Ministry of Natural Resources and Forestry/Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings
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Signoff Page

Between: Her Majesty the Queen in Right of Canada as represented by the Minister of Fisheries, Oceans, and the Canadian Coast Guard (DFO)

And: Her Majesty the Queen in Right of Ontario as represented by the Minister of Natural Resources and Forestry (MNRF)

Whereas, the Constitution Act, 1867 assigns to the federal government exclusive jurisdiction for sea coast and inland fisheries and the Fisheries Act sets out powers and duties of the federal government with respect to the protection of fish and fish habitat, including fish that are part of or support commercial, recreational and Aboriginal (CRA) fisheries;

Whereas, the Constitution Act, 1867 assigns to the provinces exclusive jurisdiction over matters dealing with property and civil rights, the management of public lands and matters of a local or private nature in the province and based on these heads of power, the provinces may regulate certain aspects relating to fisheries and fish habitat;

Whereas, the Province of Ontario has assigned the Ministry of Natural Resources and Forestry as the steward of Ontario's provincial parks and protected areas, forests, fisheries, wildlife, mineral aggregates, petroleum resources and Crown lands. MNRF's vision is for a healthy and naturally diverse environment that enables and contributes to sustainable development in Ontario. The Ministry's mission is to manage Ontario's natural resources in an ecologically sustainable way to ensure that they are available for the enjoyment and use of future generations;

Whereas, Ontario administers the management of freshwater fisheries in the province via regulations made under the Fisheries Act and the federal government is responsible for the protection of fisheries (including fish habitat) under the Fisheries Act;

Whereas, DFO recognizes that MNRF has established laws and policies that provide for the integration of fishery and fish habitat protection and conservation considerations and measures in its decision-making and regulatory processes;

Whereas, the federal government, provinces and territories, including Ontario have entered into an Agreement on Inter-jurisdictional Cooperation with Respect to Fisheries and Aquaculture that provides both the foundation for the Canadian Council of Fisheries and Aquaculture Ministers (CCFAM) and the principles of cooperation that CCFAM has developed to implement a Freshwater Fisheries Strategy;

Whereas, DFO and MNRF are committed to the protection and conservation of fish habitat required to sustain Ontario's fisheries resources so as to provide social, economic and environmental benefits for present and future generations of Canadians;
Whereas, DFO and MNRF are committed to collaborating and sharing responsibilities in the protection of the sustainability and ongoing productivity of CRA fisheries or fish that support such a fishery in the Province of Ontario, where it is of mutual interest;

Whereas, Canada and Ontario have signed the Canada-Ontario Fisheries Agreement (COFA 1987);

Whereas, Canada and Ontario both have responsibilities for protecting species at risk under the Species at Risk Act, 2002 (SARA) and the Endangered Species Act, 2007 (ESA);

Whereas, Canada and Ontario have established the Canada-Ontario Fisheries Advisory Board (CONFAB), to implement the Canada Ontario Fisheries Agreement (1987) by facilitating inter-agency coordination as necessary to ensure the successful achievement of fisheries programs in Ontario;

Therefore, Canada as represented by DFO and Ontario as represented by MNRF agree to the following Protocol for protecting fisheries and fish habitat during the planning and implementation of forest management activities in Ontario.

1.0 Purpose and Objectives

This Protocol is intended to facilitate a collaborative approach that best maintains and enhances the sustainability and ongoing productivity of Ontario’s CRA fisheries or fish that support such a fishery and fish habitat during the planning and implementation of forest management activities on managed Crown forests in the Province through the application of federal and provincial legislation, regulations, policies and programs identified herein.

2.0 General Provisions

2.1 The Parties agree that protecting the sustainability and ongoing productivity of CRA fisheries or fish that support such a fishery, and associated fish habitat, during the planning and implementation of forest management activities on managed Crown forests in Ontario will be carried out in accordance with the federal Fisheries Act and the provincial Crown Forest Sustainability Act 1994 (CFSA), as well as their associated regulatory and policy frameworks.

2.2 The regulatory and legal decision making authority of DFO and MNRF are not delegated or otherwise affected by this Protocol.

2.3 The Parties agree that this Protocol will not impose any financial responsibilities. Each Party will be responsible for their respective costs incurred related to the implementation of the Protocol. The Parties may agree to jointly fund and support projects and initiatives that support the program activities.
2.4 The interpretation and meaning of terms in the Protocol are defined in the glossary and suggested reading section of the Protocol.

3.0 Scope of Application

3.1 This Protocol applies to the construction and decommissioning of all proposed road water crossings in accordance with the forest management planning process on managed Crown forests in Ontario.

3.2 This Protocol pertains to the administration of Sections 20, 21, 35 and 38(4) of the *Fisheries Act*.

4.0 Management Provisions

4.1 DFO and MNRF executive will oversee implementation of this Protocol and will establish an "MNRF/DFO Fisheries Protocol Implementation Team to ensure effectiveness of the Protocol by recommending changes to the Protocol as required; and providing an issues resolution mechanism.

4.2 The MNRF shall prepare and submit to DFO an annual report on the implementation of this Protocol. The annual reporting period will be from April 1 to March 31 of each year, the report will be sent to DFO by March 1st of the next year.

The annual report to DFO from MNRF will identify:

a. the overall number of water crossings constructed and/or decommissioned under the Protocol;

b. the number of water crossings constructed and/or decommissioned for which a water crossing Standard was applied under the Protocol; and the number constructed and/or decommissioned that were subject to review and approval under the Protocol;

c. the percent of water crossings subject to compliance monitoring by the Proponent;

d. the percent of water crossing subject to compliance monitoring by the MNRF.

5.0 Roles and Responsibilities / Operating Principles

5.1 The Parties agree to undertake the roles and responsibilities for protecting the sustainability and ongoing productivity of CRA fisheries or fish that support such a fishery during forest management activities on managed Crown forests in Ontario, as outlined in the Protocol.
5.2 The Parties agree to participate in the periodic review of the Protocol to ensure that it remains consistent with the agency roles and responsibilities described therein. The Parties further agree to collaborate on the creation of harmonized policies, water crossing standards guidelines, and mitigation measures to guide decisions in protecting CRA fisheries or fish that support such a fishery and fish habitat.

5.3 The Parties agree to carry out compliance and effectiveness monitoring activities in order to ensure that the Protocol implementation and protection of the sustainability and ongoing productivity of CRA fisheries or fish that support such a fishery and associated fish habitat responsibilities are carried out in a consistent and effective manner.

5.4 The Parties agree to develop and deliver joint training programs for staff and forest industry representatives, as required.

6.0 Issue Resolution

6.1 When issues regarding implementation of the Protocol cannot be resolved at the staff level, the following mechanism shall be applied:
   - Timely resolution shall be sought through consultation at the appropriate Regional/District management level of DFO and MNRF;
   - For issues remaining unresolved at the Regional/District management level, resolution shall be sought through the Protocol Implementation Team;
   - For issues remaining unresolved by the Protocol Implementation Team, resolution will be sought through CONFAB.

7.0 Term

7.1 This Protocol comes into effect on the date signed by DFO and MNRF and shall remain in effect until terminated in accordance with Subsection 7.5.

7.2 This Protocol replaces the 2005 version of the “Protocol for Review of Water Crossings Proposed through the Forest Management Planning Process in Ontario” and will apply to the planning, review, approval, and monitoring of road water crossing construction and/or decommissioning activities, as per the effective date set out in Subsection 7.1, and direction in the most recent version of the Forest Management Planning Manual (FMPM).

7.3 This Protocol shall be reviewed by MNRF and DFO personnel three years after the date of it coming into force to evaluate its effectiveness and report the findings to CONFAB.
7.4  This Protocol may be amended at any time in accordance with the following requirements:

7.4.1  Any amendments to Sections 1 through 6 of the Protocol shall require the signature of a DFO and MNRF representative who is authorized to amend the Protocol;

7.4.2  Changes to the Protocol’s approved water crossing standards, glossary and suggested reading, and appendices may be approved by the “MNRF/DFO Fisheries Protocol Implementation Team” and reported to the DFO and MNRF Executive.

7.5  This Protocol is an expression of the mutual intentions of the Parties and is not legally binding on them or enforceable against them. Either of the Parties may terminate this Protocol on twelve months written notice to the other Party.

8.0 SIGNATURES

For Her Majesty the Queen in Right of Canada as represented by the Minister of Fisheries Oceans, and the Canadian Coast Guard

___Original signed by__________ Date: ______24/05/17_______________
Dale Nicholson
A/Regional Director General
Central & Arctic Region
Fisheries and Oceans Canada

For Her Majesty the Queen in Right of Ontario as represented by the Minister of Natural Resources and Forestry

___Original signed by__________ Date: ___29/05/17__________________
Rosalyn Lawrence
ADM Policy Division
Ministry of Natural Resources and Forestry
**Disclaimer:**

It is the responsibility of the proponent to be in compliance with all federal and provincial laws and regulations, all municipal by-laws, and any other orders, rules and by-laws. Compliance with this Protocol does not relieve proponents from possible prosecution under either Canada’s *Fisheries Act* or Ontario’s CFSA. The approval framework provided in this Protocol, including the implementation of the water crossing standards and the review and approval by MNRF staff, is premised on a risk management approach to facilitate compliance with both pieces of legislation. The Province of Ontario and the Government of Canada expressly disclaim any liability for damages or contraventions of any kind arising from the use of this Protocol.

The Province of Ontario is bound by the *Freedom of Information and Protection of Privacy Act* (Ontario) and any information provided to the Province in connection with this Protocol or otherwise in connection with the Protocol may be subject to disclosure in accordance with that Act.
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SECTION 1 – INTRODUCTION

The purpose of the Ministry of Natural Resources and Forestry/Fisheries and Oceans Canada Protocol for the Review and Approval of Forestry Water Crossings, 2017 (the Protocol) is to help ensure that fish and fish habitat that are part of Ontario’s CRA fisheries or fish that support such a fishery, as defined under the Fisheries Act and related policy, are considered during the planning, review, approval and monitoring of water crossings constructed and/or decommissioned during forest management activities on Crown lands in Ontario. The Protocol is intended to facilitate compliance with the Fisheries Act, and in cases where required, assist with attaining the necessary Fisheries Act approvals that are required before water crossing construction and decommissioning activities can begin.

The development and implementation of this Protocol is a mandated requirement under the Ontario Ministry of the Environment and Climate Change’s (MOECC) Declaration Order made under the Environmental Assessment Act regarding MNRF’s Environmental Assessment Requirements for Forest Management on Crown Lands in Ontario (Declaration Order MNR-75). The Protocol is developed and implemented in collaboration with DFO and representatives of Ontario’s forest industry to provide a risk-informed framework for the efficient planning, review, approval and monitoring of water crossings to prevent, minimize and mitigate the potential effects of forest management activities on fish and fish habitat that are part of CRA fisheries or fish that support such a fishery.

The need for modernized approaches to water crossing approvals and MNRF client services was prompted by Declaration Order MNR-75, approved in August 2015, coupled with legislative changes to the Fisheries Act in 2012, and organizational changes within both MNRF and DFO. The Protocol introduces a risk-informed Proponent self-screening approach for lower-risk water crossings that utilizes pre-determined and mandatory technical water crossing standards to direct routine water crossing construction and decommissioning activities in a manner that protects the productivity of Ontario’s CRA fisheries or fish that support such a fishery. Adopting this type of risk-informed and modernized approach will allow government and industry stakeholders to focus resources towards planning and reviewing water crossing activities that pose a greater potential risk of serious harm to Ontario’s CRA fisheries or fish that support such a fishery.

The Protocol describes the roles and responsibilities for MNRF, DFO, and Proponents pertaining to water crossing planning, reviews, approvals and monitoring. The Protocol enables timely and efficient water crossing approvals while providing for fisheries and fish habitat protection and sustainability.

The risk-informed and modernized approach detailed in the Protocol is consistent with and supports the Fish Habitat Referral Protocol for Ontario (2009), DFO’s Fisheries Protection Policy Statement (2013), and MNRF’s strategic directions, including Ontario’s Provincial Fish Strategy (2015).
SECTION 2 – GOALS AND OBJECTIVES

The Protocol, first developed in 2005, continues to provide for timely and efficient water crossing approvals. This version of the Protocol builds on the 2005 Protocol and incorporates a modernized planning and approval framework that addresses the following three objectives:

1. Help ensure that water crossings in Crown managed forests are planned, constructed, and decommissioned in a manner that minimizes potential negative impacts to the aquatic environment; and protects fish and fish habitat that are part of CRA fisheries or fish that support such a fishery, as defined by the Fisheries Act and related policy.

2. Utilize a risk-informed self-assessment framework for Proponents that employs pre-determined and mandatory technical water crossing standards for the construction and/or decommissioning of lower-risk water crossing projects, while focussing MNRF and DFO efforts and resources on the review and approval of proposed construction and/or decommissioning of higher-risk water crossings.

3. Support the transformation of Ontario’s public sector and modernize business processes to ensure Ontarians receive quality services that are effective and efficient; and continue to implement opportunities to improve organizational flexibility and responsiveness, modernize policy and delivery frameworks.

SECTION 3 – SCOPE OF APPLICATION

In accordance with the conditions and requirements set out in Declaration Order MNR 75, the application of this Protocol applies to the construction and decommissioning of road water crossings on all permanent and intermittent streams on Crown lands within Ontario’s Area of the Undertaking (i.e. managed Crown forests).

Section 7 of this Protocol includes best management practices for non-road (equipment only) water crossings; although these types of crossings are outside the scope of the Protocol, they have been developed to support decision-making during the course of operations and serve as a means to facilitate compliance with the Fisheries Act.

SECTION 4 – LEGISLATIVE CONTEXT

The responsibility to protect fish and fish habitat during forest management activities in Ontario is shared between the federal and provincial governments through the Fisheries Act and Ontario’s Crown Forest Sustainability Act 1994 (CFSA). Certain aquatic species at risk may also be protected under federal or provincial species at risk legislation (i.e. SARA and ESA).

Proponents are responsible for ensuring compliance with all provincial or federal legislation and regulations. Additional measures may need to be taken before engaging in activities related to the construction and/or decommissioning of a water crossing.
The Fisheries Act

The Fisheries Act became one of Canada’s first laws in 1868. In recognition that healthy and productive fisheries require healthy fish habitat, the habitat protection and pollution prevention provisions were incorporated into the Fisheries Act in the 1970s. In 2012, changes made to the Fisheries Act shifted its focus to managing threats to the sustainability and productivity of Canada’s CRA fisheries or fish that support such a fishery. The most relevant changes to the Fisheries Act relative to this Protocol include a prohibition against causing serious harm to fish that are part of CRA fisheries or fish that support such a fishery (Section 35), as well as provisions for flow and passage (Sections 20 and 21).

Additional changes to the Fisheries Act that support the goals and objectives of this Protocol include:

- Enhanced compliance and protection tools;
- Provide clarity, certainty and consistency of regulatory requirements through the use of standards and regulations;
- Enable enhanced partnerships to ensure agencies and organizations that are best placed to provide fisheries protection services to Canadians are enabled to do so.

The Ontario Environmental Assessment Act

The Ontario Environmental Assessment Act, administered by MOECC, sets out a planning and decision-making process to consider the potential environmental effects of projects before they begin.

The Declaration Order MNR-75 outlines 61 conditions MNRF must adhere to when undertaking forest management in the province. Declaration Order MNR-75 covers the recurring forest management activities of constructing forest access roads and water crossings, harvesting trees, renewing the forest, and conducting forest maintenance, and provides direction for the preparation and implementation of Forest Management Plans (FMPs).

The Crown Forest Sustainability Act (CFSA)

The CFSA provides for the sustainability of Crown forests and requires Crown forests to be managed in a way that meets the social, economic and environmental needs of present and future generations. The CFSA requires a FMP to be prepared for every management unit. Each FMP must have regard for a number of values such as plant and animal life; quality of water, soil, air; and social and economic values, including recreational values and heritage values.

Through its regulations, the CFSA requires adherence to a set of four forest management manuals: the Forest Management Planning Manual, the Forest Information Manual, the Forest
Operations and Silviculture Manual and the Scaling Manual. The following three manuals are relevant to water crossing approvals on managed Crown forests:

- **Forest Management Planning Manual (FMPM)**

  FMPM prescribes the forest management planning process, including the content and process requirements for the development of FMPs and annual work schedules (AWS). The planning and documentation requirements include those related to the planning, review, approval and monitoring of water crossings construction and/or decommissioning.

