Fisheries and Oceans Canada

Technical Review Comments

Developer's Assessment Report
and Supporting Documents

Dezé Energy's Taltson Hydroelectric Expansion Project

Submitted to:
Mackenzie Valley Environmental Impact Review Board

MVEIRB Code: EA0708-007
DFO File No.: 07-HCAA-CA6-00104

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

The Dezé Energy Corporation Ltd. (the Proponent) is proposing the expansion of the existing Twin Gorges power generation facility on the Taltson River in the Northwest Territories (the Project). Modifications to the Nonacho Lake Dam Control and the South Valley Spillway and a new power plant at the Twin Gorges site would increase power output from 18 MW to the range of 54 MW and 74 MW. Power generated at the new expanded facility is intended for the existing Ekati, Diavik, Snap Lake and the proposed Gahcho Kué diamond mines and would be supplied via a 690 km transmission line routing northeast from the power facility around the East Arm of Great Slave Lake and terminating with lines branching to these northern industrial customers.

The Proponent submitted a complete water license application for the Project to the Mackenzie Valley Land and Water Board on August 10th, 2007. The Project was referred to an environmental assessment under the Mackenzie Valley Management Resources Act on October 5th, 2007.

On May 12th, 2008, DFO received a copy of the document "Trudel Creek Fish and Fish Habitat Effects Assessment Report – March 2008" for review and comment. After reviewing the aforementioned document, and other related documents supplied in the spring and summer of 2008, DFO requested additional information from the Proponent in a letter on November 13th, 2008.

On April 28th, 2009 the Mackenzie Valley Environmental Impact Review Board (MVEIRB) requested that parties begin their technical review of the Developer's Assessment Report (DAR) submitted by the Proponent on March 2nd, 2009. DFO met with the Proponent on April 29th, 2009 at which time the Proponent supplied responses to DFO's November 2008 request for additional information. Following its initial review of the document, DFO submitted a letter to the MVEIRB on July 15th, 2009 outlining additional information that would be required to conduct a technical review of the DAR. These information requests were officially entered into the environmental assessment record during the Technical Session held in Yellowknife October 1st, 2nd and 5th of 2009. DFO continued to discuss its outstanding concerns with the Proponent in sidebar meetings throughout October 2009. Meeting reports from these discussions were submitted by the Proponent to the MVEIRB on October 30th, 2009. On November 6th, 2009, interveners to the environmental assessment were advised that the MVEIRB would be accepting technical submissions on the DAR from interested parties until December 11th, for inclusion in the final public hearing scheduled in Yellowknife in January 2010.

DFO has completed its technical review of the proposed development taking into consideration the information supplied by the Proponent through correspondence with DFO, in their Developer's Assessment Report and any other pertinent documents submitted to the MVEIRB. The following comments are submitted for the environmental assessment of the Dezé Taltson Hydro Expansion Project.

1.2 Mandate

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 oceans and fresh waters.

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.

The Department'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 Department is also one of the three responsible authorities under the *Species at Risk Act*.

The *Fisheries Act* provides DFO with is regulatory powers to conserve and protect fish and fish habitat. This is accomplished through the administration of the habitat and pollution protection provisions of the *Fisheries Act* which are binding on all levels of government and the public. These include areas such as:

- the prohibition against the harmful alteration, disruption or destruction (HADD) of fish habitat unless authorized by DFO – section 35(2)
- the provision of sufficient water flows – section 22
  passage of fish around migration barriers – sections 20 and 21
- screening of water intakes – section 30
- prohibition against the destruction of fish by means other than fishing unless authorized by DFO – section 32
- prohibition to deposit deleterious substances unless by regulation – section 36(3)

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)).

With respect to fish habitat, the *Policy for the Management of Fish Habitat (1986)* (the Policy), and supporting documents such as the *Practitioner's Guide to Risk Management Framework*, provides direction to Habitat Management staff on when and how HADDs can be authorized. The Policy and supporting documents outline the decision framework and criteria to be used when reviewing specific development proposals. Generally, Proponents are to avoid or minimize HADDs to fish habitat through relocation, redesign, and/or mitigation techniques, where feasible. It is only after these steps are taken that any remaining HADD to fish habitat is considered for Authorization by the Minister. If a HADD is deemed acceptable and it is determined that an Authorization may be issued, the Minister may issue an Authorization; and the Policy generally requires that fish

habitat be created as compensation for the loss incurred as a result of the HADD. The Policy and the Practitioner's Guide to Habitat Compensation provide further direction in the form of a hierarchy of preferences for deciding upon the level, type and location of compensation works.

