-368.

<sup>13</sup> van Leeuwen, D., P. van der Zandt, T. Aldenberg, H. Verhaar and J Hermens. 1992. Application of QSARs, extrapolation and equilibrium partitioning in aquatic effects assessment. I. Narcotic industrial pollutants. *Environmental Toxicology and Chemistry* 11:267-282.

abundance as nutrients from the decaying fish carcasses are released into the water column. Subsequently, an increase in zooplankton abundance will occur when rotenone subsides to nonlethal levels (Bradbury 1986<sup>14</sup>; Eilers et al. 2011<sup>15</sup>). A reduced food source to overwintering mussel species in Miramichi Lake is not supported by the evidence.

5. [1.] *Impacts to Zooplankton and Alewife* – Section [4.5] of the application suggests a fall treatment will enhance the recovery of YOY alewife forage items (i.e., zooplankton) the following spring. Given the lower abundance of predacious fish in Miramichi Lake following the fall rotenone treatment, it is expected that zooplankton population levels will be higher than normal the following spring providing YOY alewife with a substantial forage base. Eilers et al. (2011) found that the post-treatment recovery of zooplankton and benthic invertebrates exceeded rotenone pre-treatment levels in Diamond Lake, Oregon; invertebrate abundance returned to pre-treatment levels within 1 to 2 years. The evidence suggests zooplankton abundance in Miramichi Lake will recover to pre-treatment, if not greater, levels given the general lack of predators and provide an abundant food source to Alewife the following spring and summer. Our primary concern regarding alewives in Miramichi Lake is DFO's ongoing barrier at the lake outlet which presents a long-term impact to natural migration patterns. With a successful eradication of Smallmouth Bass, the barrier will no longer be required.

### **III. Additional Information on Reestablishment Strategy**

1. *Effects on Fish Surviving Treatment* – To our knowledge, studies specifically looking at the feeding and reproductive behavior of fish surviving rotenone treatments have not been done. Seldom do natural resources management activities involve only a single action, and the effects are often difficult to separate. Nonetheless, it is expected that disruption of food webs and the potential impact on surviving fish will be heavily mitigated by the reduction in numbers of competitors and predators. Brown Bullhead survived the 2007 0.050 mg/L rotenone treatment of Lake Davis, California for Northern Pike eradication (Vasquez et al. 2012)<sup>16</sup>, and Golden Shiner likely survived the 2006 0.100 mg/L rotenone treatment of Diamond Lake, Oregon for Tui Chub eradication

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<sup>14</sup> Bradbury, A. 1986. Rotenone and trout stocking. A literature review with special reference to Washington Department of Game's Lake Rehabilitation Program. Washington Department of Game, Olympia.

<sup>15</sup> Eilers, J., H. Truemper, L. Jackson, B. Eilers, and D. Loomis. 2011. Eradication of an invasive cyprinid (Gila bicolor) to achieve water quality goals in Diamond Lake, Oregon (USA). *Lake and Reservoir Management* 27:194-204.

<sup>16</sup> Vasquez M., Rinderneck, J., Newman, J., McMillin, S., Finlayson, B., Mekebri, A., Crane, D., and R. Tjeerdema. 2012. Rotenone formulation fate in Lake Davis following the 2007 treatment. *Environmental Toxicology and Chemistry* 31(5): 1032-1041.

(Finlayson et al. 2014; J. Eilers, MaxDepth Aquatics, personal communication). Eradication of Smallmouth Bass will allow for the recovery of the existing fish species (minus SMB) by eliminating the need for DFO's long-term control and reduce program which impacts these other species.

2. *Clarification on Golden Shiner* – The high priority for re-introducing the Golden Shiner into Miramichi Lake in Table 4 is incorrect. Golden Shiner reintroduction should be a low priority because it will likely survive the treatment.
3. *Timeline for Re-establishment of Migratory species* – Section 4.2 of the application states that several diadromous species have been recorded in Miramichi Lake that include American Eel, Sea Lamprey, Atlantic Salmon, and Alewife. Most notable of these are the Alewife with large spawning runs (tens of thousands) that are known to enter Miramichi Lake each spring with significant numbers of YOY leaving in July and August (DFO 2009<sup>17</sup>; DFO 2013<sup>18</sup>).
4. *Details of Fish Re-introduction Strategy (UPDATE: Stand-alone Re-establishment Plan provided in APPENDIX D)* - Based on a DFO survey from 2010, there are a total of 17 known fish species including Smallmouth Bass present in Miramichi Lake (DFO 2013). The remaining species appear to be native to New Brunswick but not necessarily to Miramichi Lake. Removing the vast majority of the ichthyofauna from Miramichi Lake presents an opportunity to reestablish a community that is closer to what may have been historically present, if such records existed. There is a dire lack of records regarding historic fisheries data from Miramichi Lake and therefore no obvious goal for reintroduction. Instead, this project focuses on restoring the existing ichthyofauna with high priority. High priority was given to those species whose life-cycle is mostly constrained to the lake. There is no literature or guidance on ideal numbers to restock. Obviously, the more fish restocked, the more successful the reintroduction is likely to be, and the quicker the lake should recover. Recolonization is constrained by practicality and cost. The revised Table 4 from the application (see below) lists the proposed numbers and priority for reintroduction based on relative abundance of individuals captured by DFO (2013), and hence is the best available data to represent existing community structure. It is anticipated that these fish will be captured and released back into Miramichi Lake once rotenone subsides to nonlethal levels (< 0.002 mg/L).

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<sup>17</sup> DFO. 2009. Potential impact of smallmouth bass introductions on Atlantic Salmon: A Risk Assessment. DFO Canadian. Science Advisory Secretariat Advisory Report 2009/003.

<sup>18</sup> DFO. 2013. Review of control and eradication activities in 2010 to 2012 targeting Smallmouth Bass in Miramichi Lake, New Brunswick. DFO Canadian. Science Advisory Secretariat Science Response 2013/012.

Greater detail will be provided by a formal Fish Reintroduction Plan following approval of the project.

5. *Rare Species Reintroduction* (UPDATE: Stand-alone Re-establishment Plan provided in APPENDIX D with no requirement of holding fish on-site) – As stated above, there is a dire lack of records regarding historic fisheries data from Miramichi Lake and therefore no obvious goal for reintroduction. Instead, the project will focus on restoring the existing ichthyofauna with high priority. Numerically rare species were given a low priority as the likelihood of capture for reintroduction may require exhaustive fishing effort, and there is no evidence that the numerically rare species are native to Miramichi Lake.

Table 4. Proposed priorities and maximum number of fish to be reintroduced into Miramichi Lake. Actual efforts may produce lower numbers due to unforeseen circumstances.

Species	Proposed Numbers	Priority for Reestablishment
1. Yellow Perch	1,000	High
2. White Sucker	1,000	High
3. White Perch	1,000	High
4. Fallfish	200	High
5. Common Shiner	200	Low
6. Gaspereau (Alewife)	0	Low
7. Golden Shiner	200	Low
8. Brown Bullhead	200	Low
9. Banded killifish	200	High
10. American eel	100	Low
11. Brook Trout	0	Low
12. Creek chub	0	Low
13. Lake chub	0	Low
14. Sea lamprey	0	Low
15. Atlantic Salmon	0	Low
16. Pearl dace	0	Low

6. *Highly Diverse Fish Community* – There are few lakes of similar size near Miramichi Lake except for Nashwaak Lake which is not in the Miramichi River watershed, so comparisons of fish diversity and uniqueness are difficult. There is no evidence that Miramichi Lake is a unique environment given that it is open to the Southwest Miramichi River, and fish species including Smallmouth Bass have been illegally introduced. We contend that the entire Southwest Miramichi watershed is a unique environment in that it is a native ecosystem that has not been widely impacted by aquatic invasive species like so many other watersheds throughout the region, and that there is urgency to protect it through eradication of Smallmouth Bass.
7. *Temporary Native Fish Containment Water Supply* (UPDATE: Stand-alone Re-establishment Plan provided in APPENDIX D with no requirement of holding fish on-site) – The temporary, two-week, native fish containment facility that is planned will be in close proximity to the lake and will require a source of cold fresh water. There is a small cold, spring fed stream on the eastern edge of the lake adjacent to the cottages. The stream flows at about 3,000 L/min at a temperature of approximately 12 °C all year. This source of water could be diverted to the temporary containment facility. Alternatively, the water supply to the cottages that comes from a small reservoir above the buildings could be used for the temporary containment facility.
8. *Holding Conditions for Native Fish* (UPDATE: Stand-alone Re-establishment Plan provided in APPENDIX D with no requirement of holding fish on-site) – Fish will be contained in sterilized hatchery tanks supplied by the MSA and set up using a flow through system for a continuous supply of cold water and oxygen. Fish will be fed frozen whole krill, an effective feed for wild fish in captivity.
9. *Survival of Reintroduced Native Fish* (UPDATE: Stand-alone Re-establishment Plan provided in APPENDIX D with no requirement of holding fish on-site) – We cannot predict with any certainty that all of the reintroduced fish will survive to the next season, regardless of food abundance. When rotenone degrades below lethal levels, zooplankton populations will rebound and provide a food source for the reintroduced fish (Bradberry 1986; Eilers et al. 2011). This should be an adequate food source given the small numbers of fish reintroduced to the lake compared to the pre-treatment fish abundance. A study of rotenone used in a New Zealand stream to eradicate Brown Trout documented severe invertebrate density reductions, but invertebrate density returned after one year (Pham et al. 2013)<sup>19</sup>. In this study, the native galaxid species was reintroduced to the system within 10 days, and while a reduction of fish condition was observed, the

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<sup>19</sup> Pham, L., D. West, and G. Closs. 2013. Reintroduction of a native galaxid (*Galaxias fasciatus*) following piscicide treatment in two streams: response and recovery of the fish population. *Ecology of Freshwater Fishes* 22:361-373.

reintroduction was generally successful. We expect the zooplankton population in Miramichi Lake with rotenone-resistant dormant eggs to rebound more quickly than insect populations in lotic environments which generally have complex terrestrial and aquatic life stages.

#### **IV. Additional Information on Monitoring Plans (UPDATE: Stand-alone Monitoring Plan provided in APPENDIX E)**

##### 1. *Monitoring Protocols*

*Monitoring Sites* – Six monitoring sites will be located using GPS on Miramichi Lake at various depths: two sites 10 m from the shoreline, two sites at mid-depth, and two sites at the maximum depth; the six sites will be used for monitoring all parameters in Miramichi Lake. Two sites will be located on Lake Brook, one site immediately upstream of the deactivation station and one site 30-minutes water travel-time downstream at the end of the deactivation zone; the two sites will be used for only monitoring rotenone and potassium permanganate. Two sites will be located on Southwest Miramichi River, one site immediately upstream of Lake Brook and one site 5-minutes water travel-time downstream at the end of the confluence mixing zone; the two sites will be used for only monitoring rotenone and potassium permanganate.

*Rotenone* – The protocols for analyzing rotenone concentrations in lake and stream water are detailed in SOP 16.1 of Finlayson et al. (2018) and utilize liquid chromatography (LC) as described by Dawson et al. (1983)<sup>20</sup> or Sandvick et al. (2018)<sup>21</sup> or direct injection liquid chromatography/mass spectrometry (LC/MS) as described by Vasquez et al. (2012)<sup>22</sup>; these analyses have a MDL of 0.001 mg/L and RL of 0.002 mg/L rotenone. Water samples will be collected using a Kemmerer bottle in the lake or directly a few inches below the water surface in streams. Samples are put in 250-ml amber glass bottles with Teflon-lined caps, stored chilled (4 °C), and transported to the laboratory for analysis with chain-of-custody forms.

*Potassium Permanganate* – The protocols for the on-site analysis of potassium permanganate concentrations in water upstream and downstream of the deactivation station are detailed in SOP 7.1 of Finlayson et al. (2018) and utilize

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<sup>20</sup> Dawson, V., P. Harmon, D. Schultz, and J. Allen. 1983. Rapid method for measuring rotenone in water at piscicidal concentrations. *Transactions of American Fisheries Society* 112:725-727.

<sup>21</sup> Sandvik, M., T.Waaler, T. Rundberget, P. Adolfsen, H. Bardal, and R. Sandodden. 2018. Fast and accurate on-site determination of rotenone in water during fish control treatments using liquid chromatography. *Management of Biological Invasions* 9. Doi: 10.3339/mbi.2018.9.1.06.

<sup>22</sup> Vasquez, T., J. Rinderneck, J. Newman, S. McMillin, B. Finlayson, A. Mekebri, D. Crane, and R. Tjeerdema. 2012. Rotenone formulation fate in Lake Davis following the 2007 treatment. *Environmental Toxicology and Chemistry* 31(5):1032-1041.

either direct (Standard Method 4500-KMnO<sub>4</sub> B)<sup>23</sup> or indirect (USEPA DPD Method 8167 for Total Chlorine) colorimetry.

*Phytoplankton* – Grab water samples (1-L) for phytoplankton will be collected at 0.5 m depth and preserved in Lugol's solution, subsamples will be permanently mounted on slides, and measured transects are scanned at 1000× magnification using a phase-contrast compound microscope and identified to the most practical taxonomic level. Counting will be generally limited to 100 cells per sample. Biovolume estimates are calculated for each algal unit (for filamentous algae, the biovolume unit was standardized to 100 μm length of filament) based on measurements of average algal length and diameter.

*Zooplankton* – Zooplankton are collected by vertical tows of plankton net from a depth of 3m. The net has a 20 cm opening with a 30 cm reduction collar and a mesh size of 64 μm. Zooplankton will be identified to the most practical level.

*Benthic Invertebrates* – The rocky bottom of Miramichi Lake will influence the sampling gear used. The benthic macroinvertebrate data will likely be collected in triplicate using a petite PONAR (152 × 152 mm) dredge from the six monitoring sites. The samples will be sieved through a 500-μm mesh and aggregated in major taxonomic groups; some samples will be retained for analysis to species level. When identified to species, samples with more than 500 organisms will be subsampled using a Caton gridded tray with a 500-μm wire mesh and 30 grids to expand raw samples.

*Fishes* – A combination of electrofishing and netting methods (fyke, seine, minnow trap) will be employed over a 3-year post-treatment monitoring period to evaluate recovery of fish species. The diversity of methods will ensure different size classes of the various fish species are captured. This approach will generate catch per unit effort data to characterize fish community structure and provide relative abundance of the re-establishing fish species.

2. *Post-Treatment Assessment of Smallmouth Bass* – The effectiveness of the treatment in Miramichi Lake will be monitored using a combination of caged sentinel fish of equal or less sensitivity to rotenone than Smallmouth Bass and collecting water samples for rotenone analysis. The sentinel fish will be located at the six monitoring sites listed above at 0.5 m below the water surface and 0.5 m above the lake bottom and will be checked at 2 days after the application. Similarly, water samples will be collected at these sites and depths 2 days after

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<sup>23</sup> American Public Health Association. 1998. Standard methods for the examination of water and wastewater, 20<sup>th</sup> edition. American Public Health Association, Washington, D.C.

the application is complete. Rotenone residues will continue to be monitored at weekly intervals until rotenone is below detection limits (<0.002 mg/L rotenone).

A combination of electrofishing and netting techniques (fyke, seine, minnow trap) for a 3-year post-treatment period will provide data for evaluating the success of eradicating Smallmouth Bass from Miramichi Lake (i.e., the current DFO control program should be continued for 3 years to monitor for SMB). The distribution of Smallmouth Bass in Miramichi Lake is well known so the chance of false negative findings is relatively small. Additionally, samples for eDNA analysis will be collected from these areas of known Smallmouth Bass inhabitation. The absence of Smallmouth Bass from manual fish collection techniques or the lack of Smallmouth Bass eDNA in water are by themselves not conclusive evidence of their absence, but the two techniques used together increases the level of certainty that they are absent.