- **Forest Information Manual (FIM)**

  FIM prescribes the mandatory requirements, timelines, and conditions for providing information for managed Crown forests. The requirements for information prescribed in FIM complement the FMPM planning and operational requirements. FIM prescribes a series of supplemental technical specifications which outline the detailed, technical conditions of information requirements.

- **Forest Operations and Silviculture Manual (FOSM)**

  FOSM sets out the over-arching principles and accepted approaches for forest management, the standards for forest operations and silvicultural practices, the minimum qualifications for forestry workers, and the procedures for the evaluation of forest management in Ontario. FOSM sets out guidance and direction to be referenced in the preparation of a FMP and in the implementation of forest management activities.

- **Forest Management Guides**

  Forest Management guides are described in FOSM. FOSM sets out the list of guidance and direction to be referenced in the planning and implementation of forest management activities. The FMPM give directions on the use of the guidance and direction listed in the FOSM.
Other Relevant Legislation

Navigation Protection Act

The *Navigation Protection Act* is a federal statute that authorizes and regulates activities that may interfere with the public right of navigation; it is the result of the 2012 amendments to the *Navigable Waters Protection Act*.

Proponents should consider any applicable requirements under the *Navigation Protection Act* prior to commencing any water crossing projects.

Ontario Endangered Species Act, 2007 and Species at Risk Act, 2002

The Ontario *Endangered Species Act, 2007* (ESA) and the Federal *Species at Risk Act, 2002* (SARA) provide for the legal protection of species at risk in Ontario and Canada. These statutes may impact decisions related to the construction, and/or decommissioning of water crossings. Proponents are responsible for ensuring they are in compliance with provincial and federal species at risk laws and regulations.
SECTION 5 – DECISION FRAMEWORK

1. **Proponent identifies the water crossing project and determines if it applies to CRA fisheries or fish that support such a fishery.**

The Proponent is responsible for identifying water crossing projects, and following the requirements of the applicable version of the FMPM and this Protocol.

For the purposes of forest management in Ontario, all watercourses will be classified as containing fish and fish habitat that are part of CRA fisheries or fish that support such a fishery, as defined in the *Fisheries Act*. The types of watercourses that are excluded from the *Fisheries Act* and information on what data is required to demonstrate the absence of CRA fisheries or fish that support such a fishery can be found on the Fisheries and Oceans Canada website ([http://www.dfo-mpo.gc.ca/habitat/habitat-eng.htm](http://www.dfo-mpo.gc.ca/habitat/habitat-eng.htm)).

If the proposed project applies to CRA fisheries or fish that support such a fishery, **proceed to Step 2.**

If the Proponent has demonstrated that the project does not apply to CRA fisheries or fish that support such a fishery **proceed to Step 8.**

2. **Proponent identifies whether any federally and/or provincially listed aquatic species at risk are likely to be affected.**

The Proponent shall determine whether aquatic species at risk (i.e. fish and mussels) listed federally under the SARA, and/or provincially under the ESA are likely to be impacted by the water crossing project. When determining if species at risk are likely to be impacted by the project, Proponents should consider both the immediate footprint and the potential spatial and temporal extent of the possible project impacts relative to the documented presence of species at risk and/or their habitat. MNRF should be consulted early in the process if any uncertainty exists in making this determination.

At a minimum, the Proponent should:

   a) Consult DFO’s aquatic species at risk maps ([http://www.dfo-mpo.gc.ca/species-especies/fpp-ppp/index-eng.htm](http://www.dfo-mpo.gc.ca/species-especies/fpp-ppp/index-eng.htm)).

   b) In cases where the aquatic species at risk maps identify the presence of species at risk or their critical habitat, request the SARA species-specific information at the site of the proposed works by emailing fisheriesprotection@dfo.mpo.gc.ca or by phoning 1-855-852-8320.

   c) Review the most up to date confidential values layer and/or contact the local MNRF district office for information on ESA-listed aquatic species and their habitat.
If there are no relevant aquatic species at risk likely to be affected by the project, **proceed to Step 3**.

If any aquatic species at risk and/or their habitat is likely to be affected by the project, the Proponent will contact the MNRF and **proceed to Step 5**. The Proponent should also pursue the appropriate SARA/ESA processes, if required, concurrent to this Protocol’s approval framework to ensure all of the necessary approvals are obtained in a timely manner. In cases where a SARA approval is required, the Proponent should submit a Request for Review form found on the DFO website (http://www.dfo-mpo.gc.ca/habitat/habitat-eng.htm) in addition to the Appendix 1 form for submission of information on a proposed water crossing from this Protocol.

3. **Proponent determines whether a water crossing standard can be applied to the water crossing project.**

The Proponent will determine if a water crossing standard contained in this Protocol can be applied to the water crossing project. This includes confirming that the location of the project and type of water crossing standard is consistent with the approved FMP. When following a water crossing standard, the Proponent is required to meet all of the criteria and standards listed in the water crossing standard in the FMP.

If the Proponent determines that a water crossing standard can apply, **proceed to Step 4**.

If the Proponent determines that a water crossing standard cannot apply, **proceed to Step 5**.

4. **Proponent completes and submits the appropriate sections of Appendix 1 form to the MNRF for approval with, or revision to, the AWS.**

The Proponent will complete the appropriate sections of an Appendix 1 form, for each water crossing proposed for construction and/or decommissioning using a water crossing standard. Appendix 1 forms will be sent to MNRF for approval with, or revision to, the AWS.

In cases where a previously unidentified watercourse is encountered during the construction of a road, a revision to the AWS is deemed to be complete upon receipt by MNRF of Appendix 1 as per direction in the FMPM (Part D 3.5.4.1). Appendix 1 forms must be submitted to the MNRF prior to commencing the water crossing project and the water crossings are still subject to compliance and enforcement provisions under both the CFSA and the Fisheries Act.

If the project can meet the requisite water crossing standards and the requirements for the water crossing being proposed, it is not likely to result in serious harm to CRA fisheries or fish that support such a fishery and Proponent can proceed to AWS approval. No further Fisheries Act considerations or approvals/authorizations by DFO are required. **Proceed to Step 8.**
5. MNRF reviews the proposed water crossing project and determines whether the water crossing project is likely or not likely to result in serious harm to CRA fisheries or fish that support such a fishery.

The Proponent will complete and submit the appropriate sections of the Appendix 1 form to MNRF for review and approval for the construction and/or decommissioning of a proposed water crossing project that could not implement one of the water crossing standards.

MNRF will complete an Appendix 2 form for a proposed water crossing project that requires review and approval in order to evaluate whether a project is likely or not likely to result in serious harm to CRA fisheries or fish that support such a fishery. As part of the evaluation and approval process, MNRF may require design modifications and/or additional mitigation measures to ensure the project is not likely to result in serious harm to CRA fisheries or fish that support such a fishery. In some cases, site visits may be required to facilitate discussions between MNRF and the Proponent regarding these potential design modifications and/or additional mitigation measures.

Where MNRF has determined a proposed water crossing project is not likely to result in serious harm to CRA fisheries or fish that support such a fishery, and where an agreement has been reached with the Proponent in cases where design modifications and/or additional mitigation measures have been included as a condition of the approval of the project, proceed to Step 8.

Where MNRF has determined a proposed water crossing project is likely to result in serious harm to CRA fisheries or fish that support such a fishery, and where agreement cannot be reached with the Proponent regarding design modifications and/or additional mitigation measures that MNRF deems necessary, proceed to Step 6.

6. Proponent forwards water crossing project proposal to DFO for review with a copy to MNRF for information purposes.

In cases where MNRF and the Proponent cannot reach agreement regarding the details of the proposed project relative to whether a project is likely or not likely to result in serious harm to CRA fisheries or fish that support such a fishery, including any design modifications and/or mitigation measures deemed necessary by MNRF, the Proponent will forward the proposed project to DFO for review.

The Proponent will submit copies of the project’s Appendix 1 and 2 forms, a DFO Project Review Request Form (http://www.dfo-mpo.gc.ca/pnw-ppe/reviews-revues/index-eng.html), and any necessary supporting documentation to DFO for their review. A copy of the above forms and supporting information will also be sent to the appropriate MNRF office for information only.
DFO will review the details of the proposed project to determine whether they support MNRF’s assessment relative to whether a project is likely to result in serious harm to CRA fisheries or fish that support such a fishery. DFO may contact the appropriate MNRF office to attain relevant information associated with the proposed project and its location, as well as requesting additional project details from the Proponent in the event that they determine there is insufficient information to make a decision. The Proponent will then provide DFO with the requested information should they decide to continue pursuing approval for the project.

If DFO determines that the project is not likely to result in serious harm to CRA fisheries or fish that support such a fishery, they will notify MNRF and the Proponent in writing to that effect. DFO will engage in discussions with the Proponent regarding potential conditions of approval or SARA authorization or permit requirements that would enable the project to proceed. Proceed to Step 7.

If DFO determines that the project is likely to result in serious harm to CRA fisheries or fish that support such a fishery, DFO will notify the Proponent and MNRF accordingly.

7. **DFO issues Fisheries Act approval and/or SARA authorization or permit to the Proponent and notifies MNRF.**

Proceed to Step 8.

8. **MNRF ensures consistency with the approved FMP and will approve the water crossing project with, or as a revision to, the AWS.**

Once all of the necessary water crossing forms, and where applicable Fisheries Act authorizations or approvals have been completed and received, MNRF may conduct a final review to help ensure consistency with the approved FMP. Proponent incorporates any SARA/ESA requirements or conditions, if applicable to the project. The water crossing project(s) will then be approved with, or as a revision to, the AWS. Proceed to Step 9.

9. **Proponent proceeds with the water crossing project following all necessary requirements.**

The Proponent may proceed with water crossing projects that have been approved or deemed approved in an AWS.

10. **Proponent submits final water crossing project completion notification to MNRF with FMP annual report.**

Following the completion of the of the water crossing project, the Proponent will notify the MNRF of the precise location of the crossing, the details of the crossing type that was constructed and/or decommissioned, and any potential issues that were experienced during
the construction and/or decommissioning of the crossing or that might be expected throughout
the use and maintenance of the site.

The reporting and monitoring requirements for water crossings are outlined in the FMPM and
FIM.

The Proponent is also required to notify the MNRF as to the status of forest operations
(including at start-up, if temporarily suspending, and at completion) as per timelines outlined in
the procedures of the Forest Compliance Handbook.
Forestry Water Crossing Project Approval Process Flow Chart

1. Proponent identifies the water crossing project and determines if it applies to CRA fisheries or fish that support such a fishery.

2. Yes
   - Proponent identifies whether any federally and/or provincially listed aquatic species at risk are likely to be affected.

3. No
   - Proponent determines whether a water crossing standard can be applied to the water crossing project.

4. No
   - Proponent completes and submits the appropriate sections of Appendix 1 form to the MNRF for approval with, or revision to, the AWS.

5. Yes
   - MNRF reviews the proposed water crossing project and determines whether the water crossing project is likely or not likely to result in serious harm to CRA fisheries or fish that support such a fishery.

6. Water crossing Project is not likely to result in serious harm to CRA fisheries.
   - Proponent forwards water crossing project proposal to DFO for review with a copy to MNRF for information purposes.

7. DFO determines water crossing project is not likely to result in serious harm to CRA fisheries and notifies the Proponent and MNRF.
   - Proponent incorporates SARA/ESA requirements or conditions, if required.

8. No further Fisheries Act considerations and/or authorizations are required.
   - MNRF ensures consistency with the approved FMP and will approve the water crossing project with, or as a revision to, the AWS.

9. Proponent proceeds with the water crossing project following all necessary requirements.

10. Proponent submits final water crossing project completion notification to MNRF with FMP annual report.

Yes
   - Follow federal SARA and/or ESA process.

Yes
   - Proponent determines whether a water crossing standard can be applied to the water crossing project.

No
   - MNRF reviews the proposed water crossing project and determines whether the water crossing project is likely or not likely to result in serious harm to CRA fisheries or fish that support such a fishery.

Water crossing Project is not likely to result in serious harm to CRA fisheries.

Water crossing project is likely to result in serious harm to CRA fisheries.

DFO determines water crossing project is likely to result in serious harm to CRA fisheries and notifies the Proponent and MNRF.

Proponent incorporates SARA/ESA requirements or conditions, if required.
SECTION 6 – PLANNING FRAMEWORK

Planning

FMP Stage

The FMP planning process provides Proponents and MNRF staff an opportunity to strategically plan and conduct preliminary risk assessments for water crossings associated with proposed primary and branch road corridors and operational road boundaries. Risk assessments conducted at the FMP stage will help to identify potentially complex or higher-risk water crossings early in the planning process, as well as possible water crossing standards that could be considered at proposed crossing locations.

Performing planning and assessment during the FMP planning stage is intended to streamline the approval process during the AWS stage. Water crossing planning during the FMP planning process can help minimize the potential need for future plan amendments or operational delays where crossing complexities arise that require changes to the approved primary and branch road corridors operational road boundaries, or authorizations under the *Fisheries Act*.

During the development of an FMP, planning teams may identify operational management zones for fisheries, as per the FMPM. Where an operational management zone related to fisheries has been identified in an FMP, the FMP may also identify that water crossings within the operational management zone require review and approval, and a water crossing standard cannot be applied. The establishment of operational management zones for fisheries in the FMP will be in accordance with any operational guidance available from the MNRF and/or DFO.

Planning teams can also identify instances where water crossings approved in the FMP can utilize less intrusive water crossing structures without the need for further review/approval by MNRF. For example, where a round closed bottom culvert has been approved for construction but site conditions ultimately are not favorable for its construction, no further review and approval is required if a clear span bridge is constructed in its place. The FMP must clearly specify the conditions that would allow for a crossing structure substitute.

The FMP planning process is the appropriate time to develop operational prescriptions and conditions for areas of concern. Similarly, strategies and restrictions to manage any potential access or location issues/concerns created by water crossing projects (e.g., the creation of loop roads, thresholds for water crossing construction within specific watersheds, road and water crossing construction within wetlands) must be developed and included in an approved FMP. These types of planning issues are addressed in the process described in the FMPM and not through implementation of this Protocol.

Any water crossing standards from this Protocol that are intended to be used during forest operations must be included in the FMP in order to enable their implementation. Planning
teams will document water crossing standards to be used in the FMP in accordance with the requirements of the FMPM.

**AWS Stage**

Water crossings proposed for construction and/or decommissioning will be approved as part of the approval of an AWS or revision to an AWS. Water crossing project details will be submitted and, if required, reviewed as part of the review and approval of an AWS.

Proponents will plan and submit proposed water crossings to the MNRF that are expected to be constructed, and/or decommissioned during the course of the year as part of the submission of the AWS. Water crossings applications will include table AWS-1 from the FMPM (as per FMPM Part D 3.2.51 & 3.2.5.3) and Appendix 1 form for submission of information on a proposed water crossing from this Protocol.

Proponents must submit all water crossings scheduled to be constructed in the current year. Proponents may submit higher-risk and complex water crossings planned for the following year to allow for additional time for MNRF to review and conduct site visits during appropriate times of year.

In cases where water crossing approvals are required during the implementation of an approved AWS, the Proponent will submit Appendix 1 forms to MNRF with as much lead-time as possible in order to minimize any potential operational delays associated with the revision to the AWS.

AWS approvals do not carry-over from year to year; consequently any construction and/or decommissioning projects that do not occur during the implementation of the AWS must be re-submitted in future years following the decision framework process outlined above.

**Submissions: Water Crossing Standards and Site-Specific Review and Approval**

**Proponent is Implementing a Water Crossing Standard**

If the Proponent determines that their project can implement all of the requirements of a water crossing standard included in the Protocol, they will complete and submit the appropriate sections of an Appendix 1 Water Crossing Information Form. MNRF must receive an Appendix 1 form for each water crossing being constructed or decommissioned using a water crossing standard. Water crossings in which a water crossing standard is being proposed for construction or decommissioning will be approved in conjunction with the approval of, or revision to, the AWS.

The Proponent is responsible for ensuring that the proposed water crossing location and the implementation of any water crossing standards is consistent with the approved FMP.
During the construction of a road, an unidentified stream may be encountered or the actual location of a stream may be different than the portrayed location in the FMP and AWS. In cases where an applicable water crossing standard from the FMP will be implemented in its entirety, the Appendix 1 form will be completed and submitted to MNRF. Upon receipt of the applicable forms, the AWS will be deemed revised to include the water crossing. The Appendix 1 form must be submitted to the MNRF prior to operations commencing for the water crossing project.