2.0 TECHNICAL COMMENTS

2.1 Project Construction

2.1.1 Access Roads and Trails

Document/Section:
*DAR***:** 15.5.5.2

Proponent's Assessment:
The DAR identified the construction and use of winter roads during the construction phase as a project component that could potentially lead to changes in fish distribution or abundance. The Proponent committed to following DFO's *Operational Statement for Ice Bridges and Snow Fills* and *Protocol for Winter Water Withdrawal in the Northwest Territories* as well as implementing additional mitigation measures to protect fish and fish habitat outlined in their draft Erosion and Sediment Control Plan. The potential disturbance of riparian vegetation was assessed to be minimal and thus potential impacts to shoreline habitat were concluded to be minor. The Proponent further committed to restricting use of project access routes to project use only to minimize potential noise disturbances to fish or any additional fishing pressure on fisheries resources in the area.

DFO's Conclusion and Rationale:
DFO agrees with the Proponent's conclusion that adverse impacts to fish and fish habitat should be minimal provided the mitigation measures outlined above are implemented.

Recommendation #1:
DFO recommends that the Proponent consult with DFO during the finalization of the Erosion and Sediment Control Plan.

Recommendation #2:
DFO recommends that the Proponent follow the DFO Freshwater Intake End-of-Pipe Fish Screen Guidelines.

Recommendation #3:
DFO recommends that the Proponent consult with local aboriginal peoples to ensure that restricting use of the access trails and roads to construction traffic only does not impede traditional use of the Project, or surrounding, areas.

2.1.2 Transmission Lines

Document/Section:
DAR: 6.5.5.2, Table 8.4.2

Proponent's Assessment:
The proposed development would require the construction of a transmission line that would cross approximately 676 rivers, streams or lakes, with no in-stream works expected. To minimize impacts to fish and fish habitat, the Proponent has committed to construct the transmission line in accordance with DFO's Operational Statement for Overhead Line Construction with additional measures to be implemented to protect fish and fish habitat, as identified their Erosion and Sediment Control Plan. As outlined in this plan, areas near sensitive habitats will be marked on Project drawings with additional mitigative measures to be implemented where required. The Proponent concluded that potential impacts to fish and fish habitat did not require further assessment.

DFO's Conclusion and Rationale:
DFO agrees with the Proponent that adverse impacts to fish and fish habitat should be avoided provided that DFO's Operational Statement for Overhead Line Construction and the mitigation measures as outlined in the Erosion and Sediment Control Plan. As noted by the Proponent, sensitive fish habitat that may be near construction areas should be identified and given special consideration.

Recommendation #4:
DFO recommends the Proponent collect baseline information on aquatic resources in a representative number of fish-bearing waterbodies along the transmission line to form the basis of a scientifically defensible monitoring program.

2.1.3 Use of Explosives

Document/Section:
DAR: 15.2.3.1.4.5, Table 15.2.12
Commitments Arising from the Mackenzie Valley Environmental Impact Board Technical Sessions Held in Yellowknife on October 1st, 2nd, and 5th and in Lutsel K'e on September 30th, 2009: Commitment #37

Proponent's Assessment:
Construction at the Twin Gorges site will require the use of explosive in or near waterbodies. The Proponent identified three potential pathways of effects relating to fish and fish habitat: explosives leading to change in bank stability and increased erosion potential; explosives leading to blast residues; and explosives leading to fish mortality.

The Proponent concluded that the impact to fish and fish habitat would be minor for all three pathways with the following mitigation measures:

- DFO *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* would be followed;
- Charge size would be limited to that required to fracture the bedrock channel (large blasts would weaken the integrity of the rock causeway);
- Water-resistant stick explosives would be used for in and near-stream works;
- Prior to blast, the immediate area would be isolated of fish; and,

- An Environmental Construction Monitor would be present during in-stream construction activities.

DFO's Conclusion and Rationale:
Blasting creates shock waves that radiate outward from the point of detonation. The detonation of explosives adjacent to fish habitat has been demonstrated to cause disturbance, injury, and/or death to fish, and/ or the harmful alteration, disruption or destruction of fish habitat. Section 32 of the *Fisheries Act* prohibits the destruction of fish by means other than fishing. The *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky, 1998) offer guidance on the use of explosives to reduce harm to fish. However, in the north, DFO uses a more protective Instantaneous Pressure Change (IPC) threshold of 50 kPa instead of that prescribed in the Guidelines.

The Proponent has committed to meeting the *Guidelines for the use of Explosives in or near Canadian Fisheries Waters (Wright and Hopky, 1998)* as well as using the lower 50 kPa IPC threshold This should reduce the harm to fish during the blasting program. Additional detail on the specifics of the blasting program (eg.setback/ charge size combination, monitoring component) will be required at the regulatory phase to ensure that this threshold is adequately protective of fish species and lifestages present in habitats adjacent to the detonation area. The Proponent may wish to apply for a Section 32 authorization to address incidental mortalities of fish due to the use of explosives.