## **V. Other Information Requests**

1. *Re-establishment of Brook Trout Fishery* (UPDATE: Stand-alone Re-establishment Plan provided in APPENDIX D) – At a meeting between the Proponent, the Working Group, DFO, and the province on August 14, 2018, risk mitigations against future Smallmouth Bass introductions were discussed. The idea of reintroducing Brook Trout and reestablishing a highly valued recreational fish species to appease camp owners was discussed and specifically identified by DFO's Alain Hebert as a good example of a risk mitigation against future AIS introductions. Based on this input from DFO it was included in the AIS application.
2. *Risk of Smallmouth Bass Re-introduction* – It is impossible to determine the level of risk of future illegal reintroductions (by humans) of Smallmouth Bass into the lake. However, the risk can be minimized through pro-active public engagement and public/media messages with educational material on the threat of aquatic invasive species. DFO, the province, and the Working Group all have roles to play to educate the public and reduce the risk of further introductions. Our public engagement plan is available in van den Heuvel et al. 2017<sup>24</sup> and includes public education measures to reduce risk of future AIS introductions. As of September 2017, Miramichi Lake was the only waterbody in New Brunswick that

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<sup>24</sup> van den Heuvel, M., C. Pater, B. Finlayson and D. Skaar. 2017. Exploring options for eradication of Smallmouth Bass in Miramichi Lake. Report prepared for the Working Group on Smallmouth Bass Eradication in Miramichi Lake. September 2017.

had a confirmed population of Smallmouth Bass (van den Heuvel et al. 2017<sup>25</sup>; DFO 2013; DFO 2009). The other waterbodies in Gulf Region that contain Smallmouth Bass are in Nova Scotia. To date, there is no other confirmed population of Smallmouth Bass in the Gulf Region of New Brunswick so there is no chance of passive reinvasion via contiguous water bodies. Illegal reintroduction of Smallmouth Bass by humans would be the sole vector for reinvasion into Miramichi Lake.

3. *Role of Province of New Brunswick* – The Province of NB has confirmed that they have equipment and human resources that could be diverted to the project. Pending approval, project logistics would be planned with DFO, the Province and other project partners to determine capacity, expertise and specific roles required for successful execution of the work.
4. *Dead Fish Collection Plan* – A combination of shore-based and boat-based surface collection using dip nets will be used for one week, if necessary longer, following treatment. Effort will be focused on the eastern side of the lake where all of the camps are located. The number of boats and land staff required is dependent on the amount of dead fish present, usually not more than 30% of the itchyofauna present. This will improve the aesthetics around the lake by minimizing the number of dead fish. Two nearby sites on provincial crown land have been identified as potential disposal sites. Both sites are greater than 30m from a watercourse. Site 1 is an old gravel pit approximately 200m to the southeast of the public boat launch with coordinates 46°26'58.57"N, 66°57'28.36"W. Site 2 is located 1.2km to the west of the public boat launch at the end of a forest road at 46°27'3.79"N, 66°58'35.48"W. We will work with the Department of Environment and Local Government to finalize which site is most appropriate and apply for necessary provincial permits.
5. *Permit for Temporary Fish Containment Facility Water Supply (UPDATE: Stand-alone Re-establishment Plan provided in APPENDIX D with no requirement of holding fish on-site)* – An application has not yet been submitted for a provincial WAWA permit, nor is it necessary as a precondition of the AIS application process as identified on the application itself: “*Notwithstanding any Authorization received subsequent to this application, the Proponent must ensure compliance with all other relevant provincial and federal legislation and regulations...*”

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<sup>25</sup> van den Heuvel, M., C. Pater, B. Finlayson and D. Skaar. 2017. Exploring options for eradication of Smallmouth Bass in Miramichi Lake. Report prepared for the Working Group on Smallmouth Bass Eradication in Miramichi Lake. September 2017.

6. *Consultation with New Brunswick for Environmental Compliance (UPDATE: DELG has determined no EIA is required because the risk of further SMB spread and its permanent consequences outweighs the temporary risks of a treatment)* – We have established contact with DELG regarding the Environmental Impact Assessment process.

## **VI. Section 35(1) of Fisheries Act Information**

1. *Watercourse Crossing Construction* – No
2. *Shoreline Alteration* – No
3. *Reductions in Water Flow* – No
4. *Habitat Alteration Associated with Fish Removal* – No
5. *Fording Sites* – No

## **VII. Aboriginal Communities' and First Nations' Concerns**

1. *Impacts to Native Fish Communities* – Addressed in the AIS application and in the responses to the request for more information.
2. *Impacts to Aquatic Invertebrate Species* – Addressed in the AIS application and in the responses to the request for more information.
3. *Risk for Smallmouth Bass Reintroduction* – Addressed in the AIS application and in the responses to the request for more information.
4. *Less Destructive Means of Smallmouth Bass Eradication* – In 2010, DFO initiated a 3-year containment, control program using physical removal methods of electrofishing, gillnetting and fyke-netting. Eradication was not achieved since all life-history stages of Smallmouth Bass are still present to this day (DFO 2013). The effort demonstrated that eradication of Smallmouth Bass using physical methods is difficult given the moderate size of Miramichi Lake (220 ha), summer warm water temperatures ( $\leq 28.7^{\circ}\text{C}$ ) and ample spawning substrate. The control program has had impacts on other species in the lake. The extensive fishing effort with gillnets resulted in the detectable reduction in the abundance of other species including White Perch, White Sucker and Yellow Perch (DFO 30103). Furthermore, DFO's barrier at the lake outlet has an impact on natural migratory patterns of alewives.

The report prepared for the Working Group on the Smallmouth Bass Eradication in Miramichi Lake, van den Heuvel et al. (2017), assessed several eradication options including the control and reduce method that has been used by DFO from 2009 until present, biological control and genetic methods (i.e., predators and pathogens), explosives (i.e., depth cord), dewatering and genetic manipulation (i.e., sterile fish). In summary they concluded that control and

reduce strategies are ineffective worldwide, and that in many circumstances eradication is only attained through the use of chemical means or in theory, dewatering. It is impractical to dewater Miramichi Lake given its location and geography. Rotenone is the only chemical registered in Canada under PMRA for fish control, and it is more successful than the other suppression efforts in attaining eradication (Meronek et al. 1996<sup>26</sup>). It is safe to use by humans, and is a widely used and well understood method (including in Canada) for controlling unwanted invasive species with a high likelihood of success at Miramichi Lake. In summary, there are no less destructive means of attaining Smallmouth Bass eradication in Miramichi Lake. It is well established that the native ecosystem recovers quickly after a rotenone treatment and the overall impact is temporary; this contrasts to DFO's current long term control and reduce program that is having significant impacts on the lake's fish community.

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<sup>26</sup> Meronek, T., P. Bouchard, E. Buckner, T. Burri, K. Demmerly, D. Hateli, R. Klumb, S. Schmidt and D. Cobel. 1996. A review of fish control projects. *North American Journal of Fisheries Management* 16:63-74.

**DFO Request for Additional Information (2) and NSMDC Response**



Fisheries and Oceans    Pêches et Océans  
Canada                            Canada

Aquatic Invasive Species National Core Program  
343 Université Avenue  
P.O. Box 5030  
Moncton, New Brunswick  
E1C 9B6

December 20, 2019

*Your file    Votre référence*  
19-IGLF-00001

Jim Ward  
North Shore Micmac District Council Inc.  
38 MicMac Road  
Eel Ground, New Brunswick  
E1V 4B1

Dear Mr. Ward

**Subject:    Additional information is required for the review of your request.**

The Aquatic Invasive Species National Core Program (the Program) of Fisheries and Oceans Canada submitted a request for additional information to you on June 24, 2019. The Program received your response to this request for additional information on September 13, 2019. The Program has also received your request to increase the scope of your project to include approximately 10 kilometers of the Southwest Miramichi River on November 21, 2019.

On December 19, 2019, a science peer review report entitled “Review of elements of proponent application to use rotenone for the purpose of eradicating Smallmouth Bass (*Micropterus dolomieu*) from Miramichi Lake, New Brunswick. DFO Can. Sci. Advis. Sec. Sci. Resp. 2019/040” has been published on the Canadian Science Advisory Secretariat (CSAS) website ([http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ScR-RS/2019/2019\\_040-eng.html](http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ScR-RS/2019/2019_040-eng.html)).

The Program has evaluated the information you have provided, as well as the CSAS advice received, to determine if our questions in relations to your initial project application for the deposit of deleterious substance to control Smallmouth Bass in Miramichi Lake have been addressed. Our review has determined that some information and documentation is still required. In order for us to complete the review of your proposal and to determine if an authorization should be issued for the deposit of a deleterious substance to control the targeted aquatic invasive species (AIS), we ask that you provide the following additional information:

Pesticide treatment:

The characterization of the inlet tributaries of the lake identified as being intermittent in the application is not consistent with field observations by DFO staff that have conducted work in the area. For example, the first section of Four Mile Brook is swampy with minimal change in elevation up to about 1 km upstream. Additionally, the channel configuration of the lower section of some of these brooks are complex. All brooks associated to the lake need to be properly surveyed to identify the most appropriate locations for drip stations. We ask that you provide a detailed survey plan to characterize the inlet tributaries, including criteria that will be used for determining drip station locations.

Canada

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For complete removal of target fish from an area it is imperative that all habitats capable of supporting target fish are treated, unless there is conclusive evidence that the target fish are absent. It is the Programs understanding that you are proposing to conduct an electrofishing survey of all inlets to the lake prior to treatment to assess the presence of Smallmouth Bass. We ask that you provide detailed information on the proposed electrofishing survey, including timelines, extent of the survey and level of effort to be conducted. Please keep in mind that the characterization of inlet tributaries will help inform your electrofishing survey.

Survival of target fish can result from insufficient and inaccurate project area mapping of the treatment area. It is imperative that the entire treatment area be surveyed for potential treatment efficiency weaknesses such as upwelling groundwater (i.e. seeps / springs), barriers to water movement including but not limited to aquatic vegetation, marshy areas, and beaver dams. We ask that you provide all relevant information including location of all potential treatment weaknesses in the treatment area and how they will be addressed to minimize eradication failure.

It is essential to utilize accurate and up-to-date water volume and flow data in the planning and execution of the proposed project. Some physical characteristics and hydrological features provided in your application are not consistent with values reported elsewhere in the literature. The estimated mean annual flow of 0.45 m<sup>3</sup>/s provided for Lake Brook does not concord with previously reported estimates. According to Chaput and Caissie (2010), the mean annual lake outflow was estimated to be 1.06 m<sup>3</sup>/s and the combined mean annual flow from Miramichi Lake and Lake Brook was 1.38 m<sup>3</sup>/s. Additionally, there are discrepancies between available documentation of the estimated volume of Miramichi Lake. The New Brunswick Department of Energy and Resource Development lake depth database reports that Miramichi Lake has a surface area of 2.24 km<sup>2</sup> and a volume of 5.790 million m<sup>3</sup>, which is almost half the estimated volume of 11.492 million m<sup>3</sup> provided in your application. The mean annual flows and lake volume estimates of the project need to be verified and validated. We ask that you provide accurate estimates of water flow and lake volume, as well as description of how the estimates were determined.

#### Species at Risk:

In your response you have indicated that a systematic mussel survey of Miramichi Lake has been conducted by Anqotum Resource Management during the week of September 15, 2019. We ask that you provide a detailed stand-alone report from this investigation. Ensure that the report includes the detailed survey protocols, sampling locations (i.e. map, GPS locations, etc.), level of sampling effort and results.

#### Re-establishment strategy:

A re-establishment strategy was proposed in your application however, a detailed formal re-establishment strategy has not been provided to the Program. In order to be considered as potential mitigation for impacts to fish and fish habitat, we ask that you provide a formal stand-alone detailed re-establishment plan. In addition to information already provided, the re-establishment plan must include a well-defined objective (i.e. targeted outcome) for the re-establishment efforts, biological information of fish to be reintroduced (e.g. age class, sexual maturity, etc.) and details related to the proposed temporary containment. Sufficient details are required around the proposed stream water diversion to feed the fish holding tanks in order to evaluate the activities against the Fish and Fish Habitat Protection and Pollution Prevention provisions of the *Fisheries Act*. The science peer review mentioned above provides information

for your consideration in section "Validity of proposed mitigation measures to "offset" the impacts described above, in particular the effectiveness of proposed re-establishment strategy" when addressing this request.

**Monitoring:**

It is DFO's understanding that you are proposing 3 types of monitoring which can be classified as 1) treatment application monitoring; 2) eradication efficiency monitoring; and 3) environmental impact monitoring. The Program requires an unambiguous stand-alone monitoring plan with associated protocols for our assessment. We ask that you provide monitoring activities broken down by monitoring type described above. Ensure to clearly include monitoring objectives, assessment criteria, sampling locations and frequency, monitoring timelines and any pre-treatment monitoring required for comparison purposes.

**Proposed increase of treatment area:**

As a result of your request to increase the proposed treatment area to include approximately 10 kilometers of the Southwest Miramichi River where Smallmouth Bass have been confirmed, the Program will require a detailed project description in order to amend the current project. We ask that you provide all project amendment information using the Request to Authorize the Deposit of a Deleterious Substance application form. Ensure to clearly include all changes to the current project application resulting from the proposed amendment.

If it is felt there is a need to clarify the information being requested by the Program, we would be available to discuss in further detail. If this is the case, please let us know and we will schedule a meeting at the earliest convenience.

If you have any questions or want to schedule a meeting, please contact me directly at our Moncton office at 506-851-7244, or by email at [XGLFInvaders@dfo-mpo.gc.ca](mailto:XGLFInvaders@dfo-mpo.gc.ca). If any part of your current proposed project has changed please advise the Program immediately referencing your file number above.

Yours sincerely,



Daniel Bourque  
Aquatic Invasive Species Regional Coordinator Biologist

Cc. Fabiola Akaishi (DFO), Guy Robichaud (DFO), Paulette Hall (DFO)

**Response to Aquatic Invasive Species National Core Program of DFO (dated December 20, 2019) Regarding 2<sup>nd</sup> Request for Additional Information for the Application to Eradicate Smallmouth Bass from the Miramichi Watershed (19-IGLF-00001)**

Submitted by: North Shore Micmac District Council Inc.

Submitted to: Fisheries and Oceans Canada (Gulf Region)

Date: April 7, 2020

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**Question 1**

The characterization of the inlet tributaries of the lake identified as being intermittent in the application is not consistent with field observations by DFO staff that have conducted work in the area. For example, the first section of Four Mile Brook is swampy with minimal change in elevation up to about 1 km upstream. Additionally, the channel configuration of the lower section of some of these brooks are complex. All brooks associated to the lake need to be properly surveyed to identify the most appropriate locations for drip stations. We ask that you provide a detailed survey plan to characterize the inlet tributaries, including criteria that will be used for determining drip station locations.

**Response: Characterization of Inlet Tributaries and Drip Station Placement**

Inlet tributaries will be surveyed and characterized at the latest by mid-July, with GPS locations and flagging tape identifying the point at which each stream enters the lake. The criterion to identify this confluence point for each inlet tributary includes where the gradient of flowing water from the stream meets the gradient of the lake water level (i.e., where discernible flowing stream water ends and begins to be back-flooded by the lake's water level). This approach ensures that flowing waters are effectively treated with the drip stations, and other non-flowing areas are treated with backpack sprayers as part of the broader lake treatment. These areas include the low gradient complex areas near the mouths of some of the tributaries. Note: a lowering lake level throughout the summer will alter how far upstream each inlet stream is back-flooded; however, our approach is conservative because should the flowing portion of the stream extend slightly further downstream with lowering lake level, it will be encompassed in the area treated by the drip stations located upstream. There will be some overlap with the backpack sprayers to ensure coverage at these confluences. Electrofishing will begin upstream from these identified confluence points to search for SMB and to identify drip station locations based on SMB presence/absence. Criteria for determining drip station locations is associated with electrofishing results, hence is provided in the answer to Question 2.

## **Question 2**

For complete removal of target fish from an area it is imperative that all habitats capable of supporting target fish are treated, unless there is conclusive evidence that the target fish are absent. It is the Programs understanding that you are proposing to conduct an electrofishing survey of all inlets to the lake prior to treatment to assess the presence of Smallmouth Bass. We ask that you provide detailed information on the proposed electrofishing survey, including timelines, extent of the survey and level of effort to be conducted. Please keep in mind that the characterization of inlet tributaries will help inform your electrofishing survey.