**Proponent Requires Review and Approval**

In cases where the Proponent is unable to utilize a water crossing standard for the construction or decommissioning of a water crossing, the proposed crossing will require site-specific review and approval by MNRF.

In these cases, the Proponent will complete and submit the appropriate sections of an Appendix 1 form to MNRF for each proposed crossing requiring review and approval. MNRF will review each proposed crossing activity requiring approval by completing an Appendix 2 form. MNRF reviews will consider the general and crossing-specific water crossing standards and mitigation measures that have been developed and included in this Protocol, as well as the potential impacts to fishery and water quality resources when evaluating whether a project is likely or not likely to result in serious harm to CRA fisheries or fish that support such a fishery. MNRF approval of water crossing construction and decommissioning activities may incorporate some or all of the requirements from one or more of any water crossing standards and/or best management practices and mitigation measures as conditions of an approval.

If MNRF considers that the volume of crossings being submitted for review may be operationally unrealistic for a given year, MNRF may ask the Proponent to prioritize the crossings requiring immediate review, identifying “preferred” and “alternative” options that are being proposed to access the same general area(s) approved for operations, and/or reduce the amount of crossings requiring review. MNRF will prioritize their review and approval efforts to focus on high-priority and “preferred” crossings in order to strategically manage staff capacity and workloads.
Reporting

For all water crossing installations, the actual UTM crossing location, digital point feature, and crossing type/water crossing standard that was constructed must be submitted to MNRF in conjunction with the submission of the FMP Annual Reports.

Proponents will continue to follow the requirements of the MNRF Forest Compliance Handbook regarding the start-up and completion notifications of water crossing activities.

Proponents and their contractors will also abide by the *Fisheries Act* Section 38(4) Duty to Notify provisions. These provisions obligate persons whose actions have led to occurrences that result in serious harm to fish that are part of or support a CRA fishery and have not been authorized under the Act or where there is a serious and imminent danger of such an occurrence to notify DFO (notify through email: fisheriesprotection@dfo.mpo.gc.ca or by phone: 1-855-852-8320).

Proponents must also immediately report the spill of any material harmful to the environment (e.g. fuel, fluids, silt, etc.) in waters to the Ministry of the Environment and Climate Change Spills Action Centre at 1-800-268-6060 and take corrective measures. In such cases, Proponents must also notify on the details of the occurrence and the corrective measure being taken.

Monitoring

Ongoing effectiveness and compliance monitoring activities will be used to evaluate how the stated goals and objectives of the Protocol are being met while supporting an adaptive management approach to policy development. Data and feedback collected as part of MNRF, DFO and/or Proponent monitoring activities will be used to support improvements and revisions to future versions of this Protocol.

a) Compliance monitoring of construction and decommissioning activities

MNRF will continue to implement focused monitoring and compliance efforts on water crossing construction and decommissioning projects as per approved FMPs and AWS, the requirements of the MNRF Forest Compliance Handbook, and this Protocol.

When developing annual compliance and monitoring priorities, MNRF may choose to prioritize some of their efforts on higher-risk water crossing projects. Compliance and monitoring efforts for water crossings using a water crossing standard should focus on compliance with the requirements set out in the applicable water crossing standard and determining if the selected water crossing standards were appropriate for the actual site conditions at the crossing.

b) Effectiveness monitoring of the Protocol
MNRF will review the effectiveness of the Protocol to confirm that the Protocol is providing for timely and efficient approvals of forestry water crossings.

MNRF and DFO will also evaluate the effectiveness of the Protocol in achieving its stated objectives. The requirements of water crossing standards will be evaluated relative to new science and operational experience, and updated when required to help ensure that the objectives of the Protocol continue to be achieved.

In order to achieve effectiveness monitoring of the Protocol, MNRF and/or DFO may pursue strategic partnerships with the forest industry and/or other external and academic partners and the science community to collect the necessary data to make informed assessments of the efficacy of the Protocol.
SECTION 7 – APPROVED WATER CROSSING STANDARDS

These water crossing standards have been developed collaboratively with input from the MNRF, DFO and representatives from Ontario’s forest industry. They represent minimum levels of performance requirements that must be met by Proponents when constructing and decommissioning water crossings using the proponent self-screening approval framework detailed in this Protocol.

The conditions and requirements included in the general and specific water crossing standards have been deemed by MNRF and DFO staff as the necessary mitigation measures required to classify the water crossing project as not likely to result in serious harm to CRA fisheries or fish that support such a fishery. If a Proponent determines that the requisite water crossing standards that apply to their specific project can be implemented, they may proceed with their activity, so long as the water crossing standards notification requirements are met, and forest management approval processes outlined in this Protocol and the appropriate version of FMPM are followed.

In cases where a Proponent determines that the requisite water crossing standards that apply to their specific project cannot be implemented, a review and approval will be required by either MNRF and/or DFO as per the approval framework outlined in this Protocol.

Failure to follow the requirements of these water crossing standards could result in compliance and enforcement actions under both the Fisheries Act and the CFSA.

Part 3.0 of this section details water crossing construction, maintenance and decommissioning best management practices and mitigation measures. Although not mandatory, it is highly recommended that Proponents consider these best management practices and mitigation measures in relation to the planning, design, construction, maintenance and decommissioning of water crossing. The tools and approaches contained in this section support Proponents in meeting the water crossing standards included in Part 1.0 and 2.0 in this section.
Part 1.0 General Water Crossing Standards That Apply To All Water Crossings

This general water crossing standard applies to all water crossings constructed or decommissioned under the authority of the CFSA for which a self-screening approval approach is being implemented. Additional measures that are specific to certain water crossing types or structures must also be implemented and are detailed in Part 2.0 of this Protocol.

General Standards

- The implementation of water crossing standards (i.e. type and location of project) must be consistent with the applicable and approved FMP.

- The implementation of water crossing standards must be overseen or carried out by individuals who are trained and competent to:
  
  - Understand the intent and objectives of the specification’s standards;
  - ensure that specification’s water crossing standards and appropriate mitigation measures are satisfactorily applied; and
  - Recognize when water crossing standards and appropriate mitigation measures have not been satisfactorily implemented and understand the requirements to report and correct any mistakes that have occurred.

- The project must be compliant with applicable water crossing standards and guidelines in the most recent versions of Ontario’s forest management guide(s) that address the conservation of biodiversity at the landscape scale and the stand and site scales and MNRF’s Crown Land Bridge Manual.

Design and Location

- The project does not include watercourse realignment.

- Projects are designed and constructed in a way that minimizes loss or disturbance to riparian vegetation. The removal of riparian vegetation must be restricted to the disturbance footprint required for the construction, maintenance and decommissioning of water crossings.

Erosion and Sediment Control

- Erosion and sediment control measures must be installed prior to the commencement of construction or decommissioning activities to prevent the release of sediment or other deleterious substances to the watercourse. Erosion and sediment control measures will be:
  
  - Effective and installed properly with respect to the site conditions;
  - Inspected regularly during the course of construction with any necessary repairs being made if any damage occurs;
o Maintained until the site has become stabilized through the permanent re-establishment of vegetation (i.e., a root mass has been established that ensures site stabilization), either naturally or through planting and tending activities within disturbed areas and approaches, and/or they have been stabilized with rip-rap, or appropriately sized non-erodible aggregate material.

- Fill material placed below the normal high water mark will be erosion-resistant and/or protected from erosion.

- Water crossings are to be constructed and decommissioned to help ensure that storm water runoff from bridge decks, side slopes, and road approaches and ditches are directed away from the watercourse and into a retention pond or vegetated areas to remove suspended solids, dissipate velocity, and prevent sediment and other deleterious substances from entering the watercourse. Erosion and siltation in ditch lines adjacent to watercourse crossing approaches are to be controlled by using sediment traps such as rock/soil dams or log jams as site conditions warrant.

- Crossing sites are to be stabilized during and post construction and decommissioning, including any material stockpiling, spoil, and/or other waste materials to prevent sediment or other deleterious substances from entering the watercourse. Cut and fill slopes around the water crossing structure and decommissioned sites are to be stabilized at a 2:1 slope or stable angle of repose for the materials used using site appropriate methods.

**CRA fisheries or fish that support such a fishery**

- At any time of year, the free movement of water and the passage of fish may not be blocked or otherwise impeded up and down stream of the crossing, with the exception of potential and temporary blockage due to water crossing construction/decommissioning activities.

- All in-water construction and decommissioning activities must abide by the appropriate fisheries in-water timing windows documented in approved FMPs and/or forest management guides in order to avoid disrupting sensitive fish life stages. In cases where the fishery community inventories at the location of the proposed project are not well documented, the most restrictive in-water timing window must be used.

- All in-water construction and decommissioning activities must be undertaken in an uninterrupted fashion and be completed in an appropriate timeframe so as to minimize the potential for site disturbance.

- The construction and decommissioning activities must not employ the use of any explosives.
Construction and Maintenance

- Machinery must be maintained free of fluid and fuel leaks.

- Machinery must be operated on land with tracks/wheels above the normal high water mark, or on ice in a manner that avoids disturbance to the banks of the watercourse and adjacent riparian vegetation areas.

- Machinery must be washed, refueled and serviced a minimum of 30 metres away from the watercourse. Fuel and other materials for the machinery are to be stored a minimum of 30 metres away from the watercourse to minimize the chance of any deleterious substance from entering the water.

- Removal of riparian vegetation must be restricted to the disturbance footprint required for the construction, maintenance and decommissioning of water crossings. Site-specific operational and/or safety concerns that warrant the removal of additional riparian vegetation will be determined on a case-by-case basis and will be kept to a minimum within the road right-of-way in order to help maintain the stability of watercourse banks.

- All debris resulting from construction and decommissioning activities must be removed from the work site following the completion of the undertaking.

- If machinery fording the watercourse is required during the course of construction activities, it will be limited to a one-time event (over and back) per piece of equipment that is essential to implementation of the project, and must occur only if an existing crossing at another location is not available or practical to use.
  
  - If minor rutting is likely to occur, watercourse bank and bed protection methods (e.g., swamp mats, pads) are to be used provided they do not constrict flows or block fish passage;
  - Grading of the watercourse banks for the approaches is not permitted;
  - If the watercourse bed and banks are steep and highly erodible (e.g., dominated by organic materials and silts) and erosion and degradation are likely to occur as a result of equipment fording, a temporary crossing structure or other practice must be used to protect these areas;
  - The one-time fording must adhere to the appropriate in-water timing windows; Fording must occur under low-flow conditions and not when flows are elevated due to local rain events or seasonal flooding.
Part 2.0 Water Crossing Standards That Apply To Specific Water Crossings Structures/Practices

The following water crossing standards apply to specific water crossing structures and/or practices and must be implemented in addition to the general water crossing standards outlined in Part 1.0 of this document.

2.1 Water Crossing Standards for the Construction of Clearspan Bridges

This water crossing standard applies to the construction of clearspan bridges and their footprints, including associated abutments, cribs and/or sill logs.

General Standards

- The conditions and requirements of the general water crossing standards must be implemented in addition to, and in conjunction with, this water crossing standard.

Design and Location

- Bridges must not be located on meander bends, braided watercourses, alluvial fans, or any other area that is inherently unstable and may result in the alteration of natural stream functions or erosion and scouring of the water crossing structure.

Erosion and Sediment Control

- Appropriate site-specific mitigation measures must be enacted to ensure the construction of clearspan bridges, including bridge cribs, abutments, and associated fill slopes are not subjected to the impacts of long-term or ongoing erosion. At a minimum, measures must include:
  - Clearspan bridges, including bridge cribs and fill slopes must be stabilized with appropriately sized non-erodible material (e.g., rocks, cobble sized stones). Rock used to stabilize crossings and watercourse banks will be clean, free of fine materials, and of sufficient size to resist displacement during peak flood events. The rock must be placed at the original watercourse bank grade to ensure there is no infilling or narrowing of the watercourse.
  - Fill material placed below the normal high water mark of the watercourse must be erosion resistant and/or protected from erosion.

CRA fisheries or fish that support such a fishery

- The project must not be located within 100 metres of fisheries spawning or sensitive habitat if any in-water work is a requirement of the project.

Construction and Maintenance
• The bridge, including its abutments, must be placed entirely outside the normal high water mark.

• The construction of clearspan bridges must not result in the alteration of the bed or banks of the watercourse or infilling or narrowing of the watercourse channel.

2.2 Water Crossing Standards for the Decommissioning of Clearspan Bridges

This water crossing standard applies to the decommissioning of clear span bridges and their footprints, including associated abutments, cribs and/or sill logs. In certain cases, local site conditions may create a higher likelihood for potential damage to watercourse banks and/or fish habitat when bridges abutments, cribs, and/or sill logs are completely removed as opposed to leaving them in place. In these cases, Proponents must ensure that appropriate sedimentation and erosion mitigation approaches, in addition to any necessary public safety actions, continue to be implemented.

General Standards
• The conditions and requirements in the general water crossing standards must be implemented in addition to, and in conjunction with, this water crossing standard.

• Decommissioning of water crossings will only occur if it is consistent with the approved road use management strategy in the applicable FMP and is scheduled for decommissioning in the current AWS (Table AWS-2).

Erosion and Sediment Control
• Upon decommissioning, including the removal of bridge abutments, cribs, and/or sill logs, the site must be stabilized and protected against erosion.

• Bridge abutments and cribs may be left in place if they are in good condition, stable for the long term, are not affecting watercourse or fish community dynamics, and are permissible in the approved FMP and/or AWS-2 table.

• Surface water runoff and road approaches and ditches must be directed away from the watercourse and into vegetated areas. Diagonal berms or waterbars must be installed where the erosion potential of the road approaches is likely to result in the road’s gravel surface and underlying fill being deposited into the watercourse over time. Sediment traps used within ditch lines adjacent to the watercourse crossing approach should be replaced and/or maintained to their original condition at the time of crossing decommissioning.

CRA fisheries or fish that support such a fishery
• The project must not be located within 100 metres of fisheries spawning or sensitive habitat if any in-water work is a requirement of the project.
Construction and Maintenance

- The decommissioning of clearspan bridges, including the removal of bridge abutments, cribs and/or sill logs will not result in the alteration of the bed or banks of the watercourse or infilling or narrowing of the watercourse channel.

2.3 Water Crossing Standards for the Construction of Open Bottom Arch Culverts

Arch culverts are open-bottom structures that typically span the width of the waterbody channel, require minimal in-water construction activities and result in minimal impacts to the banks of the waterbody.

General Standards
The conditions and requirements in the general water crossing standards must be implemented in addition to, and in conjunction with, this water crossing standard.

Design and Location
- The arch culvert must not be located on meander bends, braided watercourses, alluvial fans, or any other area that is inherently unstable and may result in the alteration of natural stream functions or erosion and scouring of the water crossing structure.

- Culverts must be sized to a minimum Q25 design flow using MNRF water engineering/calculation software, or equivalent software programs deemed acceptable by the MNRF.

Erosion and Sediment Control

- Appropriate site-specific mitigation measures must be enacted to ensure the construction of arch culverts and associated footings and fill slopes are not subjected to the impacts of long-term or ongoing erosion. At a minimum, measures must include:
  - Stabilizing the crossing, including footings and fill slopes, with appropriately sized non-erodible material (e.g., rocks, cobble sized stones). Rock used to stabilize crossings and watercourse banks must be clean, free of fine materials, and of sufficient size to resist displacement during peak flood events. The rock must be placed at the original watercourse bank grade to ensure there is no infilling or narrowing of the watercourse.
  - Fill material placed below the normal high water mark of the watercourse will be erosion resistant and/or protected from erosion.

CRA fisheries or fish that support such a fishery
- The project must not be located within 100 metres of fisheries spawning or sensitive habitat if any in-water work is a requirement of the project.
Construction and Maintenance

- The project cannot result in any excavation and/or reconstruction of the streambed.

- The crossing must be installed under low-flow conditions and not when flows are elevated due to local rain events or seasonal flooding.

- The culvert must be secured on continuous footings outside of the normal high water mark and will be constructed according to the manufacturer’s specifications using materials that are appropriate for the site and expected loads.

- Where footings are constructed with concrete, appropriate measures must be taken to ensure concrete materials do not encroach into the bed of the watercourse.

- The construction of arch culverts must not result in the alteration of the bed or banks of the watercourse or infilling or narrowing of the watercourse channel.