Recommendation #5:
DFO recommends that monitoring be developed and implemented to ensure the 50 kPa IPC threshold is adequately protective of fish species and lifestages in habitats adjacent to the point of detonation. Adaptive management measures to lower the IPC threshold should be developed should the 50 kPA prove to cause injury or mortality of fish. The monitoring and adaptive management program should be included in the Proponent's Drill and Blast Management Plan

2.1.4 Nonacho Lake Drawdown

Document/Section: 15.2.3.2.9

Proponent's Assessment:
Construction at the Nonacho Lake Control Structure would require the one time 0.85 m drawdown of Nonacho Lake over a six-month period beginning in the month of September. This drawdown would be equivalent to the annual drawdown under the 36 MW scenario. In the DAR, the impact to fish and fish habitat was considered minor; however, this conclusion did not consider potential impacts to spawning lake trout and incubating eggs.

In its July 15th, 2009 information request submission to the MVEIRB, DFO advised that the one time drawdown during construction and fluctuating water levels during operations has the potential to dewater lake trout eggs prior to emergence if they are within the drawdown zone. Lake trout are known to spawn in shallow water depths in the

NWT. This is supported by the personal experience and observations of Myles Carter, a guide with the Nonacho Lake Fishing Camp.

In a follow-up e-mail, the Proponent informed DFO that the potential overlap between the drawdown area and the shallowest spawning depths for lake trout observed in Nonacho Lake was approximately 0.25 m for the one-time drawdown during construction and operations under 36 MW scenario while for operations under the 56 MW scenario no overlap was expected. The effect assessment for lake trout spawning in Nonacho Lake was considered "not significant" as some eggs may be impacted, but that most spawned eggs would not.

Notwithstanding this conclusion, to address potential impacts to lake trout in Nonacho Lake due to the one-time drawdown and water level fluctuations due to operations, the Proponent has committed to a two-phased monitoring/assessment program to assess the current use of shallow areas for lake trout spawning. Phase 1 has already been completed and included a desktop investigation to identify and map potential lake trout spawning locations. Phase 2 will consist of a field study program of identified shallow spawning sites and nearby deep water habitats to provide an assessment of relative fish use of these areas.

DFO's Conclusion and Rationale: As identified in the Proponent Monitoring Program, limited information is available on the relative use of shallow reef habitats and deep water habitats for lake trout spawning in Nonacho Lake. It is essential to determine what depths are being used for spawning by lake trout in Nonacho lake prior to drawdown taking place in order to identify site specific mitigation and/ or operational changes that will minimize potential impacts.

Recommendation #6:
DFO recommends that the Proponent continue to proceed with the two phased pre-construction assessment of lake trout spawning habitat in Nonacho Lake identified in the draft monitoring plan. DFO is willing to assist the Proponent in developing the asessment plan, analyzing the results, and working together to refine drawdown scenarios in order to mitigate potential impacts.

Recommendation #7:
DFO recommends that the Proponent involve the Nonacho Lake Fishing Camp in this study as their lodge relies on a healthy lake trout population. Potentially affected aboriginals should also be included in these discussions.

2.2 Project Operation

2.2.1 Impacts to the Zones 1 and 2

Document/Section:
DAR **:** 13.3**,** 13.9
Commitments Arising from the Mackenzie Valley Environmental Impact Board Technical Sessions Held in Yellowknife on October 1st, 2nd, and 5th and in Lutsel K'e on September 30th, 2009

Proponent's Assessment:

Zone 1 (Taltson River below Nonacho Dam to upstream of the Forebay): As stated in the DAR, under the 36 MW expansion scenario, flow would be reduced in the Taltson River downstream of Nonacho Lake from May through September. Peak annual flow would occur in January or February as opposed to July. The annual hydrograph based on mean monthly flows would therefore be substantially different than baseline under the 36 MW scenario. Under the 56 MW expansion scenario, releases from Nonacho Lake would generally be similar to baseline resulting in an annual hydrograph that mimics the current baseline hydrograph.

For the 36 MW expansion scenario, the Proponent concluded that no project effect pathways would be valid in terms of inducing potential impacts to fish and fish habitat. For the 56 MW expansion scenario, only the potential restriction of fish movement from Nonacho Lake to the downstream Taltson River system were deemed to be valid and minor, as the Proponent considered fish populations in Nonacho Lake and in the Taltson River downstream of the power plant to be self-sustaining.

Zone 2 (Tronka Chua Gap to Lady Grey Lake): Under existing conditions, the DAR states that flow from Nonacho Lake over the Tronka Chua Gap into the Tronka Chua Lakes system (Zone 2) is always present. Under the 36 MW scenario flow at Tronka Chua Gap would regularly cease to flow (flowing 65% of the time) while under the 56 MW scenario, flow would only be expected during wetter than average years, or 30 % of the time.

For the 36 MW scenario, the Proponent identified only two project effects pathways as valid and likely to produce a minor impact to fish and fish habitat: flow management as it relates to food supply; and, flow management as it relates to fish habitat structure and cover. The latter was deemed minor as it was assumed that while access may be reduced to some habitats, other closely located habitats would continue to supply a food source for fish in the system. The former was also deemed minor as it was assumed that the riparian zone would re-establish and return to its functional capacity within 5 to 10 years.