### **Response (relates to questions 1 & 2): Survey to Characterize SMB Presence in Inlets and Criteria for Drip Station Placement**

Electrofishing surveys of all inlet streams to Miramichi Lake are conducted in July and immediately prior to treatment in late-August/early-September to investigate for SMB presence and determine drip station location. Electrofishing surveys will begin at each confluence where inlets meet the lake (see criterion in response to Question 1), with surveys progressing upstream. The water temperatures of the inlets are noted during the surveys. A crew of three will install a block net across the mouth of each inlet prior to surveying for fish. One person will operate the electrofisher and the remaining two, one of either side of shocker, will net the stunned fish into plastic buckets. All seeps and springs and channels are surveyed for fish. The survey will continue upstream including all channels until no SMB are found for 300 m. The upstream boundaries of SMB inhabitation are noted using GPS coordinates and flagging. Similar to the collaborative efforts to determine distribution of SMB in the Southwest Miramichi River, it is expected that DFO and NB DNRED staff will be involved in determining the upstream distribution of SMB in the inlets to Miramichi Lake.

The collected fish are identified to species and enumerated on a data collection sheet; the fish, with the exception of SMB, are released back into the stream. All SMB are placed in plastic bags and frozen for submission to DFO and later inspection.

Drip stations, and the upstream extent of treating each inlet, will be 300 m upstream of the last SMB found or 100 m upstream from the stream/lake confluence if no SMB are present in the electrofishing surveys. All flowing inlets will have one drip station at a minimum. If required, additional drip stations are placed at 1-h water travel time intervals downstream of the head station and sentinel fish in cages are placed downstream ahead of the next contiguous station. We anticipate that only 1 drip station is required per inlet tributary since these streams are relatively small. Complex areas near the mouths of streams in areas that are backflooded by the lake and have no flowing water will be sprayed by hand using a backpack sprayer containing a 2% solution of Noxfish II to ensure all areas are treated. The response of the sentinel fish in the inlets will determine whether application adjustments are needed.

### **Question 3**

Survival of target fish can result from insufficient and inaccurate project area mapping of the treatment area. It is imperative that the entire treatment area be surveyed for potential treatment efficiency weaknesses such as upwelling groundwater (i.e. seeps / springs), barriers to water movement including but not limited to aquatic vegetation, marshy areas, and beaver dams. We ask that you provide all relevant information including location of all potential treatment weaknesses in the treatment area and how they will be addressed to minimize eradication failure.

### **Response: Efforts to Minimize SMB Eradication Failure through Increased Rotenone Exposure**

All water flowing into Miramichi Lake will be treated with rotenone. The following include anticipated complex areas that require special attention to minimize treatment weaknesses and maximize likelihood of success:

- The inlets are treated using drip stations and/or sprayers as indicated above, and the success of treating the inlets are monitored by in-situ bioassays with sentinel fish of equal or less sensitivity to rotenone than SMB (i.e., Yellow [Marking and Bills 1976] or White Perch [Wujtewicz et al. 1997]) as outlined in SOP 5.1 (Finlayson et al. 2018). Corrective measures including increasing the rotenone dose or the number or placement of drip stations are employed if the sentinel fish are not responding after several hours during application.
- Other difficult areas where SMB may be located include the emergent aquatic weed beds and marshy areas on the lake's periphery. These are sprayed with a 2% solution of Noxfish II using a boat and a gasoline-powered high pressure pump with a firefighting nozzle (see SOP 8.1; Finlayson et al. 2018).
- Any beaver dams found within the treatment area that are impeding the flow of treated water are breached immediately prior to treatment.
- Any upwelling ground water flowing into the treatment area is treated with a combination of Noxfish II and Vectocarb (50:50) as outlined in SOP 13.1 (Finlayson et al. 2018).
- The small east branch tributary to Lake Brook is remote and will be investigated in summer 2020 for best treatment approach, which may include application via a drip station(s), helicopter, or backpack sprayer.

#### **Question 4**

It is essential to utilize accurate and up-to-date water volume and flow data in the planning and execution of the proposed project. Some physical characteristics and hydrological features provided in your application are not consistent with values reported elsewhere in the literature. The estimated mean annual flow of 0.45 m<sup>3</sup>/s provided for Lake Brook does not concord with previously reported estimates. According to Chaput and Caissie (2010), the mean annual lake outflow was estimated to be 1.06 m<sup>3</sup>/s and the combined mean annual flow from Miramichi Lake and Lake Brook was 1.38 m<sup>3</sup>/s. Additionally, there are discrepancies between available documentation of the estimated volume of Miramichi Lake. The New Brunswick Department of Energy and Resource Development lake depth database reports that Miramichi Lake has a surface area of 2.24 km<sup>2</sup> and a volume of 5.790 million m<sup>3</sup>, which is almost half the estimated volume of 11.492 million m<sup>3</sup> provided in your application. The mean annual flows and lake volume estimates of the project need to be verified and validated. We ask that you provide accurate estimates of water flow and lake volume, as well as description of how the estimates were determined.

#### **Response: Miramichi Lake Volume, Lake Brook and Inlets Discharges**

Lake Brook mean annual flow was determined by van den Heuvel et al. (2017) based on a regional flow model using 13 gauged stations in the region with similar precipitation (both Environment Canada and the author's data); the mean annual flow rate of Lake Brook was estimated to be 0.45 m<sup>3</sup>/s. Manual flow measurement at the outlet of Lake Brook on June 22, 2017 showed a flow rate of 0.69 m<sup>3</sup>/s (van den Heuvel et al. 2017). Regardless of mean annual flow calculation from models for planning purposes, an up-to-date flow measurement in Lake Brook will be taken manually immediately prior to treatment in order to calculate the accurate quantity of rotenone formulation required to achieve the treatment concentration. The water velocity in Lake Brook measured immediately prior to treatment will determine the number and placement of rotenone drip stations and monitoring sites. Additionally, flows in the inlets to Miramichi Lake will also be measured directly immediately prior to treatment and used to calculate the correct dosing for the flowing water portions of the treatment area.

The lake volume of 11.49 million m<sup>3</sup> reported in the application was obtained from van den Heuvel et al. (2017); the authors had originally referenced this value from a bathymetric map produced by the province of New Brunswick in 2009. We have re-checked this value with the province to determine its accuracy and method of calculation. Biologist Christ Connell reported that the volume of 11.49 million m<sup>3</sup> from the provincial document from 2009 was incorrect, and resulted from a default setting in ArcMap in the volume calculation tool. The default setting meant that volume was calculated from a bottom plane upwards to the bathymetric TIN surface, whereas the correct calculation is from an upper plane at the lake's water surface downward to the TIN surface. Chris Connell re-calculated the correct lake volume to be **5.36 million m<sup>3</sup>**. This reduces the quantity of rotenone formulation to less than half of the original requirement to achieve the desired treatment concentration of 75 ppb.

### **Question 5**

Species at Risk:

In your response you have indicated that a systematic mussel survey of Miramichi Lake has been conducted by Anqotum Resource Management during the week of September 15, 2019. We ask that you provide a detailed stand-alone report from this investigation. Ensure that the report includes the detailed survey protocols, sampling locations (i.e. map, GPS locations, etc.), level of sampling effort and results.

### **Response: Mussel Survey**

Please see APPENDIX C for the mussel survey and results.

### **Question 6**

Re-establishment strategy:

A re-establishment strategy was proposed in your application however, a detailed formal re-establishment strategy has not been provided to the Program. In order to be considered as potential mitigation for impacts to fish and fish habitat, we ask that you provide a formal stand-alone detailed re-establishment plan. In addition to information already provided, the re-establishment plan must include a well-defined objective (i.e. targeted outcome) for the re-establishment efforts, biological information of fish to be reintroduced (e.g. age class, sexual maturity, etc.) and details related to the proposed temporary containment. Sufficient details are required around the proposed stream water diversion to feed the fish holding tanks in order to evaluate the activities against the Fish and Fish Habitat Protection and Pollution Prevention provisions of the *Fisheries Act*. The science peer review mentioned above provides information for your consideration in section “Validity of proposed mitigation measures to “offset” the impacts described above, in particular the effectiveness of proposed re-establishment strategy” when addressing this request.

### **Response (Question 6): Re-Establishment Strategy**

Please see APPENDIX D for a stand-alone re-establishment strategy.

### **Question 7**

Monitoring:

It is DFO's understanding that you are proposing 3 types of monitoring which can be classified as 1) treatment application monitoring; 2) eradication efficiency monitoring; and 3) environmental impact monitoring. The Program requires an unambiguous stand-alone monitoring plan with associated protocols for our assessment. We ask that you provide monitoring activities broken down by monitoring type described above. Ensure to clearly include monitoring objectives, assessment criteria, sampling locations and frequency, monitoring timelines and any pre-treatment monitoring required for comparison purposes.

### **Response: Monitoring Plan**

Please see APPENDIX E for a comprehensive stand-alone monitoring plan.

### **Question 8**

Proposed increase of treatment area:

As a result of your request to increase the proposed treatment area to include approximately 10 kilometers of the Southwest Miramichi River where Smallmouth Bass have been confirmed, the Program will require a detailed project description in order to amend the current project. We ask that you provide all project amendment information using the Request to Authorize the Deposit of a Deleterious Substance application form. Ensure to clearly include all changes to the current project application resulting from the proposed amendment.

### **Response**

Please see APPENDICES E and F for details related to the expansion of this project to include a section of the SW Miramichi River as a result of SMB being discovered in the river while this application was being reviewed in 2019.

### **References**

Finlayson, B., Skaar, D., Anderson, J., Carter, J., Duffield, D., Flammang, M., Jackson, C., Overlock, J., Steinkjer, J., and Wilson, R. 2018. Planning and standard operating procedures for the use of rotenone in fish management – rotenone SOP manual, 2<sup>nd</sup> edition. American Fisheries Society, Bethesda, Maryland.

Marking, L., Bills, T. 1976. Toxicity of rotenone to fish in standardized laboratory tests. Investigations in Fish Control 72. U.S. Fish and Wildlife Service, Washington, D.C.

Wujtewicz, D., B. Petrosky, R. Dorene. 1997. Acute toxicity of 5% non-synergized emulsifiable rotenone to White River Crayfish *Procambarus acutus acutus* and White Perch *Morone americana*. Journal World Aquaculture Society 28(3):249-259.

van den Heuvel, M., Pater, C., Finlayson, B., and Skaar, D. 2017. Exploring options for eradication of smallmouth bass in Miramichi Lake. Report prepared for the Working Group on Smallmouth Bass Eradication in Miramichi Lake. September 2017.

## Questions from DFO and Proponent Answers

Date: 13 May 2020

Here are 4 key elements that were highlighted by PMRA in which they are seeking clarification on the proposed use and the following label restriction: 1) the label prohibits using Rotenone within 0.5km of drinking water sites, 2) that the product may only be used immediately above lakes, reservoirs and the like and only in streams, 3) the rates for the stream was too high and 4) potential new application method (i.e. drip).

### 1) the label prohibits using Rotenone within 0.5km of drinking water sites

“Do not use water treated with rotenone to irrigate crops or release within ½ km upstream of a potable water or irrigation water intake in a standing body of water, such as a lake, pond, or reservoir.”

As per the label, this product must not be used for irrigation or be used within ½ km of potable water. In order to assess conformity to the registration label, information on all potable water source within a ½ km of treatment area is required by Health Canada. In addition, information on any treated water used to irrigate crops or used for household purposes (e.g. washing dishes and bathing) by nearby cottages is required.

Information on potable water sources should be available through provincial representatives from NB Environment and Local Government, Source and Surface Water Management.

### 2) the product may only be used immediately above lakes, reservoirs and the like and only in streams

“USE LIMITATIONS: Use against fish in streams, ponds, lakes or reservoirs.”

“Avoid contamination downstream/downlake of the treatment area, through release of rotenone treated water, during or after treatment.”

Health Canada (PMRA) brought to our attention that the proposed product currently cannot legally be applied to the Lake Brook or the Southwest Miramichi River. Based on the current registration, the product can be used in lakes, ponds, reservoirs and streams (immediately above lakes and ponds or reservoirs).

There are currently 3 registered rotenone piscicides in Canada: 1) NOXFISH FISH TOXICANT – 14558; 2) PRENTOX NUSYN-NOXFISH FISH TOXICANT- 19985; 3) NOXFISH FISH TOXICANT II – 33247. All 3 are not registered for downstream/downlake and river use.

However, there is a possibility of an emergency use request, which is processed by Health Canada (PMRA) upon request. Through the emergency registration process use downstream/downlake and in river could be allowed if criteria are met. If you wish to pursue

this route please inform us in writing. Additional information can be found here:  
<https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/registrants-applicants/product-application/emergency-use.html>.

**3) the proposed rates for the stream was too high**

**“The maximum application rate for streams is not to exceed 0.05 ppm rotenone.”**

The proposed application rate of 0.075 ppm in the 4 lake inflows would also be a prohibited use. The application rate for the lake inflows must not exceed the maximum application rate of 0.05 ppm rotenone. Proponents need to confirm in writing that the application rate will not exceed the maximum application rate indicated in the label.

**4) potential new application method**

**“Under appropriate circumstances application can be made from shore, by boat, jet boat, helicopter or fixed-wing airplane.”**

Note that application via drip is not included on registered label; however, if product is released below the water’s surface this may be considered the same as application by boat. In order to assess conformity to the registration label, please confirm how the product will be delivered via drip stations. It is our current understanding based on your application, that the product will not be delivered below water as indicated in Figure 5.5 from van den Heuvel et al. 2017 which refers to Finlayson et al. 2010 (SOP 11).

**Reply from Working Group:**

1. The label prohibits use within 0.5 km upstream of a drinking water or irrigation intake site while it is active:

**“Do not use water treated with rotenone to irrigate crops or release within ½ km upstream of a potable water or irrigation water intake in a standing body of water, such as a lake, pond, or reservoir.”**

NB DELG advised us that “there is no drinking water approval to operate for a communal system in that area”. However, we understand from camp owners that there is, in reality, a communal drinking water supply fed by a small inlet tributary to the lake located uphill from the camps (upstream from the lake) and upstream/outside of the proposed treatment area.

Given that we will not be treating any areas within 0.5 km upstream of drinking water or irrigation sites, as per the label, this restriction is not relevant to our proposal.

[Note: Our review of the product label in the United States indicates that the intent of this restriction is to prohibit an intake from taking water for drinking or irrigation of crops

while a rotenone treatment is occurring within 0.5 km upstream of the intake. The intake can be turned off during treatment and opened again when the residues fully dissipate.]

2. The product label states that Noxfish II can be used in “streams, ponds, lakes, or reservoirs.” Therefore, Miramichi Lake, its inlets, its outlet Lake Brook, and the SW Miramichi River should all fall under the use pattern on the label. However, there are no use instructions for free-flowing waters downstream of ponds, lakes, or reservoirs included on the label. This antiquated label needs to be revised and harmonized with existing use patterns in the United States and the European Union. We are pursuing a label revision with the product registrant to clarify these issues for future use.

The label states “avoid contamination downstream/downlake of the treatment area, through release of rotenone treated water, during or after treatment.” Both Lake Brook and the SW Miramichi River could be eligible for treatment according to the label. They are both part of the “treatment area” and downstream impacts would be avoided through deactivation at the downstream end of treatment as per the label. However, similar to the lack of use instructions for rotenone in streams there is insufficient instructions on the label for deactivation with KMnO<sub>4</sub>. This antiquated label needs to be revised and harmonized with existing use patterns in the United States and the European Union.

We have consulted with pesticide regulatory experts and PMRA and know of two ways to correct the lack of information: (1) An Emergency Use authorization, as you suggested, to proceed immediately this year; and (2) Revising the label for longer term use. We are in the process of pursuing both of these actions; consider this our written notification of our intent to apply for an Emergency Use permit through PMRA.

For the application, we require a letter of support or no objection from involved regulatory agencies, this includes DFO and the province of NB. We have submitted a request to the province, and please consider this our request to DFO for a letter of support or no objection for the emergency use. Please treat this with urgency, it is a time sensitive matter as rotenone needs to be ordered in June for an August/September treatment.