2.4 Water Crossing Standards for the Construction of Snow Fill and Ice Bridge Crossings

Snow fills and ice bridges, two types of water crossings that provide cost-effective access when lakes, rivers and streams are frozen, are typically used for temporary winter access in remote areas. Ice bridges are normally constructed on larger watercourses that have sufficient stream flow and water depth to prevent the ice bridge from coming into contact with the stream bed or restricting water movement beneath the ice. Snow fills, however, are temporary crossings constructed by filling the channel of a watercourse with clean compacted snow.

General Standards

- The conditions and requirements of the general water crossing standards must be implemented in addition to, and in conjunction with, this water crossing standard.

Design and Location

- The work must not include dredging, placing fill, or grading or excavating the bed or banks of the watercourse.

Erosion and Sediment Control

- No earth fill or aggregate is permitted below the normal high water mark of the watercourse. Crossings must be constructed of clean water, ice and snow that are free of dirt and debris.

CRA fisheries or fish that support such a fishery

- Snow fills and ice crossings must not restrict water flow within the watercourse where it occurs naturally during winter conditions, or otherwise completely obstruct fish passage at any time.
• The project must not be located within 100 metres of fisheries spawning or sensitive habitat.

Construction and Maintenance
• Appropriate seasonal conditions must be present (e.g., adequate depth of snow and ice, winter temperatures) to provide certainty that the construction and removal water crossing standards can be satisfactorily implemented.

• Aggregate or loose woody material cannot be used to top the crossing.

• If logs or corduroy are used to stabilize the approaches of ice and snow fill crossings:
  o The logs must be clean;
  o The logs may be securely bound together to facilitate removal and minimize site disturbance;
  o No logs or woody debris can be left within the watercourse;
  o Corduroy (if used) adjacent to the watercourse banks must be removed and placed outside the floodplain to help prevent a damming effect on the site. Corduroy that is frozen or embedded into the road approaches or watercourse banks must be left in place so as to not expose mineral soil adjacent to the watercourse. The remaining snow and ice can be left to melt in the spring. If required, remedial work will be carried out on the site after the crossing is removed to ensure that no logs or woody debris can wash back into the watercourse.
  o Logs may be placed on road approaches to assist in diverting runoff away from the watercourse; however, they must be placed outside of the floodplain and in such a manner as to ensure that they do not wash back into the watercourse.

• Sanding of snow and ice crossings must be kept to a minimum and within the bounds of operational health and safety considerations.

• Corduroy logs or brush mats must be installed on the approaches to the watercourse crossing when conditions are soft in order to avoid disturbing the banks and crossing approaches.

• If water is being pumped from a watercourse to reinforce the crossing, the intakes must be sized and adequately screened to prevent debris blockage and fish entrainment.

2.5 Water Crossing Standards for the Construction of Single, Small Closed-Bottom Round Culverts

This water crossing approval specification applies to the construction of single, round, corrugated, closed-bottom steel, aluminum, or plastic culverts that are less than or equal t
1200 millimeters (4’) in diameter and do not require site-specific engineering approval (i.e., span less than three (9.8’)), as per MNRF’s Crown Land Bridge Manual, 2008.

**General Standards**

- The conditions and requirements in the general water crossing standards must be implemented in addition to, and in conjunction with, this water crossing standard.

- The project does not:
  - Replace an existing open-bottom crossing (e.g., clear span bridge, arch culvert);
  - Replace an existing closed-bottom culvert that is larger in diameter than that being installed; or
  - Involve the installation of more than one closed-bottom culvert at the crossing location.

**Design and Location**

- Culvert crossings must be located, designed and constructed to minimize the likelihood of ongoing outlet scour, culvert undermining and/or the erosion of fill in order to provide for stable and non-perched crossing sites that can provide for fish passage.

- The culvert must not be located on meander bends, braided watercourses, alluvial fans, or any other area that is inherently unstable and may result in the alteration of natural stream functions or erosion and scouring of the crossing structure.

- Culverts must be sized to a minimum Q25 design flow using MNRF water engineering/calculation software, or equivalent software programs deemed acceptable by MNRF.
  - In cases where an unmapped watercourse is encountered during the construction of a road, and where a proper watershed analysis cannot be completed to determine the Q25 design flow, the culvert must be sized to ensure that it spans from bank to bank within the watercourse.

- Culverts must not be installed where the channel slope at the crossing location (i.e., physical rise over run of the culvert footprint prior to construction) is of a gradient greater than 2.0%.

- Culverts must not be installed where the slope of road approaches or either of the bank approaches is greater than 30%/17°.

- Crossing locations must be selected where culverts can be embedded below the grade of the watercourse bed. The amount of embedment should be determined by local conditions.
Erosion and Sediment Control

- Appropriate site-specific mitigation measures must be enacted to ensure the construction of the culvert crossing does not result in the ongoing erosion of fill. At a minimum, measures must include:
  - Both the inlet and outlet ends of the culvert must be stabilized with appropriately sized non-erodible material (e.g., rocks, cobble sized stones) to prevent erosion of the fill slope and the watercourse bed. Rock used to stabilize crossings and watercourse banks must be clean, free of fine materials and of sufficient size to resist displacement during peak flood events. The rock shall be placed at the original watercourse bank grade to ensure that there is no infilling or narrowing of the watercourse.
  - Fill material placed below the normal high water mark of the watercourse must be erosion resistant and/or protected from erosion.

CRA fisheries or fish that support such a fishery

- The project must not be located within 100 metres of fisheries spawning or sensitive habitat.

- The project must not be located within 500 metres of any brook trout spawning or upwelling areas.

- The project must not be located on any watercourses or tributaries that flow into, and are within 500 metres, of known naturally reproducing brook trout lakes.

- The combination of culvert size, length, slope and drainage area will not create accelerated water velocities that will consistently and predictably impede the passage of fish.

Construction and Maintenance

- The crossing must be installed under low-flow conditions and not when flows are elevated due to local rain events or seasonal flooding.

- Both the interior and exterior of round, closed bottom culverts that are installed on CRA fisheries or fish that support such a fishery waterbodies must be corrugated to ensure structural stability and facilitate fish passage.

- The grade of the culvert must reflect the grade of the natural watercourse bed.

- Backfill must be adequately compacted around the culvert. Only clean sand or gravel can be used as backfill and must be compacted around the culvert in layers.
• Culverts must be the correct length to permit banks to be sloped at an angle of 2:1 or a stable angle of repose for the materials used.

2.6 Water Crossing Standards for the Decommissioning of Single, Small Closed-Bottom Round Culverts

This water crossing approval specification applies to the decommissioning of all round, closed-bottom steel, aluminum, or plastic culverts that are less than or equal to 1200 millimeters (4’) in diameter.

General Standards
• The conditions and requirements in the general water crossing standards must be implemented in addition to, and in conjunction with, this water crossing standard.
• Decommissioning of water crossings will only occur if it is consistent with the approved road use management strategy in the applicable FMP and is scheduled for decommissioning in the current AWS (Table AWS-2).
• If the construction of the crossing was originally reviewed and approved by MNRF and/or DFO, all applicable conditions of approval must be fulfilled.

Erosion and Sediment Control
• Upon decommissioning, the site must be stabilized and protected against erosion. Approaches to the watercourse should be stabilized at a 2:1 slope or stable angle of repose for the materials used using site appropriate methods.
• All exposed soil must be seeded and/or stabilized immediately following completion of activities. Erosion and sediment control measures must be appropriate for the site conditions and maintained until vegetation has become permanently re-established within disturbed areas and/or exposed mineral soils have been stabilized with rip-rap or appropriately sized non-erodible rock material.
• Materials removed or stockpiled during decommissioning (e.g. grubbing, overburden fill) must be deposited outside the floodplain and stabilized/protected against erosion to ensure material does not enter the watercourse.
• Surface water runoff and road approaches and ditches must continue to be directed away from the watercourse and into vegetated areas. Diagonal berms or waterbars must be installed where the erosion potential of the road approaches is likely to result in the road’s gravel surface and underlying fill being deposited into the watercourse over time. Sediment traps used within ditch lines adjacent to the watercourse crossing approach must be replaced and/or maintained to their original condition prior to the construction of the crossing.
• Appropriately sized erosion-resistant materials must be used below the normal high water mark for stream bank rehabilitation.

**CRA fisheries or fish that support such a fishery**
• The project must not be located within 100 metres of fisheries spawning or sensitive habitat if any in-water work is a requirement of the project.

**Construction and Maintenance**
• The crossing must be decommissioned under low-flow conditions and not when flows are elevated due to local rain events or seasonal flooding.

• The watercourse must be restored as closely as possible to its original condition prior to the construction of the crossing, including retaining as close as possible the original stream alignment.

• All crossing infrastructure must be completely removed from the site.

• Grubbing must be minimized to leave as much of the existing vegetation intact.
Part 3.0 Water Crossing Construction, Maintenance and Decommissioning Best Management Practices and Mitigation Measures

Introduction

The best management practices and mitigation measures outlined in this section are aimed at supporting Proponents in meeting the requirements described in the water crossing standards in Part 1.0 and 2.0 of this document. These best management practices and mitigation measures constitute a suite of planning, design, construction, maintenance and decommissioning tools and approaches that can support Proponents in the implementation of water crossing standards.

In many cases, the mitigation measures included in this section represent existing industry construction practices. In other cases, the mitigation measures represent best management practices that would provide an increased level of assurance that the water crossing standards will be met. Proponents have the flexibility to utilize any or all of the mitigation measures detailed below as site conditions warrant, recognizing that Proponents are required to comply with the water crossing standards.

3.1 Crossing-Specific Design, Construction and Fisheries Best Management Practices and Mitigation Measures

3.1.1 Clearspan Bridges

- Ideal site conditions for bridge construction include narrow water width, solid foundations for abutments, erosion-resistant soils and shallow water depths. A preferred site with these characteristics is a riffle or rapids section of a stream or river. These areas can also have a high value for fisheries, either as a spawning or feeding area and are also important for their recreational value and potential for historical or archaeological material.

- Road fill can be kept from spilling into the water opening by using wing walls on bridges.

- Concrete buckets, wheelbarrows, or shovels should not be washed in watercourses. They should instead be washed with hoses so that run-off is filtered through vegetation. Cement or fresh concrete are not permitted to enter waterways.

- Treated wood contains toxic substances that must be controlled during installation around water. The following practices should be used when using treated wood:
- Timber should be specified as free of surface oils and meet CSA Standard 080.
- Timbers used below or near water level should be reasonably dry without surface oils. Those timbers with surface oils should be used at the back of the crib, above the normal high water mark and against the road fill.
- Field cuts and drill holes should be done on land to keep chips and sawdust out of the water. When drilling over water, a vacuum should be used to collect chips and sawdust.
- To prevent decay, field cuts and drill holes must be liberally painted with preservatives. Field applied preservative should be approved for domestic use (e.g. copper napthanate) and be applied following instructions on the container.
- Field applied preservatives should be allowed to thoroughly dry before placement in water.
- Waste pieces of treated timber must not be burned. The only legal and safe disposal is in an approved waste disposal site.
- When building cribs, use an inside lining of planks or filler timbers to contain the crib fill material unless all of the fill is larger than the spaces between crib timbers.
- Minimize spaces in bridge decks, and use curbs to prevent road gravel from falling into the water.

3.1.2 Snow fill and Ice Crossings
- Choose an approach to snow fill construction that is appropriate for site and environmental conditions:
  - True snow fills are most typically used in association with ephemeral, intermittent and/or very small slow moving permanent watercourses. Clean snow is pushed into a waterway that has either frozen solid to the bottom or has ceased to flow during the winter months. The idea is to pass over the stream and not disturb the existing ice/snow cover on the stream and banks.
  - Snow fills can often be reinforced by freezing the clean snow as it is pushed into the waterway or by using a log fill approach whereby a layer of logs is built / corduroyed into the snow fill well above the ice level to both reinforce the snow and facilitate the movement of water in the event of seasonal winter thaws. Freezing of the snow as it is pushed will produce maximum strength and durability. The best freezing is achieved by compaction and by adding water.
  - When water flow on permanent watercourses is assumed or confirmed to be occurring under the watercourse ice, a culvert can also be placed on top of the frozen watercourse channel before building the snow fill to add further reinforcement to the crossing while also providing for the movement of water and/or fish in the event that a seasonal winter thaw occurs. In this case, cables are often attached to the culvert to facilitate its removal before the spring freshet.

- Winter crossings should be located in low areas and where the approach roads have grades of 5% or less.
• Approaches should be constructed using clean compacted snow and ice to a thickness that will protect the banks of the watercourse and the vegetation root mat (30 cm or more).

• Dark materials should be kept away from the surface of the snow fill as they tend to thaw the road and could end up in the stream. For example, sanding trucks should minimize or avoid sanding the snowfill crossing, within the bounds of health and safety requirements. In these cases, signs should be placed on the road to mark out no sanding areas.

• Ensure that erodible materials do not enter the water when the spring melt occurs.

• Crossings should be rehabilitated before spring break-up. Keep a close watch on weather conditions near the end of the winter to ensure sufficient time for removal before the ground softens. It is better to remove a crossing earlier rather than take the risk of running out of time due to an early spring.

• When the crossing season is over and where it is safe to do so, a v-notch can be created in the centre of the ice bridge to allow it to melt from the centre and also to prevent blocking fish passage, channel erosion and flooding. Compacted snow should be removed from snow fills prior to the spring freshet.

3.1.3 Round Culverts

• The preferred characteristics of a culvert water crossing site are different than those for a bridge. Conditions favorable for culvert installation include:
  
  o Little or no curve in stream as it reaches the culvert, so the straight pipe will fit the channel and reducing debris backing up at the curve, blocking the opening.
  o A fine grained substrate to provide suitable bedding (gravel or finer).
  o A stable foundation that will not significantly settle when the fill is added.
  o No bedrock or large boulders that will prevent setting the pipe into the streambed.
  o Narrow water surface width (less than 3m).
  o Streambed slope is less than 2%. Culverts are not recommended in streams with >2% slope and are most suitable in slow moving streams with fine bottom sediments.
  o A shallow stream with a water depth of less than 1.5m.

• Culverts should be installed to ensure that they are not, or will not become, perched and impede the free passage of fish. Best management practices and mitigation measures include:
o Crossing locations should be selected where culverts can be embedded below the grade of the watercourse bed to support the free passage of water and fish, enable natural watercourse substrate to fill in within the culvert, and reduce the likelihood of outlet scour and undercutting at the crossing site. The amount of embedment should be determined by local conditions, however, a minimum of 10% embedment is recommended.

o During installation, the Proponent should evaluate the site and recognize the potential for embedment challenges or the likelihood of long-term erosion of the watercourse bed downstream of the culvert location.

o Unexpected site conditions (e.g. the presence of a large boulder or bedrock) does not negate the need to ensure fish passage through the culvert. Where site conditions will not allow for a minimum of 10% embedment, the Proponent should consider alternative crossing locations or structures (e.g. from a round culvert to a bottomless arch culvert or a clearspan bridge).

• Culverts should be installed/embedded to ensure that a minimum of 20cm of water passes through the culvert during low-flow periods of the year, where it would occur under natural conditions, to enable year-round fish passage.

• The installation of the culvert must not create flow velocities that surpass the swimming abilities of the watercourse’s fishery. One or more of the following measures and practices can be utilized:

  o Culvert flow estimating software and procedures to predict the potential flow velocities passing through the culvert,
  o Predicted velocities can be considered relative to distance and fatigue swimming curves (e.g., accessible from DFO or in scientific literature) for the species of fish potentially affected by the project,
  o In cases where velocities are likely to exceed the swimming abilities of the species of fish in the watercourse, particularly at critical life stages where migration is expected to be occurring (e.g., spawning periods), the crossing should be redesigned to reduce the expected velocities passing through the culvert (e.g., select a different crossing location, consider larger diameter and/or shorter length culvert, install baffles to create resting pools within the culvert, utilize alternative clear-span crossing structures).

• Culvert diameter is determined by hydrology analysis, with the ultimate size of culvert being selected to ensure that normal water level rises no higher than half the diameter of the pipe and no higher than the top of the pipe at the design flood flow.

• The constriction caused by a culvert should not cause significant upstream backflooding.
• Select appropriate lengths of culverts to keep road fill from spilling into the water opening.

• Culvert installations during winter/frozen conditions should be avoided in order to ensure that construction water crossing standards continue to be met post-construction and the culvert installations remains safe and stable. For example, there is a higher likelihood of backfill installed during winter/frozen conditions settling or shifting upon thawing and creating conditions of culvert undermining and structural instability.