For the 56 MW scenario, the Proponent concluded that in spite of the reduced flow from Nonacho Lake into the Tronka Chua system, there would be no changes to riparian habitats in the Tronka Chua Lakes. The only project effects pathway deemed valid and likely to produce a minor impact to fish and fish habitat was: flow management as it relates to migration and/or access to habitats. As stated in the Commitments document, given that 22% of baseline flow would continue to be provided to the Tronka Chua Lake from other sources, the Proponent considers this assessment as reasonable and conservative. The Proponent does, however, acknowledge that these predictions are based on no field studies for Zone 2 and limited field studies for Zone 3 and therefore require validation and have committed to a monitoring program for Tronka Chua Lake.

DFO's Conclusion and Rationale:

The impacts to fish and fish habitat in Zones 1 and 2 depend on which expansion scenario is approved. While it appears that the 56 MW expansion scenario mimics the natural hydrograph in the Taltson River better than the 36MW scenario, it would result in a severe reduction in flow through Tronka Chua Gap which is currently the dominant source of flow to the Tronka Chua system, including Tronka Chua Lake and Thekulthili Lake. This would be especially true during the winter where flow through the gap could stop completely. To date, no baseline data has been collected for wetlands, aquatic resources, fish and fish habitat, ice structure or dissolved oxygen levels in water in Zone 2. Limited baseline data was provided for Zone 1. The Proponent has therefore relied heavily on modelling and assumptions to make a determination regarding effects.

The Proponent has committed to conducting a pre operation assessment in Tronka Chua Lake, specifically examining lake depths and assessing fish species, fish habitat, winter dissolved oxygen and ice thickness characteristics. Both expansion scenarios will reduce the amount of riparian/ littoral habitat in Zones 1 and 2. The Proponent has committed to a riparian habitat monitoring program for the Taltson River. DFO is willing to assist in determining the number of sites and where they should be located.

The aquatic effects monitoring program developed for Zones 1 and 2, as for other aspects of the project, must include adequate baseline data and be complemented with a detailed and action oriented adaptive management plan. The Proponent should be aware that impacts that are greater than were predicted may warrant adaptive measures which include operational changes.

Recommendation #8:
DFO recommends that the monitoring program for Tronka Chua Lake include a pre-operations bathymetric survey.

Recommendation #9:
DFO recommends that the Proponent investigate the potential cost/benefits of maintaining flow through Tronka Chua Gap throughout the year for the 56MW expansion scenario and/or the feasibility of diverting flow through the Tronka Chua Gap post-construction should the impacts to the Tronka Chua system be greater than was anticipated.

Recommendation #10:
To better inform the analysis in DFO's Recommendation #9, DFO recommends that the proposed assessment and monitoring program for Tronka Chua Lake be expanded to include Thekuthili Lake since flow over Tronka Chua Gap is its dominant source of flow. Baseline information will also be essential for determining whether impact predictions were accurate.

2.2.2 Fish Mortality from Entrainment and Displacement

Document/Section:
*DAR***:** 15.3, 15.3.14
Meeting Report with DFO and Dezé re: Entrainment - October 30th, 2009

Proponent's Assessment:
The Proponent is of the opinion that the Project includes several design features to prevent the injury or mortality of fish through the turbines at the North Gorge site and the loss of fish in the Forebay to the downstream Taltson River, including:

- Habitat in the 1.2 km intake canal which would be of poor quality and would hold no unique features that would attract fish to the canal, thus reducing the likelihood of fish of being swept into the turbines;
- The approach velocity of the water in the canal being less that that of the burst speeds of adult and juvenile fish using the Forebay, such that fish are able to exit the canal should they enter; and,
- The use of Low Kaplan Turbines, where economically and technically feasible, which have been shown to result in lower fish mortality.

Additionally, it is hypothesized by the proponent that as the fish species present in the Forebay are not migratory, the likelihood of purposeful downstream fish migration is low. Given that other options for downstream migration exist over the South Valley Spillway and the South Gorge site, the low likelihood that fish will use the intake canal, and high survival rates for the Kaplan turbines, the overall significance of the impact to fish was deemed not significant.

As a result of further discussions with DFO, the Proponent also committed to:

- "Investigating if screen sizes <100 mm are effective in preventing applicable fish species and life stages from being entrained or impinged and if they are operationally feasible
- Investigating technical feasibility of utilizing turbines with the least impact to fish (i.e. minimal blades etc.).
- Developing a monitoring program to confirm the assumption that North Gorge intake canal fish use would be low and that adult and juvenile fish can escape the canal if they swim into it.
- [Discussing the] outcome of [the] monitoring program with DFO and [identifying] if additional monitoring or mitigation / adaptive management [would be] required to protect fish populations." (Meeting Report with DFO and Deze re: Entrainment - October 30th, 2009)

DFO's Conclusion and Rationale:
It is unclear whether eliminating habitat diversity in the intake canal would deter fish from utilizing it and whether the velocity will be low enough to allow fish to exit the canal prior to going through the penstocks and the turbines. As acknowledged by the Proponent, "examples of hydroelectric projects utilizing intake canals designed to be unsuitable for fish habitat are rare."

