Fisheries and Oceans Canada | Pêches et Océans Canada

FINAL TECHNICAL SUBMISSION

Hamlet of Tuktoyaktuk, Town of Inuvik and Government of the Northwest Territories

Inuvik to Tuktoyaktuk Highway Project

Submitted to:
Environmental Impact Review Board
October 29, 2012

Canada

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1.0 NON-TECHNICAL SUMMARY

The Department of Transportation (Government of the Northwest Territories), the Hamlet of Tuktoyaktuk, and the Town of Inuvik (the Developer) are proposing to develop a 137 km two-lane gravel highway from Inuvik, NT to Tuktoyaktuk, NT. The proposed Inuvik to Tuktoyaktuk Highway Project (the Project) would involve the crossing of 70 watercourses and provide increased access to fisheries resources within the corridor. On June 7, 2011, the Developer submitted an Environmental Impact Statement in order to satisfy the requirements of the guidelines developed for the environmental impact review of the project, initiated in April 2010 through a referral to the Environmental Impact Review Board (EIRB) by the Environmental Impact Screening Committee.

The Department of Fisheries and Oceans (DFO) has completed its technical review of the proposed development, taking into consideration the information supplied by the Developer through their correspondence with DFO, their Environmental Impact Statement (EIS), information requests, technical sessions and other pertinent documents submitted to the EIRB Review Panel. The following technical comments and recommendations are based upon our departmental mandate under the *Fisheries Act*, specifically related to the management of fish and fish habitat. DFO's primary focus in reviewing proposed developments in and around Canadian fisheries waters is to ensure that the works and undertakings are conducted in such a way that the developers are in compliance with the applicable provisions of the *Fisheries Act*. The following is a summary of DFO's conclusions and recommendations for the proposed Inuvik to Tuktoyaktuk Highway.

On August 10th, 2012, the Environmental Impact Review Board (EIRB) issued direction to parties on the content requirements for this technical submission. As per the EIRB directive, DFO's submission contains a summary of all issues our department has been tracking throughout the review process and includes a rationale for whether each issue has been satisfactorily addressed, or whether it is (or parts of it are) still unaddressed. The issues that DFO has been tracking include: watercourse crossings, sedimentation, water withdrawal, fisheries management and harvesting, borrow sites, monitoring, blasting, and the Developer's plans to offset the loss of fish habitat.

DFO has conducted a thorough review of the project information provided by the Developer to date. DFO has identified areas where there remains outstanding information that will be required in the regulatory phase.

The project will require the construction of stream crossings, some of which will have the potential to harmfully alter, disrupt or destroy fish habitat. Although many of the details have not yet been provided by the Developer in their environmental impact statement, measures to mitigate the potential environmental impacts of stream crossings are well developed and employed routinely for road construction projects, and there is little risk that offsets for any residual effects to fish habitat would not be feasible. Given this, DFO is of the opinion that, with the implementation of appropriate mitigation measures and an acceptable plan to offset the loss of fish habitat, the project could be carried out in a manner that is likely to avoid negative impacts to fish and fish habitat.

2.0 ACRONYMS AND DEFINITIONS

Abbreviation	*Definition*
BMP	Best Management Practices
CEAA	*Canadian Environmental Assessment Act*
DFO	Department of Fisheries and Oceans
EC	Environment Canada
EIRB	Environmental Impact Review Board
EIS	Environmental Impact Statement
EMP	Environmental Management Plans
FA	*Fisheries Act*
FJMC	Fisheries Joint Management Committee
GNWT	Government of the Northwest Territories
HADD	Harmful alteration, disruption or destruction of fish habitat
IFA	Inuvialuit Final Agreement
ISR	Inuvialuit Settlement Region
ITH	Inuvik to Tuktoyaktuk Highway
kPa	Kilopascal

Term	*Definition*	*Source*
Fish	includes (a) parts of fish, (b) shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine mammals, and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals;	*Fisheries Act*
Fish Habitat	Means spawning ground and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes;	*Fisheries Act*
Developer	Hamlet of Tuktoyaktuk, Town of Inuvik and the Government of Northwest Territories Department of Transportation	

3.0 PARTY IDENTIFICATION

The following are the names, technical qualifications and full contact information of the DFO technical reviewers for this submission:

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4.0 INTRODUCTION

4.1 Mandate of Fisheries and Oceans Canada

On behalf of the Government of Canada, DFO is responsible for developing and implementing policies and programs in support of Canada's scientific, ecological, social and economic interests in relation to sea, coastal and inland fisheries, and oceans in general.

DFO is a national and international leader in marine safety and in the management of oceans and freshwater resources. Departmental activities and presence on Canadian waters help to ensure the safe movement of people and goods. As a sustainable development department, DFO will integrate environment, economic and social perspectives to ensure Canada's oceans and freshwater resources benefit this generation and those to come.

DFO's guiding legislation includes the *Oceans Act*, which charges the Minister with leading oceans management and providing coast guard and hydrographic services on behalf of the Government of Canada, and the *Fisheries Act*, which confers responsibility to the Minister for the management of fisheries, habitat and aquaculture. The Minister of Fisheries and Oceans is also one of the three responsible authorities under the *Species at Risk Act* and is responsible for the protection of aquatic species at risk.

DFO's primary focus in reviewing proposed developments in and around Canadian fisheries waters is to ensure that works, undertakings and activities are conducted in a manner that complies with the applicable provisions of the *Fisheries Act*. In particular, subsection 35(1) of the *Fisheries Act* (R.S., 1985, c. F-14, s. 35; 2012, c. 19, s. 142) prohibits the "harmful alteration or disruption, or the destruction" (HADD) of fish habitat without authorization from the Minister of Fisheries and Oceans (or other prescribed person or entity), or where the work, undertaking or activity is not in accordance with regulations made by the Governor in Council under the *Fisheries Act*. Additionally, subsection 32(1) prohibits the killing of fish by any means other than fishing unless authorized by the Minister of Fisheries and Oceans (or other prescribed person or entity) or under regulations made by Governor in Council. There are other sections of the *Fisheries Act* that pertain to the conservation and protection of fish and fish habitat. They include section 20 (fish ways) and section 21 (fish guards), among others.

Section 36 prohibits the deposit of a deleterious substance in water frequented by fish, or in any place under any conditions where the substance may enter water frequented by fish unless authorized by a regulation under the Fisheries Act. Through an agreement, Environment Canada (EC) is responsible for the administration and enforcement of the pollution prevention provisions of the *Fisheries Act* on behalf of DFO (section 34 and sections 36-42).