• Where site conditions warrant, consideration should be given to proactively installing beaver deterrents at the end of culverts during construction as an approach to mitigate potential future beaver activity and possible failure of the crossing/road.

• Culverts are to be inspected/monitored more regularly for blockage in areas where the presence of beavers are known to occur or floating debris is known to be significant.

• The culvert should be installed on a flat gradient.

• Erosion should be controlled with stable trimmed slopes (e.g. use rip rap).

• A protective erosion resistant capping should be placed on fill slopes around the culvert inlet and outlet. Acceptable materials include coarse clean gravel, boulder rip rap, blasted rock rip rap, and vegetation.

• Where flow exiting a culvert may scour the streambed, an erosion resistant rip rap apron should be placed in the streambed. Streambeds with steeper slopes are especially vulnerable. The apron should extend up to six culvert diameters beyond the end of the pipe and it should have a “V” shaped cross section to allow fish migration in low water.

• Before equipment moves away from the water crossing a formal inspection should be made by supervisory staff to confirm the mandatory water crossing standards are met. The cost to correct deficiencies is much lower when equipment is on site.

• In the construction of some water crossings a temporary diversion of flowing water may be needed so the crossing structure can be built under dry conditions. Working in dry conditions can increase the likelihood of a successful installation while significantly reducing the amount of sediment produced during the work, and as such, should be considered in cases where installation activities will take more than a few hours or where site conditions (e.g., bed substrate) will likely result in significant sediment being released into the watercourse. In order to attain dry conditions partial or complete diversions can be constructed. Partial diversions consist of cofferdams which block the flow in a portion of the stream and pumps to keep the work area dry. Complete diversions direct stream flow through pumps, pipes or into a new temporary channel.
Once the crossing is installed the natural channel is re-watered and water flows through the new structure. Best management practices for temporary flow diversion include:

- In cases where water will be partially diverted or removed to allow for dry installations, the appropriate MNRF office should be consulted to ensure that any additional necessary permits are attained prior to work commencing (e.g., license to collect fish).
- The selection of the dam and pump stream diversion method or the bypass channel method depends on the stream flow and how long the diversion is needed. Dam and pump stream diversion is effective for small streams and can be used during the closed season for applicable in-water timing windows.
- Sufficient waterway size must be provided for the diversion to pass floods expected during construction. Suggested design flows for different lengths of time are:
  - Less than one week - use observed flow x2, if no rain is forecasted or;
  - More than one week (but not during the spring) - design for the 2 year flood.
- In-stream cofferdams should be constructed using erosion-resistant material such as rock fill, coarse rip rap, sandbags, precast concrete blocks, water-inflated bladders or sheet piling.
- In-stream sediment control techniques such as stake silt fences or floating silt curtains to isolate working equipment from shallow open water are to be used. These fences are often improperly installed and should not be placed across streams where there is discernable flow as it will block flow and lead to erosion or failure.
- When excavating a bypass diversion channel, work in dry conditions where possible, begin at the downstream end and move upstream. The diversion channel should have gentle curves and be at the same approximate slope gradient as the natural stream.
- Diversion channels are used in larger streams or when the isolation must be in place for more than a few days.
- Sandbags at the upstream end can be used to direct flow into diversion channel.
- Shallow water flow may be permitted to pass through the work area on clean rock.
- Old culverts may be used as a bypass pipe.
- The newly excavated temporary bypass channel should be protected with an erosion-resistant lining (e.g. geotextile or channel liner erosion control blanket). The lining can be held in place with gravel piles, stones or stakes to keep water from getting underneath.
- The point where the old and new channels meet will be very susceptible to erosion. Vulnerable areas can be protected with erosion controls and energy dissipating measures.
- When pumping water, a screen should be used on the intake pipe to keep fish out and the outlet should discharge water on land to naturally remove sediment from the turbid water.
3.1.4 Non-Road Water Crossings—Equipment Only

The following water crossing mitigation measures and best practices apply to the construction of non-road forestry water crossings typically involving the use of operational forestry equipment such as fellers, bunchers, skidders, and forwarders.

Many watercourses, including permanent and/or intermittent streams with defined channels, as well as ephemeral surface/shallow ground water flows (e.g., swales, seeps), are encountered by forest harvesting equipment during the course of operations. These watercourses could potentially contain CRA fisheries or fish that support such a fishery.

These best management practices are intended to supplement related operational considerations found in Ontario’s forest management guides, and the numerous resources available to support practitioner’s efforts to distinguish the differences between permanent/intermittent streams and ephemeral surface/shallow ground water flows, such as MNRF’s Stream Permanency Handbook for South-Central Ontario (2013).

The EA Declaration Order and this Protocol does not mandate any requirements for non-road water crossings. The following best management practices for non-road water crossings have been developed to support decision making during the course of operations and serve as a means to facilitate compliance with the Fisheries Act:

- Appropriate and site-specific measures should be taken to avoid disturbing watercourses, ephemeral surface, and shallow groundwater flow in such a way that
disrupts their hydrological function by impeding, accelerating or diverting water movement.

- The project must be compliant with applicable water crossing standards and guidelines in the most recent versions of Ontario’s forest management guide(s) that address the conservation of biodiversity at the landscape scale and the stand and site scales.

- Unless required by the FIM (e.g., discovery of a new unmapped value) or specifically by an approved FMP, there are no reporting requirements for the construction of non-road operational forestry water crossings.

- Although equipment-only non-road forestry water crossings are highly temporary and typically don’t span great lengths, the Proponent should consider implementing the requirements of water crossing standards found in this Protocol as an approach to help promote compliance with the *Fisheries Act*.

- Crossing through watercourses and ephemeral surface/shallow groundwater flows with forestry equipment should be avoided as often as possible. Where crossings cannot be avoided, clearspan skidder bridges/pads or native timber bridges built to satisfy occupational health and safety requirements are preferred crossing structures and are recommended for use in as many cases as are operationally and economically feasible.

- Where crossings are absolutely necessary, the number of crossing locations should be minimized and chosen strategically to reduce the potential damage to channel banks and beds and the hydrological function of the feature.

- Crossing locations should be selected where the approach slopes and watercourse grades are as small as possible.

- Crossing approaches should be installed as much as possible at right angles to the watercourses.

- Disturbance to the banks of watercourses and the hydrological function of aquatic features should be kept to a minimum with the installation of brush mats, swamp mats, corduroy or snow/ice on the approaches to the crossings.

- Ground disturbance at the crossing location should be kept to a minimum and as much adjacent vegetation as possible must be retained.

- Ruts caused by machinery within the approaches to the crossing should be rehabilitated following the completion of operations to ensure that surface water runoff is diverted away from the watercourse channel. Rehabilitation of ruts should be conducted in a way that does not increase the amount of damage or hazard to the watercourse channel.
• Operational debris or mitigation measures that were implemented such as brush/swamp mats or corduroy should be removed from the watercourse channel or ephemeral surface/shallow groundwater flows to ensure that natural drainage patterns are maintained.
3.2 General Design, Construction and Fisheries Best Management Practices and Mitigation Measures

3.2.1 General Best Management Practices and Mitigation Measures

- Develop a construction strategy for every water crossing so everyone involved knows the risks, the details about how it will be built, and the measures needed to comply with the approval criteria.

- Approach fills to the water crossing should be built by end-dumping to minimize the need to remove the ground cover vegetation. Try to maintain as much vegetation as possible to reduce future erosion risk. The removal of stream boulders for rip rap is not acceptable except where it is necessary to set a culvert at the correct elevation.

- All construction material and equipment should be at the construction site prior to beginning in-water work in order to reduce the in-water disturbance time.

- Equipment and material piles are to be stored and stabilized in a manner that prevents them from entering any watercourse.

3.2.2 Cumulative Effects Best Management Practices and Mitigation Measures

- The number of water crossings should be minimized to support the management of the potential cumulative impacts of forest water crossings on fisheries and aquatic environments. Every effort should be made within the bounds of realistic operational, safety, and economic considerations to minimize the number of new water crossings.

- Existing trails, roads, or cut lines should be used wherever possible to avoid disturbance to watercourse banks and the riparian vegetation.

3.2.3 Design Flow Best Management Practices and Mitigation Measures

- Industry infrastructure can be protected and the potential environmental impacts of crossing failures minimized in the face of increasing frequency and intensity of extreme rain and weather events by using larger design flows (e.g., Q50, Q100) for culvert crossings, particularly on longer term roads such as primary and branch forestry roads. In these cases, appropriate watershed analyses and construction techniques (e.g., culvert embedment) should be undertaken to ensure that a minimum wetted area within the culvert is maintained during low flow periods of the year to allow continued fish passage through the crossing.
3.2.4 Crossing Location Best Management Practices and Mitigation Measures

- When selecting a crossing location:
  - Select a straight stretch having a single channel with stable streambed and banks.
  - Design and construct approaches so that they are as perpendicular as possible to the watercourse. This will simplify culvert or bridge construction and minimize the loss or disturbance of riparian vegetation.
  - Choose a site where the road approaches are favorable and earth cuts are not required within 100 m of the water’s edge.
  - As site conditions permit, avoid ditching road approaches within 30m of the crossing site to avoid funneling sediment-laden rainwater directly towards the watercourse.
  - If possible, avoid areas of wide water or very deep water (i.e. more than 1.5 m deep) to avoid the potential construction challenges associated with larger and longer water crossing structures.

3.2.5 Deleterious Substances Best Management Practices and Mitigation Measures

- The Fisheries Act prohibits the deposition of deleterious substances into water frequented by fish. General mitigation measures to help satisfy this prohibition include:
  - Prior to moving equipment to the water crossing, wash equipment to remove leaked petroleum products and prevent the introduction of invasive species.
  - Repair equipment before construction to minimize leaks.
  - Keep an emergency spill kit on site in case of fluid leaks or spills from machinery and be prepared to use petroleum-absorbing “diapers” if necessary.
  - Locate refueling areas and hazardous material containment areas away from streams and other sensitive areas.
  - Establish appropriate areas for washing concrete mixers, and prevent concrete wash water from entering rivers and streams.
  - Take steps to prevent leakage of stockpiled materials or project spoil into streams or other sensitive areas (e.g., locate the stockpiles and spoil piles away from watercourses and other sensitive areas, use sediment traps, cover during heavy rains).
  - Control materials on the jobsite so that loose boards, nails, and other debris will not enter the waterway and flow downstream. A boom should be used downstream of the project if there is a chance that debris could enter the water.

3.2.6 Temporary Fords Best Management Practices and Mitigation Measures

- Consider the following best management practices and mitigation measures if there is a need to ford the watercourse to temporarily access the far side and enable construction/decommissioning activities to proceed:
Ford the stream at only one location where the best conditions exist. Sites favorable for a ford are those where:
- The banks are low and the stream is shallow;
- There are no spawning sites at the crossing or downstream that could be impacted;
- The streambed must carry the equipment load, therefore, firm rock, boulder or coarse gravel bottom is best;
- The water depth should be less than one metre (for work and equipment safety).
- Construct crossings at right angles to the stream to have the shortest length of impact.
- If possible, locate the ford on a section of the stream that would be altered during the water crossing construction.
- Limit the number of equipment crossings on the ford to one time per piece of equipment.
- Equipment crossing the ford should be clean of mud and be mechanically sound with no oil or gas leaks.
- If equipment will be working in-stream keep the amount of time in-stream to the bare minimum required and install an oil absorbent boom across the stream in a quiet area downstream in case of an oil spill.

3.2.7 Erosion and Sediment Control Best Management Practices and Mitigation Measures

Every site is unique and it is important that the most applicable erosion and sedimentation control techniques are selected to meet the needs of the site. It is critical to evaluate drainage patterns, soils, and construction activities to develop a customized approach for that site. The following erosion and sedimentation techniques are not exhaustive but offer a substantive list of possible options to consider in isolation or in combination with one another to help manage various potential site-specific sediment and erosion challenges.

- Determine the project’s risk of sediment entering the water by considering:
  - Off-land erosion risk: topography, soil type, soil exposure, time until protected,
  - Instream erosion risk: water depth, flow velocity, soil type, degree of isolation from open water,
  - Ease or difficulty of erosion and sedimentation control for the given design,
  - Materials available to work with,
  - Possible weather conditions, and
  - Staff competence and compliance monitoring effort.

- Establish the consequences of sediment in the water, considering:
  - How close to the in-water timing restrictions is the scheduled work;
  - How far downstream the sediment could move (potential zone of impact);
Whether there are fish habitat values within the deposition zone that could be affected;
Whether sediment from construction is compatible with natural stream sediments and channel morphology;
Sediment transport capability of the stream;

- The seriousness of the expected short-term or long-term change due to sediment.
- During the construction phase, workers are expected to follow the strategy developed in project planning but also be prepared to deal with changes and make improvements where possible.
- Ensure that sediment control structures are maintained and that excess accumulated sediment is removed and stabilized above the normal high water mark.
- Supervisors should conduct inspections to ensure compliance with the mandatory water crossing standards.

3.2.7.1 Administrative Considerations

Administrative considerations can help ensure erosion and sediment control objectives are met. They cost little or no extra money and are aimed at ensuring operations are always under control.

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- Clearly assign responsibility to specific individuals who are made accountable for erosion and sediment control. Their role will be to inspect, maintain, and respond to changing conditions on the project.
- When working around water, it is preferable to have workers who are experienced with the working conditions and familiar with regulatory requirements.
- Water crossing planning should address erosion and sediment control and include ideas from equipment operators and on site supervisors.
- Do contingency planning to anticipate “worst case” scenarios, like a heavy rainstorm, and have the materials readily available to respond accordingly.
- Schedule work for dry weather periods and delay work if long periods of heavy rain are in the forecast.
3.2.7.2 Slope stabilization

Slope stabilization consists of trimming the slope flatter than the angle of repose of the material to increase the chances of early re-vegetation. A steep cut or fill slope of mineral soil will erode because the particles are unstable and unable to hold vegetation.

Flattening a steep slope involves adding fill or taking out additional cut material. For example, an earth cut slope in sandy material excavated at 1H:1V would be unstable and be subject to an erosion problem. Flattening the same slope to 2H:1V or flatter will result in better stability and quicker re-vegetation. Once a stable angle of repose is reached there is little benefit of further flattening: this will just increase the area of soil exposed to erosion.

Best Management Practices and Mitigation Measures

- The best time to flatten slopes is during the initial rough grade construction.
- Flatten slopes to a stable angle of repose.
- Although a steep cut can be trimmed back economically it is very costly to flatten an existing road fill that is too steep. It is best to construct stable fill slopes from the beginning of construction rather than trying to correct them once the road is built.
- Round off the corners to reduce erosion at sharp grade changes.
- Graded areas can be roughened to slow down water and reduce the risk of gully erosion by using a bulldozer or other tracked machine to walk up and down the slope leaving a pattern of tread imprints parallel to slope contours. The tread indentations trap seeds, hold moisture, and encourage plants to become established. The tracks also introduce roughness and slow the velocity of sheet flow.

3.2.7.3 Rip Rap

Rip rap is a layer of coarse erosion resistant material used to cap and protect the underlying mineral soil from erosion. It also slows down the flow of water by presenting roughness in the water’s path. This reduces the erosive forces acting on the soil and provides a lining of stable material too large for the water to displace. The reduced flow velocity encourages water infiltration into the ground and eventually vegetation will grow between the rip rap particles if soil is close to the surface.

Rip rap can be used on any exposed mineral soil subjected to flowing water where the velocity of water flow, seriousness of erosion, steepness of slope, or material type prevents satisfactory establishment of vegetative cover. Some form of rip rap is normally used at all water crossings.
where fills are exposed to stream flow (e.g. at culvert inlets or bridge abutments). It can also be effective in lining ditch bottoms to prevent erosion. Boulders from a borrow pit are the most common rip rap on access roads.

Although quite effective, the treatment can be expensive especially in some areas of Ontario where there are neither rock cuts nor suitable pit boulders close by. In these areas, a cover of dense vegetation may be an attractive alternative.

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- Surface grading of the surface to receive the rip rap layer is important. Slopes should be shaped to steepness no greater than 2H:1V.

- At water crossings ensure the rip rap extends down the slope for stability reasons.

- The protection should also extend up the slope above the expected high water level in a flood.

- Consider the possible installation of a non-woven geotextile fabric used under rip rap to prevent soil movement out though the rip rap. There are several options when selecting the type of erosion control geotextile to place under rip-rap. Multiple factors must be taken into consideration. The soil type and its percentage of fines play an important role in choosing the correct geotextile. The weight and angularity of the rip-rap and the height at which it is dropped will determine the required geotextile strength. Finally, anticipated water flow should be considered. Installation of geotextiles should follow manufacturers’ recommendations.