3. The Emergency Use application will specify a concentration of rotenone (0.075 ppm) throughout the treatment area including Miramichi Lake, its inlets, Lake Brook and the SW Miramichi River and its inlets (i.e., any lakes, rivers, or streams within the treatment area). This concentration is within the maximum allowed on the Noxfish II label and has been previously justified in the AIS application in response to DFO’s first round of questions (Appendix A of the application).
4. The label stipulates that for use in streams immediately above ponds, lakes, or reservoirs, that the “product must be released below the water’s surface.” In our Emergency Use Permit application, we will specify drip stations with release above the water’s surface in any stream or river within the treatment area as permitted in the product’s other labels abroad.



**From:** Gulf Aquatic Invaders / Envahisseurs aquatiques du Golfe (DFO/MPO) <[XGLInvaders@dfo-mpo.gc.ca](mailto:XGLInvaders@dfo-mpo.gc.ca)>

**Sent:** June 15, 2020 4:54 PM

**To:** [jimward@nb.aibn.com](mailto:jimward@nb.aibn.com)

**Cc:** Nathan Wilbur <[NWilbur@asf.ca](mailto:NWilbur@asf.ca)>; Akaishi, Fabiola <[Fabiola.Akaishi@dfo-mpo.gc.ca](mailto:Fabiola.Akaishi@dfo-mpo.gc.ca)>; Robichaud, Guy <[Guy.Robichaud@dfo-mpo.gc.ca](mailto:Guy.Robichaud@dfo-mpo.gc.ca)>

**Subject:** Request for details of other activities; File 19-IGLF-00001

Good Afternoon M. Ward,

As you may remember, in our initial request for more information DFO had requested you provide information on the following:

“To determine whether the proposed project site preparation contains works, undertakings or activities that could result in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery which is prohibited under subsection 35(1) of the Fisheries Act, provide detailed information if any of the following apply:

1. Watercourse crossing construction (permanent or temporary); **None**
2. Shoreline alteration (e.g. dredging, infilling, boat slip construction, etc.); **None – We will install a temporary floating dock. Note that the installation and removal of seasonal wharves that do not require any construction or excavation during installation or removal do not require a WAWA permit as per the Wetland and Watercourse and Wetland Alteration Technical Guidelines (page 12):**

<https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/WatercourseWetlandAlterationTechnicalGuidelines.pdf>

3. Reductions in water flow (e.g. withdrawals); **None**
4. Habitat alteration associated to fish removal; **None (unless beaver dam breaching qualifies here, and we will pursue a WAWA permit for this activity)**
5. Fording sites” **None**

To this requested information, DFO was informed that no such activities would take place. Much has evolved in this file since this correspondence and it has come to our attention that there is now the possibility of such activities taking place in the proposed project being assessed. For each of the items listed, please confirm if the activities are intended as part of your proposed project. Additionally, if the activity is proposed please provide the requested details which our Fish and Fish Habitat Protection Program (FFHPP) require for their consideration in providing the Aquatic Invasive Species National Core Program (AIS NCP) input/advice for our assessment of the proposed project. Any mitigation/avoidance measures provided by FFHPP for such proposed activities would be included in the Rotenone application authorisation if granted. To avoid delays in the assessment process please provide all necessary details.

1. Beaver dam breaching (if required): This activity was identified in the amended project proposal. A WAWA application will be needed for this activity. Beaver dams should be breached following the WAWA technical guidelines. Information required: site access plan and method of breaching. Typically, DFOs FFHPP would not receive files on this activity from the provincial WAWA staff for review unless specific concerns were raised. **We will pursue a WAWA permit for**

this activity that is described in Appendix B of the amended AIS application. We anticipate that there will be beaver dams on Lake Brook and potentially on the inlet tributaries to the lake. They will be accessed by boat and/or by foot and temporarily breached according to the WAWA technical guidelines. MSA has extensive experience with beaver dam breaching.

2. Build a boat slip and dock at the Lake: This activity was discussed in meetings, however, was never officially submitted as part of your application. A WAWA application will be needed for this activity. The application should include the footprint, details on tree clearing needed, mitigation measures such as sediment and erosion control and a work-in-the-dry plan. It is likely that DFOs FFHPP would receive a request for review from WAWA for these activities. **A temporary floating dock will be installed for the project. It will be built away from the lake and transported to the shoreline. There will be no trees cleared, no permanent structure, no construction in the lake, nor will there be shoreline habitat altered.** The installation and removal of seasonal wharves that do not require any construction or excavation during installation or removal do not require a WAWA permit as per the Wetland and Watercourse and Wetland Alteration Technical Guidelines (page 12):

<https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Water-Eau/WatercourseWetlandAlterationTechnicalGuidelines.pdf>

3. Temporary barrier installation and fish rescue in the Southwest Miramichi River: This activity was discussed in meetings, however, was never officially submitted as part of your application. A WAWA application will be needed for the barrier installation. A section 52 Fisheries General Regulation (FGR) licence to capture fish and a Section 56 FGR (Introduction and Transfer) licence to move the fish to the other side of the barrier. Please provide 1) timeline for the barrier installation (i.e. installation; duration; removal); 2) location of proposed barrier; 3) details of materials used; 4) installation/removal methods; and 5) any mitigation measures to potential constraints/impediments to the completion of the proposed activity (e.g. water flow, water temperature, etc.). It is likely that DFOs FFHPP would receive a request for review from WAWA for these activities. **A brief description of this activity was officially included in Appendix F of the amended AIS application. We will pursue a WAWA permit and the section 52 and 56 permits for this activity as separate regulatory processes. This does not relate to any of the five items listed above from the AIS application, therefore we anticipate this has no bearing on the review of the AIS application.**
4. Please provide details on any other activities that would require a WAWA and/or DFO FFHPP review. If unsure an activity requires a review please contact us to discuss. **N/A**

**From:** Gulf Aquatic Invaders / Envahisseurs aquatiques du Golfe (DFO/MPO) <XGLFInvaders@dfo-mpo.gc.ca>

**Sent:** July 6, 2020 3:23 PM

**To:** jimward@nb.aibn.com

**Cc:** Nathan Wilbur <NWilbur@asf.ca>; Akaishi, Fabiola <Fabiola.Akaishi@dfo-mpo.gc.ca>; Robichaud, Guy <Guy.Robichaud@dfo-mpo.gc.ca>

**Subject:** Request for confirmation/clarification on proposed deposits; File 19-IGLF-00001

Good afternoon M. Ward,

DFOs Aquatic Invasive Species National Core Program (AIS NCP) is requesting confirmation, as well as some clarifications in relation to proposed deposits and treatment/deactivation areas. Please provide the following information based on your preferred and most effective approach to conduct both the lake and river treatments simultaneously.

- 1) It is DFOs AIS NCP understanding that there are 2 proposed deactivation stations. Is this correct?

**Answer:** There would be two deactivation stations only if the lake and river are treated separately. Our preferred option is to treat the lake, Lake Brook, and the river simultaneously, in which case there would only be one deactivation station located at the furthest downstream extent of the river treatment reach.

This would mean that rotenone-treated lake water would be discharging into the SW Miramichi River for several days after the river was treated and deactivated. This is inconsequential because the river will have been just treated and will be treated again in the coming weeks, and mitigation measures will still be in place holding adult salmon downriver behind the barrier safe outside of the treatment reach. However, to be conservative, the deactivation crew will remain on-site on the river with adequate resources to further deactivate until sentinel brook trout can survive. This will ensure that rotenone from lake discharge has deactivated to safe/undetectable levels at the downstream extent of the treatment area.

At the end of the treatment and deactivation of the SW Miramichi River (1.25 days after starting), there should be 56.2 ppb rotenone in Miramichi Lake. Based on discharges, we expect the river:brook dilution level to be at least 10:1, in which case the estimated duration to reach the desired <2ppb with dilution level in the river is 5 days. This is considered conservative because it does not take into account the effect of natural deactivation of lake water through photolysis and metabolic pathways while it flows through the ~7km of Lake Brook.

- Deactivation station in Lake Brook (at confluence with Southwest Miramichi River) and is expected to run for 7 days. Is this correct?

**Answer:** This deactivation station is only necessary if the lake/Lake Brook component is treated at a different time than the river component, and in this case it would run for 7 days. However, as explained above, we wish to treat the river and lake simultaneously for efficiency and effectiveness, in which case there would only be one deactivation station at the downstream extent of the entire treatment area on the river.

- Deactivation station in the Southwest Miramichi River (downstream of the proposed treatment area) and is expected to run for 1 day (Is that per treatment if a second treatment is conducted?). Is this correct?

**Answer:** Correct. The deactivation station on the river will be at the downriver extent of the treatment reach and will operate approximately for 24.75 hours (Appendix G of the amended AIS application) for each of the two proposed river treatments. It is possible that the run time may be shorter. We will oxidize the river bed each time until the oxidation-reduction reaction stabilizes. Because rotenone-treated lake water will be discharging into the SW Miramichi, the deactivation crew will remain on-site until sentinel brook trout survive in the river water as explained above.

- 2) Please confirm if the proposed treatment section of the Southwest Miramichi River will be treated twice.

**Answer:** Yes, we propose to treat the river section and Lake Brook twice. The reason for a second treatment is that there are more places for fish to avoid treatment in complex riverine environments; repeating a treatment thus increases the likelihood of eradication as fish will move to other locations over time and the parameters of no two treatments are exactly the same.

- 3) If a section of the Southwest Miramichi River is proposed to be treated twice please provide details around timelines

- Will there be a gap between treatments? If so, specify timeframe (i.e. next year, following week, following day, ...).

**Answer:** The second treatment is planned to be approximately 30 days after the first treatment concludes, but the gap may be slightly shorter or longer depending on environmental conditions. The exact timing will depend on weather and flow conditions. For example, if there are high flows after the first treatment, we may need to wait for flows to subside before the second treatment. Optimally, the first treatment would be in August, followed by the second in September, avoiding having to hold adult salmon at the downriver barrier too close to the spawning period. Salmon will need time to migrate and reach their preferred spawning areas in October.

- 4) How will the deactivation station be run, taking into account multiple treatments? Will there be a pause? Will the streambed need to be oxidized again prior to treatment? Provide details.

**Answer:** Deactivation will occur after each of the two river treatments with a gap in between dictated by the timing of the treatments. As explained above, the deactivation crew located at the downstream extent of the treatment area on the river will remain prepared to further deactivate rotenone-treated lake water discharging from Lake Brook into the river for several days until sentinel brook trout can survive. The purpose of oxidizing the streambed is to eliminate interferences with oxidizing rotenone, and it is possible that oxidizable materials will redeposit in the streambed in the interim between the two treatments. We are planning to oxidize the streambed twice, each time until the oxidation-reduction reaction, in the absence of rotenone, stabilizes.

- 5) How is Lake Brook going to be treated? It is DFOs AIS NCP understanding that multiple drip stations will be placed along Lake Brook to ensure that the proposed Rotenone concentration is maintained. Since these are flowing waters will this section also be multiple times? Please

provide details around treatment frequency, duration of the treatment (i.e. Rotenone); duration of deactivation (noted in application: expected deactivation is 7 days)

**Answer:** Our intention is to treat all waters downstream of Miramichi Lake twice. The 6-h duration of treatment will be the same as for the SW Miramichi River and will occur at the same time for each of the two treatments. Deactivation will occur at the downstream extent of treatment on the SW Miramichi River (note: the treated waters of Lake Brook will be deactivated for 7 days only if the treatment of Miramichi Lake and Lake Brook occur at a different time than the SW Miramichi River, but that is not the preferred approach).

- 6) Appendix E mentions “LB1; deactivation location subject to change if river is treated simultaneously”(LB1 is in Lake Brook) How would it change? Please specify.

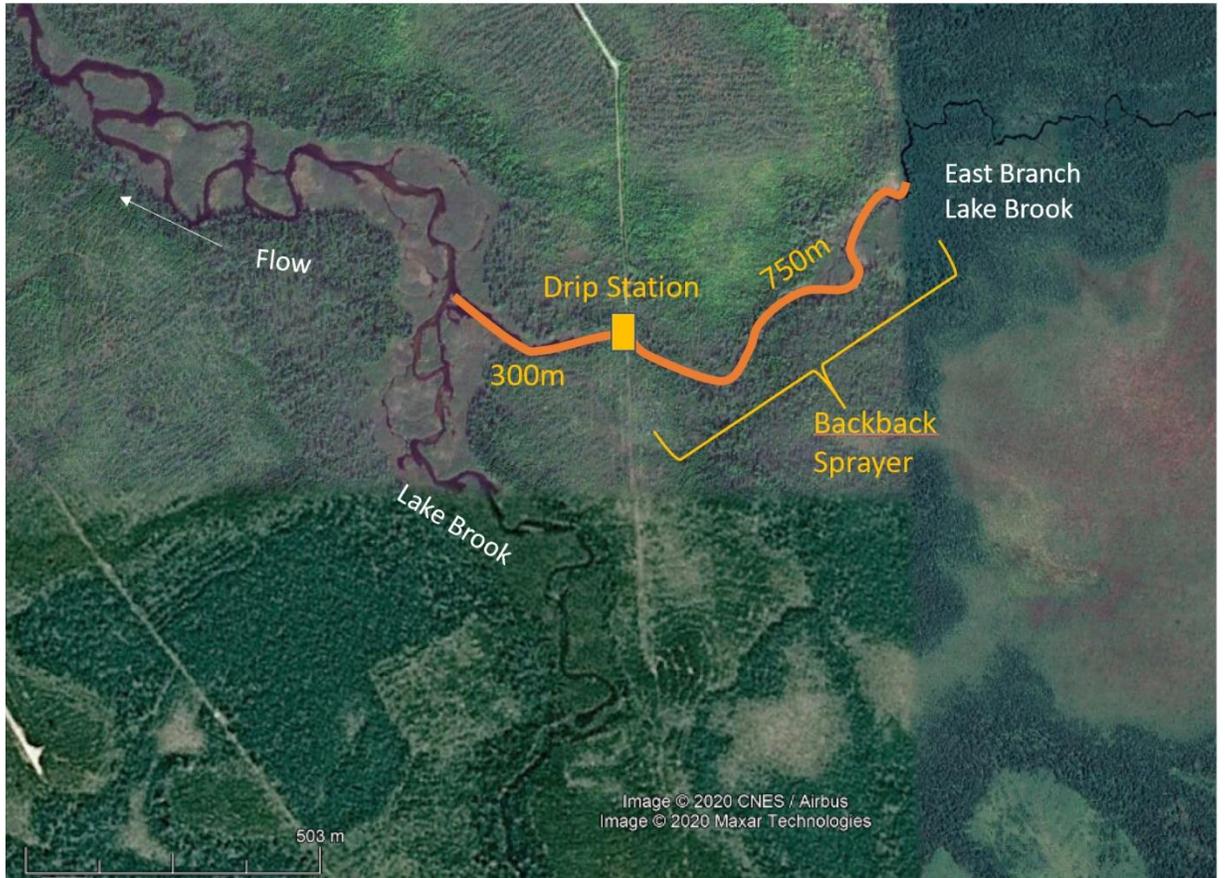
**Answer:** If the river is treated simultaneously, there would be no deactivation station on Lake Brook (i.e., at LB1) because both Lake Brook and the river would be being treated. The deactivation will occur at the downstream extent of the entire treatment area on the river.

- 7) How long will the proposed drip stations in the lake inlets be maintained (i.e. duration of treatment).

**Answer:** The drips will begin 1 to 2 hours prior to the lake treatment and will continue for the duration of the 2-day treatment.

- 8) Appendix B states “The small east branch tributary to Lake Brook is remote and will be investigated in summer 2020 for best treatment approach, which may include application via a drip station(s), helicopter, or backpack sprayer.” Has the best treatment approach been determined? Unless helicopter application has been ruled out, provide details around how product will be delivered through this method.

**Answer:** We have not finalized a plan for East Branch Lake Brook yet. However, our tentative plan is to treat the lower 300 m section of the brook with a drip station installed at the old road crossing, and then treat by backpack sprayer for an additional 750m upstream of the old road crossing (see map below).