DFO provides general guidance on the application of the Fish Habitat Protection provisions of the *Fisheries Act* and applies to all works, undertakings, and activities that have the potential to harm fish habitat. The long-term objective of DFO is to achieve a net gain in the productive capacity of fish habitat for Canadian fisheries resources. A fundamental strategy for achieving this objective is to prevent the further loss in productive capacity of existing habitats through habitat management. Productive Capacity is defined to mean the "maximum natural capacity of habitats to produce healthy fish, safe for human consumption, or to support or produce aquatic organisms upon which fish depend".

In reviewing proposed works, undertakings, and activities DFO strives, on a case-by-case basis, to maintain the productive capacity of habitats supporting fisheries resources. DFO works with project developers to avoid impacts by the application of mitigation measures. Unavoidable habitat losses are balanced through DFO's requirement, under regulatory instrument, of fish habitat "compensation" by the project developer.

Should it be determined through the environmental impact and regulatory review processes that a HADD of fish habitat is unavoidable, DFO must determine whether authorization under paragraph 35(2)(b) of the *Fisheries Act* is appropriate. This regulatory decision considers the implementation of all appropriate mitigation measures to avoid impacts to fish and fish habitat, the construction of compensatory habitat (compensation) that offsets residual fish habitat losses, and an effective monitoring plan that will ensure that mitigation measures and compensation are effective.

In determining the acceptability of proposed habitat compensation measures, DFO considers the certainty or likelihood of success. This includes an evaluation of the feasibility, practicality and risks associated with compensation options, including the extent of monitoring and adaptive management that may be required in order to ensure the greatest probability of success. It is DFO's expectation that the Developer consult with impacted Aboriginal communities during the development of any fish habitat compensation plans.

4.2 The Scope of the Technical Submission

DFO's Technical Submission focuses on the following sections of the Terms of Reference for the Environmental Impact Statement:

10.1.1 – Impact Assessment on Terrain, Geology, Soils and Permafrost
10.1.4 – Impact Assessment on Water Withdrawal and Water Quality
10.1.6 – Impact Assessment on Fish and Fish Habitat
10.5 – Determination of Significance
11.0 – Cumulative Effects Assessment
12.1 – Mitigation
12.2 – Mitigative and Remedial Measures
13.1 – Environmental Monitoring
13.2 – Compliance Monitoring
13.3 – Environmental Management Plans

4.3 DFO's Role in the Review

DFO is participating in the environmental assessment for the Inuvik to Tuktoyaktuk Highway as an expert advisor to the Review Board on potential physical impacts of the development on fisheries and fish habitat as well as a regulator for the construction and operation of highway crossings.

4.4 Issues Review

Section 5 of this Technical Submission describes the issues DFO has been following throughout the review process and includes a rationale for whether each issue has been satisfactorily addressed, or whether it is (or parts of it are) still unaddressed. It provides specific comments on each issue, outlines the conclusions made during the review, and provides DFO's recommendations. The general issues include water crossings, fish habitat assessment, fish passage, sediment and erosion control, water withdrawal, fisheries management, monitoring, borrow site management, blasting, and the development of a plan to offset losses to fish habitat.

5.0 ISSUES TRACKING

5.1 Issue - Water Crossings

5.1.1 Summer Installations

This issue is discussed in:

Feb 2012	Developer Response to EIRB Information Request – IR Response #59 (Page 2 of meeting minutes)
March 1, 2012	Information Request from DFO to Developer – IR #2
March 30, 2012	Developer Response to March 8, 2012 Information Requests (Round 2) from EIRB – IR Response # 104.1, 106
August 13, 2012	DFO Issues for Discussion at the Technical Sessions for the Inuvik to Tuktoyaktuk Highway – Issue #4
Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.1.1
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.1.1
Sept. 20, 2012	DFO Hearing Undertaking – Issue #1
Oct. 15, 2012	DFO Information Request #2 – IR #4

Issue Status

This issue is partly addressed and can be completed in the regulatory phase.

Developer's Assessment

The Developer has summarized their position with regards to this issue as follows:

"As stated in the EIS, it is anticipated that all water crossings will be completed in the winter period; however, if a summer water crossing installation is required, the Developer will provide DFO with information on the water crossing type, construction methodology and mitigation measures to reduce or eliminate effects to fish or fish habitat during the regulatory approvals phase. Summer works are anticipated to be limited to out of streambed activities, such as bridge girder and deck construction and associated works. All in-stream activities are anticipated to be carried out during winter construction."
The Developer confirmed that DFO's Timing Windows Operational Statement will be used for any summer construction that may occur and that further consultations with DFO and communities will be undertaken as appropriate.

DFO's Conclusions and Recommendations

DFO welcomes the Developer's commitment to conduct installation of culverts during the winter construction seasons and notes that installing culverts in the open water season would requires mitigation

to focus on other aspects in addition to erosion, sedimentation, and channel effects. Open water installation can require site isolation, stream diversion, and other techniques not described in the Developer's information to date.

Recommendation #1 - DFO recommends that the Developer create a potential crossing installation scenario for summer installations, including mitigation measures and monitoring to demonstrate the efficacy of these measures, for review by DFO prior to undertaking any summer installations.

5.1.2 Aggregate and other Access Roads

This issue is discussed in:

Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.1.2
Sept. 20, 2012	DFO Hearing Undertaking – Issue #2

Issue Status

This issue is addressed. The Developer and DFO are in agreement.

Developer's Assessment

The Developer has stated that only winter roads will be used to access aggregate sources and that no other permanent crossings or roads will be built for the project. The Developer confirms that the DFO Ice Bridges and Snow Fills Operational Statement will be used for the construction and decommissioning of all winter roads associated with the Highway.

DFO's Conclusions and Recommendations

Recommendation #2 - DFO recommends the use of the Ice Bridges and Snow Fills Operational Statement (Appendix I) for the construction and decommissioning of all winter roads associated with the proposed Inuvik-Tuktoyaktuk Highway project.

5.1.3 Selection of Crossing Types

This issue is discussed in:

Feb 2012	Developer Response to EIRB Information Request – IR Response #59 (Page 2 of meeting minutes)
Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.1.3
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.1.3

Issue Status

This issue is partly addressed, and can be completed in the regulatory phase.

Developer's Assessment

During the Technical Sessions (August 22, 2012), the Developer committed to conducting consultations after the Public Hearings with the Inuvik and Tuktoyaktuk Hunters and Trappers Committees, the Tuktoyaktuk-Inuvik Working Group and other groups with regards to selection criteria for crossings. The Developer has stated that DFO will be invited to attend these consultations.

The Developer has stated that they "will consider, at a minimum, stream category when determining the type of structure to be placed at stream crossings."

The Developer has stated that "juvenile burbot will be the 'design fish' to determine appropriate culvert dimensions."