- Select an appropriate rip rap material based on local availability and where the rock must be used.

- Do not use mine slag or rock that generates acid or other toxic trace elements (e.g. arsenic) near water crossings.

- Boulders may be the easiest to obtain, but they tend to roll on each other; therefore, a flatter slope will be necessary than would be the case if blasted rock were available. Boulders can be separated from pit run gravel with the backhoe teeth or with a screening plant (e.g., grizzly bars).

- Blasted rock fragments available from rock cut areas make the best rip rap material because their rough angular shape prevents them from shifting and they can be made to the desired particle size.
• Rip rap linings can be made to withstand most velocities if the proper size of rock is selected. The size of rock needed depends on the active force of flowing water. Larger rip rap is needed in faster moving water (blasted rock is the best material to use against channel flow).

• Rip rap should be leveled and packed to a uniform layer, approximately twice as thick as the average particle size.

3.2.7.4 Seeding

Vegetation provides effective protection against erosion and sediment transport. Soil erosion only occurs in areas not protected by vegetation. Re-vegetation will occur naturally as wind-carried seeds blow onto the soil. However, techniques such as seeding, mulching, and fertilizing will speed up the growth process and improve the chances of success for short-term erosion control while the plants become established (see 3.2.7.5 on soil coverings).

A variety of seed is available to protect soil from erosion. Planting several plant species rather than a single type will increase the chances of success. In northern Ontario, mixes developed and specified by TransCanada Pipelines and the Ontario Ministry of Transportation have proven successful. These can be purchased from local seed supply stores. Some seeds are preferred for wildlife habitat (e.g. clover) and this may be a consideration in selecting seed. In all cases, seeding should only be considered when there is enough growing season remaining for significant root growth; otherwise, alternative erosion and sediment control measures and practices should be implemented.

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• Evenly distribute seeds and ensure contact with the soil.

• Cover seeds with a shallow layer of soil (10 mm thick) for best results.

• Seed small areas, such as water crossings, by hand or with a hand-operated broadcast seeder.

• Seed by hand after each water crossing is done rather than waiting to seed everything at once at the end of the road project.

• Plant seeds when temperatures, moisture, and sunlight are moderate, usually in the spring and fall.

• Hydro-seeding and mulching are cost efficient for large areas. It is a one step process for spraying a slurry of seed, fertilizer, mulch, and water. The critical factor in hydro-seeding
is the ability of the spray to adhere to the soil and hold the seed in place during rainfall and wind.

- Apply fertilizer according to the manufacturer’s instruction and prevent it from entering a watercourse.
- Monitor plant growth and apply seed a second time in any bare spots.

3.2.7.5 Soil Coverings

Soil coverings are materials placed over exposed mineral soil to give immediate, short-term protection while vegetation becomes established. Instead of striking the soil directly, the raindrop impact is absorbed by the covering. Soil coverings also assist seed germination by providing shade, moderating soil temperature, shielding germinants from wind, and reducing evaporation losses. Soil covers are justified where the consequences of short-term erosion are serious and must be controlled during the time it takes for vegetation to become established (e.g. near water crossings). Soil coverings commonly used on access roads include slash mulch, black organic material, and manufactured erosion control blankets.

Organic Mulch

Organic mulch is an effective low-cost treatment for access roads because the raw materials are readily available. Slash and organic mulch have the further advantages of retaining moisture and providing nutrients.

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- Trim slope to a stable angle prior to proceeding. Spread organic material and slash debris (e.g. sticks, roots, small vegetation, and wood chips) from the nearby bush on the exposed soil in a thin layer about 15 cm thick.
- When available, use organic material from near the work site. In some areas the material may have to be trucked from offsite.
- Work mulch into the mineral soil with a backhoe bucket or by tracked equipment traveling over the area. Ideally the sticks would embed in the mineral soil.
- Seed the treated area with a mixture of different seeds, as described in 3.2.7.4.
- Monitor the area for successful vegetation coverage.
- Reseed bare areas to ensure full coverage of vegetation.
**Erosion Control Blankets**

Erosion control blankets are an effective soil covering that is widely available and easily installed without heavy equipment. Blankets provide immediate short-term protection while vegetation becomes established underneath. The selection of which blanket to use depends on the slope angle, the blanket life span, cost, and the risk the road designer is prepared to take.

Suppliers of these blankets provide design assistance to select which of their products should be used. Some products have biodegradable netting and some blankets can be pre-seeded by the manufacturer. The latter type should still be hand seeded with a proven local seed mix before the blankets are installed.

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- Trim the slope to a stable angle and seed the area before laying down the blanket. The seeded vegetation will be able to grow through spaces in the material.

- Install the blankets by rolling them over the seedbed down the slope in the direction of water flow.

- Anchor the top of the blanket in a shallow U-shaped trench beyond the top of the slope.

- Do not stretch blankets; rather allow them to lay loosely on the soil surface to achieve maximum soil contact.

- Overlap joints in the downstream direction so flowing water does not lift them. A 30 cm overlap is recommended.

- Be sure to select an appropriate blanket type based on slope.

- Anchor blankets to the ground with 15 cm long wire staples or wood or plastic pegs. Consider using Biodegradable pegs. The staple frequency should follow the manufacturer’s instructions.

- On frozen ground, use boulders instead of staples to anchor the blankets.

- Inspect the erosion control blankets periodically, especially after rainstorms, for erosion, undermining or blanket displacement by wind. Repair any problems as quickly as possible.

**3.2.7.6 Check Dams**
Check dams are overflow weirs placed across ditches to prevent erosion by reducing flow velocities and by creating an upstream pond where some coarse suspended sediment will deposit. They are used in long, steep roadside ditches where diversions into shrubs or treed area are not possible. Check dams allow for runoff to be stepped down the sloping ditch in a controlled manner. Their use is a short-term erosion prevention measure until vegetation becomes established for permanent erosion control.

**Best Management Practices and Mitigation Measures**

- Check dams can be constructed using a variety of erosion resistant material such as blasted rock, boulders, sandbags, gabions, logs, or wood planks.

- Do not use silt fences as dams in ditches (they are not strong enough).

- It is important to properly embed the dam 15 cm or more by digging a trench to prevent flow under the dam. In cross-section the check dam should be “V” shaped with the sides rising above flood levels to avoid flow washing around the edges through the native soil.

- The maximum height of a check dam is 60 cm and the centre should be at least 15 cm lower than the outer edges.

- The spacing of check dams in a ditch should be close enough that the head pond of one dam reaches the toe of the next upstream dam.

- Accumulated sediment should be removed when it reaches half the dam height, if erodible soils still exist upstream.

- The drainage area of the ditch being protected should not exceed 4 ha.

**3.2.7.7 Brush Barriers**

Brush barriers are piles of slash debris (logs, limbs, tops) placed in the path of flowing water to provide immediate short-term erosion control by covering the soil and filtering sediment laden water. They reduce flow velocity and thus trap sediment in the branches and limbs. Brush barriers can trap 80% of suspended sediment entering them. Brush barriers are normally used at the toe of fill slopes near a water crossing.

**Best Management Practices and Mitigation Measures**

- Position a large anchor log at the toe of the fill, parallel to the direction of the road.

- Secure the anchor log in position by placing it against stumps, rocks or trees.
• Place stockpiled slash (not exceeding 15 cm in diameter and 4m in length) on the fill slope above the anchor log.

• Do not include stumps in the slash.

• Compact the windrow of slash by tamping it with the excavator bucket. This produces a relatively dense windrow embedded in the surface to prevent flow under it.

3.2.7.8 Silt Fences

Silt fences are lightweight structures suitable for filtering small volumes of water flow associated with small drainage areas. They are installed in the path of overland flow to reduce velocity and create a short shallow pond where some sediment will deposit. They act like a strainer allowing water to seep through while sand and larger particles are trapped in an upstream pond or on the surface of the fence. They are also used to define the boundary between disturbed soil and vegetative buffers.

Silt fences are relatively inexpensive devices and are made of either woven or non-woven geotextile material. A woven product especially fabricated for silt fencing is widely used. It is the proper height with pre-fastened wood stakes and a flap for embedment.

Silt fences are commonly used in developed areas. Their use is not as preferable on forest access roads because they are constructed of non-biodegradable materials and regular maintenance is required to ensure they function properly.

Best Management Practices and Mitigation Measures

• The silt fence should be installed as early as site conditions permit, preferably before construction exposes mineral soil.

• Locate the silt fence in one of three areas: a short distance out from the toe of an embankment slope, along the bank of a sensitive stream, or at the downstream end of an erodible earth cut area.

• The area draining to the barrier should be small; typically less than 0.5 ha.

• The recommended distances between silt fences placed parallel to the contours on slopes are: 15m apart on a slope of 2H:1V; 25 m on 3H:1V; 40m on 4H:1V, and 50m on 5H:1V. Silt fences should not be used on slopes steeper than 2H:1V.

• Locate the silt fence so there is a flat area upstream where water can pond against the fence and allow suspended sediment to settle out.
• Drive vertical wood or steel posts into the ground. Maximum post spacing without wire mesh is 2 m and with mesh support is 3 m.

• Fasten the geotextile fabric on the uphill side of the posts.

• Anchor the geotextile in a trench 10 cm in depth and width to toe-in the silt fence and prevent undermining.

• Inspect silt fences after each rainfall.

• Damage such as end runs, overtopping or undercutting should be repaired quickly.

• When a fence is half full of sediment it needs to be cleaned out.

• Silt fences should not be placed across a ditch or in a drainage path that carries high volume or high velocity flow where washout could occur.

3.2.7.9 Sediment Traps

Sediment traps are used downstream of erodible soil sites and consist of sumps and ponds created in the path of flowing water to reduce the velocity and cause deposition of suspended soil particles. Generally, only the larger suspended material (sand and gravel) settles out. An effective trap can retain no more than 50% of the sediment carried into it. They are intended as temporary measures until more permanent controls stop the erosion at its source.

Best Management Practices and Mitigation Measures

• Locate the trap close to the source of the sediment, preferably in a natural low area.

• Do not use sediment traps in catchment areas greater than 1 ha or locate the trap in a watercourse.

• Construct the trap by excavating a hole in the ground or by creating an impoundment with a low head dam.

• The trap size and the spacing between traps should be selected so that sediment from expected erosion areas fills the traps about the same time that vegetation is re-established to prevent further erosion.
• Ensure that the trap is large enough for particles to settle. Often turbidity caused by water entering the trap does not allow particles to settle before the water in the trap overflows.

• An initial trap capacity should be 250 m³ for every hectare of exposed catchment area.

• The length to width ratio of the trap should be 2L: 1W or longer.

• The outlet end of a sediment trap should be protected against erosion since it acts as an overflow weir.

• Accumulated sediment should be removed to make room for the next rainstorm, if erodible soil exists upstream. They should be kept away from stream banks to reduce disturbing the riparian zone.

3.2.7.10 Forest Floor Filter

The natural undisturbed forest floor, with its organic litter and vegetative material, can filter sediment-laden water and trap suspended particles before they enter a watercourse. To be effective, there should be sufficient length of filtering material.

This technique is often used with ditch blocks and cross culverts on the approaches to water crossings so turbid runoff does not flow down the ditch and stream bank into the water directly. Although this technique works well for short-term filtering and sediment entrapment, site stabilization at the erosion source is needed to prevent a chronic problem. This treatment may require construction of a cross culvert, an earth diversion berm across the ditch (ditch block) or excavation of a channel to carry water to the edge of the right-of-way (offtake ditch or ditch turnout). A diversion berm is different from a check dam because water is diverted out of the ditch and not allowed to flow over the berm.

Best Management Practices and Mitigation Measures

• The drainage area of diverted flow at one location should be less than 2 ha.

• Where used, it is important to determine that the water will drain away from the road at a slope of at least 1 %.

• Berms should have a top width and height of at least 50 cm and side slopes of 2H:1V or flatter.

• Since the diversion berm will be redirecting flowing water, the upstream surface must be resistant to erosion from the expected flow velocities.
• The recommended spacing between ditch outlets depends on the slope of the ditch and the sensitivity of the soil to erosion.

• The required length of forest floor filter depends on the ground slope. Use 30 m of forest floor for slopes less than 15% and up to 90 m for steep slopes.

• Ditch channel, berm dimensions and outlet channel must be of adequate size to handle expected flow, including flood flows. If not properly sized the berm will overtop and flow will continue down the ditch line. In directing flow to the bush be careful not to cause gully erosion down steep erodible banks. If possible water should be spread out when it leaves the right of way rather than be concentrated.
SECTION 8 – GLOSSARY AND SUGGESTED READING

Glossary

Aboriginal, in relation to a fishery: means as defined by the *Fisheries Act*, that fish is harvested by an Aboriginal organization or any of its members for the purpose of using the fish as food, for social or ceremonial purposes or for purposes set out in a land claims agreement or treaty entered into with the Aboriginal organization.

Area of the Undertaking: the area of Crown land, on which forest management activities may be conducted in accordance with the requirements of Environmental Assessment Declaration Order MNR 75 in Ontario. Forest management plans are prepared for management units within this area. The Area of the Undertaking is depicted in Schedule 1 of Declaration Order MNR-75.

Best management practices and mitigation measures: a suite of planning, design, construction, maintenance and decommissioning tools and approaches that supports the fulfilment of water crossing standards as defined in this Protocol.

Commercial, in relation to a fishery: means as defined by the *Fisheries Act*, that the fish is harvested under the authority of a license for the purpose of sale, trade or barter.

Deleterious substance: means, as defined by the *Fisheries Act*, as any substance that if added to water, makes the water deleterious to fish or fish habitat or any water containing a substance in such quantity or concentration or has been changed by heat or other means, that if added to water makes that water deleterious to fish or fish habitat. Note that sediment is considered a deleterious substance. Note that this is a summary of the definition from the *Fisheries Act*.

Embedment: means the portion of a culvert opening that is countersunk below the natural bed of a watercourse.

Erosion: means the process by which the natural (earth) or unnatural (embankment, slope protection, structure, etc.) land surface is naturally worn away by the actions of water, wind, ice or other geological agents.

Fish: as defined by the *Fisheries Act*, includes parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

Fish habitat: means, as defined by the *Fisheries Act*, spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes.
**Fish passage:** means the migration and movement of all life stages of fish to obtain access to food, shelter or spawning habitat through bridges, culverts or other obstructions.

**In-water timing windows:** means a period of time when in-water work associated with water crossing construction and decommissioning activities is permitted and is established by the MNRF.

**In-water work:** aspects of a water crossing project that requires any machinery, or parts thereof, or disturbance within a watercourse, including any disturbance to the watercourse bed, channel, banks or adjacent riparian habitat, as delineated by its normal high water mark.

**Lower risk:** in the context of this Protocol, is a water crossing project that has been deemed to consider the sustainability of the aquatic environment, and fisheries and their habitat to such a degree that if implemented properly, satisfies the protection provisions of the *Fisheries Act*. Projects are considered Lower Risk either through review and approval by MNRF and/or DFO or through the application of the mandatory requirements contained in a water crossing standard within this Protocol.

**Normal high water mark:** for the purposes of this Protocol the usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the “active channel/bankfull level” which is often the one-to two-year flood flow return level. For inland lakes, it refers to those parts of the watercourse bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation. For reservoirs this refers to normal high operating levels (Adapted from Fisheries and Oceans Canada, 2009). The Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales refers to the normal high-water mark as the edge of vegetation communities capable of providing an effective barrier to the movement of sediment.

**Perched culvert:** the tendency to develop a falls or cascade at the outfall of a culvert due to erosion of the watercourse channel downstream of the structure. This may eliminate the ability of fish to swim upstream at the culvert.

**Proponent:** for the purposes of this Protocol, a proponent includes the person or company proposing the construction and/or decommissioning of water crossing(s) that are part of a forest operation where the *Crown Forest Sustainability Act* applies.

**Realignment:** significant alteration of channels, for example by cutting off watercourse meanders, and which results in changes to a watercourse’s hydrological function or destruction of riparian vegetation. Standard construction practices required to fit a water
crossing structure such as a culvert within the banks of a watercourse are not typically considered realignment.

**Recreational, in relation to a fishery**: means as defined by the *Fisheries Act*, that fish is harvested under the authority of a license for personal use of the fish or for sport.