Map 1. Tentative treatment approach for East Branch Lake Brook.

- 9) Please summarize timelines/order of treatments and deactivation in relations to one another. Provide details around treatment and deactivation duration, timing, overlap, etc.

#### Treatment 1: Miramichi Lake, Lake Brook, SW Miramichi River

- Time 0h: Begin drip stations on 5 inlets to Miramichi Lake and possibly hand spray marshy areas if necessary (duration: covering the 2 days of lake treatment)
- Time 1-2h: Begin treatment of Miramichi Lake (duration: 2 days)
- Time 1-2h: Begin drip stations on Lake Brook, East Branch Lake Brook, and backpack spraying (duration: 6 h)
- Time 2 h: Begin treatment of SW Miramichi at up to 10 sites along 15 km of river, backpack/boat spraying along edges and backwaters, drip stations on tributaries/springs entering river (duration: 6h)
- Time 2 h: Begin deactivation at downstream extent of treatment area on the SW Miramichi River by first oxidizing the streambed to remove interferences to oxidizing rotenone (duration: 24.75h)

#### Treatment 2: Lake Brook, SW Miramichi River ~30 days after treatment 1

- Time 0h: Begin drip stations on Lake Brook, East Branch Lake Brook, and backpack spraying (duration: 6 h)

- Time 0h: Begin treatment of SW Miramichi at up to 10 sites along 15 km of river, backpack/boat spraying along edges and backwaters, drip stations on tributaries/springs entering river (duration: 6h)
- Time 0h: Begin deactivation at downstream extent of treatment area on the SW Miramichi River by first oxidizing the streambed to remove interferences to oxidizing rotenone (duration: 24.75h)

**Question:** It is DFOs AIS NCP understanding that the proposed Rotenone treatment rate is 0.075 ppm for all treatment areas (i.e. lake inlets, Miramichi Lake, Lake Brook and the section of the Southwest Miramichi River). It is also our understanding that the proposed Potassium Permanganate deactivation rates are 4ppm with a residual concentration of 1ppm at all deactivation locations. Please confirm if our understanding is correct.

**Answer:** Your understanding is correct, the proposed treatment concentration is 0.075 ppm for all treatment areas. For deactivation, your understanding is also correct, proposed treatment rate of 4 ppm, with a residual of 1 ppm  $\text{KMnO}_4$  30 minutes water travel time downstream of the deactivation station on the SW Miramichi River. Maintaining the 1 ppm residual downstream is the important point here. To maintain this residual, because of varying amounts of  $\text{KMnO}_4$  demand in the water and streambed and rotenone concentrations, treatment levels of  $\text{KMnO}_4$  will be adjusted accordingly based on downstream feedback.

If the lake and river are treated separately (not preferred), we would have a deactivation station in the lower end of Lake Brook (LB1) to deactivate Lake discharge. In this case, we propose to maintain 4 ppm residual of  $\text{KMnO}_4$  in the deactivation zone to ensure that (1) rotenone is deactivated by the time it reaches the SW Miramichi River, and (2) that lethal conditions are sustained in the lower reach of the brook given that SMB distribution includes the brook. Upon flowing into the SW Miramichi River, the 4 ppm  $\text{KMnO}_4$  will be immediately diluted to non-lethal levels, and the rotenone will have been deactivated.

## Answers to DFO Questions on AIS Application

**Date:** 15 July 2020

**Subject:** Floating dock on Miramichi Lake and Atlantic salmon mitigation activities on the Southwest Miramichi River

Good Afternoon Daniel,

Please find below answers to your questions regarding the dock location and the salmon barrier for mitigation activities. I have also attached as a PDF so we can keep written records of all these rounds of questions.

**Question:** Clarification on the type of dock being proposed for this project is much appreciated, have you chosen a location for the floating dock? Because you mention no trees will be cleared DFO presumes that the dock will be put into the lake at public boat launch, is this correct? DFO also presumes that the boats used for the proposed work will also be put into the lake using the same boat launch. DFO would like to point out that at low water levels this the boat launch area is very shallow and could be very difficult to use as a “base station” (i.e. chemical transfer station for the boat application). Last year in the fall, DFO had to walk our boat out a great distance to deeper waters, because even the weight on one person in the boat was enough to have it touch bottom rendering it immobile. Which mean that the proposed floating dock may be resting on the bottom if it is planned for this area. Traveling back in forth under such shallow conditions with the applicator boats for refilling application equipment (i.e. transfer of Rotenone) may not be feasible. If this is the area you are proposing for your “base station” it would be advisable to assess the area to avoid any unforeseen surprises/delays.

**Answer:** Our proposed location for the floating dock is at the public boat launch access point at Miramichi Lake. We recognize that it is very shallow at this location and are exploring options to either have a very long dock into deep water, or to have a pumping system from land out to an anchored floating dock to refill boats with Noxfish Fish Toxicant II. We will keep you apprised of any details related to this and if our approach changes and requires a WAWA permit, we will apply for the necessary permit; however, with our current approach a WAWA is not required for this activity. We will follow your advice and conduct another on-site assessment of the boat launch area to finalize plans for this activity.

**Question:** DFO has read your brief description of the temporary barrier installation and fish rescue in the Southwest Miramichi River that was officially included in Appendix F of the amended AIS application as part of our review. Could you please confirm if the mitigation measures being explored (i.e. appendix F) for the river treatment will be implemented as part of your project? Since a temporary barrier and fish rescue would be considered as mitigation measures to reduce the impact of the deposit on fish species, DFO would require the requested information to assess the impact to fish and fish habitat as part of the review of the AIS application. If this activity is still being proposed, please provide sufficient details for the previously requested information 1) timeline for the barrier installation (i.e. installation; duration; removal); 2) location of proposed barrier; 3) details of materials used; 4) installation/removal methods; and 5) any mitigation measures to potential constraints/impediments to the completion of the proposed activity (e.g. water flow, water temperature, etc.). DFO must consider the impact of all

activities in it's review, even mitigation activities, since in this case they may have impacts on migrating species.

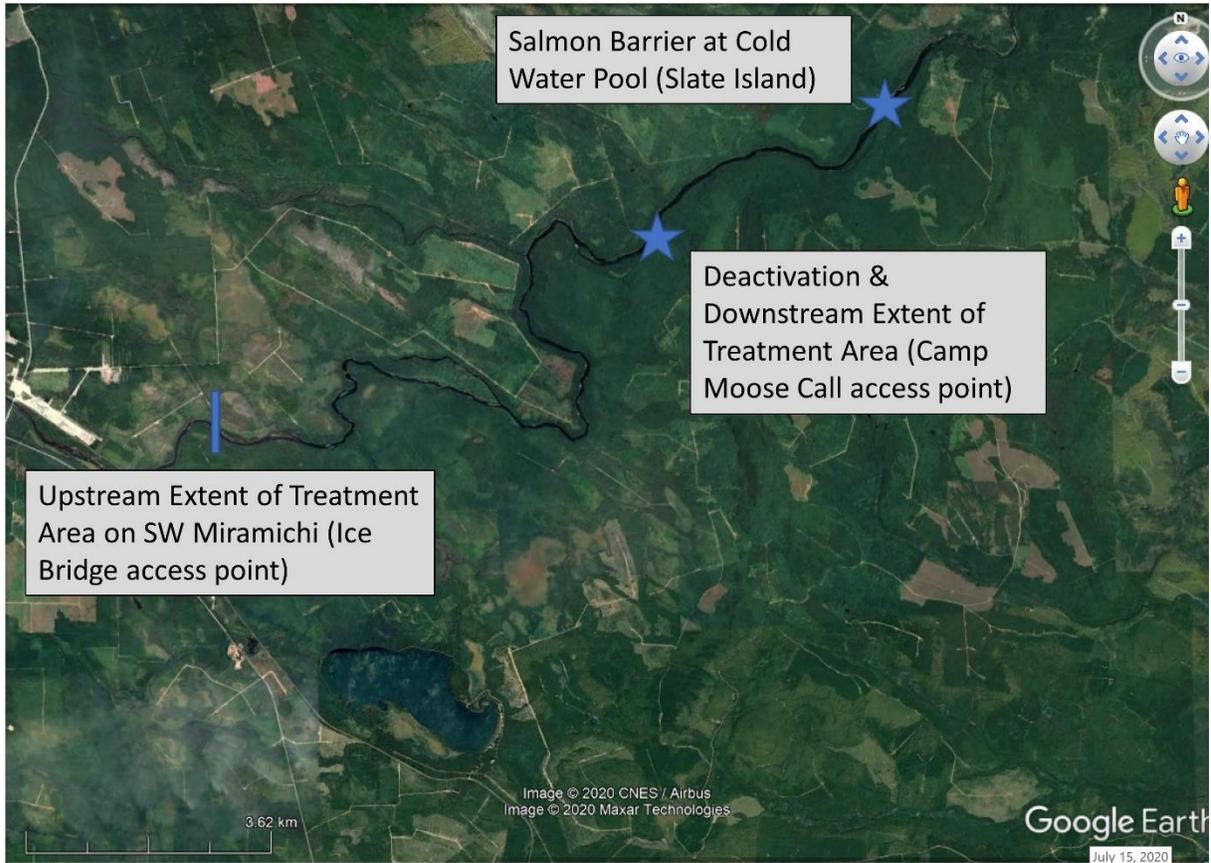
**Answer:** Yes, we will implement a salmon rescue and salmon barrier on the Southwest Miramichi to mitigate against the impacts of the treatment to Atlantic salmon and other large fish that may migrate into the treatment area. Since the river stretch will be treated twice (objective is 30 days between treatments), the preferred timing is to treat in late August and again in late September. The barrier would be removed after successful deactivation of rotenone after the second treatment, and this would allow the salmon time to migrate to their preferred spawning locations.

The fish rescue in the treatment area will consist of seining known cold water holding pools to capture and relocate salmon to below the barrier at Slate Island (see map) where there is a cold water refuge. The barrier will be installed in mid August approximately 2 weeks prior to the first treatment, providing time for the fish rescue to occur. During this time of year, most of the salmon will be aggregating in cold water holding pools in the treatment area, of which there are very few on the proposed treatment reach, making it easier to target salmon for the fish rescue. Near the mouth of McKiel Brook is an example of a known salmon holding area in summer. Other suspected pools in the reach will be snorkeled to investigate for salmon and will be seined based on what is observed and in consultation with DFO during the rescue process. Fish relocation will be via helicopter or by tank and truck depending on the remoteness of the location.

Below are answers to the specific questions on the barrier:

- 1) A barrier will be installed below the treatment area at Slate Island (see map), approximately 4.5 km downriver of the deactivation station at Moose Call in "a safe zone" about 2 weeks before the first treatment. The barrier would be installed in mid August and removed after the second river treatment in late September. The advantage of this site is good access, physical river conditions suitable for a barrier, and a cold water holding pool for Atlantic salmon. This will prevent adult salmon and other larger fish such as suckers from moving into the treatment zone. During the treatment, small mesh netting will be placed on the barrier to capture dead fish floating downriver from the treatment area.
- 2) The preferred location is Slate Island (see map) given the current understanding of the distribution of smallmouth bass in the river and based on our proposed deactivation site. The location may change depending on the distribution of smallmouth bass from eDNA surveys in 2020.
- 3) The barrier is made of metal and consists of tripods placed every 10' joining 2 horizontal channel irons with holes drilled in them to allow conduit pipe to go through the 2 channels to form a barrier wall. This is a commonly used type of salmon barrier and similar to the one DFO uses at the outlet of Miramichi Lake. Rebar will be driven into the substrate above the tripods to attach a cable to the tripod for support.
- 4) The barrier is installed and removed by hand, using simple tools. It is a labour intensive operation and getting the material to the shore is extremely important.
- 5) Barriers can be very effective in blocking fish migration, but are susceptible to high water events. If there is a high water event, then the rotenone application would be delayed allowing

time to repair the barrier. The fish rescue effort would then become more intensive to capture any adult salmon in the treatment area.



Map 1. Salmon barrier location in relation to the proposed river treatment area on the Southwest Miramichi River.

## Answers to DFO Questions on Salmon Barrier and Fish Rescue

Date: 23 July 2020

Hi Daniel,

No problem, please see responses below to your questions.

Nathan

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**Nathan Wilbur, PEng, MScE**

Director, New Brunswick Programs

Atlantic Salmon Federation (ASF)

[nwilbur@asf.ca](mailto:nwilbur@asf.ca) / [506 442-2185](tel:5064422185)

**From:** Gulf Aquatic Invaders / Envahisseurs aquatiques du Golfe (DFO/MPO) <XGLFInvaders@dfo-mpo.gc.ca>

**Sent:** July 23, 2020 2:33 PM

**To:** Nathan Wilbur <NWilbur@asf.ca>; jimward@nb.aibn.com

**Cc:** Akaishi, Fabiola <Fabiola.Akaishi@dfo-mpo.gc.ca>; Robichaud, Guy <Guy.Robichaud@dfo-mpo.gc.ca>

**Subject:** Request for additional information on fish barrier/rescue; File 19-IGLF-00001

Good afternoon Nathan and Jim,

The AIS NCP has reviewed the barrier and fish rescue information provided on July 15<sup>th</sup> and have a few follow up questions to complete our file on this activity.

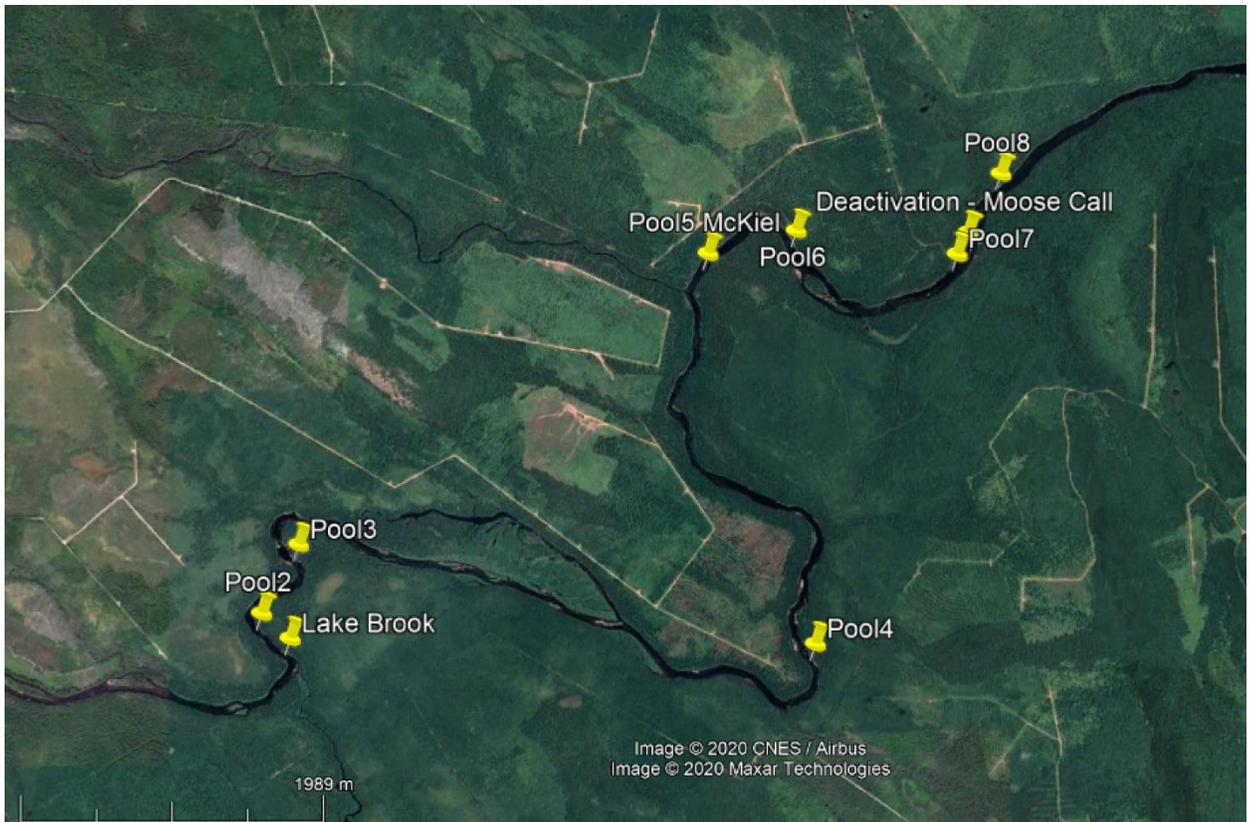
- 1) Please provide GPS coordinates for the barrier location at Slate Island as well as the deactivation station at Moose Call.