As larger bodied fish have been found to have a higher rate of mortality when passing through turbines than smaller bodied fish, several different means of reducing the potential of larger bodied fish entering the canal and being swept through the turbines are

essential. This is of additional importance for this project as the proposed methods for avoiding fish injury and mortality are untested.

Given the available information, DFO is of the opinion that the implementation of the mitigation measures committed to by the Proponent and one or more of the recommended mitigation identified below, harm to fish in the Forebay should be minimized.

Section 32 of the *Fisheries Act* prohibits the destruction of fish by means other than fishing. The Proponent may wish to apply for a Section 32 authorization to address the incidental destruction of fish should the mitigation measures committed to by the Proponent, and as recommended below, not be 100% effective in deterring fish from entering the turbines. Should an authorization be issued, a monitoring and adaptive management plan, such as the one committed to by the Proponent in the *Meeting Report with DFO and Dezé re: Entrainment - October 30th, 2009* would be included as a condition.

Recommendation #11:
DFO recommends that the Proponent proceed with a monitoring program to inform an adaptive management approach, developed in consultation with DFO, to determine whether the predictions made in the EA regarding entrainment were correct (as per the October 6, 2009 entrainment meeting report)

Recommendation #12:
DFO recommends that the Proponent incorporate mesh on the penstock screens that is of a size that will mitigate impacts to fish species/ life stages that could be present in the intake canal and could be sent through the turbines.

Recommendation #13:
DFO recommends that the Proponent investigate the use of trashracks at the entrance of the intake canal to decrease use of the canal by larger bodied fish; DFO recommends the Proponent refer to Tsikata et al, 2009 [1]to design a trash rack that protects fish but does not unduly impact hydroelectric power generation.

Recommendation #14:
DFO recommends that the Proponent utilize turbines with the least number of blades, if technically feasible, to further reduce the risk of fish mortality.

Recommendation #15:
DFO recommends that, once results from the monitoring program become available, the Proponent consult with DFO on mitigation measures that may need to be modified or added to ensure the protection of fish from entrainment or impingement.

2.2.3 Impacts to Trudel Creek from Altered Flow Regime

Document/Section:

[1] Tsikata, J., Katapodis, C., Tachie, M. (2009). Experimental study of turbulent flow near model trashracks. *Journal of Hydraulic Research* 147(2): 275-280.

DAR 14.4, 14.7

Proponent's Assessment:
In order to provide for the increased power production, a significant portion of the flows currently flowing over the South Valley Spillway into Trudel Creek would be routed through the Twin Gorges power generation plants.

Trudel Creek will experience a significant flow reduction under both the 36 and 56 MW scenarios. Under the 36 MW expansion scenario the predicted reduction in mean monthly flow will range from 77 to 87 percent and under the 56 MW option the mean monthly reduction in flow will range from 85 to 90 percent.

The DAR states that water velocities in the riverine sections of Trudel will also experience significant reductions with mean monthly decreases ranging from 59-71% for the 36 MW option and from 71-82% for the 56 MW option. Very low average velocities (0.06 & 0.07 m/s) have been predicted for the months of February to May under the 56 MW option. The Proponent further predicts that average water depths in the riverine section will also decrease for each month of the year with a range of 9% for April and 24% for July under the 36 MW option and a decrease under the 56 MW option ranging from 11-26% under the 56 MW option. The maximum changes in water depth represent drops of 1.6 and 1.7 m for the 36 MW and the 56 MW, respectively.

For both expansion scenarios all three lakes will experience a decrease in average depth from the baseline for each month of the year. The decrease will range from 5-13% for 36 MW and from 6-15% for 56 MW. The maximum monthly average drop will be 1.59 and 1.73 m in Trudel Lake in July for the 36 MW and the 56 MW power options, respectively.

To mitigate impacts to fish and fish habitat within Trudel Creek, the proponent has proposed a minimum flow of 4 m^3/s. During dry years, and potentially consecutively dry years, only the minimum flow would be maintained in Trudel Creek throughout the year, occurring once every 10 to 25 years under the 56 MW option. A 4 m^3/s equates to approximately 90% reduction in flow.

The DAR utilized weighted usable area (WUA) plots to quantify and analyze the potential loss of fish habitat due to the reduction in flows. Under both the 36 MW and 56 MW expansion scenarios, the WUA was predicted to increase over baseline for pike spawning and juvenile rearing, decrease from baseline for lake whitefish and walleye spawning, and decrease for baseline for lake whitefish adult and juvenile rearing. The Proponent thus concluded that there would be no significant impacts to fish and fish habitat.