**Riparian area**: the trees, shrubs and other vegetation that border watercourses that link water to land and that directly influences and provides fish habitat.

**Sediment**: means soil or other surface material transported by wind or water as a result of erosion. Note that sediment is considered a deleterious substance.

**Serious harm to fish**: means as defined by the *Fisheries Act*, the death of fish or any permanent alteration to, or destruction of, fish habitat.

**Trained and competent**: a person who has undergone specific training to understand the objectives and rationale of the water crossing standards and/or approval conditions that are being implemented for a project defined as Lower Risk in this Protocol, and has the authority and ability to ensure that the approval water crossing standards and/or conditions are correctly implemented, and in cases where they are not, understands the requirements to notify MNRF and DFO.

**Undermining**: the seepage or loss of water under a culvert or other structure.

**Values**: a term used to describe known natural, cultural or First Nation or Métis resource attribute or use of land, including all lakes and streams, which must be considered in forest management planning. (Declaration Order MNR-75)

**Watercourse**: a flowing waterbody such as a river, stream or creek, including the bed, channel, banks and adjacent riparian areas delineated as the area below the normal high water mark. A watercourse has a defined channel that may have either permanent or intermittent flow of water throughout the year.

**Water crossing standard**: thresholds establishing a minimum level of performance or quality and that provides mandatory direction that must be implemented when utilizing the proponent self-screening approval framework detailed in this Protocol.
Suggested Reading


APPENDICES

Appendix 1 Submission of Information on a Proposed Water Crossing

Appendix 1 form for submission of information on a proposed water crossing must be completed by the Proponent to provide the details of proposed water crossing projects.

Appendix 1 form have been developed to aid both the Proponent and MNRF in the submission of critical data to facilitate the planning, review, approval, and monitoring of water crossings. The data fields in Appendix 1 are the baseline requirements that must be completed by either the Proponent and/or MNRF. The form can be modified by the planning team for the FMP to add additional information requirements; however, these baseline requirements must remain as mandatory submission fields in order to help ensure ongoing provincial consistency in water crossing data submission and decision making.

Part A Requirements

- **Water Crossing Identifier**

Each water crossing shall have a specific identifier. Proponents will follow the appropriate naming nomenclature as set out in the FIM’s technical specifications.

- **Watercourse Crossing Location**

A point feature representing a 200 metres crossing location will be submitted for all proposed water crossing locations. The approval for water crossings will apply to construction activities occurring within the 200 metres spatial boundary. The UTM coordinates for the 200 metres crossing location will also be provided. A map detailing the proposed crossing location (including UTM coordinates) is required, but can be submitted as part of the watershed analysis map (see below).

- **Applicable Work-in-Water Timing Window**

Work-in-water timing windows are one of the most important measures used to protect fisheries and fish habitat. Timing windows are developed to protect fisheries from the impacts of works or undertakings occurring in and around water by restricting in-water work during spawning, migrations and other critical life history stages.

Applicable work-in-water timing restrictions for Ontario have been developed and must be documented in approved FMPs.
• Identify Whether the Proposed Crossing has Been Previously Submitted, Reviewed and/or Approved

Numerous proposed water crossings are reviewed and/or approved for construction and/or decommissioning on an annual basis, but for a myriad of reasons, may not be needed or implemented in the AWS in which they are approved for construction. Proposed crossings that have previously been reviewed and/or approved for construction and that are being re-submitted in another AWS must be identified appropriately to facilitate tracking and the management of water crossings.

• Road Type

Identifying the road type associated with a proposed water crossing allows MNRF reviewers to make informed assessments regarding appropriate levels of risk of potential serious harm to CRA fisheries or fish that support such a fishery occurring relative to the expected lifespan of a crossing on the landscape (e.g. primary road crossings are expected to be on the landscape longer than operational road crossings, and thus carry a higher degree of risk)

Part B Requirements

• Design flow/watershed analysis and map

Proponents will submit a map illustrating the 200 metres crossing location and its drainage area. The proposed UTM point feature location may also be identified in the watershed analysis map. The map will be submitted in conjunction with a watershed analysis that depicts the design flow, including calculated culvert sizes for the Q25 return interval. The UTM point feature location used for calculation needs to appropriately represent the watershed information for the entire 200 metres crossing location.

Closed-bottom round culverts designed and installed to meet the Q25 return interval is currently considered the most effective baseline approach to providing for long-term fish passage, as they typically span the normal high water mark and therefore result in minimal impact to the watercourse’s form, function and hydrology (e.g., increases to velocity, high levels of infill or damage to banks to “fit” a culvert).

Culvert size calculations for additional return intervals, including the normal high water flow rate (Q1.1), and the Q10, Q50, and Q100 flow rates should also be calculated to facilitate the approval process in cases where alternative design flows are being proposed for review (e.g., short-term crossings).

• Stream gradient at crossing
Low-gradient streams (i.e. <2%) are preferred crossing locations for closed-bottom round culvert installations. Closed-bottom round culverts installed on stream reaches with slopes greater than 2% are likely to result in stream flow velocities that increase the likelihood of impeding fish passage and/or producing outlet scour and long-term erosion issues. Stream gradients should be estimated using best available resources and tools such as topographic maps, digital elevation maps or the Ontario Flow Assessment Tool: [http://www.giscoeapp.lrc.gov.on.ca/web/mnr/wrip/ofat/Viewer/viewer.html](http://www.giscoeapp.lrc.gov.on.ca/web/mnr/wrip/ofat/Viewer/viewer.html)

In cases where estimates indicate the potential for stream gradients to be >2%, a site evaluation may be warranted. In these cases, a formal evaluation of stream gradient at the site of the potential crossing should be undertaken (e.g., using a clinometer) to measure the stream gradient within the actual footprint of the potential crossing.

When a water crossing standard is being implemented by the Proponent, the actual stream gradient at the site of the crossing must be confirmed as <2% in order to ensure compliance with the requirements of the water crossing standard.

This watershed characteristic should not be confused with the slope of the approaches towards the proposed crossings.

- **Length of culvert**

Knowing the expected length of a closed-bottom round culvert that will be installed, together with the other data submission requirements of the Protocol, enables Proponents and/or MNRF to make informed assessments of the likelihood that velocities passing though the culvert may impede fish passage by exceeding fish species swimming abilities.

- **Pictures of crossing location**

Pre-construction and post-construction pictures will serve as a best management practice for water crossings. When pictures are available, or will be available for the project, this should be identified in the Appendix 1 form. Documenting the crossing site before and after construction can serve as useful tools for both Proponents and MNRF in compliance and monitoring efforts, in addition to supporting effectiveness monitoring of the Protocol. It is recommended that photographs depict the following:

  - Pre and post-construction pictures depicting the road approaches from both sides of the water body (only one side of the waterbody may be practical pre-construction);
  - Pre-and post-construction pictures depicting upstream and downstream conditions of the crossing site

In some cases MNRF may request that the submission of pre-construction pictures be appended to the Proponent’s Appendix 1 Form for crossing that require review and approval.
Part C Requirements

The Proponent must complete Part C of Appendix 1 if a water crossing standard will be implemented. Part C requires the Proponent to identify the preferred water crossing standard that must be utilized.

The Proponent should also identify alternative water crossing standards that may be used in the event that their preferred option cannot be constructed (e.g., due to site conditions or weather/seasonality challenges).

Part D Requirements

The Proponent must complete Part D of Appendix 1 if a water crossing standard cannot be implemented. In these cases, the Proponent must identify the activity/water crossing structure that is being proposed for the construction of a water crossing.

The Proponent must also identify why a proposed water crossing project requires MNRF review and approval. In most cases, it is assumed that review and approval will be required because a water crossing standard does not exist for the proposed crossing or because the approved FMP restricts implementation (i.e., type and/or locations) of specific types of water crossing standards. However, there may be instances where a water crossing standard does exist for the proposed project, but the Proponent cannot fulfill all of its mandatory requirements. In these cases, the Proponent must identify which of the applicable water crossing standard requirements cannot be fulfilled in order to facilitate MNRF’s review of the proposed project.
Form for Submission of Information on a Proposed Water Crossing
Part A: Construction Details

Sustainable Forest Licensee:

Sustainable Forest Licensee – contact name & telephone number:

FMU:

Plan term:

AWS year:

Water crossing ID:

Watercourse name:

Water crossing location (include Municipality, Township Lot and Concession and the UTM Coordinates for the 200m crossing location). Attach map.

Applicable in-water-work timing window (insert date range):

Has the crossing (i.e., type and/or location) been submitted and/or approved for construction or decommissioning in a previous AWS?

If yes, identify the previous AWS year and water crossing ID in which the crossing was submitted/approved:

Type of activity:

Road type:

Year of structure removal, if not permanent (refer to road use management strategy in FMP):

Have the requirements in the Protocol been followed to identify whether any federally and/or provincially listed aquatic species at risk are likely to be impacted by the project?
Part B: Watershed and Construction Characteristics

Watershed area (km²):

Opening size (mm) (if a bridge, distance between abutments in metres):

Estimated stream gradient at crossing (%) (from map, OFAT, etc.):

Expected length of proposed round closed bottom culvert crossing (if applicable):

Is the Design flow/watershed analysis and map been attached?

Is the proposed structure opening size less than Q25?

Water course type:

Have/will pre-construction pictures be taken?

Part C: Application of a Water Crossing Standard

Complete if your project will be following the conditions of an approved water crossing standard

If a water crossing standard will be applied, identify the preferred and any alternative structure type.
Preferred water crossing standard to be implemented:

Alternative water crossing standard to be implemented:

Additional information:

Part D: Request for Review and Approval

Complete if your project cannot follow the conditions of an approved water crossing standard

If review and approval is required, identify the structure type:

Please indicate why a project review is required. If a water crossing standard exists for the proposed project, specifically identify why it cannot be followed.

Have the appropriate section of an Appendix 2 form been completed and attached?
Additional information:
Appendix 2 Evaluation of Potential Serious Harm for a Proposed Water Crossing

An Appendix 2 form for evaluation of potential serious harm for a proposed water crossing must be completed for each proposed water crossing where the requirements of an approved water crossing standard cannot be implemented and thus requires MNRF review and approval. The Proponent is responsible for completing the construction details section of Appendix 2. MNRF is responsible for completing the remainder of the form (i.e., Parts A through D).

In some cases, the Appendix 2 form can be completed for certain proposed water crossings during the FMP stage in order to potentially facilitate the final determination of crossing types, locations, and/or conditions of approval for more complex crossings that are typically associated with primary and branch roads.

When completing Appendix 2 form, MNRF will conduct a comprehensive review of all the existing data, perform field investigations to supplement existing data as necessary, and assess the project to determine:

- The presence and sensitivity of the fishery and fish habitat,
- The likelihood and severity/consequences of potential impacts associated with the project,
- The need for project design modifications, additional mitigation measures, and/or conditions on construction, and
- If there is a residual effect on CRA fisheries or fish that support such a fishery after mitigation and, if so, whether the residual effect(s) may result in serious harm.

A detailed list of MNRF project evaluation criteria is included in Appendix 3 considerations.

Part A Requirements

An Appendix 2 form should be submitted to MNRF with Part A completed by the Proponent. This is information that has already been included in Appendix 1.

Part B Requirements

If any Schedule 1 aquatic species at risk, as per SARA, are likely to be impacted by the project, the project should be referred to DFO for their review by completing a formal request for review via the DFO website: http://www.dfo-mpo.gc.ca/pnw-ppe/reviews-revues/index-eng.html. More information can be found on the SARA Registry (www.sararegistry.gc.ca).
When determining proximity to a proposed project location, an informed decision should be made regarding the likelihood that any potential effects caused by the project will not result in contraventions of SARA. If uncertainty exists regarding the potential for the species at risk to be impacted by the project, the Proponent should contact DFO (fisheriesprotection@dfo-mpo.gc.ca) and/or MNRF staff for advice.

Part C Requirements

Part C involves a list of questions that can be answered with the information provided in the AWS and a completed Appendix 1 form (for submission of information on a proposed water crossing), without conducting a site visit or requiring in-depth knowledge of the fishery and fish habitat. Other online data sources that may provide additional information to help answer the questions in Part C include aerial imagery, topographic maps, etc. The intent is to screen-out less complex crossings that pose a smaller potential risk of causing serious harm to fish that are part of CRA fisheries or fish that support such a fishery; impede fish passage; or the deposition of deleterious substances.

Part C may be completed for some water crossings at the FMP stage.

This combination of questions should:

- Allow a reviewer to complete a quick evaluation of the water crossing in relation to the fisheries protection provisions of the *Fisheries Act* (e.g., serious harm, passage, deleterious substance);
- Identify whether there is sufficient information on the proposed water crossing for the risk evaluation; and,
- Identify whether there is sufficient information on the watercourse for the risk evaluation, or whether a site visit is required.

The questions may provide the following rationale:

1. A low stream gradient indicates that there is likely a location in the 200 metres crossing location where neither coarse substrate nor riffle habitat is present. This condition allows installation of a crossing without changing a riffle (habitat), and permits proper installation (passage). Reviewers should utilize resources such as aerial imagery and photographs to identify discernable riffles, as well as tools such as digital elevation models and OFAT III to determine estimates of stream gradient.

2. Low gradient streams (i.e. <2%) are preferred crossing locations for closed-bottom culvert installations. Closed-bottom culverts installed on stream reaches with slopes >2 % are likely to result in stream flow velocities that increase the likelihood of impeding fish passage and/or producing outlet scour and long term erosion issues. Stream gradients can be estimated using such resources and tools as topographic

In cases where estimates indicate the potential for stream gradients to be >2%, or where local knowledge or management concerns exist, a site evaluation may be warranted. In these cases, a formal evaluation of stream gradient at the site of the potential crossing should be undertaken (e.g., using a clinometer) to measure the stream gradient within the actual footprint of the potential crossing location.

3. **Slope** is a surrogate for a stream valley cross-section. A proposed crossing at a location with a shallow valley cross-section (i.e. approach/shoreline slopes < 30%/17º) and with corresponding AOC dimensions of ≤50 metres is less likely to have chronic erosion problems (sediment) and long structures, with associated higher fill heights, which would be required where there are steeper approaches (habitat, passage). In cases where crossings are being proposed at sites with approach slopes >30%/17º, mitigation measures requiring additional/enhanced slope armoring should be strongly considered.

4. A water crossing with a minimum Q25 design flow has a lower-risk of crossing failure (serious harm/habitat, sediment), and is less likely to result in channel infill (structure width ~ channel width, serious harm/habitat) or accelerated water flow (passage). In some cases, water crossings with less than a Q25 design flow may be proposed. These crossings should be reviewed with consideration given to the length of time that it would be on the landscape relative to the likelihood of the crossing failing and/or resulting in serious harm occurring to CRA fisheries or fish that support such a fishery, in addition to the increased monitoring efforts that would be required to ensure that under-sized water crossings are maintained and decommissioned in an appropriate time. Typically, approved crossings with less than a Q25 design flow would not be permitted to remain on the landscape past one spring freshet.

5. A water crossing installed within the work-in-water timing window will protect fish during sensitive life stage periods if there will be in-stream activities associated with construction of the crossing. If there are no in-stream activities, there should be reduced risk to fisheries and their habitat.

6. Any fish habitat values (including rare or sensitive habitats) must be described, and the suitability of the water crossing location must be rationalized in Part D.

7. If the water crossing construction and decommissioning water crossing standards and guidelines from the forest management guide(s) that address the conservation of biodiversity at the landscape scale and the stand and site scales are met, the probability of fish passage problems or long term erosion problems (serious harm/habitat, sediment) is low.
Part D Requirements

Part C may not adequately identify all concerns. Part D enables the evaluator to identify additional concerns, based on his/her professional knowledge, experience, and the use of Appendix 3.

Additional habitat features such as rare habitat types, aquatic vegetation, groundwater concerns, etc. should also be documented in Part D.

Part E Requirements

If concerns are identified in Parts C and D, they are to be documented in Part E, including the provision of rationale for additional conditions on construction (if necessary), or site visits to be conducted.

- Conditions of construction

For crossings requiring review and approval, any conditions on water crossings that have been identified by the Proponent and/or by MNRF as a result of a review of the proposed crossing will be identified.
Form for Evaluation of Potential Serious Harm for a Proposed Water Crossing
Part A: Construction Details
Sustainable Forest Licensee:

Sustainable Forest Licensee – contact name & telephone number:

FMU:

Plan term:

AWS year:

Water crossing ID:

Watercourse name:

Water crossing location (include Municipality, Township Lot and Concession and the UTM Coordinates for the 200m crossing location). Attach map.