Salmon barrier at Slate Island: 46.535262°, -66.880830°

Deactivation station at Moose Call: 46.519050°, -66.925637°

- 2) Will all known salmon pools in the proposed treatment area be snorkel surveyed to determine what pools will be seined for fish relocation? How many pools are within the treatment/relocation area?

The pools are not well defined in this reach, so it is difficult to say exactly how many salmon pools there are. However, based on experience canoeing this stretch several times over the past year, the map provided below shows potential holding areas for salmon that will be snorkeled to investigate for salmon prior to treatment. Given that treatment 1 is proposed to occur in August, this is typically a warm water period which means salmon will be concentrated in cold water refuge pools making them easier to locate. The only known cold water pool within the treatment reach is Tent Pool just below the mouth of McKiel Brook. This will likely be where most of the salmon in the reach are holding during warm water conditions; however, the other areas will also be investigated. The salmon will be relocated to a cold water pool at Slate Island in a safe zone outside of the treatment and deactivation reach.



Map 1. Potential salmon holding areas that will be investigated for salmon presence as part of the fish rescue prior to river treatment.

- 3) Is it your intention to have only one barrier installed (downstream of the proposed treatment area)? At one point, was there not discussions around installation of an upstream barrier as well? Please provide reasoning/implications around the choice of 1 vs 2 barriers.
- Yes, it is our intention at this point to have only one barrier at the downstream end at Slate Island. An upstream barrier may also be of help but due to limitation in fence resources we have chosen to put the barrier at the downstream end as migration is typically primarily in the upriver direction and our goal is to prevent salmon from moving into the treatment reach.

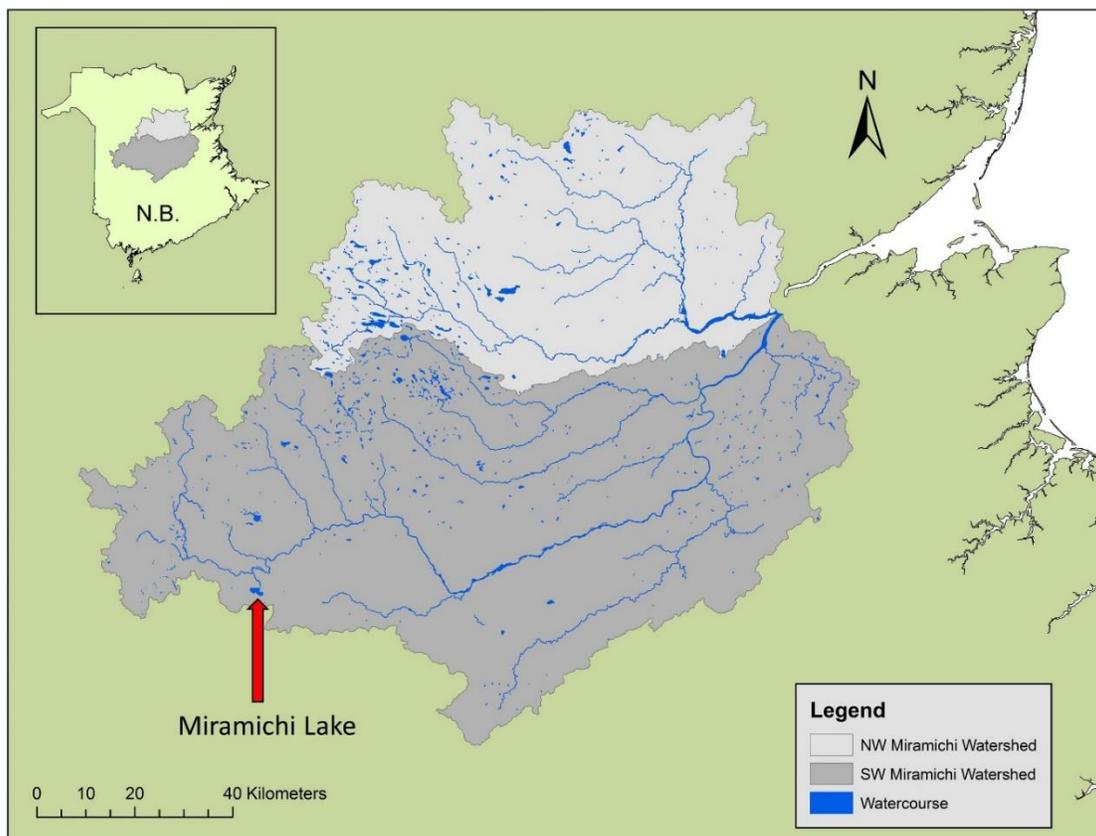
# Proponent Responses to PMRA Questions

## Emergency Use Registration Process

Date: 7 August 2020

- 1- What are the uses of the treated water (e.g. irrigation of crops, swimming, drinking, fishing, household purposes)?

Miramichi Lake is located in a remote area of west-central New Brunswick (Map 1). It has 16 cottages along its shores located on the east side of the lake. The majority of land surrounding the lake includes crown land (province of NB) and industrial freehold forestry land (J.D. Irving, Limited). Cottage owners use the lake for swimming throughout the summer months and there is occasional recreational fishing activity but the lake does not support any well known or popular fisheries for the general public. It is not a fishing destination or typically used by anyone other than the cottagers. The recreational fishing season closes on September 15 each year on the Lake and Lake Brook. There is no agricultural land in the area and neither the lake nor any of the treated waters are used to irrigate crops. For drinking and household purpose water use, please see response to question 2. For recreational uses of Lake Brook and the proposed treatment area of the SW Miramichi River, please see response to question 3.



Map 1. Location of Miramichi Lake in New Brunswick.

- 2- Where are the drinking water intakes relative to the treated water bodies (i.e. are campers/cottage owners drawing water from the treated body? Upstream or downstream of the treatment, within what distance?)

We contacted the NB Source and Surface Water Management Branch under the Department of Environment and Local Government regarding records of drinking water sources around the lake. The response was: “From a drinking water and household perspective, the department doesn’t regulate nor keep track of individual private drinking water systems from surface water bodies. Furthermore, a search all around the Miramichi Lake in our Online Well Log database doesn’t return any well log report. Which means that existing cottages around the Miramichi Lake might have their drinking and household water either from the Lake or from a well drilled before 1994 or from a dug well.”

Through our direct engagement with cottage owners, we understand there are two water sources that are each used for drinking water and household use. The majority of cottages, except two, obtain water from a communal drinking water supply fed by a small inlet tributary to the lake located uphill from the cottages (upstream from the lake) and upstream/outside of the proposed treatment area. Two cottage owners indicated that they share a 20-foot deep shallow well which they believe is fed by groundwater and surface water adjacent to the lake (see Map 2). As potential mitigation measures for the two cottages with the shallow well, we have officially offered those cottage owners three options in writing:

**Email to cottage owner, [REDACTED], on July 15, 2020:**

*We have discussed amongst the group the matter you brought forward about your shallow well that is shared between 2 cottages and is potentially fed in part by surface water from the lake. We have consulted with Brian Finlayson and Steve Maricle to get guidance on what the standard protocol is for lakeside wells. Both of them have had experience with similar situations.*

*The literature and their experience monitoring deep and shallow wells before/after rotenone treatments show that no traces of rotenone or any other formulation ingredients have been found in the well monitoring. Also, rotenone does not travel further than a few centimetres into the soil and is not known to be a groundwater contaminant. This indicates that there should be no impact to your well water; however, we understand your genuine concerns and recognize that drinking water is one of the most basic and important aspects of life anywhere, and that one needs to be comfortable with their drinking water source.*

*As such, we have put together 3 options for you to consider. All 3 options include a request that you not use the well for the duration of the project as a precaution. Should the project go ahead, we offer to:*

- 1. Provide drinking water to your two cottages on the well for the duration of rotenone presence in the lake (2-3 weeks), and test the well water before and after the treatment; or*
- 2. If logistically possible, connect your two cottages to the existing spring water source used by the other cottages that is upstream of the treatment area; or*
- 3. Drill you a new proper deep well with no surface water input*  
*Alternatively, if some combination of these options is favourable to you or you have another option in mind, we are certainly open for discussion on the approach that makes you feel most comfortable.*

Map 2 shows the location of the shallow well that supplies two cottages, including coordinates and the distance from lake shore. The map also shows the location of a spring water source and reservoir tank that supplies most cottages along the lake, located 500 m uphill from Miramichi Lake.



Map 2. Locations of two water sources used by cottages for drinking water and household use adjacent to Miramichi Lake.

The photographs below show the spring water intake location (located 500 m uphill from Miramichi Lake) which runs by pipe into the water reservoir approximately 40 m downhill from the intake.



(a) Spring water intake

(b) Water reservoir fed by spring

***1) With the sampling/analytical method for rotenone planned for monitoring, how soon are results available after sampling? In the application package, please include the proposed monitoring plan.***

The sampling approach monitoring for the shallow well will be as follows:

1. One day pre-treatment of Miramichi Lake,
2. When rotenone is gone from the lake (est. 18-d post-treatment), and
3. One month post-treatment.

A laboratory will analyze water samples for rotenone with an MDL of 1 ppb and a RL of 2 ppb using liquid chromatography (LC) or LC/mass spectrometry (MS) and the methods described by Dawson et al. (1983), Vasquez et al. (2012), and Sandvik et al. (2018). We are only planning on looking for rotenone since the inert ingredients are gone by the time rotenone is gone.

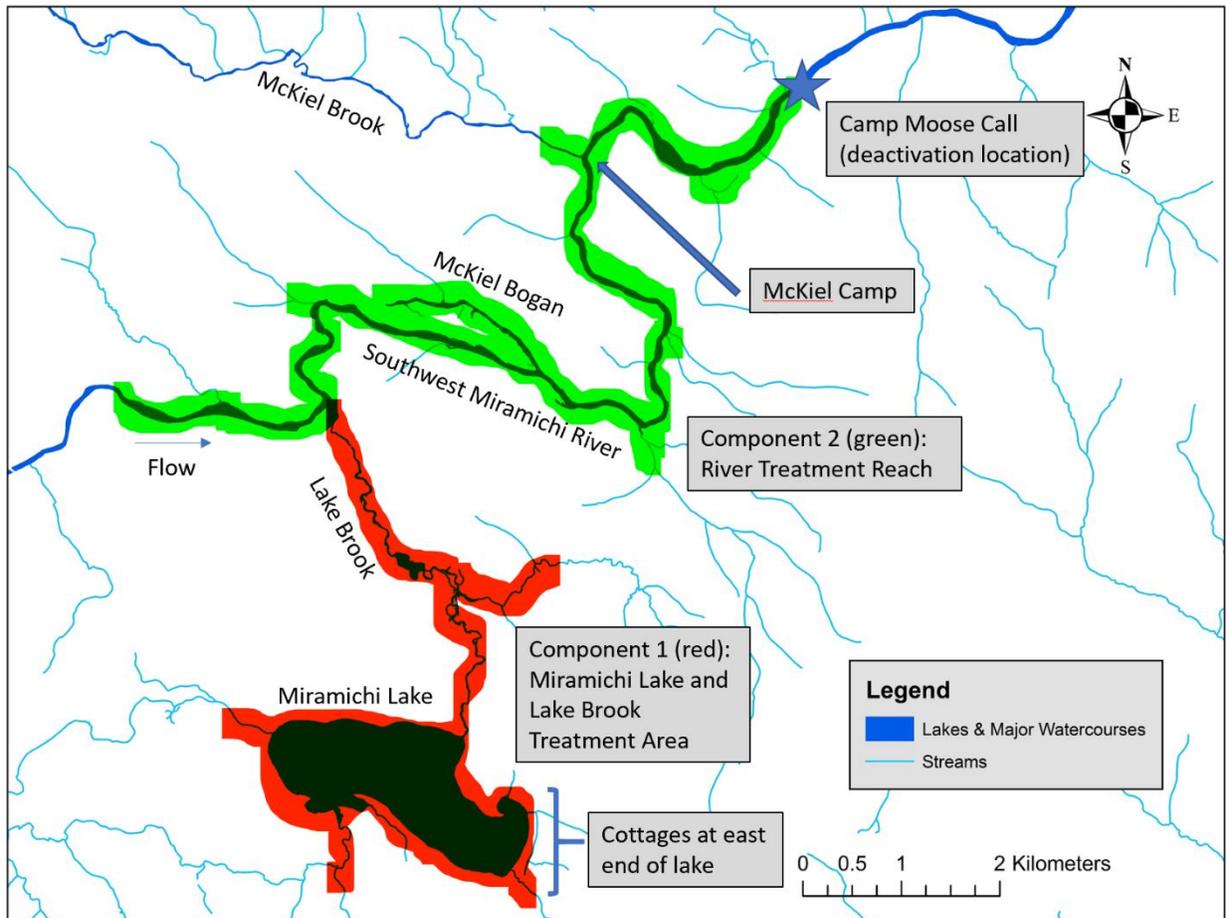
The sample containers, sample volume and analytical turnaround time are dependent on the analytical laboratory. Typically, results can be available within a day or two from a local laboratory. Samples would be collected in duplicate utilizing travel blanks. The well would need to be purged prior to each sampling to ensure that the quality of the water is reflective of the surrounding aquifer. Typically, the well would be sampled from an exterior faucet closest to the well. Most of this is detailed in SOP 16.1 of the Rotenone SOP Manual (Finlayson et al. 2018).

### 3- What activities are expected around the treatment areas (i.e. hiking, camping)?

**Lake** – There are no campgrounds or hiking trails around the lake, thus the area is not normally used by the public for these activities. Cottage owners use the lake for swimming throughout the summer months and there is occasional recreational fishing activity but the lake does not support any well known or popular fisheries for the general public. It is not a fishing destination. The recreational fishing season closes on September 15 each year.

**Lake Brook** – Lake Brook is very remote and is inaccessible by road. Due to its remoteness, it is not normally used for any recreational activity. The sole landowner along both sides of the brook is J.D. Irving, Limited, who is a partner in the eradication project (see their support letter as part of the Emergency Use Registration application package).

**SW Miramichi River** – The proposed treatment reach of the SW Miramichi River is remote, and land access is restricted by controlled gate. There are no public access points via land to this stretch of the river. The sole landowner along both sides of the river is J.D. Irving, Limited, who is a partner in the eradication project (see their support letter as part of the Emergency Use Registration application package). There are occasional canoers that paddle through this reach of river, but not typically in the low water conditions in late summer/early fall when we propose to treat. Signage will notify canoers at the two canoe launch points upriver of the treatment area and at the upstream extent of the treatment area, as well as personnel there operating the drip station to notify any potential canoers. The Atlantic salmon recreational angling season closes on the river on October 15. There is 1 camp on the treatment reach (mouth of McKiel Brook), and 1 camp at the deactivation location (Camp Moose Call) (see Map 3). Both camp owners lease the land from J.D. Irving, Limited, and are in support of the eradication of smallmouth bass.



Map 3. Locations of camps and cottages adjacent to treatment areas.

4- What is the timing, frequency and duration of potential post application activities?

