Taltson Hydroelectric Expansion Project

Commitments 2009

COMMITMENTS ARRISING 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.

October, 2009

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COMMMITMENT # 1

Subject: Instream Works

Request:
Dezé commits that concrete works will be conducted in dry conditions and won't be in contact with water bodies.

Response:
Dezé commits that concrete works will be conducted in dry conditions and won't be in contact with water bodies. Monitoring (i.e.: visual observations of work; pH measurements of waste water) will be conducted during concrete works that have potential to affect water bodies.

COMMITMENT # 2, 3, 4, 5, 16, & 17

Subject: Entrainment

Request:

Commitment 2

Dezé to provide in writing, by October 30th, 2009, rationale and additional information on the specific life history movement characteristics of the fish species that may use the canal to support the three assumptions presented in Section 15.3.2.8.1.5

Commitment 3

Dezé to provide in writing, by October 30th, 2009, revised proposed mortality estimates presented in Section 15.3.2.8.1.5.

Commitment 4

Dezé to provide in writing, by October 30th, 2009, an assessment of the potential for downstream displacement or entrainment of fish during the operation of the Nonacho Lake control structure, as well as the requirement for fish passage for lake trout and/o

Commitment 5

To provide in writing, by October 30th, 2009, an assessment of potential population level impacts and fish movement characteristics for lake trout, northern pike, and lake white fish in Nonacho Lake.

In addition to the commitments above, the following commitments are also addressed here, as well as reproduced in chronological order.

Commitment 16

Dezé to indicate how mortality estimates included both direct immediate mortality and indirect delayed morality from injury.

Commitment 17

Dezé to provide calculations on the mortality on large fish and views on potential impact.

Response:

Dezé and DFO have come to an agreement on the interests of commitments 2, 3, 4, 5, 16, and 17, including the issues, concerns, and monitoring associated with entrainment, as contained in the October 06, 2009 Meeting Report forwarded to MVEIRB. Dezé commits to investigating, during detailed design, additional mitigation measures that could be incorporated into the project design to reduce potential for fish mortality, to monitoring the assumptions that the canal North Gorge intake canal fish use would be low and that adult and juvenile fish can escape the canal if they swim into it, and to discussing outcomes of the monitoring program with DFO and identify if additional monitoring or mitigation / adaptive management is required to protect fish populations.

COMMITMENT # 6, 7, & 8

Subject: Dissolved Oxygen

Request:

Commitment 6:

Dezé to provide an assessment of impacts to overwintering fish in Tronka Chua Lake, due to reduced dissolved oxygen levels.

Commitment 7:

Dezé to provide in writing, by October 30th, 2009, a reassessment of the potential impacts to aquatic life using the cold water dissolved oxygen values presented in the CCME Guidelines.

Commitment 8:

To write up commitment, prior to October 30th, for what they can do to verify the model for winter dissolved oxygen, and provide supporting evidence to the conclusion that the reduced flow expected during the winter season will be sufficient to uphold the concentration of dissolved oxygen, as prescribed in the CCME guidelines for cold water.

Response:

Commitment 6

Tronka Chua Gap is a natural saddle in the south-west corner of the lake. It is important to note that prior to the construction of the Nonacho control structure in 1968 there was likely no discharge over the Tronka Chua Gap and all outflow from Nonacho Lake was naturally routed through the mainstem of the Taltson River. Engineering studies indicate that the water in Nonacho Lake during the pristine time period could have passed through Tronka Chua Gap during "a really big flood year, but it was far from a regular occurrence" (T. Vernon, personal communication 2008).

Reduced flows during freeze-up and throughout the winter under both expansion scenarios have the potential to impact overwintering fish habitat through reduced dissolved oxygen levels. Reduced flows during freeze-up are likely to result in earlier ice formation on Tronka Chua Lake, which could lead to reduced dissolved oxygen in overwintering habitat. As described in the DAR, under the 36 MW scenario the changes in flow conditions are not expected to have a large effect on thermal lake ice formation through this zone. Under the 56 MW development scenario, flows through Tronka Chua Gap would be considerably less than the baseline condition. Lower stream flows during freeze-up are likely to result in earlier ice formation and a more stable ice cover on the lake.

Baseline winter flows over Tronka Chua Gap into Tronka Chua Lake average 9.2 m^3/s, and there are approximately 2.7 m^3/s flowing into the lake from other sources, for a total inflow of 11.9 m^3/s. The baseline DO in Tronka Chua Lake is anticipated to be considerably lower than that in Trudel system, given these inflows, and the size of Tronka Chua Lake.

Under the proposed water management scheme, the average winter flow over Tronka Chua Gap would be 6.7 m^3/s under the 36 MW scenario or 0.9 m^3/s for the 56 MW scenario. This would result in an average total winter inflow to Tronka Chua Lake of 9.4 m^3/s or 3.6 m^3/s for the 36 and 56 MW scenarios respectively and lead to the reasonable conclusion that the reduction in DO in Tronka Chua Lake will be less than that for the Trudel Creek lakes because the magnitude of the reduction is less. Winter inflows to Tronka Chua Lake will be 79% (under 36 MW) or 30%

(under 56 MW) of baseline, whereas winter inflows in Trudel Creek will be 0.07% or 0.06% of baseline (under the 36 MW and 56MW scenarios, respectively; see Table 13.3.8 of the DAR). Even if there is no flow over Tronka Chua gap, the inflows to Tronka Chua Lake from other sources would provide an inflow of 22% of baseline.

Therefore, it is the option of Dezé that the predictions presented in the DAR (Table 13.4.10 and discussed in Section 15.4.5.4) are reasonable and conservative, thus the effects to fish presented in DAR Section 13.9 also reasonable. However, Dezé recognizes that these predictions require verification due to the potential for effects to fish should the environment differ from assumptions; see commitment #8 in this regard below.

Commitment 7:
The dissolved oxygen (DO) model used to conduct the effects assessment was developed for the lakes in Trudel Creek as, based on the Basin Model, these lakes would experience the greatest change in water level, and are assumed to be representative of the greatest potential effect on dissolved oxygen. All other Taltson River system water level changes were assumed to affect dissolved oxygen to a lesser extent than that of Trudel system.

The following table summarizes the anticipated changes in dissolved oxygen levels from baseline conditions (outputs from the DO model) within the Trudel Creek lake systems under both proposed operation scenarios.

Lake	**Dissolved Oxygen (mg O_2/L)**				
	Baseline	**36 MW**	**Change from Baseline to 36 MW**	**56 MW**	**Change from Baseline to 56 MW**
Gertrude Lake	9.8	8.9	**0.9**	8.8	**1.0**
Trudel Lake	8.7	7.2	**1.5**	7.1	**1.6**
Un-named Lake	7.3	5.4	**1.9**	5.2	**2.1**

The CCME thresholds for DO in cold water bodies is 9.5 mg O_2/L for sensitive early life-stages and 6.5 mg O_2/L for other life-stages respectively. Under baseline conditions, only Gertrude Lake meets the sensitive early life-stage threshold; all three lakes meet the threshold for other life-stages. Under both expansion scenarios, Gertrude Lake DO levels would drop below the sensitive early life-stage threshold.

Trudel Creek winter flows are predicted on average to decrease from 76.6 m^3/s to 15.6 m^3/s and 7.35 m^3/s, for the 36 and 56 MW scenarios respectively. Most of this flow is due to releases over the SVS as other inflows to the system are negligible. Dezé is committed to a minimum release of 4 m^3/s.

The DO model was designed to take a conservative approach in estimating DO concentrations. The model assumes that each lake is a closed system where no inflows occur and, therefore, overestimates the decrease in DO. Inflows of surface water provide an influx of oxygen-rich water because the water is constantly flowing and is shallower than in lakes. This is especially true if the flowing water is turbulent and exposed to air. Turbulence brings air bubbles in the water, allowing oxygen to dissolve from the air in those bubbles into the water. In addition, the model assumed that the anticipated small increases in ice thickness during the winter months would prolong ice cover in lakes by an entire month.

Water turnover times were calculated for Unnamed, Trudel and Gertrude Lakes by dividing the total lake volume by the average winter flow into the system. The time needed for a complete turnover of all the water in Gertrude, Trudel, and Unnamed lakes was calculated to be 0.6, 0.5, and 1.3 days, respectively.