DFO Conclusions and Recommendations

In reference to their concerns respecting criteria for crossing selection, two crossings on the Tuktoyaktuk-Source 177 Road were identified by Tuktoyaktuk community members as being important subsistence harvesting areas and concern has been expressed from the community about the size and quality of the culverts installed at both of those crossings (Gungi Creek- Crossing 6, and Big Lake, Crossing 4). In particular with Crossing 6, community concerns include a change in the depth and structure of the creek, impacting subsistence harvesting.

Recommendation #3 - With regards to selection criteria for the type of crossing to be used, DFO recommends incorporating both biological and subsistence harvesting information prior to determining the type of crossing to be installed (bridge, minor, or major culvert).

5.1.4 Winter Fish Habitat

This issue is discussed in:

Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.1.4
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.1.4
Sept. 20, 2012	DFO Hearing Undertaking – Issue #4
Oct. 15, 2012	DFO Information Request #2 – IR #2

Issue Status

This issue is partly addressed, and can be completed in the regulatory phase.

Developer's Assessment

The developer has stated the following: "As per the September 2012 Master Watercourse Crossings List, culverts will be used at all minor water courses and some of the medium (intermediate) water courses. Bridges will be used for major water course crossings and some medium (intermediate) crossings. All stream crossings which will utilize a culvert are expected to be frozen to the stream bed during the winter period. If water is present during the winter period due to subterranean water upwelling, water depths within the watercourse would still be too low to permit fish overwintering. Due to the low potential for the presence of fish overwintering habitat, a winter field survey of water courses to be crossed using culverts is not deemed necessary."

DFO Conclusions and Recommendations

The fish habitat surveys completed to date did not provide specific information on winter fish habitat. Annual variations in precipitation, groundwater recharge/discharge and climate will alter the winter habitat characteristics of a watercourse on a seasonal basis. Given the limitations of the Developer's sampling program there are data gaps, particularly with regard to the identification of overwintering habitats.

In undertaking their assessment, the Developer has assumed that the majority of the streams freeze to the bottom. However if flowing water is present at a stream crossing in the winter, impacts to fish habitat downstream could occur due to construction activities, and additional mitigation would be required. Measures to mitigate impacts to winter fish habitat under flowing water conditions have not been identified or described by the Developer.

Recommendation #4 - DFO recommends that a survey of winter habitat be completed on crossings that have potential for overwintering habitat or flowing water and are scheduled to be a culvert crossing.

Recommendation #5 - DFO recommends that a contingency plan, to be employed in the event flowing water conditions are encountered during winter construction, be prepared by the Developer and reviewed by DFO prior to commencement of construction.

5.1.5 Potential Impacts to Fish Habitat from Stream Crossings

This issue is discussed in:

Feb 2012	Developer Response to EIRB Information Request – IR Response #59
March 1, 2012	Information Request from DFO to Developer – IR #2, 3
March 30, 2012	Developer Response to March 8, 2012 Information Requests (Round 2) from EIRB – IR Response # 104.1, 106
August 13, 2012	DFO Issues for Discussion at the Technical Sessions for the Inuvik to Tuktoyaktuk Highway – Issue #2, 3
August 22-23, 2012	Technical Sessions, Inuvik, NT
Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.1.5

Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.1.5
Sept. 20, 2012	DFO Hearing Undertaking – Issue #3, 5
Oct. 9, 2012	Final Hydrotechnical Report – Appendix J – Watercourse Crossing Summary Table
Oct. 15, 2012	DFO Information Request #2 – IR #2, 3

Issue Status

This issue is partly addressed and is expected to be fully addressed in the regulatory phase.

Developer's Assessment

The Developer has confirmed that during the regulatory phase, detailed design and associated site specific mitigation for stream crossings will be submitted to DFO and other regulators for review and approval.

DFO Conclusions

The Developer has provided the names of the crossings, site location, some information on bankfull width, and notes from the June freshet report in Appendix J of their assessment. However, additional information on fish habitat in relation to the proposed crossings will be required in the regulatory phase.

DFO Recommendations

Recommendation #6 - DFO recommends that the Developer provide "scenarios" describing each type of crossing and associated mitigations, along with the approximate numbers of each type of scenario. This will provide the developer an opportunity to efficiently assess and mitigate the impacts to fish and fish habitat for each crossing type.

Recommendation #7 - DFO recommends that the Developer provide site-specific stream crossing design criteria, habitat assessment, and mitigation measures as developed for the scenarios. These should be provided to DFO for review as soon as possible.

5.1.6 Planning and Efficacy of Mitigation Measures

This issue is discussed in:

March 1, 2012	Information Request from DFO to Developer – IR #1
March 30, 2012	Developer Response to March 8, 2012 Information Requests (Round 2) from EIRB – IR Response # 103
August 13, 2012	DFO Issues for Discussion at the Technical Sessions for the Inuvik to Tuktoyaktuk Highway – Issue #1
August 22-23, 2012	Technical Sessions, Inuvik, NT
Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.1.5
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.1.5
Sept. 20, 2012	DFO Hearing Undertaking – Issue # 5

Oct. 15, 2012 DFO Information Request #2 – IR #1

Issue Status

This issue is partly addressed and can be completed in the regulatory phase.

Developer's Assessment

The Developer has committed to providing a lessons learned document regarding the previously developed construction and operation of the Tuktoyaktuk-Source 177 Road. The issues were outlined and discussed by DFO at the Jan. 31, 2012 meeting between DFO and the Developer (Yellowknife, NT), the Inuvik Technical Sessions (Aug 23, 2012) as well as the Public Hearings in Inuvik (Sept 20, 2012).

In the Inuvik Hearing undertaking (Sept. 20, 2012) DFO stated that a "lessons learned" analysis was requested and the Developer confirmed that they would provide this as an appendix to the Hydrotechnical Report. Past DFO requests have outlined the following for the lessons learned document. These include:

- High-flow design considerations
- culvert embedding
- providing fish passage
- beaver dam management
- culvert ice management/road blowout avoidance
- riprap management (cleanliness and size)
- sediment and erosion control fencing management
- placement of overflow culverts
- including biological and subsistence harvesting into crossing selection criteria
- monitoring and monitor training
- communications between regulators, the Developer and contractors

A 'lessons learned' document in relation to the previously constructed Source 177 Road Project was provided by the Developer as Appendix K to the Hydrotechnical Report. Winter construction efficiency, embankment construction, blasting, pit selection, road shaping and road stability were outlined and it was noted that the sediment and erosion control measures had been successful. It was acknowledged that additional mitigation measures pertaining to culverts and riprap would need to be provided for the proposed project prior to construction.

DFO Recommendations

The list above provides illustration of the issues encountered on the Tuktoyaktuk-Source 177 Road and therefore could be predictive of potential impacts of the environment on the Inuvik to Tuktoyaktuk Highway Project.