DFO's Conclusion and Rationale:
The proposed fixed minimum flow release of 4m^3/s is a concern for DFO because studies have shown that variable flow is required to maintain a healthy and sustainable ecosystem. The WUA analysis for both the 36 MW and 56 MW hydro expansions

options estimated habitat size using the proposed minimum flow release of 4 m3/s in conjunction with the 13 year modelled flow record which meant that habitat size was not limited only to the minimum flow release. The lack of a formal variable flow regime poses the risk that the proposed fixed minimum flow may become the only release for Trudel Creek at some point in time.

Of further biological concern are the potential delays in the spring freshet for Trudel Creek. The delay in spring freshet could impact the entire system and not just Trudel Creek. As the Proponent states, the delay in the freshet could cause a delay in spawning of spring spawners because of lower water temperatures. This impact may be significant in northern latitudes where the growing season is already short.

More importantly, under the proposed new flow regime, the frequency of a spring freshet will be reduced in Trudel Creek and during a dry period the system may experience a flat 4 m^3/s flow throughout the year during a dry year. In the event of a prolonged dry period, Trudel Creek could experience 4 m^3/s throughout the year for several consecutive seasons.

For spring spawners (Northern pike, walleye and white sucker), opportunities for successful spawning and emergence of fry will be affected if there are changes to the quantity and quality of spawning habitat. It cannot be predicted with certainty whether there will be a positive or negative effect as we do not have enough biological or physical habitat information specific to the system that might give us some insight into this question. Generally, higher flows produce better spawning habitat and large fluctuations in flow post spawning typically has a negative effect on recruitment. For example, Northern pike spawn in flooded vegetation that would be limited if flows did not increase water surface elevation (WSE), whereas walleye and white sucker that spawn in riffles may have eggs displaced by high flows post spawning. The fact that Trudel Creek will have reduced frequency of spring freshet will likely mean limited spawning habitat in the riverine sections. The reduction in aquatic vegetation will also impact rearing habitat for juvenile fish and invertebrate production.

Upon reviewing the cross section placement on Trudel Creek used to develop the WUA plots, DFO believes there are an inadequate number of cross sections and the cross sections that were surveyed appear to be placed in locations with simple channel morphometry, capturing none of the riffles, rapids or complex braided channel. Because of the cross section placement the measured velocities are lower than expected, potentially underestimating spawning habitat for Walleye and Lake Whitefish in the WUA analysis. Results from the WUA analysis presented in the DAR showed changes in habitat size based on average flows and large river reaches which was of limited value in terms of capturing impacts due to the effect of flow frequency and duration and changes to specific habitat types. For the riverine section, mean monthly averages were based on the average of all transects which may also underestimate changes in depth and velocity at specific crossings or other locations. Changes in water depth may influence connectivity in the system as well.

Therefore, with the current data, the WUA plots likely underestimate the impacts to fish habitat, as shallow habitat will be impacted to a far greater extent by changes in discharge for both velocity and wetted area. For the reasons mentioned above, DFO recommends a more protective flow regime for Trudel Creek.

Notwithstanding, DFO recognizes that the flow regime in Trudel Creek has been significantly altered several times since the construction of the Twin Gorges in 1965, with much larger flows released into the system over the South Valley Spillway than would have been experienced under natural conditions. The shutdown of the Pine Point mine in 1986 and subsequent reduction in power generation at the Twin Gorges site would have likely further increased flows into Trudel Creek to approximately 75% of the annual flows in the Taltson River. The biological communities within Trudel Creek may not have stabilized yet from this last alteration in flow and, as stated by the Proponent, erosion and sedimentation into Trudel Creek could potentially be reduced under the proposed lower flows. The establishment of a smaller more ecologically stable riverine system may therefore be of some benefit to the biological communities within Trudel Creek. However, in order to ensure that reduced flows into Trudel Creek does indeed lead to a smaller yet stable and productive ecosystem, extreme caution must be taken when determining an acceptable flow regime or minimum flow for Trudel Creek. The potential impacts that ramping events could have on the stabilization of a smaller ecologically healthy river system is discussed in Section 2.2.4.

To ensure that no significant adverse impacts occur, minimum flow requirements for Trudel Creek need to be determined based on the biological needs of the aquatic resources in the system. The Proponent concluded that the assessment provided a conservative estimate of potential impacts to fish and fish habitat as higher flows would be expected at different times of year. As stated above, this does not address periods of extended low flows where all additional water could be used for power generation.

Based on a preliminary analysis of an earlier set of the 1978 to 1990 modelled flow data, DFO recommends the 95% exceedance (5th percentile) baseline monthly flow data with a minimum 4 m^3/s, whichever is greater, as an interim option for the monthly flow hydrograph for Trudel Creek. The 95% baseline flow exceedance has been considered protective in other projects to address flow needs for fish and fish habitat.