The anticipated reduction in flow is roughly 60 m^3/s which would increase turnover times by a factor of about 15 (60 divided by 4) to 9.0, 7.5 and 19.5 days respectively for the three lakes. Therefore, even though the DO concentration was modelled for 211 days with no inflow, complete replenishment of the waters in Gertrude and Trudel Lakes occurs at least once two weeks and every three weeks in Unnamed Lake.

Additionally, there are three places in the Trudel system where it is quite likely that the inflowing water will remain ice free all winter due to turbulence. These are over the SVS, in two constrictions between Trudel and Gertrude lakes and in another constriction downstream of Gertrude Lake (see DAR Figure 14.8.2). Therefore, oxygenated water will be flowing into Unnamed lake and the de-oxygenated water flowing out of Unnamed Lake will be re-oxygenated upstream of Trudel Lake all winter.

Commitment 8:
Dezé recognizes that the model has not been verified, and that additional information on Tronka Chua Lake will help understand the DO characteristics of that lake, and enable the model to be applied to the lake. In addition, Dezé notes that some winters could experience zero flow over Tronka Chua Gap. Therefore, Dezé proposes to gather additional information on Tronka Chua Lake pre-constriction, as described below.

In addition to the dissolved oxygen, Dezé also recognizes that limited environmental data is available for Zone 2, specifically Tronka Chua Lake, and that testing prior to project construction, of the assumptions made to complete the effects assessment, such as fish species composition, habitat availability, lake depths, and winter dissolved oxygen is required. Winter DO measurements will allow for verification of the model, and confirmation that the reduced flow will be sufficient to uphold the concentration of dissolved oxygen, as prescribed in the CCME guidelines for cold water, or similar DO concentrations to the baseline conditions. Fish and fish habitat information and DO testing in Tronka Chua Lake, as well as DO monitoring in Trudel system to verify the model, has been included in the Taltson Expansion Project Monitoring Program.

In addition, Dezé will continue to revise the power generation model and subsequently the Basin Model, to identify if a preferred operational scenario for both generation water balance and environmental effect mitigation is feasible.

COMMITMENT # 9

Subject: Littoral Vegetation

Request:
Dezé to supply information about the wetland surveys illustrating the impacts or potential impacts to the project.

Response:
Dezé recognizes the value of a monitoring program that would confirm assumptions and monitor predictions. Therefore, a key component of the aquatics monitoring for the Project is selection and monitoring of environmental components and conditions (i.e. vegetation, aquatics, fish, etc.) associated with select littoral zones in the Taltson River system. This is described in the Taltson Expansion Project Monitoring Program.

COMMITMENT # 10

Subject: Littoral Vegetation

Request:
Dezé to provide an assessment of the potential impacts to fish and benthic invertebrates should re-establishment of littoral zones not occur in the best case scenario of one to three years.

Response:
As documented in the transcripts of the technical sessions, the focus of this commitment was primarily on Trudel Creek, as opposed to the Taltson Basin, therefore, is discussed in commitment numbers 21 and 22. However, as a result of the interest in littoral habitat transitions in the Taltson Basin, the timeframe for vegetation re-establishment presented in the DAR (3 to 10 years) was reviewed. The timeframe is based on available literature and expert judgment. In discussion with local and regional experts, very little information exists in regard to transition or growth of littoral vegetation in northern climates. All information sources located or suggested by various parties (including those provided by the MVEIRB experts) were reviewed and no information exists that would contradict this estimated timeframe. One document that was not referenced in the DAR, but which provides regional content is Cott (2004) Northern Pike (*Esox lucius*) Habitat Enhancement in the Northwest Territories, Canadian Technical Report of Fisheries and Aquatic Sciences 2528 (http://www.dfo-mpo.gc.ca/Library/280081.pdf). This document discusses the development and natural revegetation of pike habitat on the Stagg River, created as a requirement under the Fisheries Act. The document states that:

> The constructed pond was left to naturally vegetate and therefore wasn't anticipated to be viable spawning habitat for a few years. However, in all three years of post construction monitoring, adult pike were observed during spawning surveys and young-of-the-year (YOY) pike were collected during mid-summer surveys….their presence in the pond confirms successful spawning and the utilization of nursery habitat. Also, within two years of construction, the infilled area had settled below the waterline and re-vegetated, and adult pike were observed.

Attachments:
Cott, P. 2004. Northern Pike (*Esox lucius*) Habitat Enhancement in the Northwest Territories, Canadian Technical Report of Fisheries and Aquatic Sciences 2528 (http://www.dfo-mpo.gc.ca/Library/280081.pdf).

COMMITMENT # 11 & 12

Subject: Taltson River Fish

Request:

Commitment 11

Dezé to submit outcome of sidebar meeting, concerning additional information required to complete review of the DAR.

Commitment 12

Dezé to assess the possibility that higher flows in the winter will initiate early spawning by fish species that normally spawn in the spring, in correlation with the annual freshet.

Response:

Commitment 11

Dezé has submitted outcomes of sidebar meeting with DFO to MVEIRB.

Commitment 12

Higher flows in the winter are not expected to initiate early spawning as spawning cues are triggered by water temperature and photoperiod, rather than discharge. Thermal regime is likely one of the greatest selective forces and most influential abiotic factors affecting fish populations because temperature influences spawning times, foraging patterns, and survival (Galarowicz, 2003. Kocovsky and Carline 2001, Philipp 1992). Huh et al. (1976) studied the effects of temperature and light on the growth of walleye and yellow perch, and states:

> "Cyclic and seasonal variations in growth, reproduction, and physiological activities of fish are undoubtedly regulated by temperature and light (photoperiod) conditions of their surroundings. Temperature has been considered as the most significant of the controlling factors (Fry 1971) and functions as a signal factor (Brown 1957; Nikolsky 1963) which induces metabolic processes, spawning, and migration, etc."

Temperature has been identified as an influencing factor on spawning site selection even under increased flow regimes in other hydropower projects. In other systems, increased flow scenarios influenced the migration of spawners, but fish continued to spawn during their typical timing windows and temperatures thresholds (Geist et al. 2008, Jager and Rose 2003).

In the Taltson/Trudel system, fish are not making large migrations to spawning areas, and temperatures are expected to change only by 1 or 2 degrees under operational scenarios (see DAR Section 14.4). Temperatures during the winter higher flows are expected to remain close to freezing. As such, the increase in discharge over the winter is not anticipated to initiate early spawning by fish species.

References:

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Fry, F. E. J. 1971. The effect of environmental factors on the physiology of fish. Pages 1-93 in W. S. Hoar and D. J. Randall, eds. Fish physiology. Vol. VI. Academic Press, New York and London.

Galarowicz, T. L. and D. Wahl. 2003. Differences in Growth, Consumption, and Metabolism among Walleyes from Different Latitudes. Trans. Am. Fish Soc. 132:425-437.

Geist, D.R., E.V. Arntzen, C.J. Murray, K.E. McGrath, Y. Bott, and T.P. Hanrahan. 2008. Influence of River Level on Temperature and Hydraulic Gradients in Chum and Fall Chinook Salmon Spawning Areas Downstream of Bonneville Dam, Columbia River. N. Amer. J. Fish. Mgmt. 27:30-41.

Huh, H. T., H. E. Calbert and D. A. Struiber. 1976. Effect of Temperature and Light on Growth of Yellow Perch and Walleye using Formulated Feed. Trans. Am. Fish. Soc. (2):254-259.

Jager, H.I. and R. A. Rose. 2003. Designing Optimal Flow Patterns for Fall Chinook Salmon in a Central Valley, California, River. N. Amer. J. Fish. Mgmt. 23:1-21.

Jansen, M.E. 1993. Induction of Ovulation in Arctic Char held under unchanging Temperature and Photoperiod. The Progressive Fish-Culturist. 55:32-34.

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COMMITMENT # 13

Subject: Aquatics Monitoring Program

Request:
Dezé to provide draft monitoring frameworks for the Taltson River watershed, Trudel Creek, and canal construction, and canal operation.

Response:
The Draft Taltson Expansion Program Monitoring Program including monitoring frameworks for the Taltson River watershed, Trudel Creek, canal construction and canal operations, along with other monitoring components, has been submitted to the MVEIRB with these commitments.

COMMITMENT # 14

Subject: Mercury

Request:
Dezé to investigate the empirical values further to see if they have some information that they could make use of that. And if not, look at the other fish species that were used to see if there is a better empirical value that's more appropriate to lake trout.