Recommendation #8 - DFO recommends that the Developer complete the lessons learned document based on their experiences constructing the Tuktoyaktuk-Source 177 Road, which would include culvert embedding challenges, ensuring fish passage, assumption of fish presence in small streams, addressing beaver dams, addressing ice in culverts during freshet, riprap management, sediment and erosion control,

overflow culverts, planning (including consultation and incorporating subsistence harvesting considerations), communication between the Developer, regulators and contractors as well as any other design challenges associated with that road (e.g flow rates, embankment, slumping). This document can then be employed in the planning and development of mitigation measures for similar issues for the proposed Inuvik to Tuktoyaktuk Highway Project.

5.2 Issue – Sedimentation

This issue is discussed in:

March 1, 2012	Information Request from DFO to Developer – IR #7
March 30, 2012	Developer Response to March 8, 2012 Information Requests (Round 2) from EIRB – IR Response # 109
Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.2
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.2
Sept. 20, 2012	DFO Hearing Undertaking – Issue #6

Issue Status

This issue is addressed. The Developer and DFO are in agreement.

Developer's Assessment

The Developer has stated "Prior to construction, the Developer will provide a draft Sediment and Erosion Control Plan (SECP) to regulators and other interested parties. The document will be finalized prior to construction... Final design and associated site specific mitigation will be provided for DFO during the regulatory/permitting phase of the proposed project. DFO will have the opportunity during this regulatory phase to review and comment on the site specific designs and mitigation…Furthermore, environmental monitors will inspect sediment and erosion control measures to ensure they are working properly and to have them corrected if issues arise. The environmental monitors will also be recording turbidity in watercourses during the construction phase."

DFO's Conclusions and Recommendations

The Developer will be required to provide a draft sediment and erosion control plan as a part of any Fisheries Act Authorization. The Government of Northwest Territories Department of Transportation, with support from DFO, has been working on a Sediment and Erosion control manual for highway construction projects in the NWT. This document should be finalized prior to the construction of the proposed highway development and would assist in mitigating any potential impacts on fish and fish habitat.

Recommendation #9 - DFO recommends that the Developer complete a comprehensive Sediment and Erosion control plan, to the satisfaction of DFO, prior to construction of the proposed highway.

5.3 Issue - Water Withdrawal

This issue is discussed in:

Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.3
Sept. 20, 2012	DFO Hearing Undertaking – Issue #7

Issue Status

This issue is addressed. The Developer and DFO are in agreement.

Developer's Assessment

The Developer has stated the following:

"Total water withdrawal for all activities is not to exceed 5% of the instantaneous flow rate of a single watercourse at the time of withdrawal. In cases where there are multiple users withdrawing water from a single watercourse, the total combined withdrawal rate is not to exceed 5% of the instantaneous flow rate at the time of withdrawal. Therefore, consistent and coordinated water source identification is essential."

The Developer confirmed that fish screens developed using the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline will be used for all water withdrawals to protect fish from entrainment or impingement.

Detailed water requirement estimates, water source identification, construction camp siting, and the location of winter access and haul roads will be submitted in the regulatory applications. All water withdrawal planning and implementation will include identification of suitable water withdrawal sources (lakes and streams), assessment of allowable withdrawal quantities, unique source identification, and water withdrawal volume tracking.

A Water Withdrawal or Management Plan will be developed and finalized prior to the start of construction. This plan will be developed with input from community consultations, DFO and others as required.

The Developer has also stated that when extracting water from waterbodies for the construction of winter roads, dust suppression and other activities, the DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut (2010) would be used.

DFO's Conclusions and Recommendations

In order to adhere to all the conditions within the DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut (2010), site specific information such as bathymetry, locations and quantities of water must be provided. Furthermore, the Developer has stated that they will also be withdrawing water from streams and has stated that it will provide an assessment of allowable withdrawal quantities per source. It should be noted that DFO's Winter Water Withdrawal Protocol does not apply to watercourses.

DFO will require the identification of streams proposed for withdrawal as well as the instantaneous flow rate to assess the potential impacts on fish and fish habitat prior to construction.

Recommendation #10 - DFO recommends that the Developer provide information required for water withdrawal as soon as possible for review by DFO.

5.4 Issue – Fisheries Management and Harvesting

This issue is discussed in:

Feb 2012	Developer Response to EIRB Information Request – IR Response #32
March 1, 2012	Information Request from DFO to Developer – IR #9, 10
March 30, 2012	Developer Response to March 8, 2012 Information Requests (Round 2) from EIRB – IR Response # 111, 112, 144
August 13, 2012	DFO Issues for Discussion at the Technical Sessions for the Inuvik to Tuktoyaktuk Highway – Issue #7
Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.4
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.4
Sept. 20, 2012	DFO Hearing Undertaking – Issue #8
Oct.4, 2012	Letter from Fisheries Joint Management Committee (FJMC) to the EIRB

Issue Status

This issue is partly addressed and is expected to be completed prior to construction.

Developer's Assessment

The Developer has stated the following:

"As previously indicated, the EIS acknowledges that there is the potential for increased fishing pressure due to the presence of the Highway. Increased pressure, if it were to occur, would likely be mainly from residents of the communities of Inuvik and Tuktoyaktuk. It is difficult to predict what, if any, potential increased fishing pressure may occur. The potential for increased fishing pressure would exist regardless of the alignment of the proposed Highway. Most of the watercourses provide little opportunity for sport fishing, although Hans and Zed creeks do provide some sport fishing potential.

The proposed Highway does not provide direct access to major named lakes, which are known to provide fishing opportunities. Those wishing to fish these lakes would be required to travel off the Highway to access them. The inability to directly access these lakes from the Highway will reduce the number of people who will try and access them for fishing purposes. Increased fishing pressure is a human management issue, which can be addressed through education, guidelines, regulations and enforcement."

"The Husky Lakes, which provide habitat for several game fish species, is therefore the most critical of

the waterbodies potentially indirectly affected by increased access and exploitation."

The Developer has committed to providing assistance to the Tuktoyaktuk-Inuvik Working Group, the FJMC, and DFO in the development of a fisheries management plan for the highway corridor.

DFO's Conclusions and Recommendations

It is the responsibility of DFO and its co-management partners (FJMC, HTCs) to manage fisheries resources along the highway corridor. The Developer has committed to working in cooperation with users to assist in the management of fisheries, particularly in terms of signage and ensuring the highway is designed to prevent or discourage overfishing. The Developer has also recently committed to working with the Tuktoyaktuk-Inuvik Working Group to assist in the development of a fisheries management plan for the proposed highway corridor. This commitment occurred at the Fisheries Joint Management Committee meeting in Whitehorse on Sept. 30, 2012.

Recommendation #11 - DFO recommends that the Developer provide support for and participate in the development and implementation of a fisheries management plan for the proposed highway corridor.