A refined minimum flow regime could be developed once additional baseline information and further analysis is provided. The following information would assist the proponent in determining minimum flow requirements for Trudel Creek acceptable to DFO:

- The completion of additional cross section surveys with attention paid to habitat breaks and where habitat diversity can be captured within Trudel Creek to increase the level of detail/ accuracy of the model. DFO is willing to assist with defining these locations;
- A fish tagging study which would establish baseline conditions for monitoring (connectivity re: fish passage, overwintering),

- Riverine WUA data extracted from the revised WUA analysis, as the inclusion of the less severely impacted lake systems may hide areas of habitat within the river system that could be more severely impacted. Currently only “Lake Data” is split out.
- Wetted area versus discharge plots for the lake and river reaches of Trudel Creek.
- Specific details of fish habitat use including sensitive areas that require greater protection such as the location of whitefish spawning areas.
- Dissolved oxygen data in areas that are most likely to be impacted by lower flows, both in lake and stream sections of the Trudel Creek system.

Recommendation #16:
In order to address the need for variable flow to protect fish and fish habitat in Trudel Creek, DFO recommends that the proponent adopt a flow regime that incorporates the minimum flow release of 4 m3/s in conjunction with a variable 95% exceedance (5th percentile) baseline monthly flow hydrograph, where the greater of the two flows would define the minimum monthly flow release. The minimum monthly flow release could be refined with additional baseline information and analysis. DFO recognizes the need to balance the developers flow needs for an economically viable project with the minimum flow required to sustain the fish habitat in Trudel Creek for the target species in our flow recommendation.

Recommendation #17:
DFO recommends that the Proponent develop a rigorous pre and post project monitoring program capable of determining changes in aquatic habitat to verify impact predictions and to determine if changes in operations are required.

Recommendation #18:
DFO recommends that the Proponent investigate options for maintaining the existing pool sucker habitat near South Valley Spillway.

Recommendation #19:
DFO recommends that the Proponent further refine and implement a monitoring program, in consultation with DFO, to verify model predictions for WUA, DO, temperature and implement adaptive management measures, including operational changes, where impacts were underestimated.

Recommendation #20:
DFO recommends that the Proponent develop and implement an active riparian/ aquatic replanting program, in consultation with DFO, in order to expedite the successful re-colonization of vegetation along and within the new stream channel.

2.2.4 Impacts Due to Scheduled and Unscheduled Ramping Events

Document/Section:
DAR: 14.8, 17.5.6

Meeting Report with DFO and Deze re: Fish Stranding during Ramping Events (October 30, 2009)

Proponent's Conclusion:
The scheduled or unscheduled shutdown of the Twin Gorges power generation plants would result in a dramatic increase in flow, or ramping, into Trudel Creek over 8 hours, as flow would be routed away from the Twin Gorges site and over the South Valley Spillway. Once the turbines were restarted, flows in Trudel Creek would return to pre-outage conditions at the uppermost portion of the system within 8 hours.

Ramping events could impede the re-establishment of meadow vegetative communities, disturb aquatic plants and invertebrate communities, displace incubating eggs during increased flows, increase erosion and deposition which may smother incubating eggs, and/or displace or strand juvenile and adult fish within Trudel Creek and downstream of the tailrace in the Taltson River.

The Proponent has proposed a bypass spillway (referred to as the South Gorge Spillway) with a 30 m^3/s capacity and staged gate control as a mitigative measure to reduce the amount of flow that would be directed over Trudel Creek during these ramping events, thereby lessening the potential for fish displacement and/or stranding. Additionally, a staggered start-up of the turbines would occur following a shutdown event to reduce the rate of decrease in flow experienced in Trudel Creek once flow was redirected to the Twin Gorges site. The Proponent concluded that with these mitigation measures, and given the infrequent occurrences of a full unscheduled outage, the impact to fish and fish habitat would not be significant.

In response to an information request arising at the October 1st to 5th technical session, the Proponent supplied a cost benefit analysis of the alternatives available to the South Gorge 30 m^3/s Bypass Spillway. Five options were assessed:

- a controlled and uncontrolled bypass into South Gorge capable of a 1/1000 year return period flood (900 m^3/s) – very high cost but would eliminate any increase in flows into Trudel Creek during outage events;
- a controlled bypass spillway into South Gorge for 75-150 m^3/s – high cost but could fully eliminate flows from 36 MW turbine and eliminate 90% of flows from the 56 MW turbine;
- a controlled bypass spillway into South Gorge for 30 m^3/s – the preferred option, which would reduce 28% and 18% of the flows from the 36 MW and 56 MW turbines, respectively, into Trudel Creek during an outage, and has a low cost; and,
- two other 30 m^3/s bypass options that would be of low cost but due to reliability or the mitigation of effects downstream of the dam, were determined to be of low cost/benefit.

The proponent selected the controlled bypass spillway into South Gorge for 30 m^3/s as they opined that the overall benefit/cost would be highest.