Response:
Tissue concentrations were modelled based on the mercury model presented by Johnston et al. (1991). The variables used to predict methylmercury concentrations in Lake Trout were based on empirical values for Lake Whitefish because variable for Lake Trout were not measured by Johnston et al. (1991). It was suggested that the variables for Lake Trout should be based on a piscivorous fish (i.e. fish that consume other fish), rather than Lake Whitefish, which are not piscivorous. It was also recommended that the values for predicted methylmercury concentrations in Lake Trout be updated by using the variables for Northern Pike provided by Johnston et al. (1991) as surrogate values.

This assessment provides the updated modelled concentrations in Lake Trout and Lake Whitefish using the recommended Northern Pike variables. This assessment also provides a sample calculation for both species (<350mm) for Nonacho Lake based on the 36 MW scenario.

The updated values correspond to the following tables in the DAR:

Table 13.5.4 – 36 MW: Modelled Mercury Concentrations in **Chapter 13.5.5.1**
Table 13.5.6 – 56 MW: Modelled Mercury Concentrations in **Chapter 13.5.5.2**.

To calculate the MERC for each fish species, a two-variable linear regression model was used. The two-variable linear models for MERC were calculated as:

$$MERC_i = b0 + b1X1 + b2X2 + \varepsilon$$

Where: MERC*i* = predicted mean mercury burden of species *i*.

- *X1* and *X2* = lake environment factors, PDA/UPDA or AVR/UAVR.
- *b0* = baseline MERC for species *i*.
- *b1* and *b2* = species-specific independent fitted parameters for the mercury model suggested by Johnston et al. (1991) for Lake Whitefish and Northern Pike. Northern Pike was used as a surrogate species for Lake Trout, which are both piscivorous fish.

Applying the mercury model to predict concentrations in Taltson Basin fish is considered a conservative approach. Based on the HEC-ResSim modelling, the annual peak water levels may be higher than the baseline for years with high precipitation because this water would be stored in Nonacho Lake. However, the absolute maximum water level (i.e. the highest water level ever reached during the 13-year modelling period) in Nonacho Lake under the proposed 36 MW and 56 MW scenarios would not exceed baseline absolute water levels since a greater water demand is required at the Twin Gorges power facility to maintain the higher power generation. Hence, Nonacho Lake would experience no new inundation of terrestrial soils. Therefore, an influx of mercury from the soil into the aquatic environment is not expected; only existing mercury in disturbed sediments may be redistributed in the water.

Sample calculations for predicted methylmercury concentrations in fish tissue are presented below. Scenario 1 presents the calculation for predicting methylmercury in Lake Whitefish that are <350 mm in Nonacho Lake under the 36 MW power output option.

Scenario 1: Lake Whitefish <350 mm for Nonacho Lake at 36 MW

b_0	= 11.3955		Based on mean weight = 168.2 grams
b_1	= 0.85		Johnston et al. (1991)
b_2	= 2.45		Johnston et al. (1991)
X_1	= 1.9144		PDA
X_2	= 0		UPDA
$MERC_i$	= 11.3955 + (0.85 x 1.9144) + (2.45 x 0)		
	= 13.02274		
	Predicted mercury concentration		= $MERC_i$ / mean weight
			= 13.02274 / 168.2 g
			= 0.07744 mg/kg ww

Scenario 2 presents the calculation for predicting methylmercury in Lake Trout that are <350 mm in Nonacho Lake under the 36 MW power output option. The variables for b1 and b2 were obtained from Johnston et al. (1991) for Northern Pike.

Scenario 2: Lake Trout <350 mm for Nonacho Lake at 36 MW

b_0	= 38.5111		Based on mean weight = 272.9 grams
b_1	= 5.80		Johnston et al. (1991)
b_2	= 30.86		Johnston et al. (1991)
X_1	= 1.9144		PDA
X_2	= 0		UPDA
$MERC_i$	= 38.5111 + (5.8 x 1.9144) + (30.86 x 0)		
	= 49.61462		
	Predicted mercury concentration		= $MERC_i$ / mean weight
			= 49.61462 / 272.9 g
			= 0.18183 mg/kg ww

36 MW Option
The updated model results for the 36 MW scenario show that there could be approximately a 28% increase in methylmercury concentration for <350 mm Lake Trout in Nonacho Lake and a marginal increase in Taltson Lake. The predicted mercury concentration for Lake Trout <350 mm was 0.18183 mg/kg ww, which is well below the Health Canada guideline of 0.5 mg/kg ww. Lake Trout >350 mm in both lakes had marginal increases in methylmercury concentrations, and the effects are considered negligible compared to baseline.

36 MW: Modelled Mercury Concentrations

Fish Species	FISH UNDER 350 mm		FISH OVER 350 mm	
	Average Baseline Mercury Concentration (mg/kg ww)	Predicted 36 MW Average Mercury Concentration (mg/kg ww)	Average Baseline Mercury Concentration (mg/kg ww)	Predicted 36 MW Average Mercury Concentration (mg/kg ww)
Nonacho Lake				
Lake Trout	0.14114	0.18183	0.39550	0.40099
Lake Whitefish	0.06775	0.07743	0.13671	0.13714
Taltson Lake				
Lake Trout	0.13100	0.13215	0.32503	0.32516
Lake Whitefish	0.03744	0.03747	0.07913	0.07913

56 MW Option
The updated model results for the 56 MW scenario show that there could be approximately a 14% increase in methylmercury concentration for <350 mm Lake Trout in Nonacho Lake and a marginal increase in Taltson Lake. The predicted mercury concentration for Lake Trout <350 mm was 0.16105 mg/kg ww, which is well below the Health Canada guideline of 0.5 mg/kg ww. Lake Trout >350 mm also had marginal increases in methylmercury concentrations for both lakes, and the effects are considered negligible compared to baseline.

56 MW: Modelled Mercury Concentrations

Fish Species	FISH UNDER 350 mm		FISH OVER 350 mm	
	Average Baseline Mercury Concentration (mg/kg ww)	Predicted 36 MW Average Mercury Concentration (mg/kg ww)	Average Baseline Mercury Concentration (mg/kg ww)	Predicted 36 MW Average Mercury Concentration (mg/kg ww)
Nonacho Lake				
Lake Trout	0.14114	0.16105	0.39550	0.39819
Lake Whitefish	0.06775	0.07249	0.13671	0.13714
Taltson Lake				
Lake Trout	0.13100	0.13155	0.32503	0.32509
Lake Whitefish	0.03744	0.03746	0.07913	0.07913

References:
Johnston, T.A., R.A. Bodaly and J.A. Mathias. 1991. Predicting Fish Mercury Levels from Physical Characteristics of Boreal Reservoirs. Canadian Journal of Fisheries and Aquatic Science. 48: 1468 - 1475.

COMMITMENT # 15

Subject: Mercury

Request:
Dezé to explain why they feel sediment monitoring would be sufficient (as it relates to changes in mercury levels).

Response:
Terrestrial flooding in newly-constructed hydroelectric reservoirs is commonly associated with bioaccumulation and biomagnification of methylmercury (the most toxic form of mercury). Flooded soils and the resulting changes in soil chemistry release soil-bound mercury into the aquatic environment. Although the proposed Project expansions would not flood any additional terrestrial soils in the Nonacho Lake reservoir, the expansion would result in changes to the hydrograph. These changes would increase the fluctuation in water levels, which could disturb sediment layers. This in turn could increase methylmercury in the aquatic environment by re-mobilizing mercury that has settled in benthic sediments. Increasing the availability of methylmercury raises the potential for bioaccumulation and biomagnification in the food chain.
Mercury previously released from soils in the original reservoir flooding in 1965 is likely still present in the deeper sediment layers. Increased variation in water levels associated with the Project expansion may disturb these sediments and re-mobilize sediment-sequestered mercury into the water column.

The methylation of elemental mercury from increased water level fluctuations is secondary to flooding and presents less of a risk to the biota relative to new flooding. In the proposed Expansion Project, annual water levels in Nonacho Lake would be more frequently closer to the existing minimum and maximum levels, and would disturb a larger surface area of the lake bottom compared to the existing water level regime due to the increased water level variation. The increases in water level variations (i.e., higher draw-downs and maximum water levels) would expose and disturb aquatic sediments that are environmental sinks for methylmercury. Methylmercury that has settled to lower sediment layers over time is sequestered away from the food chain. Sediment disturbance redistributes sediment-bound methylmercury back into the water column, making it available to small organisms; the mercury concentration can then rise through the food chain. Increases in water level variation caused by the Project compared to the current variation would disturb a greater surface area of the lake bottom. The disturbance in lake-bottom surface area relative to the total volume of the basin was considered the primary factor that could contribute to increases in mercury concentrations in fish tissue.