5.5 Issue – Borrow sites

This issue is discussed in:

Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.5
Sept. 20, 2012	DFO Hearing Undertaking – Issue #9

Issue Status

This issue is addressed. The Developer and DFO are in agreement.

Developer's Assessment

The Developer confirms that the 50 m setback for development of borrow sites will apply to both watercourses and waterbodies. The Developer confirms that the Sediment and Erosion Control Plan will include mitigation for borrow sites. In the August 31st, 2012 commitments table, the Developer has indicated that "borrow sites will not be developed within 50m of any watercourses and 1km of the Husky Lakes."

DFO's Conclusions and Recommendations

Mitigation measures to reduce or eliminate potential impacts to fish and fish habitat include: selecting borrow sites that are located away from water bodies (where practical), the use of erosion and sediment control measures during pit operation, and reclamation and re-vegetation of the borrow sites during decommissioning. If properly implemented and used in conjunction with an effective monitoring program, these measures should ensure adequate protection of fish and fish habitat. The Developer has already

committed to developing a Sediment and Erosion control plan for the project, which will include the borrow sites.

Recommendation #12 - DFO recommends the Developer provide complete information with respect to sediment and erosion control plans as soon as possible in order to assess any regulatory requirements under the *Fisheries Act* for borrow sites.

5.6 Issue –Monitoring

This issue is discussed in:

Feb 2012	Developer Response to EIRB Information Request – IR Response #60
March 1, 2012	Information Request from DFO to Developer – IR #7,8
March 30, 2012	Developer Response to March 8, 2012 Information Requests (Round 2) from EIRB – IR Response # 109, 110, 145.1
August 13, 2012	DFO Issues for Discussion at the Technical Sessions for the Inuvik to Tuktoyaktuk Highway – Issue #3, 6
Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.1.1
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.1.1
Sept. 20, 2012	DFO Hearing Undertaking – Issue #1
Oct. 15, 2012	DFO Information Request #2 – IR #4

Issue Status

This issue is partly addressed. DFO will need to review monitoring plans in the regulatory phase prior to the issuance of any approvals.

Developer's Assessment

The Developer has stated the following:

"All stream crossing culverts will be regularly inspected as part of normal highway monitoring efforts. All crossings will be sampled for turbidity during construction and mitigative measures will be applied if turbidity criteria are exceeded … turbidity monitoring will also occur at the time of highest runoff, which typically occurs during spring freshet."

"Habitat conditions related to highway drainage and stream crossing structures will be monitored for a period of time following Highway completion, as determined in consultation with regulators, and, regular road, culvert, and bridge inspections will be conducted throughout the life of the Highway. Specifically, the Environmental Management Plan (EMP) created for this project will clearly identify monitoring procedures, including reporting requirements, invocation of work stoppages, and environmental criteria."

The Developer has committed to monitoring culverts in fish bearing streams annually for three years to verify that fish passage is maintained, particularly during migration periods.

DFO Conclusions and Recommendations

Recommendation #13 - DFO recommends that the monitoring plan to be developed by the Developer consist of systems for detection, response and follow-up, and should be adaptive and responsive to field conditions in case first remedial actions are not successful. The plan should also include long-term monitoring for each type of crossing employed in the proposed highway. DFO will also require monitoring as a part of any *Fisheries Act* Authorization issued. Monitoring plans should be provided with adequate time to review prior to the start of construction.

5.7 Issue - Blasting

This issue is discussed in:

March 1, 2012	Information Request from DFO to Developer – IR #6
March 30, 2012	Developer Response to March 8, 2012 Information Requests (Round 2) from EIRB – IR Response #
August 13, 2012	DFO Issues for Discussion at the Technical Sessions for the Inuvik to Tuktoyaktuk Highway – Issue #5
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.7
Sept. 20, 2012	DFO Hearing Undertaking – Issue #11

Issue Status

This issue is addressed. The Developer and DFO are in agreement.

Developer's Assessment

It was stated in the August 31st, 2012 commitments that "should the Developer require the use of explosives, any planned activities will be provided to DFO for review during the construction phase to ensure appropriate best practices are followed."

The Developer confirms it will follow DFO *Guidelines on the Use of Explosives In or Near Fisheries Waters* and that DFO will receive all necessary information on any blasting that may be conducted near fisheries waters. The Developer has committed to following the DFO-recommended *Monitoring Explosive-Based Winter Seismic Exploration in Water Bodies NWT 2000-2002* (Cott and Hanna 2005), and in particular, that the maximum peak pressure not exceed 50 kPa.

DFO's Conclusions and Recommendations

DFO is confident that the use of standard mitigation and monitoring measures as described in our guidelines as well as a lower threshold value for blasting can be effectively employed for the project to mitigate any blasting impacts on fish.

Recommendation #14 - DFO recommends the Developer provide complete information with respect to blasting plans as soon as possible in order to assess any regulatory requirements under the *Fisheries Act*.

5.8 Issue - Plan to Offset the Loss of Fish Habitat

This issue is discussed in:

August 13, 2012	DFO Issues for Discussion at the Technical Sessions for the Inuvik to Tuktoyaktuk Highway – Issue #9
Sept. 10, 2012	DFO Draft Technical Submission – IR # 4.8
Sept. 13, 2012	Developer Response to Parties' Technical Submissions – Section 3.0 IR Response # 4.8
Sept. 20, 2012	DFO Hearing Undertaking – Issue #12

Issue Status

This issue is addressed.

Developer's Assessment

The Developer has stated that it "will submit to DFO its plan for No Net Loss during the regulatory phase of the project. This plan will be prepared following completion of detailed design, which will also be in the regulatory phase of the project."

DFO Conclusions and Recommendations

While the Developer has provided a preliminary estimate of impacted area of fish habitat, complete information related to a plan for achieving no net loss of fish habitat has not yet been provided. Offsetting residual habitat impacts through the application of habitat compensation is viewed as a means of mitigating significant adverse environmental effects to fish habitat under CEAA.

DFO will need information in respect to crossing design details, fish habitat classification, fish habitat compensation, mitigation measures and monitoring to address the information requirements necessary to make a regulatory decision and issue Authorizations under ss.35(2) of the *Fisheries Act*. DFO will not be able to issue a *Fisheries Act* Authorization until such time as all information requirements are satisfactorily met.

Recommendation #15 - DFO recommends that all outstanding information with regards to a plan to offset the loss of fish habitat be submitted to DFO as early as possible to complete the regulatory review process.

6.0 CONCLUDING REMARKS

As outlined in this report, DFO has a number of recommendations for the EIRB to consider in their deliberations on the Inuvik-Tuktoyaktuk Highway Project. DFO would like to reiterate that these recommendations are made relative to DFO's mandate, the relevant legislation and the policies that were described previously in this document.

The final environmental management plans, fisheries management plans, and plans to offset the loss of fish habitat will dictate the extent of fish and fish habitat impacts to be considered in the regulatory phase.