Activities are explained in detail in the AIS application. Post application activities will include:

- Fish collection and disposal period for approximately 2 weeks (Section 5.3 of the AIS application)
- 5-year monitoring program consisting of four components: (1) rotenone treatment monitoring (2) rotenone deactivation monitoring, (3) short-term and long-term SMB eradication monitoring, and (4) ecological recovery monitoring. **See Appendix E of the AIS application for the standalone detailed monitoring plan.** Ecological monitoring will be carried out annually for 5 years with spring, summer, and fall sampling period frequency.
- Testing of the shallow well that supplies two cottages with drinking and household use water (see sampling details in Question 2 above)

## References

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- EPA, 2007. Registration eligibility decision for rotenone, EPA 38-R-07-005. U.S. Environmental Protection Agency, Prevention, Pesticides and Toxic Substances, Special Review and Registration Division, March 2007
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- Sandvik, M., T. Waaler, T. Rundberget, P. Adolfsen, H. Bardal, and R. Sandodden. 2017. Fast and accurate on-site determination of rotenone in water during fish control treatments using liquid chromatography. *Management of Biological Invasions* 9(1): 59-65.
- Vasquez M., Rinderneck, J., Newman, J., McMillin, S., Finlayson, B., Mekebri, A., Crane, D., and R. Tjeerdema. 2012. Rotenone formulation fate in Lake Davis following the 2007 treatment. *Environmental Toxicology and Chemistry* 31(5): 1032-1041.

## Response to DFO Questions Regarding AIS Application

Date: 11 August 2020

Prepared by: The Working Group

Email questions from DFO Gulf Aquatic Invasive Species section:

Good afternoon Jim and Nathan,

As per discussion at our July 13<sup>th</sup> meeting, here is the list of questions for documentation purposes. As mentioned during our discussions, I have tried to capture some relevant elements provided during our call in my questions for ease of response. However, some may require more extensive details.

### Treatment timing:

#### Context:

Timing of treatment is important for assessing the potential impacts of the proposed project on migratory native species as well as efficiency of the proposed treatment. If treatment timing is changed, this may change potential deposit impacts and may require further assessment and consultation with sectors and other regulating bodies.

#### Question:

- 1) As per discussion at the July 13<sup>th</sup> meeting, it is the AIS NCPs understanding that to accommodate a second treatment of Lake Brook and the defined section of the SW Miramichi River, the first treatment will be conducted in August (Miramichi lake, Lake brook and section of SW Miramichi river) and the second in September (Lake Brook and the section of the Southwest Miramichi River).
  - a. Please confirm the proposed timeline and specify if timing early, mid or late month. The AIS NCP understands that the timing could be dependant on water flows, as such please specify your ideal timing and potential deviation from this timing.

**Answer:** Ideal timing for the first treatment is mid August, allowing for the second treatment to occur in mid to late September. Flows are typically low in August so we do not anticipate significant deviation from the timing of the first treatment. The second treatment will be targeted for 30 days after the first, and will include only Lake Brook and the specified reach of the SW Miramichi River. The second treatment will be more prone to a high water event, which is why we plan to carry out the first treatment in mid August, allowing flexibility to carry out the second treatment in the mid to late September period depending on water conditions.

- b. The SWMR Feasibility Assessment appendix states “The second treatment should occur  $\geq$  one week  $\leq$  four weeks after the first treatment.” Based on our discussions on July 13<sup>th</sup>, it is the AIS NCPs understanding that the best timing for a second treatment of the flowing waters (i.e. Lake Brook and the section of the Southwest Miramichi River) would be one month after the first (~4 weeks), to allow for any SMB having found refuge from the first treatment to move into now vacant areas where the second treatment would

be more efficient at eliminating these fish. Please confirm your intent to conduct the second treatment approximately 4 weeks after the first.

**Answer:** Upon further consultation with Brian Finlayson on maximizing effectiveness and minimizing the risk of missing SMB in the river, we confirm that it is our preferred approach to carry out the second treatment 4 weeks after the first.

### **Deposits and concentrations:**

#### Context:

As part of DFOs evaluation, we are required to define the proposed deposits. The AIS NCP had requested information in relation to the proposed deposits on July 6<sup>th</sup>, 2020. You have provided answers to these questions on July 9<sup>th</sup> and July 13<sup>th</sup>. Due to multiple treatment scenarios being presented (i.e. treating the lake and the downstream flowing waters separately or treating all proposed areas together) some clarification on the proposed treatment plan(s) was required. A few points of clarification around deactivation were raised during our July 13<sup>th</sup> meeting discussions

#### Question:

- 1) It is the AIS NCPs understanding that only one deactivation station is being proposed downstream of treatment area. The location of the deactivation station depends on the treatment scenario.
  - a. If the lake, brook and river are treated together, the deactivation station will be located downstream of the proposed SW Miramichi River treatment area. At this location, deposit of Potassium Permanganate (PP) would at a concentration of 4 ppm to obtain a residual concentration of 1 ppm at end of 30 minute travel distance. This deactivation station would be maintained for approximately 24 hours pending water flows and monitoring results. No other deactivation will occur in relation to treated water exiting the lake. Is this the case?

**Answer:** Yes, correct. And this is the preferred scenario.

- b. If the lake is treated independently from lake Brook and SW Miramichi River, the deactivation station for Miramichi Lake would be located at 30 minute travel time from the confluence of Lake Brook and the SW Miramichi River. At this location, Potassium Permanganate (PP) concentration would be maintained at 4 ppm over the entire deactivation zone (i.e. 30 minute travel distance). Once the PP reaches the SW Miramichi it is expected to dilute to non-lethal levels. This deactivation station would be maintained for approximately 7 days pending water flows and monitoring results. Is this the case?

**Answer:** Yes

- i. In this scenario, Lake Brook and the SW Miramichi would be treated twice at later dates. For each treatment, the deactivation station would be located downstream of the proposed SW Miramichi River treatment area. At this location, deposit of Potassium Permanganate (PP) would at a concentration of 4 ppm to obtain a residual concentration of 1 ppm at end of 30 minute travel

distance. This deactivation station would be maintained for approximately 24 hours pending water flows and monitoring results. Is this the case?

**Answer:** Yes

- 2) The AIS NCP understands that your preferred scenario is to treat the lake, brook and river together. Is this the case?

**Answer:** Yes

### **Other project impacts to fish and fish habitat:**

#### Context:

As part of DFOs evaluation, we are required to consider any other project activities that may have an impact on fish and fish habitat. These activities may also require further evaluation through the provincial Watercourse and Wetland Alteration process and DFOs Fish and Fish Habitat Protection Program. Please note: 1) these activities can include mitigation measures as they can have impacts too and 2) changes to activities once assessment is complete could necessitate a re-evaluation of the proposed project.

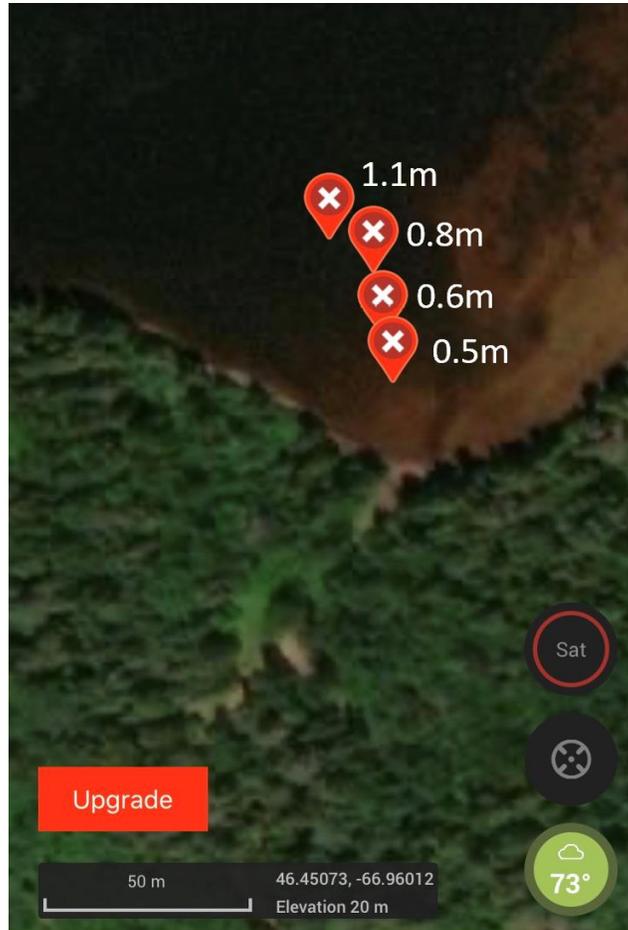
#### Question:

- 1) What other activities (activities other than the deposits) are planned as part of this proposed project? Please confirm if the following will or may take place. If they will take place provide sufficient details to determine any potential impacts.
- a. Beaver dam removal if present. It is the AIS NCPs understanding that beaver dams are expected in Lake Brook and that the necessary permitting will be obtained for their removal following the outlined provincial guidelines. Is this the case?  
**Answer:** Yes, we will pursue the necessary WAWA permits from provincial DELG.
  - b. Floating dock in the lake. It is the AIS NCPs understanding that you are currently exploring options to either have a very long dock into deep water, or to have a pumping system from land out to an anchored floating dock to refill boats with Noxfish Fish Toxicant II. And that you will provide details as they become available. If further details are available please provide.

**Answer:** Our preferred approach is to use a floating dock from the public boat launch at Miramichi Lake. We investigated the site on July 20, 2020 and measured water depths are various distances from shore (note: water was very low so this is considered worse case scenario). Table 1 and Map 1 show water depth gradient near the boat launch and it was deemed this is a suitable location for a long floating dock of approximately 30-45 m. This is preferred over, for example, building a new road into a location where water is deeper closer to shore.

Table 1. Water depths at the Miramichi Lake public boat launch.

Distance from Shore (m)	Water Depth (m)
20	0.5
30	0.6
45	0.8
55	1.1



Map 1. Depth gradient at Miramichi Lake public boat launch.

- c. SWMR Fish barrier and rescue. It is the AIS NCPs understanding that this activity is proposed and that all additional required permits will be obtained. Details have been provided to DFO on July 15<sup>th</sup>. The AIS NCP will review the provided information and follow up with any additional questions.

**Answer:** Yes, we will apply for the necessary WAWA permits from DELG to install the mitigation fish barrier at Slate Island.

- d. Dead fish removal. It is the AIS NCPs understanding that only the floating fish will be removed from the lake, which is typically a small portion of the fish biomass. The sinking fish will be left to decompose in the lake. The focus of the fish collection will be on the shoreline in the area where the cottages are located. Is this the case? Will there be any other fish removal conducted on the water?

**Answer:** Yes, correct. Only the floating fish will be collected and the focus of removal will be on the east end of the lake where cottages are located, but floating dead fish removal efforts will cover the entire lake. Dead fish arriving at the salmon barrier on the river will also be removed.

- e. Rotenone storage area. Will this area be located in the riparian zone? If so provide details including the footprint.

**Answer:** The cleared area near the public boat launch that we intend to use as a staging area and rotenone storage area was investigated on July 20, 2020. It is greater than 30 m from the lake and from any watercourse and wetland so it is not within the riparian zone and will not require a WAWA permit.

- f. Water diversion for fish storage tanks. It is the AIS NCPs understanding that this activity is no longer being pursued. Is this the case?

**Answer:** Correct, no longer being pursued.

- g. Drip can installation in flowing water portion. Will any structures need to be installed in the streambed to accommodate drip can installation? If so provide details, including how, what, where and how many structures.

**Answer:** On the streams, the drips will come directly from a tank on the bank, no structures will be installed in the stream. In the river, we have not finalized the method for rotenone delivery at the five to 10 locations along the 15 km treatment reach, but it will be one of two methods: (1) three to four drip cans are spaced at equal intervals across the width of the river at each site, this will work at sites shallow enough for foot access and to securely position the cans (could also use large protruding boulders); (2) a peristaltic pump with flowmeter capable of delivering 100 to 1,000 ml/min injects rotenone into a long PVC pipe that is elevated over the river's width and having evenly spaced emitters. The PVC pipe method may require support at various locations across the river. It may be secured to protruding boulders or temporary tripod structures across the river. As planning proceeds and we finalize details on potential supports in the river, we will consult DELG on whether this activity requires a WAWA permit and will apply for the necessary permit if so.

- h. Please provide any other activities that has not been mentioned.

#### **Negative impacts of the deposit of deleterious substance to Human Use:**

##### Context:

As part of DFOs evaluation we are required to consider the negative impact of the deposit of deleterious substance, in this case Rotenone, on human use. The AIS NCP understands there will be site access restrictions to treated area during the 2 day treatment and 3 days post-treatment.

Questions:

- 1) Please provide any potential impacts to human use during and post-treatment? Please list known activities that will be impacted (e.g. fishing, swimming, crop irrigation, drinking water, household use, etc.).
  - a. In the application it is stated “Public comment and opinion will be noted at each meeting with identified groups, individuals, and communities. Feedback will be shared with working group members and permitting agencies.” Have concerns around activities (human use) been raised during these consultations? If so, please provide a summary of these concerns (including potential post-treatment perceptions that could impact human use).

**Answer:** Our answer to this question is specific to non-indigenous feedback from our engagement activities. Indigenous feedback, questions, and our answers have been captured in DFO’s official indigenous consultation process.

The majority of land surrounding the lake includes crown land (province of NB) and industrial freehold forestry land (J.D. Irving, Limited). Cottage owners use the lake for swimming throughout the summer months and there is occasional recreational fishing activity but the lake does not support any well known or popular fisheries for the general public. It is not a fishing destination or typically used by anyone other than the cottagers. The recreational fishing season closes on September 15 each year on the Lake and Lake Brook. There is no agricultural land in the area and neither the lake nor any of the treated waters are used to irrigate crops.

We have carried out many public engagement efforts, including meeting with fishing guides, outfitters, and fishing camps on the SW Miramichi, other provincial NGO conservation groups, we held a public webinar with 150-200 attendees, have published several articles, blogs, and media stories, have met with both provincial and federal politicians, and have met with all Miramichi Lake cottage owners, plus a second meeting with the steering committee of the cottage owners, along with ongoing emails with project updates to cottage owners. There has been extensive public engagement and ample opportunity for concerns to be raised.

The only sustained concerns we have received are from the cottage owners on the lake, who are concerned about human health and ecosystem recovery post-treatment. They are concerned about swimming and drinking water.

We contacted the NB Source and Surface Water Management Branch under the Department of Environment and Local Government regarding records of drinking water sources around the lake. The response was: *“From a drinking water and household perspective, the department doesn’t regulate nor keep track of individual private drinking water systems from surface water bodies. Furthermore, a search all around the Miramichi Lake in our Online Well Log database doesn’t return any well log report. Which means that existing cottages around the Miramichi Lake might have their drinking and household water either from the Lake or from a well drilled before 1994 or from a dug well.”*

Through our direct engagement with cottage owners, we understand there are two water sources that are each used for drinking water and household use. The majority of cottages obtain water from a communal drinking water supply fed by a small inlet tributary to the lake located uphill from the cottages (upstream from the lake) and upstream/outside of the proposed treatment area. Two cottage owners indicated that they share a 20-foot deep shallow well which they believe is fed by groundwater

and surface water adjacent to the lake. As potential mitigation measures for the two cottages with the shallow well, we have officially offered those cottage owners three options in writing:

**Email to cottage owner, [REDACTED] on July 15, 2020:**

*We have discussed amongst the group the matter you brought forward about your shallow well that is shared between 2 cottages and is potentially fed in part by surface water from the lake. We have consulted with Brian Finlayson and Steve Maricle to get guidance on what the standard protocol is for lakeside wells. Both of them have had experience with similar situations. The literature and their experience monitoring deep and shallow wells before/after rotenone treatments show that no traces of rotenone or any other formulation ingredients have been found in the well monitoring. Also, rotenone does not travel further than a few centimetres into the soil and is not known to be a groundwater contaminant. This indicates that there should be no impact to your well water; however, we understand your genuine concerns and recognize that drinking water is one of the most basic and important aspects of life anywhere, and that one needs to be comfortable with their drinking water source.*

*As such, we have put together 3 options for you to consider. All 3 options include a request that you not use the well for the duration of the project as a precaution. Should the project go ahead, we offer to:*

- 1. Provide drinking water to your two cottages on the well for the duration of rotenone presence in the lake (2-3 weeks), and test the well water before and after the treatment; or*
  - 2. If logistically possible, connect your two cottages to the existing spring water source used by the other cottages that is upstream of the treatment area; or*
  - 3. Drill you a new proper deep well with no surface water input*
- Alternatively, if some combination of these options is favourable to you or you have another option in mind, we are certainly open for discussion on the approach that makes you feel most comfortable.*

We have discussed with and provided the cottage owners information on ecosystem recovery from studies of other rotenone-treated lakes throughout the world, and have reviewed literature around the product's safe use by humans. We understand that the cottage owners have also met with DFO and Health Canada to express these concerns and received further information on the product's safe use. The bottom line is that the product is registered for use in Canada by PMRA under Health Canada and has undergone the scientific scrutiny necessary to ensure it can be used safely and effectively by humans. Following the product label will ensure public safety according to Health Canada.