Monitoring of Nonacho Lake sediments would provide an early indication of the potential for increased mercury into the food chain. If the proposed Expansion Project does cause mercury levels to increase in the sediments it could take between 2 to 5 years before this is detected in the fish population. If changes in mercury sediment are detected, adaptive management through biologic monitoring would be proposed and discussed with stakeholders as needed. Dezé currently has a robust fish tissue mercury dataset from both potentially impact and reference lakes for future comparison.

COMMITMENT # 16, & 17

Subject: Entrainment

Request:

Commitment 16

Dezé to indicate how mortality estimates included both direct immediate mortality and indirect delayed morality from injury.

Commitment 17

Dezé to provide calculations on the mortality on large fish and views on potential impact.

Response:

Dezé and DFO have come to an agreement on the interests of Commitments 2, 3, 4, 5, 16, and 17, including the issues, concerns, and monitoring associated with entrainment, as contained in the October 06, 2009 Meeting Report forwarded to MVEIRB. Dezé commits to investigating, during detailed design, additional mitigation measures that could be incorporated into the project design to reduce potential for fish mortality, to monitoring the assumptions that the canal North Gorge intake canal fish use would be low and that adult and juvenile fish can escape the canal if they swim into it, and to discussing outcomes of the monitoring program with DFO and identify if additional monitoring or mitigation / adaptive management is required to protect fish populations.

COMMITMENT # 18

Subject: Hydrology Model

Request:
Dezé to indicate whether or not going constantly across all thirteen years the simulation was done in the DAR; these monthly target releases could lead to under-prediction of the variation in level of the lake.

Response:
The question may be re-stated as whether the Basin Hydrology Model would under-predict flow variability in the system due to the assumption of a set of release targets from Nonacho Lake that do not vary with time through the simulation period (i.e. they do not reflect the variable inflows say in the Tazin River, and therefore higher or lower potential target releases from Nonacho Lake).

In operation, Dezé agrees that target releases from Nonacho Lake would likely be somewhat more variable than the fixed set utilized in the Basin Model. It is likely that operations would attempt to take into account both the expected inflows from the downstream system (primarily from the Tazin River), and the current level and anticipated inflows into Nonacho Lake, in defining a daily or probably weekly target release. The new gauging systems installed in 2007 will help in developing and refining that release target definition.

The result of a different target release regime may be somewhat increased variability in flows between Nonacho Lake and the Tazin River confluence with the Taltson River, but decreased variability in the flows downstream of this point. The impact on Nonacho Lake level variability is not likely to be significant, as it would be expected that current constraints on operating releases and minimum/maximum levels would remain in place in the Expansion system. As Nonacho Lake is quite large at 875 km^2, lake level variation occurs over monthly periods. We believe the types of variation to be seen in logical operating scenarios would not alter these relatively slow changes in levels, and lake level variability to be expected is therefore reflected in the results shown in the DAR. As for other lakes in Zone 2 downstream of Nonacho Lake, these too are relatively large area lakes, and are not expected to exhibit any significant increased variability in levels due to different assumptions of target releases in the range that have been modeled.

COMMITMENT # 19

Subject: Ice

Response:
Dezé to provide their predicted impacts that result from changes and fluctuations in ice level along the shoreline zone downstream, and how that will affect prey species that fish depend on.

Response:
Ice formation processes and potential alterations to ice structure in the Taltson River as a result of the proposed Expansion Project are discussed in DAR Section 13.6 Alteration of Ice Structure, and summarized below. The Project effects on ice conditions were taken into consideration when conducting the various Valued Ecosystem Component effects assessments, including wildlife and fish.

Ice conditions on the Taltson River have been reviewed and assessed qualitatively on the basis of three available ice surveys. Predictions have also been made on how the development of either a 36 MW or 56 MW Expansion Project would affect the existing ice regime in this reach.

For the 36 MW development scenario, the proposed changes to the management of flows from Nonacho Lake include releasing near to baseline flows from October through December, suggesting that ice freeze-up would be similar to the baseline condition. Discharges from the reservoir are predicted to increase above baseline conditions from January through April. At rapids sections and in the open water leads, increasing the flow may cause staging or backwatering effects and increase the potential for localized flooding along the shoreline.

For the 56 MW development scenario, releases from Nonacho Lake into the Taltson River would be higher than baseline from October through December, but flows through the Tronka Chua Gap would be lower than baseline. For regions downstream of the Taltson/Tazin confluence, ice formation flows are expected to be similar to the baseline condition. An increase in flow may slow the ice cover formation somewhat in the reach between the Taltson/Tazin confluence and the Nonacho reservoir. It is expected that an ice cover would continue to form relatively quickly on the many lakes and slow-velocity reaches in this zone in spite of the increased flow. However, the open-water leads that currently exist at the narrower channel sections and rapids would likely be a bit larger in extent. The increased open water area may lead to the development of a rougher and thicker ice cover immediately downstream of any of these open-water areas.

The changes to operations at Nonacho Lake are not expected to have an effect on the large lakes downstream of the reservoir. The increased lake depth during the freeze-up period is not expected to change the mechanism of thermal ice generation. The ice thickness should remain consistent with baseline conditions. However, on Nonacho Lake, the lake level is expected to decrease throughout the winter months, which is likely to break up the ice cover close to the shoreline. This is similar to what occurs under baseline conditions.

It is possible that during scheduled outage events at the Twin Gorges facility, the Trudel Creek ice cover may partially break up and re-jam within the channel or in the Taltson River downstream of Elsie Falls. This could lead to localized flooding at and immediately upstream of any ice-jam. Although there is potential for this to occur under baseline conditions, the probability of this occurring would increase under the proposed Expansion Project.

Based on these localized effects the effects along the shoreline and on fish and wildlife was considered to be low.

Dezé recognizes that one effect of concern to local land users is the effect to ice during a plant shutdown and startup event, when water patterns through the turbine could temporarily change. This change may affect ice downstream of Twin Gorges where people may use the ice as a travel corridor. Therefore, Dezé intends to work with people that travel on the Taltson River ice between Tsu Lake and Twin Gorges to develop a communication system to advise users of the potential changes to the ice structure as a result of a shutdown/startup event.

COMMITMENT # 20

Subject: Fish

Request:
Dezé to provide predictions on potential impacts to palatability of fish upriver and downriver, and what criteria is used when making that prediction.

Response:
Fish palatability and fish condition in general, can be affected by the environment in which the fish reside.

Environmental factors that could affect fish condition, thus palatability, are assessed in the DAR. Factors include changes to habitat conditions, food sources, dissolved oxygen, water temperature, and methyl mercury. Although some changes to some of these factors are anticipated to occur as a result of the Project, no changes are anticipated to negatively affect the condition of fish in the Taltson River.

Dezé proposes to monitor changes to environment factors within the Taltson River system that could affect fish and fish habitat, as described in the draft Taltson Expansion Project Monitoring Program.

COMMITMENT # 21, 22, & 10

Subject: Trudel Weighted Usable Area Model and Trudel Fish Habitat

Request:

Commitment 21

Dezé to provide the rationale and approach used to develop the methods for conducting the assessment of flow related impacts in Trudel Creek by October 31, 2009.

Commitment 22

Dezé to develop habitat exceedance curves for the various valued component species and life stages. As part of this analysis, a summary of the equivalent percent habitant exceedance values corresponding to the 4 cubic metres per second minimum flow release.

In addition to the commitments above, the following commitment is also discussed here, as documented in the transcripts of the technical sessions, the focus of this commitment was primarily on Trudel Creek, as opposed to the Taltson Basin.

Commitment 10

Dezé to provide an assessment of the potential impacts to fish and benthic invertebrates should re-establishment of littoral zones not occur in the best case scenario of one to three years.

Response:

Commitment 22:

Dezé has sent to DFO, habitat exceedance and other habitat - flow relation curves, and continues to develop additional habitat curves, to advance the discussion of effects to fish from the proposed flow reduction in Trudel Creek. This is confirmed in the October 26th Meeting Form between DFO and Dezé consultants.