With the implementation of recommendations intended to minimize impacts as outlined in this submission, including appropriate mitigation measures and an acceptable plan to offset the loss of fish habitat, DFO is of the opinion that the project could be carried out in a manner that is likely to avoid negative impacts to fish and fish habitat.

Any related authorizations issued by DFO will contain specific conditions to ensure that mitigation measures for the protection of fish and fish habitat are implemented; that monitoring and follow-up studies to address the efficacy of mitigation measures and verify impact predictions are undertaken; and that habitat losses identified are adequately offset.

In closing, DFO welcomes this opportunity to share our views with the Board and to provide this information for their consideration in reaching a decision with respect to the Inuvik-Tuktoyaktuk Highway Project.

7.0 SUMMARY OF DFO RECOMMENDATIONS

Recommendation #1 - DFO recommends that the Developer create a potential crossing installation scenario for summer installations, including mitigation measures and monitoring to demonstrate the efficacy of these measures, for review by DFO prior to undertaking any summer installations.

Recommendation #2 - DFO recommends the use of the Ice Bridges and Snow Fills Operational Statement (Appendix I) for the construction and decommissioning of all winter roads associated with the proposed Inuvik-Tuktoyaktuk Highway project.

Recommendation #3 - With regards to selection criteria for the type of crossing to be used, DFO recommends incorporating both biological and subsistence harvesting information prior to determining the type of crossing to be installed (bridge, minor, or major culvert).

Recommendation #4 - DFO recommends that a survey of winter habitat be completed on crossings that have potential for overwintering habitat or flowing water and are scheduled to be a culvert crossing.

Recommendation #5 - DFO recommends that a contingency plan, to be employed in the event flowing water conditions are encountered during winter construction, be prepared by the Developer and reviewed by DFO prior to commencement of construction.

Recommendation #6 - DFO recommends that the Developer provide "scenarios" describing each type of crossing and associated mitigations, along with the approximate numbers of each type of scenario. This will provide the developer an opportunity to efficiently assess and mitigate the impacts to fish and fish habitat for each crossing type.

Recommendation #7 - DFO recommends that the Developer provide site-specific stream crossing design criteria, habitat assessment, and mitigation measures as developed for the scenarios. These should be provided to DFO for review as soon as possible.

Recommendation #8 - DFO recommends that the Developer complete the lessons learned document based on their experiences constructing the Tuktoyaktuk-Source 177 Road, which would include culvert embedding challenges, ensuring fish passage, assumption of fish presence in small streams, addressing beaver dams, addressing ice in culverts during freshet, riprap management, sediment and erosion control, overflow culverts, planning (including consultation and incorporating subsistence harvesting considerations), communication between the Developer, regulators and contractors as well as any other design challenges associated with that road (e.g flow rates, embankment, slumping). This document can then be employed in the planning and development of mitigation measures for similar issues for the proposed Inuvik to Tuktoyaktuk Highway Project.

Recommendation #9 - DFO recommends that the Developer complete a comprehensive Sediment and Erosion control plan, to the satisfaction of DFO, prior to construction of the proposed highway.

Recommendation #10 - DFO recommends that the Developer provide information required for water withdrawal as soon as possible for review by DFO.

Recommendation #11 - DFO recommends that the Developer provide support for and participate in the development and implementation of a fisheries management plan for the proposed highway corridor.

Recommendation #12 - DFO recommends the Developer provide complete information with respect to sediment and erosion control plans as soon as possible in order to assess any regulatory requirements under the Fisheries Act.

Recommendation #13 - DFO recommends that the monitoring plan to be developed by the Developer consist of systems for detection, response and follow-up, and should be adaptive and responsive to field conditions in case first remedial actions are not successful. The plan should also include long-term monitoring for each type of crossing employed in the proposed highway. DFO will also require monitoring as a part of any *Fisheries Act* Authorization issued. Monitoring plans should be provided with adequate time to review prior to the start of construction.

Recommendation #14 - DFO recommends the Developer provide complete information with respect to blasting plans as soon as possible in order to assess any regulatory requirements under the Fisheries Act.

Recommendation #15 - DFO recommends that all outstanding information with regards to a plan to offset the loss of fish habitat be submitted to DFO as early as possible to complete the regulatory review process.

8.0 COMMITMENTS SUMMARY

DFO Commitments

DFO has committed to working collaboratively with the Tuktoyaktuk-Inuvik Working Group, the FJMC, and the Developer in the development and implementation of a fisheries management plan for the proposed highway corridor.

DFO is committed to working with Developer to finalize mitigation and monitoring plans to avoid impacts to fish and fish habitat.

Developer Commitments

In addition to the commitments made as per the Developer's Commitments Table (Table F) from Sept. 28, 2012, the Developer has committed to working with the Tuktoyaktuk-Inuvik Working Group to assist in the development of a fisheries management plan for the proposed highway corridor. This commitment occurred at the Fisheries Joint Management Committee meeting in Whitehorse on Sept. 30, 2012.

The following commitments have been made by the Developer as per the Developer's Commitments Table (Table F) from Sept. 28, 2012 and have relevance to DFO's mandate:

1. The Developer will install educational signage related to harvesting, fishing, hunting, and responsible use of the Highway at appropriate and highly visible locations.

2. At this time, the Developer's policy is to not allow its employees or contractors to fish while engaged in their employment activities.

3. The proposed Highway will be sited and designed to avoid or mitigate adverse effects on fish and fish habitat (i.e. HADD) for the various stream crossings. Where a HADD is unavoidable, the Developer will provide sufficient information for the purpose of the authorization and will develop suitable compensation strategies.

4. Bridges and culverts will be designed in accordance with the current Canadian Highway Bridge Design Code addressing stream hydraulics, design flood, scour, fish passage, vertical clearance, structure design life, climatic conditions, geotechnical design, structural design, protective aprons, and slope stabilization.

5. Summer construction will not take place between April 1 and July 15, in accordance with the DFO timing window for spring spawning fish (respecting grayling and northern pike, which are the only large-bodied fish species likely to use Project area streams for spring spawning).

6. An Environmental Management Plan will be developed to provide broad guidance relating to maintaining existing stream channel, fish habitat, and water quality conditions.

7. The EMP will contain the following types of plans:

- Explosives management;
- Environmental management;
- Spill contingency;
- Environmental Emergency Response Plan (if needed);
- Erosion and sediment control;
- Pit development for borrow sources;
- Fish and fish habitat protection;
- Wildlife management;
- Health and safety;
- Waste management;
- Hazardous waste management; and
- Archaeological site(s) protection.

Where necessary, the Developer and its contractor(s) will seek approval for the plans prior to use.