- b. Are any impacts to human use likely after the 2 day treatment and 3 days post-treatment? Is the fish decomposition expected to impact human use?

**Answer:** The eradication will benefit human use. Human activities within the Miramichi River watershed will benefit post-treatment because we will eliminate an invasive species that would have negatively impacted the native ecosystem, an ecosystem that supports such important human use activities as indigenous food fisheries and recreational fisheries important to the local culture and rural economy.

In the lake itself and other treated waters, given the expected half-life (2.5 d) of rotenone in Miramichi Lake during the proposed treatment scenario based on data from Finlayson et al. 2001 and Finlayson et al. 2014, the initial 0.075 mg/L rotenone is expected to degrade to 0.0375 mg/L rotenone in 2.5 d, a level below the suggested safe drinking water level of 0.040 mg/L rotenone proposed by EPA (2007).

Should some individuals choose subjectively to not swim in the lake or use it post-treatment beyond the 3 day non-use period, that is their prerogative. The science is clear that following the product label approved by Health Canada will ensure public safety, and is what we are required to do by law.

**Risk of re-introduction:**

Context:

As part of DFOs evaluation we are required to consider the risk of re-introduction of the targeted species to the proposed treatment area post-treatment. As part of your application, it was mentioned that education and outreach would be an early priority to be addressed to avoid re-introduction.

Questions:

- 1) Is education and outreach being proposed as a mitigation measures to be considered as part of this project application?
  - a. If so, provide details of your commitment (timeline, target groups, venues, etc.) to role out the education/outreach.

**Answer:** Yes, we have carried out extensive public engagement and education as a mitigation measure to reduce the risk of future re-introductions. Below is an updated activity table from our February 2020 communications plan:

*Table 2. Ongoing communication and education activities carried out by the Working Group.*

Activity	Description/Timeline	Targeted Group
Media relations	Respond to media requests regarding the eradication of smallmouth bass from the Miramichi. <b>Ongoing:</b> Several CBC interviews on Shift and articles by Connell Smith; Op-Ed published in Telegraph Journal.	All
Website design and launch	Create a website for Miramichi smallmouth bass eradication to educate the public and key groups about the project. <b>Complete</b> (www.miramichismallmouth.com)	All
Proactive communications	Develop blog posts, op-eds, and social media to convey key messages. <b>Blog:</b> complete/ongoing ( <a href="https://www.asf.ca/news-and-magazine/salmon-news/clear-and-present-danger">https://www.asf.ca/news-and-magazine/salmon-news/clear-and-present-danger</a> ); blog also prepared in conjunction with	All

	<p>resumption of spring work in June 2020; another blog planned for summer 2020</p> <p><b>Social media:</b> ongoing, timed with media relations and proactive communications</p> <p><b>Webinar:</b> public webinar held ins spring 2020 with 150-200 attendees locally and from across the world (session recorded and publicly available (google: "ASF alien invaders"))</p> <p><b>Articles:</b> several published in the Atlantic Salmon Journal</p>	
Meeting with camp owners	<p>Conduct a public meeting with Miramichi Lake camp owners involving experts on rotenone eradication</p> <p><b>Completed January 26<sup>th</sup> with follow-up with steering committee in March; educational brochure produced</b></p>	Miramichi Lake camp owners
Meet with members of Eel Ground and Red Bank FN	<p>Conduct a public meeting with Miramichi Lake camp owners involving experts on rotenone eradication</p> <p><b>Completed January 27<sup>th</sup></b></p>	Miramichi First Nations
Brief public officials	<p>Hold meetings with key officials and politicians from federal and New Brunswick government to share project details, update progress, and seek support</p> <p><b>Several sessions have been held, more briefings to occur as necessary or requested</b></p>	Public officials
Engage with salmon stakeholders	<p>Engage with camps, outfitters, guides in the Miramichi River Valley to inform of project, answer questions</p> <p><b>Meetings held &amp; ongoing</b></p>	Stakeholders, public officials

Engage with non-government organizations	Contact all environmental and conservation NGOs in New Brunswick to inform them of the eradication project and urge that questions or concerns be raised with the Working Group. <b>Complete/Ongoing</b>	Environmental/Conservation NGOs
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- b. Have SMB materials already been developed specifically for this mitigation activity to be rolled out in NB?

**Answer:** Yes, we have developed SMB/invasive species educational materials so far and plan to develop more. Materials to date include:

- An educational brochure on the SMB issue in the Miramichi watershed
- Website with educational materials for the public ([www.miramichismallmouth.com](http://www.miramichismallmouth.com))
- Several blog posts available on [www.asf.ca](http://www.asf.ca)
- Several articles in the Atlantic Salmon Journal, read by thousands of people
- Webinar recorded and publicly available on [www.asf.ca](http://www.asf.ca) (Google search: "ASF alien invaders")

**Public Safety:**

Context:

As part of DFOs evaluation we are required to consider public safety. The AIS NCP understands that the public will be directed to keep away from the treatment area for the two-day application and for a three-day period after that as specified on the Noxfish II label. This will be accomplished by posted signage at all public entry points to notify the public of the treatment. Additionally, the camp owners will be contacted directly with notification of the temporary five-day restriction and associated dates. It has also been mentioned the application that a Public Information/Liaison Officer will be responsible for communicating with the general public, other government agencies and other interested parties during the treatment.

Questions:

- 1) Is the posted signage the only means employed to restrict access to the proposed project area? Will there be any other means used to ensure restricted access to the area?

**Answer:** See #2 below.

- 2) What are the known entry point to the proposed treatment area, which will have signage posted. Please provide a map indicating these locations.

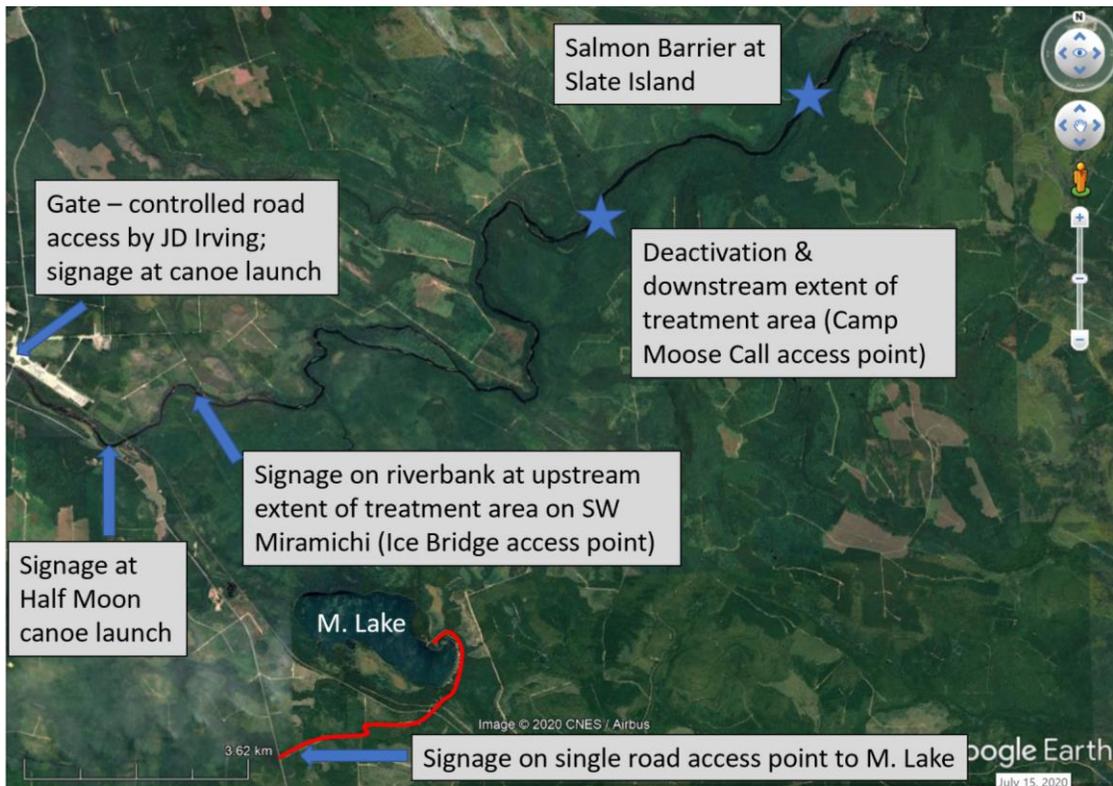
**Answer:**

**Lake** - There is only one road access to Miramichi Lake; it will have signage and the access road will also be monitored for the duration of treatment and the 3-day post-treatment period by a public safety officer informing any visitors of the eradication activity and treatment area use

restrictions. The lake is typically only accessed by the few cottage owners, with little public use and so we expect no, or low, volume of traffic on the lake road during the eradication.

**Lake Brook** - There is no road access to Lake Brook.

**SW Miramichi River** - Road access to the treatment reach on the SW Miramichi River is controlled by J.D. Irving and is restricted by gate and full time personnel at the Deersdale scales office. Irving is a partner in the project and employees will be briefed on the eradication timing. There are occasional canoers on this reach of river (not typically in low water conditions during the time of year we propose to treat) and signage will be placed at the known launch points at Deersdale and Half Moon. There will also be signage placed at the upstream extent of the treatment reach at the Ice Bridge, which will have personnel on-site carrying out the treatment who can inform any canoers that may have disregarded the signs upstream at Deersdale and Half Moon. McKiel Salmon Club, Camp Moose Call, and Slate Island Camp are the only camps on this reach of river and will be notified of treatment timing. The few camps that are located immediately downriver of the treatment area will also be notified; however, we do not expect any boat traffic upstream from these camps because the river will likely be too shallow to motor, and the camps do not use motor canoes in this reach regardless. Personnel at the salmon barrier will monitor any potential upstream boat movement. Again, the entire region's road network is controlled by gate by J.D. Irving so any camps in the area will be apprised of the eradication timing and limits on use of the treatment reach. See Map 2 for the signage locations at publicly accessible points.



Map 2. Signage locations at publicly accessible points throughout the treatment area.

- 3) Given the recent information surrounding the potential use of proposed treated water as a drinking water source. Please provide details on how you propose to deal with this potentially problematic situation given the product label restrictions.

**Answer:** See answer to Question 1 above in the section “**Negative impacts of the deposit of deleterious substance to Human Use**”. Here we describe how we are addressing this situation, and we include the letter we sent to [REDACTED] regarding options for solutions around the use of her shallow well adjacent to the lake, which may or may not be fed partially by lake surface water.

- 4) As requested by PMRA, we also require confirmation around the use of treated waters, more specifically in relations to drinking water and household/cottage use. As previously discussed, we also will require documentation of this use (e.g. maps, cottage owner letters, etc.).

**Answer:** We have contacted cottage owners regarding this information, and the information is included in the response we prepared for Fabiola Akaishi to the recent PMRA questions (submitted to Fabiola on August 13, 2020).

- 5) It is stated in the application “There will be no public or private vessels on the Lake, other than those used for the treatment”. Has a plan been formulated on how to maintain other boats out of the water? If so, could you provide it to us?

**Answer:** Yes, a plan has been formulated, see #2 above on signage and access point control, and associated map.

#### **Mitigation of ecological and fisheries impacts:**

Context: The deposit of a deleterious substance, such as Rotenone, will have negative impacts since it's intended use is to kill a targeted species. Mitigation measures can be proposed to reduce the secondary impacts of the deposit on native species. In order to assess the efficiency of the proposed mitigation measure, the AIS NCP requires sufficient details to determine 1) its feasibility, 2) the level of mitigation achieved by the measure, and 3) potential impacts caused by implementation of the mitigation measure.

#### Questions:

- 1) A request for more details around the fish barrier/rescue in the SW Miramichi River was sent to you on June 15<sup>th</sup> and a follow up on June 29<sup>th</sup>. DFO received a response on July 15<sup>th</sup>. The information will be reviewed and if required the AIS NCP will follow up for clarifications.

**Answer:** Ok

- 2) A re-establishment strategy has been proposed in your application as a mitigation measure for impacts to native species in Lake Miramichi. In the application documentation provided to the AIS NCP, 2 options were presented. In our July 13<sup>th</sup> conference call, the working group asked DFO what their preferred option was. DFO answered, that from a regulatory review perspective, and based on the science advice received on the previously proposed re-establishment strategy, either option would be acceptable.

- a. Please confirm your choice of the 2 presented options for re-establishment. Indicating when non-migratory native fish species would be reintroduced (i.e. spring following treatment or after 2 years monitoring if required).

**Answer:** We will pursue the option to transplant non-migratory native fish after 2 years based on monitoring results.

- b. In relation to your re-establishment performance measure “Presence of adults and juveniles,” could you provide details around your target threshold? In other words, what abundance (or similar measurement) of adults and juveniles will be considered as the indicator (tipping point) to decide if re-introduction of non-migratory fish is required?

**Answer:** If any number of both adults and juveniles are present of a given non-migratory native species, we will not transplant and will allow the species to recolonize naturally. Note that the presence of even a small number of fish caught in a sampling procedure is indicative of many more in the unsampled areas of the lake. Therefore, the indicator to transplant or not will be based on a binary presence or absence in the sampling.

- c. If performance measures are not achieved are there additional contingency measures being proposed? For example, if re-establishment of one or more species is not observed after introduction from other lakes, will further efforts be made to re-establish those species?

**Answer:** After the first transplantation, if there is no evidence of establishment of a given non-migratory native species (i.e., no adults and juveniles present) by year 5, we will conduct another round of transplantation at year 5, the final year of the monitoring plan. Note that because 100 individuals are planned for transplantation, this low abundance may result in species not being captured in the sampling within a year or two after introduction. This is why we propose to wait until year 5 before making the decision on a second transplantation effort if certain species are still not present.

### **Monitoring:**

Context: Monitoring activities are crucial to the successful delivery of a project of this nature. The monitoring plan should consist of the following components: (1) rotenone treatment monitoring, (2) rotenone deactivation monitoring, (3) short-term and long-term SMB eradication monitoring, and (4) ecological recovery monitoring.

### Questions:

- 1) The AIS NCP had a few questions in relation to the proposed monitoring activities, however, during our July 13<sup>th</sup> meeting DFO was made aware that a monitoring proposal was going to be provided in the following days. DFO received the monitoring proposal on July 14<sup>th</sup>. The AIS NCP will review the provided information and follow up if there are any outstanding questions or clarifications needed.

**Answer:** Ok

**Other questions:**

- 1) Just a point of clarification on land owners and cottages. In the application it is stated "This will primarily impact camp owners who use the lake recreationally (21 privately owned parcels of land)." In our July 13<sup>th</sup> meeting discussions you mention 14 cottage owners. Could you please explain the situation of land owners vs cottage owners? Additionally, how many camps are within the treatment/deactivation area on the SW Miramichi River?

**Answer:** The difference between landowners and cottage owners is that not all landowners on the lake have cottages. For example, J.D. Irving Limited, Crabbe Lumber, and the Village of Stanley are all landowners but do not have cottages. There are also four cottages on crown leases near the public boat launch that are not directly on the lake but are nearby. The lake is mostly heavily used by the cottage owners; therefore, the lake treatment will primarily affect their recreational use of the lake during the treatment period. All landowners on the lake and nearby lease holders were contacted directly as part of our engagement efforts and have been receiving project updates. On the river, both sides of the treatment reach are owned by J.D. Irving Limited. Moving from upstream to downstream, there is one camp on the treatment reach (McKiel Camp - salmon club that leases from JDI), one camp at the deactivation location (Camp Moose Call - leases from JDI), and Slate Island Camp at the salmon barrier location (leases from International Paper).

Thank you,  
Daniel

**Aquatic Invasive Species National Core Program / Programme national sur les espèces aquatiques envahissantes**

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