Commitment 21:

A principal effect of the Taltson Hydroelectric Expansion Project would be flow reductions in Trudel Creek that affect the water depth and velocity, which could affect the quality and quantity of fish habitat. Dezé has been in discussions with DFO in regard to the effects of the minimum flow in Trudel Creek since 2007. The project was originally presented to DFO with a minimum release to Trudel Creek of less than 4 m^3/s (ie. between 0 m^3/s to 4 m^3/s). However, in consideration of basic ecological values associated with summer inflows to a system (e.g., nutrients, habitat complexity, etc.), the project revised the minimum release to 4 m^3/s, at a project cost of the equivalent power generation reduction.

To conduct the assessment, a baseline environmental condition from which to assess the change and associated affects needed to be determined. Prior to the construction of the existing Twin Gorges facility in 1964, there was likely no connectivity, or very periodic connectivity, between Taltson River and Trudel Creek. Based on airphotos the fish habitat was considerably less than currently exits in the system. Post-1964 excess water not used for hydropower generation was spilled to Trudel Creek, substantially changing the hydrology and habitat conditions of the creek. The Expansion Project will result in Trudel Creek flows being closer to the flow regime that occurred pre-Twin Gorges development. Although Trudel Creek has experienced considerable flow and associated habitat changes over the past 45 years, Dezé is assessing the fish and fish habitat effects based on changes from current conditions.

To assist with the effects assessment of the reduced flow to Trudel Creek, methods for assessing the reduction in fish habitat were reviewed. The method selected was the Assessment Methods for Aquatic Habitat and Instream Flow Characteristics in Support of
Applications to Dam, Divert, or Extract Water from Streams in British Columbia (Lewis et al., 2004). These methods, and the weighted useable area (WUA) model component of the methods, were developed by the Province of BC and DFO.

The BC methods provide a scientifically-based approach to determine the habitat usability of the stream channel, as expressed in WUA for selected valued components (VCs). The methodologies and input parameters for development of the WUA model were first discussed with DFO, Yellowknife office in September 2007. As additional information became available, the model was continually refined until submission to DFO of the Trudel Creek Fish and Fish Habitat Effects Assessment report, March 2008 and subsequently the DAR in March of 2009. The following information describes the development history of the WUA model.

Development of the model began by stratifying Trudel Creek into three distinct reaches defined by specific meso-habitats (pools, glides, runs etc.). At the time of the initial development of the model, two fish and fish habitat field programs had been conducted in Trudel Creek and the entire system had been photo-catalogued (vertical aerial photographs in addition to aerial oblique photographs and field photos). The following is a brief description of the meso-habitats associated with each reach; a more detailed analysis can be found in Section 14.8 of the DAR.

Reach 1 is 5,100 m in length and is dominated by high, eroding cut-banks and bedrock outcroppings. Substrate in this reach is dominated by sand and mud along with a few bars consisting of cobbles and boulders. Cover is provided intermittently by aquatic vegetation that grows adjacent to the shoreline in areas where the banks are lower, as well as boulders and large woody debris that has been carried into Trudel Creek by slope failures. The meso-habitats identified in Reach 1 include a riffle-pool along the upstream portion with a slow moving glide meso-habitat associated with the downstream portion.

Reach 2 is 8,000 m in length and includes Gertrude Lake, Trudel Lake and a small riverine section of Trudel Creek. Each lake was classified as lacustrine meso-habitats, separate from the riverine section of the reach. The riverine section of Reach 2 is characterized by a narrow strip of aquatic vegetation along both sides of Trudel Creek. Immediately adjacent to the narrow strip of vegetation, the stream margin becomes steeply sloped to depths greater than 2 m. In general, the riverine section is wide (greater than 80 m, on average) and slow moving (less than 0.5 m/s under average summer seasonal flow) and is characteristics of a slow moving glide meso-habitat.

Reach 3 is 18,000 m in length and includes Un-named Lake, classified as lacustrine meso-habitat and a long riverine section of Trudel Creek. The riverine section of Reach 3 contains features such as shallow sand bars created from sediment deposition, side bay habitats with dense submergent/emergent vegetation, and sections of steeply sloped stream margins associated with bedrock cliffs. In general, velocity conditions associated with each of these habitat types are slow moving and, therefore, the sites are characteristic of a slow moving glide.

The second stage in the development of the WUA model was selecting appropriate VECs to represent the flow sensitive habitats and fish species present within Trudel Creek. The baseline conditions identified in the fish and fish habitat assessments, and as generally described above, were reviewed with DFO, where it was determined that the key meso-habitats (based on fish species composition and fish use of habitats within Trudel) were the vegetated benches associated with the littoral zone of the slow moving glide meso-habitats and the deep water (pelagic zones) associated with both the slow moving glide and lacustrine meso-habitats.

Based on the identified key habitat types and in conjunction with DFO input, the VECs selected were northern pike and lake whitefish. Northern pike was selected as a VC, as it has specific habitat requirements along vegetated stream margins and/or shorelines that overlap with the other known species within Trudel. Lake whitefish was selected as a VC due to its relative abundance in Trudel Creek and because it is predominately a deep-water species, thereby complementing the preferred habitat conditions of northern pike and acting as an indicator of potential effects to deep water areas. Riffle and/or faster flowing habitats were considered limited within Trudel Creek and were documented to have low fish use by the first two fish and fish habitat field programs. In addition, the known species found in Trudel Creek were not anticipated to rely on shallow riffle-pool meso-habitats to complete any stage of their life history. As such, a VC was not selected to represent faster flowing riffle habitats.

Following the selection of the VECs, habitat suitability index (HSI) curves were created based on information gathered through primary literature and professional judgement. The HSI curves were presented to DFO and were further refined to incorporate DFO's feedback. As the proposed low flow into Trudel Creek is anticipated to primarily affect the littoral habitat areas along the associated shorelines and the availability of deep water habitat, HSI curves were developed for life-stages that rely on these zones of Trudel Creek. These life-stages include northern pike spawning, northern pike juvenile rearing, lake whitefish spawning, lake whitefish adult rearing and lake whitefish juvenile rearing. In addition to representing the identified key habitats in Trudel, the selected life-stages represented both spring and fall spawners and their associated egg incubation periods. Following the BC methods, the habitat values associated with the HSI curves were used to develop weighted usable widths (WUW) along each transect of the HEC-RAS hydrological model in Trudel Creek and subsequently WUA curves for each reach/meso-habitat.

The outputs of WUA model provide a quantitative tool to assess habitat change within Trudel Creek. Recognizing that the WUA model is dependant on the Basin Model and HEC-RAS model, an inherent degree of uncertainty is associated with the predicted changes from current conditions. In addition, assumptions were also incorporated into the model regarding the anticipated biophysical conditions associated with Trudel Creek during operations (i.e. submergent and emergent vegetation re-establishment)

To understand the uncertainties/assumptions and to assess the validity of the predicted changes in habitat quantities generated from the WUA model, a series of "professional checks" to the model were conducted and subsequently alterations or tweaks were made to increase the level of confidence. The following list identifies the professional checks associated with development of the model, which are further described below:

- Review of hydrological transect locations with respect to representative meso-habitat values of the VECs and their life-stages;
- Confirmation assessment that riffle-pool meso-habitats at the upstream section of Reach 1 has low value with respect to fish habitat values and fish usage;
- Assessment of in-stream submergent/emergent vegetation communities and the potential effects to these communities during operations; and
- Review the significance of using average channel velocities at each transect;

The first professional check involved the analysis of transect locations used in the HEC-RAS hydrological model. The 18 transect locations associated with the HEC-RASs model were established at positions within Trudel Creek where it would be best suited to gather hydrological information. Therefore, a field program was conducted to review the habitat conditions associated with each transect and to determine if they are representative of the habitats found in the associated reach. Analysis of the transect locations involved a desktop review of aerial photographs and a ground truthing field program. The outcome of the analysis indicated that some of the transects utilized in the hydrological model were not representative of the typical habitats associated with the reach and/or the preferred habitat conditions of the VECs. For example, one transect was established between two bedrock cliffs and no littoral zone habitats were represented. As such, a precautionary approach was applied and the model was refined to utilize only those transects representative of the meso-habitats of the reach and/or VECs. The following table outlines the 8 riverine transects and reach locations incorporated into the final WUA model.