8. Fish and Fish Habitat Protection Plan - The Developer will develop and implement a fish and fish habitat protection plan in cooperation with DFO, FJMC and the Tuktoyaktuk-Inuvik Working Group that will include mitigation measures and adherence to Operational Statements or other direction by DFO.

9. The Developer will develop and implement an erosion and sedimentation control plan as part of the EMP. The plan will comply with appropriate erosion and sediment control guidelines, GNWT best management practices (currently being prepared in coordination with DFO), and measures outlined in the DFO (1993) *Land Development Guidelines for the Protection of Aquatic Habitat*. Some measures that will be followed include:
    - Limiting the use of construction equipment to the immediate footprint of the Highway or borrow source;
    - Minimizing vegetation removal and conducting progressive reclamation at the clear-span abutments, culvert installations and borrow sources;
    - Keeping ice bridge and ice road surfaces free from soils and fine gravel that may be tracked out by vehicles;
    - Avoiding the use of heavy equipment in streams or on stream banks during summer months, and the adherence to the DFO Operational Statement for Temporary Stream Crossings (DFO 2008), where this is deemed necessary;
    - Installing silt fencing and/or checking dams, and cross drainage culverts as necessary to minimize siltation in runoff near waterbodies; and
    - Appropriately sizing and installing culverts, based on hydrological assessments and local experience, to avoid backwatering and washouts, and to ensure fish passage.

10. The Developer will conform to Section 36(3) of the *Fisheries Act*, prohibiting the deposit of a deleterious substance through implementation of erosion and sediment control measures.

11. A Fishery Compensation Plan will be completed for all watercourses where crossings are likely to result in the harmful alteration, disruption or destruction of fish habitat.

12. Additional fish habitat assessments will be undertaken in 2012 for the proposed Highway alignment selected as required. This will be determined in discussions with DFO during the regulatory phase.

13. No instream work will occur in fish bearing streams during critical time periods.

14. Where critical fish habitat cannot be avoided, mitigation will be incorporated into the design.

15. Individual site-specific circumstances might preclude complete adherence to DFO Operational statements. In such cases, DFO will be consulted in advance to discuss and approve of proposed plans, which will include mitigation measures necessary to prevent or minimize effects.

16. In accordance with DFO (2009a), the installation of culverts in fish bearing streams will not permitted between April 1 and July 15 for watercourses that provide habitat for spring/summer spawners.

17. Should the Developer require the use of explosives, any planned activities will be provided to DFO for review during the construction phase to ensure appropriate best practices are followed.

18. Where Authorizations may not be required, details on the use of Operational Statements and commitment to ensuring that they are being applied correctly will be provided to DFO.

19. The Developer will consider, at a minimum, stream category when determining the type of structure to be placed at stream crossings.

20. The installation of culverts and the construction of bridges will be guided by an Environmental Management Plan (EMP), which will include construction scheduling restrictions, environmental construction guidelines, methods to prevent spills of deleterious substances, erosion and sediment control plan, and monitoring plan. The implementation of the measures contained in the EMP is intended to avoid or minimize effects to aquatic resources.

21. Summer construction will not take place between April 1 and July 15, in accordance with the DFO timing window for spring spawning fish (i.e., grayling and northern pike, which are the only large-bodied fish species likely to use Project area streams for spawning).

22. Sediment inputs from drainage ditches will involve implementation of sediment controls such as ditch breaks, silt fences, or ditch rerouting, in conjunction with an investigation to determine the source of the sediment. Streambank erosion will require temporary stabilization with mats or longer term armouring.

23. Training will be provided for environmental monitors to identify sources and causes of erosion and sedimentation, and these individuals will also have access to professional engineers and biologists who can assist in identifying and rectifying potential or actual erosion sources.

24. The Developer expects its primary construction phase mitigation plan, the Fish and Fish Habitat Action Plan, to be developed six months prior to the commencement of construction.

25. Habitat conditions related to highway drainage and stream crossing structures will be monitored for a period of time following Highway completion, as determined in consultation with regulators, and, regular road, culvert, and bridge inspections will be conducted throughout the life of the Highway.

26. Erosion control and plans to control runoff from the borrow sites, including any stockpiles that may be developed, will be addressed in pit development plans. Site drainage controls, including localized ditching/swales within the borrow sites and silt fencing will be employed as necessary to ensure that sedimentation contained in meltwater from ground ice in the aggregate, or site runoff in general, are appropriately managed and are not released into the surrounding watershed.

27. The Developer will develop and implement a fish and fish habitat protection plan in cooperation with DFO, FJMC and the Tuktoyaktuk-Inuvik Working Group that will include mitigation measures such as:
    - Designing appropriate crossing structures based on site conditions;
    - Completing primary construction activities during winter months;
    - Applying erosion and sediment control measures and best practices
    - Minimizing riparian disturbance (footprint);
    - Placing abutments at a sufficient distance from active stream channels;
    - Employing best management practices for culvert installation;
    - Annually monitoring for culvert subsidence or lifting;
    - Constructing in fish-bearing and non-fish bearing streams during winter;
    - Sizing culverts appropriately based on hydrological assessments and local experience;
    - Maintaining equipment away from waterbodies;
    - Having on-site spill containment equipment and operators trained to handle spills;
    - Reported spills will be contained by trained maintenance crews;
    - Maintaining a sufficient buffer of undisturbed land between borrow sources andwaterbodies;
    - Following DFO-recommended *Monitoring Explosive-Based Winter Seismic Exploration in Water Bodies NWT 2000-2002* (Cott and Hanna 2005), and in particular, that the maximum peak pressure not exceed 50 kPa;
    - Following DFO-recommended *Discussion on Seismic Exploration in the Northwest Territories 2000-2003* (Cott, Hanna and Dahl 2003);
    - Following DFO-recommended *Offshore Oil and Gas Environmental Effects Monitoring: Approaches and Technologies* (Armsworthy et al. 2005);
    - Following DFO G*uidelines for the Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998), where applicable;
    - Following DFO (2010) P*rotocol for Winter Water Withdrawal in the Northwest Territories*;
    - Following the DFO *Operational Statement for Culvert Maintenance* (DFO 2009b) where applicable;
    - Following the DFO *Operational Statement for Clear-span Bridges* (DFO 2009b) where appropriate;
    - Allowing filtration by natural vegetation;
    - Installing silt fences at each road-stream intersection;

- Building regularly spaced cross-drainage culverts;
- Applying spill response measures according to an approved spill contingency plan
- Posting signage at regular, visible intervals on Highway;
- Constructing or installing stream crossing structures to avoid the impingement of active stream channels;
- Effectively suppressing dust (i.e., through the use of water trucks) during the dry season; and
- Following the recommendations of the Water License (once approved).