Applicable in-water-work timing window (insert date range):

Has the crossing (i.e., type and/or location) been submitted and/or approved for construction or decommissioning in a previous AWS?

If yes, identify the previous AWS year and water crossing ID in which the crossing was submitted/approved.

Previous AWS year:

Water crossing ID:

Type of activity:

Road type:

Year of structure removal, if not permanent (refer to road use management strategy in FMP)

Part B - MNRF to complete
Have any Schedule 1 aquatic species at risk have been identified in proximity to the proposed water crossing – Refer to the SARA Registry for a list of species at risk (http://www.dfo-mpo.gc.ca/habitat/habitat-eng.htm)

Yes ☐ No ☐

If Yes, refer the project to DFO for review.
**Part C - MNRF to complete**

Is the portion of stream within the 200 m crossing location likely to contain a riffle?
Yes ☐ No ☐

Is the channel gradient/slope at the crossing location estimated to be >2%?
Yes ☐ No ☐

Is the AOC width > 50m (i.e., approach slopes > 30%/17oon either side of the watercourse)?
Yes ☐ No ☐

Is the proposed structure opening size less than Q25?
Yes ☐ No ☐

Will construction occur outside of the work-in-water timing window?
Yes ☐ No ☐

Are there any fish habitat values potentially impacted by the crossing?
Yes ☐ No ☐

Will the construction and mitigation approaches deviate from the water crossing standards and guidelines in the forest management guide(s) that address the conservation of biodiversity at the landscape scale and the stand and site scales?
Yes ☐ No ☐

**Part D - MNRF to complete**

Are there concerns regarding the submitted details in Part C? If “Yes”, discuss in Part E.
Yes ☐ No ☐

Are there any other concerns pertaining to information described in Appendix 3? If “Yes”, discuss in Part E.
Yes ☐ No ☐

If answers to all questions in Parts B and C are “No”, risk evaluation is “low”.

**Part E - MNRF to complete**

Describe any concerns, and rationalize additional conditions on construction (if necessary) for questions answered “Yes” in Parts B and C.

Risk Evaluation
Low ☐ Medium/High ☐

Site Inspection Required
Yes ☐ No ☐
If Yes, Date Completed:

DFO Referral
Yes ☐ No ☐

If Yes, Date Completed:

MNRF Review Conducted
Name:

Date:
Appendix 3 - Risk Factors, Evaluation Parameters and Decision Criteria for Evaluating the Risk of Proposed Water Crossings to Fish and Fish Habitat

Appendix 3 table details the numerous risk factors, evaluation parameters and decision criteria that are intended to support MNRF staff in their evaluation of risk for proposed water crossings. Appendix 3 does not assign priority to any individual or combination of risk factors, and it is not assumed that one or more of the evaluation parameters that are within “medium” or “high” risk decision criteria will necessarily shift a project into a similar risk assessment category.

Appendix 3 table should be used in conjunction with DFO Pathways of Effects (PoE) diagrams (http://www.dfo-mpo.gc.ca/pnw-ppe/pathways-sequences/index-eng.html) to better understand the type of cause-effect relationships that are known to exist and the mechanisms by which stressors ultimately lead to effects in the aquatic environment.

MNRF reviewers should utilize the contents of Appendix 3 table as a collection of considerations, together with local knowledge, site conditions and fishery management objectives that help to inform the development of appropriate mitigation measures to reduce or eliminate the potential effects of proposed projects.
### Table - Risk Factors, Evaluation Parameters and Decision Criteria for Evaluating the Risk of Proposed Water Crossings to Fish and Fish Habitat

#### Risk Factor: Fish Presence

<table>
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<tr>
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<tbody>
<tr>
<td>Channel type (permanent, intermittent, ephemeral)</td>
<td>Intermittent ephemeral</td>
<td>Permanent</td>
<td>Permanent</td>
<td>Topographic maps, Aerial photographs, Forest resource inventory maps</td>
<td>Permanent streams are accepted to support fish and thus have fish habitat associated with them.</td>
</tr>
<tr>
<td>Watershed area</td>
<td>Very small watersheds, no significant water surface area</td>
<td>Small watersheds</td>
<td>Large watersheds; significant water surface area</td>
<td>Topographic maps, Aerial photographs, Forest resource inventory maps</td>
<td>The probability of fish being present at a site is correlated with stream size. Watershed area and stream order are indicators of stream size. The threshold watershed size varies with the species, stream characteristics (slope, etc) and geographic/physiographic area.</td>
</tr>
<tr>
<td>Watershed position (1:20,000) Stream order/</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; order (unless flows directly to 3&lt;sup&gt;rd&lt;/sup&gt; order or higher or known fish-bearing water)</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; order (unless flows directly to 3&lt;sup&gt;rd&lt;/sup&gt; order or higher or known fish-bearing water)</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; order and greater</td>
<td>Topographic maps, Aerial photographs, Forest resource inventory maps</td>
<td></td>
</tr>
<tr>
<td>Barriers that would prevent fish passage</td>
<td>Physical - downstream</td>
<td>Physical - downstream; passable only in some years</td>
<td>None</td>
<td>Topographic maps, Aerial photographs</td>
<td>Temporary natural (beaver dam) or man-made barriers should not be considered as indicators of the probability of fish being absent upstream.</td>
</tr>
<tr>
<td>Fish presence</td>
<td>Confirmed absent from similar/nearby watersheds</td>
<td>Confirmed present in similar/nearby watersheds</td>
<td></td>
<td>Lake surveys, Research Investigations, Public reports, Direct observations</td>
<td></td>
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</tbody>
</table>
## Risk Factor: Fish Habitat

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</thead>
<tbody>
<tr>
<td>Fish community sensitivity</td>
<td>Generalist</td>
<td>Specialist</td>
<td>Lake surveys Research Investigations Public reports Direct observations LIO Scientific literature Decision support tools</td>
<td>Generalist/specialist can refer to habitat requirements or life history depending on context, and varies with life stage, e.g. brook trout and walleye are specialists, and bass are generalists.</td>
<td></td>
</tr>
<tr>
<td>Species at Risk</td>
<td>Absent</td>
<td>Potentially present</td>
<td>Present</td>
<td>LIO</td>
<td>For the Species At Risk in Ontario (SARO) list please refer to the MNRF website: <a href="https://www.ontario.ca/environment-and-energy/species-risk-ontario-list">https://www.ontario.ca/environment-and-energy/species-risk-ontario-list</a> or Environment Canada’s website (<a href="https://www.registrelep-sararegistry.gc.ca/species/default_e.cfm">https://www.registrelep-sararegistry.gc.ca/species/default_e.cfm</a>)</td>
</tr>
<tr>
<td>Habitat type: spawning, rearing, nursery, feeding, migration</td>
<td>Marginal</td>
<td>Important</td>
<td>Critical</td>
<td>LIO</td>
<td>Aerial photographs Surveys Research Direct observations</td>
</tr>
<tr>
<td>Area impacted (total habitat impacted m²)</td>
<td>Small streams; narrow flood plains; relatively short structures (low fills)</td>
<td>Large streams; causeways; long structures (high fill, wide road)</td>
<td>Aerial photographs Direct observations</td>
<td>Depending on the type of structure, the area impacted may be reduced. For example, portable bridges would generally impact a smaller area than culverts.</td>
<td></td>
</tr>
<tr>
<td>Productive capacity</td>
<td>Bedrock/sand substrate, dystrophic waters, no cover</td>
<td>Aquatic macrophytes; silt/sand, cobble/ boulder substrate, instream or overhead cover</td>
<td>Aerial photographs Soils maps Direct observations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substrate (habitat sensitivity)</td>
<td>Bedrock</td>
<td>Sand, gravel, cobble; groundwater discharge</td>
<td>Aerial photographs Soils maps Surficial geology Maps Direct observations</td>
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</tr>
<tr>
<td>Habitat supply</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>LIO Aerial photographs Surveys Research Direct observations</td>
<td>If habitat is in low supply, any impacts to that habitat by construction of the crossing elevate the risk to fish that use that habitat.</td>
</tr>
<tr>
<td>Cumulative impact</td>
<td>No other developments in area</td>
<td>Water crossings in area</td>
<td>Other developments in area or large numbers of crossings already in the watershed</td>
<td>LIO Sustainable forest licensee maps of roads and water crossings</td>
<td>This parameter relates to the density of development in the watershed.</td>
</tr>
<tr>
<td>Potential for fishery</td>
<td>Low probability</td>
<td>Possible</td>
<td>Existing</td>
<td>MNRF files Knowledge</td>
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</tbody>
</table>
### Risk Factor: Fish Passage

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</thead>
<tbody>
<tr>
<td>Structure installation</td>
<td>Slope of channel at structure location</td>
<td>&lt;0.5%</td>
<td>0.5-2.0%</td>
<td>&gt;2.0%</td>
<td>Topographic maps Digital terrain model Aerial photographs Decision support tools (OFAT)</td>
<td>The risk associated with a specific slope varies with stream size and substrate characteristics. As slope increases, it is more likely that a culvert cannot be properly imbedded due to coarser substrates. A culvert installed where the channel is sloped will have higher water velocity during high flows; low water depth during low flows and is less likely to have natural channel substrates inside the structure.</td>
</tr>
<tr>
<td>Structure installation</td>
<td>Channel substrate</td>
<td>Sand and gravel</td>
<td>Cobble</td>
<td>Boulders and bedrock</td>
<td>Direct observation Aerial photographs Surficial geology Maps</td>
<td>The risk associated with a specific slope varies with stream size and substrate characteristics. As slope increases, it is more likely that a culvert cannot be properly imbedded due to coarser substrates. A culvert installed where the channel is sloped will have higher water velocity during high flows; low water depth during low flows and is less likely to have natural channel substrates inside the structure.</td>
</tr>
<tr>
<td>Structure sizing</td>
<td>Design flow</td>
<td>25 yr or greater</td>
<td>10 yr</td>
<td>5 yr</td>
<td>Supplied by sustainable forest licensee</td>
<td>Structures with lower design flows, or which constrict flows (prevent access to floodplain), will have higher water velocity</td>
</tr>
<tr>
<td>Structure sizing</td>
<td>Structure width relative to channel or flood plain width</td>
<td>&gt;1.0 %</td>
<td>0.5 – 1.0 %</td>
<td>&lt;0.5 %</td>
<td>Direct observation Aerial photographs</td>
<td></td>
</tr>
<tr>
<td>Structure sizing</td>
<td>Changes to water velocity</td>
<td>Little change or low velocities</td>
<td>Some change or moderate velocities</td>
<td>Substantial change or high velocities</td>
<td>Installation practices at crossing provided by sustainable forest licensee Published literature on fish swimming abilities</td>
<td>High water velocities can act as barriers to fish passage. The influence of water velocity is different for each species.</td>
</tr>
<tr>
<td>Base flow depth</td>
<td>Water depth in structure</td>
<td>&gt;20cm (depth adequate for most migrating fish, sturgeon may be an exception)</td>
<td>10cm</td>
<td>&lt;5cm</td>
<td>Digital terrain model Topographic maps</td>
<td>Beaver dams should not be considered barriers to fish movement because they are a natural influence on most watercourses. Beaver dams are generally temporary in nature.</td>
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</tr>
<tr>
<td>Fish present</td>
<td>Barriers</td>
<td>Other barrier to fish movement immediately downstream</td>
<td>No barriers</td>
<td>Aerial photographs</td>
<td>Direct observation</td>
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### Risk Factor: Erosion/Sedimentation

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<tbody>
<tr>
<td>Erosion and sedimentation from on land activities</td>
<td>Slope of approaches</td>
<td>1 – 4%</td>
<td>5 – 8%</td>
<td>9 – 12%</td>
<td>Digital terrain model, slopes provided by Regional Engineering Unit.</td>
<td>Stream valley cross-section describes the slope of the approaches and potential for erosion.</td>
</tr>
<tr>
<td>Erosion and sedimentation from on land activities</td>
<td>Length of approaches</td>
<td>0 to 10m</td>
<td>10 to 50m</td>
<td>&gt; 50m</td>
<td>Information supplied by sustainable forest licensee</td>
<td>Approaches sloping to water crossings are sources of sediment through runoff which is exacerbated through improper grading.</td>
</tr>
<tr>
<td>Short-term sediment and direct impacts to fish</td>
<td>Timing (species</td>
<td>Construction outside the</td>
<td>Construction inside the timing</td>
<td>Information supplied by</td>
<td></td>
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<tr>
<td></td>
<td>occurrence or</td>
<td>timing window</td>
<td>timing window</td>
<td>sustainable forest</td>
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<td></td>
<td>thermal regime)</td>
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<td>licensee</td>
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<tr>
<td>Short-term sediment and direct impacts to fish</td>
<td>Installation method</td>
<td>Isolated from flowing water</td>
<td>In stream</td>
<td>Information supplied by</td>
<td></td>
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<td>sustainable forest</td>
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<td>licensee</td>
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<tr>
<td>Short-term sediment and direct impacts to fish</td>
<td>Planning and</td>
<td>All of listed items</td>
<td>None of listed items</td>
<td>Information supplied by</td>
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<td></td>
<td>practitioner proficiency</td>
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<td>sustainable forest</td>
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<td>licensee MNRF training</td>
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<td>Compliance records</td>
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<tr>
<td>Long-term (change to natural channel processes)</td>
<td>Soils on banks</td>
<td>Bedrock, stony</td>
<td>Loam, clay</td>
<td>Surficial geology maps</td>
<td></td>
<td>Type of soil influences erodibility</td>
</tr>
<tr>
<td>Long-term (change to natural channel processes) C</td>
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<tr>
<td>Long-term (change to natural channel processes)</td>
<td>Stream type</td>
<td>Bedrock dominated, entrenched,</td>
<td>Meandering but not entrenched,</td>
<td>Rosgen, 1996</td>
<td></td>
<td>The influence of stream type must be considered within the context of channel slope (see Structure installation) and the type of structure proposed for installation at the site.</td>
</tr>
<tr>
<td></td>
<td>(Rosgen 1996)</td>
<td>step, pool Aa+, A, B,</td>
<td>stable banks, riffle/pool C, D, E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-term (change to natural channel processes)</td>
<td>Changes to water</td>
<td>Little change or low</td>
<td>Some change or moderate velocities</td>
<td>Installation practices at</td>
<td></td>
<td>Changing the water velocity and alignment of the flow can cause downstream erosion.</td>
</tr>
<tr>
<td></td>
<td>velocity</td>
<td>velocities</td>
<td></td>
<td>crossing provided by sustainable forest licensee</td>
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</tr>
<tr>
<td>Long-term (change to natural channel processes)</td>
<td>Fill height</td>
<td>1 – 1.5 m</td>
<td>1.6 - 3.9</td>
<td>4.0 + m</td>
<td>Information supplied by sustainable forest licensee</td>
<td>Higher fill heights mean there is greater surface area for water to impact, even if graded to a stable angle of repose. Stabilization of fill slopes would lower risk. Fill acts as a dam and the greater the fill height, the more head and risk of ‘piping’ through the fill.</td>
</tr>
<tr>
<td>Long-term (change to natural channel processes)</td>
<td>Fill material</td>
<td>Rock, cobble</td>
<td>Pit run gravel</td>
<td>Sand, silt, clay</td>
<td>Information supplied by sustainable forest licensee</td>
<td></td>
</tr>
<tr>
<td>Crossing failure</td>
<td>Design flow</td>
<td>25 yr or greater</td>
<td>10 yr</td>
<td>5 yr</td>
<td>Information supplied by sustainable forest licensee</td>
<td>The risk of catastrophic failure</td>
</tr>
<tr>
<td>Crossing failure</td>
<td>Fill type</td>
<td>Rock, pit run gravel</td>
<td>Loam, clay</td>
<td>Sand, silt</td>
<td>Information supplied by sustainable forest licensee</td>
<td>Fill type influences erodibility and hence the likelihood of failure.</td>
</tr>
<tr>
<td>Downstream fish habitat occurrence</td>
<td>Downstream habitat type</td>
<td>Marginal</td>
<td>Important</td>
<td>Critical</td>
<td>LIO</td>
<td>If a chronic or catastrophic sedimentation event occurs, downstream habitat may be directly or indirectly impacted. Distance downstream at which an impact will occur is dependent upon flow, velocity and type of material being transported. Professional judgment is used to identify how far downstream habitat may be impacted.</td>
</tr>
</tbody>
</table>