Transect Number	Reach Break
TDL1	Reach 3
TDL5	
TDL7	
TDL8	
TDL11	
TDL14	Reach 2
TDL16	Reach 1
TDL18	

A second professional check was to determine the validity of excluding the riffle-pool meso-habitat from the habitat model. The riffle-pool meso-habitats were not represented in the habitat model as the known fish species within the Trudel Creek system do not require shallow fast flowing riffles to carry out any stage of their life history; however, this is a unique habitat type found only in a few sections of Trudel Creek. Therefore, a field program was initiated to re-evaluate the riffle-pool meso-habitat and determine the potential fish usage. The fish and fish habitat program conducted in August 2008 identified walleye at a small riffle-pool section at the base of the bedrock control between Un-named Lake and Trudel Lake. Taking into consideration that a single walleye had previously been observed in the riffle sections of Reach 1 and that the life history requirements for walleye suggest faster flowing and shallow meso-habitats are utilized for spawning, an HSI curve for walleye spawning was created. The HSI curve was reviewed with DFO and added to the habitat model as an indicator of change to the riffle-pool meso-habitats within Trudel Creek.

Following the assessment of shallow fast flowing riffle habitats, an assessment of the in-stream vegetation communities was also conducted. The primary assumption that was made during the development of the WUA model was that in-stream submergent/emergent vegetation would re-establish along the shifted stream margins and shorelines of the riverine and lacustrine habitats respectively. This assumption was based on the following parameters:

- Trudel Creek has historically re-established a diverse community of emergent and submergent vegetation after experiencing a significant alteration to the hydrological conditions;
- The rooted depth zone in the lake systems and some sections of the riverine habitat is below the anticipated change in water level elevation; and
- Submergent/emergent vegetation appears to establish in all areas that are defined by shallow slow moving waters and fine substrates.

Recognizing that this assumption is critical to the validity of the WUA model predicted changes in habitat, a field program was initiated to measure the existing depths and growing conditions (i.e. substrate types, velocities etc.) of submergent/emergent vegetation communities within the riverine and lacustrine habitats of Trudel Creek. The conclusions of this study indicate that the in-stream vegetation communities within the lacustrine habitats of Trudel Creek are deeper than the anticipated drawdown in most areas and a substantial portion of the vegetation community would remain wetted during operations. Within the riverine habitats, vegetation communities were typically found on bars or benches along the stream margins, and were generally found to grow to shallower depths when compared to lacustrine habitats. The rooted depth zone of the vegetation is not likely restricted by depth, but by the steep drop-offs adjacent to the bars/benches into the thalweg where currents are higher. As such, a significant portion of in-stream vegetation would become dewatered in the riverine sections of Trudel Creek during operations; however, some areas would continue to support vegetation communities. It was also concluded that in-stream vegetation was present in nearly all slow moving areas dominated by fine (silt, clay) substrates. Therefore, in-stream vegetation will continue to provide cover in the lacustrine habitats and to a lesser degree the riverine habitats of Trudel Creek during the first year of operations. Therefore, the WUA model may over estimate the preferred habitat conditions of northern pike during the initial years of operations. Based on available literature (see Commitment 10) vegetation is anticipated to re-establish within 3 - 5 years, therefore, the model predictions are reasonable and no alterations to the model were required.

The final professional check involved reviewing the input velocity data used at each of the transect locations. The output of the HEC-RAS hydrological model provides one average velocity along each transect for a given flow. In general, velocities along a transect vary, with higher velocities occurring in the centre of the channel and lower velocities experienced at the stream margins. The variances between the stream margins and centre of channel are not large; however, does incorporate a level of uncertainty into the model. As the HEC-RAS model is only capable of generating an average velocity for a transect and collecting physical measurements at the proposed minimum flow is not possible, an inherent level of uncertainty remains within the model.

Following the professional checks and updates/tweaks to the WUA model, a reasonableness test of the predicted changes in habitat was conducted to gauge the validity of the model predictions. The reasonableness test was conducted on each of the generated WUA curves to confirm that they are representative of the conditions occurring within Trudel Creek. The reasonableness test adds a qualitative component to the quantitative WUA model and included an assessment of the profiles at each transect location, results of the fish and fish habitat field programs, aerial photography analyses and professional judgement on the predicted changes. A copy of the reasonableness test is attached to Commitment 27.

By completing the professional checks and the reasonableness test, it was determined that the predictions of the WUA habitat are reasonable. Finally, to complete the effects assessment, DFO's Risk Assessment Framework was followed and their developed Pathways of Effects, namely Flow Management (Altered Frequency, Amplitude, Duration, Timing and Rate of Change of Flow) and Fish Passage Issues, were used to guide the assessment of various potential effects in addition to the change in habitat quantified by the BC methods and the WUA model

Commitment 10

The timeframe for vegetation re-establishment presented in the DAR is based on available literature and expert judgment. In discussion with local and regional experts, very little information exists in regard to transition or growth of littoral vegetation in northern climates. All information sources located or suggested by various parties (including those provided by the MVEIRB experts) were reviewed and no information exists that would contradict this estimated timeframe. One document that was not referenced in the DAR, but which provides regional content is Cott (2004). This document discusses the development and natural revegetation of pike habitat on the Stagg River, created as a requirement under the Fisheries Act. The document states that:

> The constructed pond was left to naturally vegetate and therefore wasn't anticipated to be viable spawning habitat for a few years. However, in all three years of post construction monitoring, adult pike were observed during spawning surveys and young-of-the-year (YOY) pike were collected during mid-summer surveys….their presence in the pond confirms successful spawning and the utilization of nursery habitat. Also, within two years of construction, the infilled area had settled below the waterline and re-vegetated, and adult pike were observed.

Recognizing, however, that considerable interest exists in regard to the estimated time frame for vegetation to re-establish or transition in Trudel Creek due to the reduced flows, Dezé conducted an assessment in the event that vegetation would not transition as assumed. To conduct this assessment, Dezé reviewed the locations where the change in water elevation in Trudel Creek would result in substantial dewatering of emergent or submergent vegetation. As described in Commitment 21, the vegetation in the laucusterine lake habitats would remain established within the depth preferences of the fish using the vegetated littoral habitat. However, substantial portions of the riverine sections vegetation would become dewatered. Therefore, a conservative assumption was made that no riverine sections would provide submergent or emergent vegetation, and they were removed from the WUA model, leaving only the lake habitat. Habitat exceedance curves using lakes only, in the event that no vegetation were to re-establish in the riverine sections, and thus they would become unusable (a highly unlikely scenario), were generated and forwarded by email to DFO on Oct 19, 2009, as part of the ongoing effects discussion. Lake whitefish and walleye do not seek vegetated areas for spawning, however, lake-only habitat curves were also produced for these species to help understand the relation between lake and river habitats.

Based on this conservative approach, the assumption that vegetation would transition to lower elevations due to the reduced water levels is not a critical component to the ability of fish to complete their life-stages.

References:

Cott, P. 2004. Northern Pike (*Esox lucius*) Habitat Enhancement in the Northwest Territories, Canadian Technical Report of Fisheries and Aquatic Sciences 2528 (http://www.dfo-mpo.gc.ca/Library/280081.pdf).

Lewis, A., Hatfield, T., Chilibeck, B., and Roberts, C. 2004. Assessment Methods for Aquatic Habitat and Instream Flow Characteristics in Support of Applications to Dam, Divert, or Extract Water from Streams in British Columbia, [including the BC In-stream flow Methodology]

COMMITMENT # 23

Subject: Aquatic Information

Request:
Dezé to pick up additional aquatic information to support the monitoring program.

Response:
Additional aquatic information in support of the monitoring program is described in the draft Taltson Expansion Project Monitoring Program, submitted with these commitments.

COMMITMENT # 24 & 25

Subject: Fish

Request:
Commitment 24
Dezé to address the potential impacts to fish that spawn in the spring due to the one (1) month delay in the freshet, and low flow years when no freshet would occur in Trudel Creek.

Commitment 25
Dezé to access the possibility that higher flows in the winter will initiate early spawning by fish species that normally spawn in the spring in correlation with the annual freshet.

Response:
Commitment 24
As per Section 9.5.1.1.2 of the DAR, Trudel Creek contains populations of lake whitefish, white sucker, northern pike, walleye, longnose sucker, slimy sculpin, ninespine stickleback, lake cisco and burbot. Of these species, lake whitefish and lake cisco are fall spawners and burbot spawn during the winter. Other species are spring spawners.