28. The Developer will ensure that the DFO water withdrawal protocol criteria are followed.

29. The Developer is committed to carrying out bathymetric surveys on all lakes proposed for water extraction.

30. The Developer will minimize effects to water quality and quantity as a result of Highway design:
    - through the design and use of crossing structures that are appropriate for site-specific flow conditions;
    - by employing erosion and sediment control best management practices and DFO Operational Statements (where possible) as per approved Environmental Management Plans;
    - installing appropriately sized culverts to divert and manage Highway and surface drainage flows; and
    - undertaking primary Highway embankment construction activities during the winter months.

31. The Developer is committed to completing hydrological assessments prior to bridge design to determine suitable span widths and abutment placement.

32. During the bridge design of the Project, should individual site-specific circumstances preclude complete adherence to the DFO Operational Statements, the Developer will consult with DFO in advance to discuss and approve of proposed plans.

33. All water withdrawals from designated lakes or waterbodies along the Inuvik to Tuktoyaktuk Highway will be conducted in conformance with the DFO Protocol for Winter Water Withdrawal in the Northwest Territories.

34. Surface water flows (overland flows) will be managed through effective drainage designs that include the installation of appropriately sized cross culverts to divert and effectively manage Highway and surface drainage and to minimize possible ponding of water against the Highway embankment.

35. Commitment by the Developer to conduct consultations (after Public Hearings) with the Inuvik and Tuktoyaktuk Hunter and Trapper Committees, Inuvialuit Game Council, DFO and Transport Canada regarding:
    - Selection criteria for crossings;
    - Use of waterbodies; and

- Types of vessels.

Consultation dates are to be determined.

36. The Developer is committed to working closely with DFO to design appropriate crossing structures for each stream and to obtain Fisheries Authorizations, if determined to be required.

37. The Developer will install culverts according to established guidelines and will follow culvert installation guidelines such as those contained within the DFO *Land Development Guidelines* (1993), the TAC *Development and Management of Transportation Infrastructure in Permafrost Regions* (2010), and the INAC *Northern Land Use Guidelines for Roads and Trails* (INAC 2010).

38. The Developer will install appropriately sized culverts to minimize changes in water flow pattern and timing.

39. The Developer will not install culverts in critical aquatic habitats.

40. The Developer will carry out routine monitoring and inspections at watercourse crossings and culverts, including reporting on culvert performance and maintenance requirements.

41. The Developer will ensure that maintenance requirements for culverts will adhere to the DFO *Culvert Maintenance Operational Statement* (DFO 2010).

42. The Developer will ensure that when crossings are completed, disturbed materials will be replaced with similar-sized substrates and the bed and banks of the watercourse are stabilized and restored.

43. Site specific navigable waters information will be finalized as part of the NWPA applications.

44. Hydrological assessments will be conducted prior to bridge design to determine suitable span widths and abutment placement, including identification of suitable water withdrawal sources (lakes and streams); bathymetric mapping of proposed water sources; and assessment of allowable withdrawal quantities per source, unique source identification, and water withdrawal volume tracking.

45. Individual stream crossing structures will be oversized (two to three times the size used in non-permafrost areas) to prevent flow restrictions and to compensate for design uncertainties, such as settlement and ice or snow blockages (TAC 2010).

46. During the detailed design stage, flow data using regional flow gauge information will be used to model stream flows to permit suitable culvert and bridge sizing.

47. The majority of the stream crossings will involve the installation of culverts, which will follow appropriate guidelines to prevent the obstruction of fish passage.

48. Culvert installation during winter will follow procedures that include the application of bed and bank stabilization prior to snow melt to reduce erosion and downstream sedimentation at the onset of freshet flows.

49. Where it is deemed preferable to install culverts in summer, construction will adhere to appropriate guidelines, such as those identified in Dane (1978) and in the DFO *Land Development Guidelines for the Protection of Aquatic Habitats*, to avoid or minimize the potential for erosion, sedimentation or channel effects.

50. Short span bridges will be constructed bank to bank to eliminate instream activities, thus preserving natural stream flows and fish passage. Temporary erosion and sediment control measures will be utilized to protect the streams during construction, and site-specific preventive measures will be employed for each crossing as appropriate.

51. Single span structures will be used where fish habitat has been identified as present. No binwalls will be used for abutments.

52. The Developer confirms that the bridges required to cross the larger streams will be designed to span the stream widths (ranging from 10 m to 25 m in width), consistent with the specifications of the DFO *Clear-Span Bridge Operational Statement*.

53. To minimize ponding along the roadway during melt, equalization culverts will be placed regularly to allow water to run away from the road edge, and not sit trapped against the embankment.

54. All culvert crossings will be regularly inspected for signs of erosion or damage, which would likely result in increased turbidity downstream. In addition, exceedances of turbidity levels at a significant number (>10%) of the monitored streams would trigger the requirement to carry out monitoring at all stream crossings.

55. Culverts installed in fish bearing streams will be assessed annually for three years to verify that they continue to provide free access to fish passage, particularly during migration periods(up to three years only).

56. Turbidity sampling will occur at all crossing sites during construction. Sampling will follow the general guidance provided in Birtwell et al. (2008) as follows:
    - Sampling will occur at three locations: upstream (true baseline control) of the crossing structure, at the point of, and immediately downstream of, the structure.
    - Environmental monitors will visually identify potential inputs of sediment and determine suitable sampling locations accordingly.

57. Turbidity monitoring will occur at the time of highest runoff, which typically occurs during spring freshet.

58. Provide alignment sheets showing stream crossings and structure type to interested parties.

59. The Developer is committed to work closely with the ILA, the Tuktoyaktuk and Inuvik Hunters and Trappers Committees (HTCs); the Wildlife Management Advisory Committee (WMAC), the Fisheries Joint Management Committee (FJMC), the GNWT Department of Environment and Natural Resources (ENR), and selected environmental consultants to monitor environmental

conditions and to validate conformance with the mitigation measures contained in the various environmental protection plans, licenses and permits that will be issued for the Highway construction project.

60. To monitor the effects of stream crossings:
    - The following parameters will be measured: turbidity (Nephelometric Turbidity Units (NTU); pH; dissolved oxygen; conductivity; temperature.
    - Sampling will be conducted within 50 metres upstream of each crossing site and 50 and 100 metres downstream of each crossing site (i.e. three measurement sites per stream).
    - Sampling will occur in spring, following ice-out, which is the time of freshet when there is the greatest risk of erosion and sediment transport.
    - The threshold turbidity levels that will be followed for the implementation of remediation are based on the BC Ministry of Environment *Ambient Water Quality Guidelines*, as follows:
        - During clear flow periods: background levels should not be exceeded by more than 8 NTU.
        - During turbid flow periods: background levels should not be exceeded by more than 5 NTU at any time when background turbidity is between 8 and 50 NTU. When background exceeds 50 NTU, turbidity should not be increased by more than 10% of the measured background level at any one time.