As a result of further discussion with DFO, the Proponent has also committed to conducting a trial opening and closing of the spillway gate to observe potential stranding sites in Trudel Creek and in the Taltson River downstream of the tailrace. In the event of an outage, these identified sites will be monitored to determine the level of stranding or isolation occurring. The Proponent commits to consulting with DFO on the results of this monitoring program in order to determine if the stranding risk is acceptable or if further monitoring, operational changes or adaptive management measures are necessary.

DFO's Conclusion and Rationale: As identified by the Proponent, effects of ramping events can include the displacement of fish from preferred habitat, erosion and siltation, washing away or desiccation of fish eggs, and harm to benthic invertebrate communities which are an important food source for fish. While flushing flows are important to prevent excessive sediment build up, large ramping events in Trudel Creek could impede the re-vegetation of littoral and riparian zones which could make it very difficult for the system to stabilize after flows are reduced. This will affect the likelihood that the transition for riparian vegetation would take 5 to 10 years and re-establishment of littoral vegetation would take 1 to 3 years, as predicted by the Proponent. As stated in the draft monitoring plan, "in Trudel Creek, scheduled and unscheduled power outages will cause increases in flow that may also affect the development of downslope movement of meadow communities, if those communities are developing from seed, as the young plants are quite susceptible to wash out."

The successful re-establishment of riparian and aquatic vegetation in a timely manner is critically important as it provides habitat for a variety of life stages of fish species that reside in Trudel Creek.

Recommendation #21:
DFO recommends that Proponent reduce the frequency of ramping events as much as is technically feasible in Trudel Creek to allow the creek to stabilize and riparian/ aquatic vegetation communities to become re-established.

3.0 CONCLUSION

The Proponent's assessment of impacts to fish and fish habitat rely extensively on the accuracy and precision of their models and assumptions. These models and assumptions will require continued refinement as additional information, such as the results of monitoring programs, becomes available.

Based on the available information, DFO is of the opinion that once a flow regime that meets the ecological needs of Trudel Creek has been refined, and with the application of appropriate mitigation measures for other project-specific impacts, comprehensive adaptive management, follow-up and monitoring programs, as well as the development of an adequate fish habitat compensation plan for project-specific habitat losses, adverse impacts to fish and fish habitat could be minimized during the construction and operation of the Project.

The importance of an effective Aquatic Effects Monitoring Plan (AEMP) cannot be understated for this Project as many impact predictions for the assessment are based on assumptions and cannot be validated until flows are altered. The Proponent will need to collect adequate baseline information in order to ensure the development of a robust and scientifically defensible monitoring program that is capable of identifying and quantifying any effects due to the hydro expansion. This is consistent with DFO's advice to the MVEIRB on October 17, 2007:

> *Prior to the expansion of the current hydroelectric facility, a comprehensive baseline habitat suitability survey should to be completed in all representative parts of the Taltson River Drainage Basin that would experience alteration in flow and/or water level as a result of the proposed project. The results of this survey would locate and quantify the current habitat within the drainage basin, and be used as a reference point in which to gauge the projected impact. This study should also predict reservoir sedimentation rates and potential impacts to fish communities and fish habitat. The Proponent should be required to compare the projected post-expansion flow conditions to the baseline habitat study to determine the likely areas of habitat impact. These identified areas should be assessed to determine their level of importance to the fish community.*

The AEMP must be complemented by an adaptive management plan that identifies contingencies in the event that impacts are larger or different than predicted. Should the Project proceed to construction and operation, the Proponent must be prepared to implement adaptive management measures, which may include operational changes for the Project. DFO recognizes and appreciates that the Proponent has committed to developing a robust AEMP with adaptive management as an integral component. The draft monitoring program, as provided to the MVEIRB on October 30th, 2009, is a starting point for discussion. DFO looks forward to working with the company, other agencies and communities in developing a monitoring and adaptive management program that is to the satisfaction of all parties. DFO suggests the proponent consult Indian and Northern Affairs draft *Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories* and the *Guide for Preparation of Adaptive Management Plans*, appended, to inform the development of this monitoring and adaptive management program.

Should the Project proceed to the regulatory phase, prior to the issuance of any authorizations, DFO will require the Proponent to develop a "No Net Loss" Plan that adequately compensates for habitat losses that would occur as a result of the Project. DFO and the proponent have started discussions on potential habitat compensation works. Any authorizations issued by DFO in relation to the Project under review will contain specific conditions to ensure that mitigation measures for the protection of fish and fish habitat are implemented, and that comprehensive monitoring and follow-up studies to address the efficacy of mitigation measures and verify impact predictions are undertaken.

DFO appreciates the difficult decision facing the MVEIRB in its consideration of the Taltson Hydroelectric Expansion Project. The Department will continue to work cooperatively with all stakeholders, including the Proponent, to ensure that its interests for the protection of fish and fish habitat are being addressed.