A one month delay in freshet is unlikely to impact spring spawning fish as spawning cues are triggered by water temperature and photoperiod (period of light). Thermal regime is likely one of the greatest selective forces and most influential abiotic factors affecting fish populations because temperature influences spawning times, foraging patterns, and survival (Galarowicz, 2003. Kocovsky and Carline 2001, Philipp 1992). Huh et al. (1976) studied the effects of temperature and light on the growth of walleye and yellow perch, and states:

> Cyclic and seasonal variations in growth, reproduction, and physiological activities of fish are undoubtedly regulated by temperature and light (photoperiod) conditions of their surroundings. Temperature has been considered as the most significant of the controlling factors (Fry 1971) and functions as a signal factor (Brown 1957; Nikolsky 1963) which induces metabolic processes, spawning, and migration, etc.

Temperature has been identified as an influencing factor on spawning site selection under increased flow regimes in other hydropower projects. In other systems, increased flow scenarios influenced the migration of spawners, but fish continued to spawn during their typical timing windows and temperatures thresholds (Geist et al. 2008, Jager and Rose 2003).

Natural water temperature changes are strongly influenced by solar radiation on the open water. The delay in, or lack of, spring freshet in Trudel may influence the change from ice cover to open water in Trudel, although ice-melt is also influenced by other factors such as solar radiation. If a delay in ice melt were to occur as a result of the influences of a delayed or lack of freshet, a potential exists that water temperature increases could also experience a delay, which could cause an associated delay in spawning.

A delayed spawning could result in a slightly reduced growing season for Young-of-Year (YOY); however, YOY fish would still emerge prior to the main growing season, which occurs throughout the summer.

In 2007, Dezé installed tidbit temperature loggers in Trudel Creek and Gertrude Lake to record temperature conditions. These will remain in place pre-construction and during operations.

<u>Commitment 25</u>
Trudel Creek spring spawners include white sucker, northern pike, walleye, longnose sucker, slimy sculpin, and ninespine stickleback. Higher flows in the winter are not expected to initiate early spawning by these species as spawning cues are triggered by water temperature and photoperiod, rather than discharge. Thermal regime is likely one of the greatest selective forces and most influential abiotic factors affecting fish populations because temperature influences spawning times, foraging patterns, and survival (Galarowicz, 2003. Kocovsky and Carline 2001, Philipp 1992). Huh et al. (1976) studied the effects of temperature and light on the growth of walleye and yellow perch, and states:

> "Cyclic and seasonal variations in growth, reproduction, and physiological activities of fish are undoubtedly regulated by temperature and light (photoperiod) conditions of their surroundings. Temperature has been considered as the most significant of the controlling factors (Fry 1971) and functions as a signal factor (Brown 1957; Nikolsky 1963) which induces metabolic processes, spawning, and migration, etc."

Temperature has been identified as an influencing factor on spawning site selection even under increased flow regimes in other hydropower projects. In other systems, increased flow scenarios influenced the migration of spawners, but fish continued to spawn during their typical timing windows and temperatures thresholds (Geist et al. 2008, Jager and Rose 2003).

In the Taltson/Trudel system, fish are not making large migrations to spawning areas, and temperatures are expected to change only by 1 or 2 degrees under operational scenarios (see DAR Section 14.4). Temperatures during the winter higher flows are expected to remain close to freezing. As such, the increase in discharge over the winter is not anticipated to initiate early spawning by fish species.

References:

Brown, M. E. 1957. Experimental studies on growth. Pages 261-400 in M. E. Brown, ed. The physiology of fishes. Vol. I. Academic Press, New York and London.

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Galarowicz, T. L. and D. Wahl. 2003. Differences in Growth, Consumption, and Metabolism among Walleyes from Different Latitudes. Trans. Am. Fish Soc. 132:425-437.

Geist, D.R., E.V. Arntzen, C.J. Murray, K.E. McGrath, Y. Bott, and T.P. Hanrahan. 2008. Influence of River Level on Temperature and Hydraulic Gradients in Chum and Fall Chinook Salmon Spawning Areas Downstream of Bonneville Dam, Columbia River. N. Amer. J. Fish. Mgmt. 27:30-41.

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Kocovsky, P.M. and R.F. Carline. 2001. Influence of Extreme Temperatures on Consumption and Condition of Walleyes in Pymatuning Sanctuary, Pennsylvania. N. Amer. J. Fish. Mgmt. 21:198-207.

Kolkovski, S. and K. Dabrowski. 1998. Offseason Spawning of Yellow Perch. The Progressive Fish-Culturist. 60:133-136.

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Philipp, D. P. 1992. Stocking Florida largemouth bass outside its native range. Transactions of the American Fisheries Society 121:686–691.

COMMITMENT # 26

Subject: Power Outages

Request:
Dezé to present the statistics regarding frequency of unscheduled power outages.

Response:
Two sets of data have been utilized in the outage assessment estimates reported in the DAR:

Data Set 1: 1990 – 2009 (excluding 1993) outage summary for the Snare Hydro system, which includes four plants and 216 km of 115 kV transmission line to Yellowknife;

Data Set 2: 2003-2008 outage summary for the Taltson System, including the existing plant and the 150 km of 115 kV transmission line, as well as the lower voltage lines to Hay River.

The following criteria and broad assessment of the data has been used to support the estimates provided in the DAR for outages and effects.

For the Expansion Project, the following effect assumptions are made in terms of a partial or full outage:

- Outage Type 1: Outages of a few seconds to about five minutes will have no impact on the flow regime either upstream or downstream of the plant.
- Outage Type 2: Outages of five minutes to perhaps twenty minutes will cause decreases in flows below the plant, and dewatering in the immediate areas below the plant. The bypass system will be opened during this period such that dewatering does not occur.
- Outage Type 3: Outages of up to approximately 60 minutes would be contained in the forebay without significant spill over the South Valley Spillway into Trudel Creek. Restart can be made with synchronized closure of the bypass system. These are considered to have minor effects on flows along Trudel Creek.
- Outage Type 4: Significant outages are those lasting several hours and upwards, where the headpond level has increased and flows have risen substantially in Trudel Creek. Depending on the period of outage, these scenarios may require consideration of ramping on restart.
- Outage Type 5: Very significant outages are those lasting more than about 6 hours, where it is anticipated that close to the full pre-outage flows, less the bypass spill, will be routed into Trudel Creek.

An analysis of the available data indicates the following:

For the Snare Hydro System, some 144 outages of various durations are noted over a period of 18 years. Approximately half of the outages are of relatively minor duration. A total of 26 outages occur which are noted to last longer than 60 minutes, and about 9 are considered reasonably major outages. Of these, approximately 4 would be considered very significant outages lasting longer than four hours. The longest recorded outage is approximately nine hours. At 4 major outages over a period of 18 years, a major outage return period of 5 years would appear a reasonable estimate of performance of a multi-unit, single line system in the northern environment. The total outage period per year over the record is highly variable, but averages about 5.6 hours – this is considered very low.

For the existing Taltson system, some 45 outages of various durations are noted over a period of 5 years. Approximately half of the outages are of a very minor duration. A total of 5 significant outages occur in the record, with only 2 due to unscheduled loss of production (unit off-line – 1 outage was scheduled), and 2 major line outages. Outage of a single unit or line would be considered a partial outage in the Expansion system. Extrapolating these figures to multiple units (3 total) and two independent lines for the Expansion Project, it is estimated that a multiple line or plant outage would be expected about once every 5 years.

In terms of return periods for various outages, a basic tabulation assessment of the data would provide the following estimates for a partial outage (either one plant or one line) for the Expansion Project:

Outage Type 1 (up to 5 minutes):	2 – 3 per year
Outage Type 2 (5 to 20 minutes):	2 – 3 per year
Outage Type 3 (20 – 60 minutes):	3 – 4 per year
Outage Type 4 (60 – 240 minutes):	1 – 2 per year
Outage Type 5 (>240 minutes):	1 in 4 – 5 years

Assuming these estimates of occurrence would apply to either of the two plants or two lines with equal probability would double those partial outage occurrence estimates for the Expansion Project, but these remain partial outages. The full outage scenario discussed in the DAR would require simultaneous outage of both plants, for which we believe the likelihood is much lower. However, for that estimate, we have maintained the return period of about 1 in 5 years based on the existing records.

Attachments:

NTPC 2009 Data Set 1: 1990 – 2009 (excluding 1993) outage summary for the Snare Hydro includes four plants and 216 km of 115 kV transmission line to Yellowknife.

NTPC 2008Data Set 2: 2003-2008 outage summary for the Taltson System, including the existing plant and the 150 km of 115 kV transmission line, as well as the lower voltage lines to Hay River.

Northwest Territories Power Corporation L199 Transmission Line Outages 1990-2009

Table YK/FT.SMITH NTPC-16

Year	# of Transmission Outages affecting the L199	Date	Duration	Cause	Total Load at time of Transmission Outage (kW)	Load Lost (kW)	Date	Summer	Winter	Duration
1990	8	17-Jun	21	Lightning	21,000	11,200	17/06/1990	0	1	21
1990		26-Jun	7	Lightning	36,200	16,200	26/06/1990	0	1	7
1990		11-Jul	17	High Line Voltage	30,600	30,600	11/07/1990	0	1	17
1990		22-Jul	28	High Line Voltage drop – SF	26,500	26,500	22/07/1990	0	1	28
1990		12-Aug	28	Lightning	24,800	24,100	12/08/1990	0	1	28
1990		04-Sep	11	Raven 700 Sub	29,600	27,500	04/09/1990	0	1	11
1990		06-Sep	21	Complete Town and Nerco	32,700	21,200	06/09/1990	0	1	21
1990		07-Sep	21	Ground Fault Nerco Line	29,700	14,000	07/09/1990	0	1	21
1991	9	15-May	3	Lightning	31,800	29,800	15/05/1991	0	1	3
1991		20-May	3	Lightning	18,600	18,600	20/05/1991	0	1	3
1991		20-May	12	Lightning	16,400	16,400	20/05/1991	0	1	12
1991		20-May	3	Lightning	19,600	18,100	20/05/1991	0	1	3
1991		28-Jul	4	Lightning	27,100	27,100	28/07/1991	0	1	4
1991		15-Aug	9	Lightning	26,000	26,000	15/08/1991	0	1	9
1991		15-Aug	5	Lightning	18,000	18,000	15/08/1991	0	1	5
1991		18-Aug	4	L199 Line fault	12,100	12,100	18/08/1991	0	1	4
1991		06-Oct	4	High Line – Unknown	22,700	22,700	06/10/1991	0	1	4
1992	11	27-Apr	11	Voltage swings on transmission line	22,500	21,500	27/04/1992	0	1	11
1992		27-May	14	Ground fault on Giant line	21,000	19,000	27/05/1992	0	1	14
1992		08-Jun	3	Ground fault on Giant line	25,900	20,600	08/06/1992	0	1	3
1992		16-Jun	11	SR 52-1 shorted out	27,500	23,800	16/06/1992	0	1	11
1992		23-Jun	7	Over current on Giant line	24,700	24,700	23/06/1992	0	1	7
1992		02-Jul	7	Over current on Giant line	22,700	20,400	02/07/1992	0	1	7
1992		30-Jul	4	NUL watering entering cable at transformer at 100 su	26,100	24,800	30/07/1992	0	1	4
1992		08-Aug	15	Fault on Giant line, no control at 100 sub	24,100	24,100	08/08/1992	0	1	15
1992		10-Aug	34	Ground fault at 200 sub, raven	31,000	27,600	10/08/1992	0	1	34
1992		16-Aug	4	Phase to Phase on Giant line	16,200	9,100	16/08/1992	0	1	4
1992		27-Aug	4	Ground switch found closed on old 115 KV line	28,400	15,200	27/08/1992	0	1	4
1993	Incomplete data						31/12/1992	0	1	0
1994	8	19-Jan	57	Truck hit line at Giant T-4 86 relay	NA	NA	19/01/1994	0	1	57
1994		24-Jan	32	Possible line fault - S.K. high line	NA	NA	24/01/1994	0	1	32
1994		18-Jun	89	Lightning strikes, ring bus split, town on diesel	NA	NA	18/06/1994	0	1	89
1994		17-Jul	3	Lightning strikes, arrester damage @ B.H.	NA	NA	17/07/1994	0	1	3
1994		17-Jul	4	Lightning strikes	NA	NA	17/07/1994	0	1	4
1994		18-Jul	2	Lightning strikes	NA	NA	18/07/1994	0	1	2
1994		10-Aug	7	Phase relay on high line operated	NA	NA	10/08/1994	0	1	7
1994		11-Aug	69	P.T. fuse blown J.L.S. sub	NA	NA	11/08/1994	0	1	69
1995	5	15-Jul	1	Unknown; 67n,21z1	31,300	5,500	15/07/1995	0	1	1
1995		02-Aug	3	Ring bus split, system unstable, dumped hydro	30,100	6,200	02/08/1995	0	1	3
1995		11-Aug	54	Paralleling transformers	33,200	33,200	11/08/1995	0	1	54
1995		11-Aug	30	T2 lockout on gas alarm	25,100	25,100	11/08/1995	0	1	30
1995		26-Dec	3	High line, 21z1,59T.L.	33,000	22,200	26/12/1995	0	1	3
1996	15	26-May	71	Lightning strike on highline/hunting during diesel - hy	33,400	33,400	26/05/1996	0	1	71
1996		29-Jun	119	Lightning strike relay 67N & 59TL	31,200	31,200	29/06/1996	0	1	119
1996		02-Jul	26	50. I relay possible lightning strike	36,500	36,500	02/07/1996	0	1	26
1996		02-Jul	34	Separating 34.5 ring bus	36,500	36,500	02/07/1996	0	1	34
1996		02-Jul	11	Lightning strike on highline	36,500	36,500	02/07/1996	0	1	11
1996		08-Jul	7	67N relay on BH infeed	33,100	33,100	08/07/1996	0	1	7
1996		10-Jul	7	Ring bus separating 34.5	24,500	15,300	10/07/1996	0	1	7

Nothwest Territories Power Corporation L199 T Line Ooutages 1990-2009

1996		11-Jul	10	Unknown 27G &81G	32,100	32,100	11/07/1996	0	1	10
1996		01-Aug	24	Lightning BH Line	34,200	34,200	01/08/1996	0	1	24
1996		09-Aug	40	Raven 700 sub- town z protection	35,200	35,200	09/08/1996	0	1	40
1996		12-Aug	11	Lightning highline	37,000	37,000	12/08/1996	0	1	11
1996		12-Aug	8	Lightning	34,400	34,400	12/08/1996	0	1	8
1996		31-Aug	12	Westinghouse maintenance at BH tripped plant	29,100	17,800	31/08/1996	0	1	12
1996		21-Sep	62	Raven @BH	26,100	26,100	21/09/1996	0	1	62
1996		23-Nov	62	50G BH Infeed	38,500	37,500	23/11/1996	0	1	62
1997	9	06-Jan	139	High line fault	33,300	33,300	06/01/1997	0	1	139
1997		08-Feb	116	High line fault	32,200	32,200	08/02/1997	0	1	116
1997		08-May	19	Snare Fall governor oil system failed	25,000	25,000	08/05/1997	0	1	19
1997		30-Jun	8	Snare Cascades tripped (shaft seal water flow) causi	22,000	14,500	30/06/1997	0	1	8
1997		05-Jul	19	Line to ground fault on Giant protection	23,500	21,500	05/07/1997	0	1	19
1997		11-Jul	3	T4 LTC limiting	24,400	7,900	11/07/1997	0	1	3
1997		23-Sep	7	Raven Bluefish line	26,400	12,100	23/09/1997	0	1	7
1997		24-Sep	16	Raven Bluefish line	24,500	13,200	24/09/1997	0	1	16
1997		20-Dec	44	Snare Falls trip. Went from partial to full outage due t	32,000	15,000	20/12/1997	0	1	44
1998	8	29-Apr	71	Fault at Royal Oak	30,800	27,000	29/04/1998	0	1	71
1998		13-Jul	8	Lightning, no control over 500/700 subs	27,400	27400	13/07/1998	0	1	8
1998		15-Sep	72	Insulator at SF sub blew apart (37 & 35)	26,700	26,700	15/09/1998	0	1	72
1998		25-Oct	11	T # 4 gas detection trip at JLS	28,500	28,500	25/10/1998	0	1	11
1998		23-Nov	13	SF Gov. oil s/d	28,300	28,300	23/11/1998	0	1	13
1998		01-Dec	20	Static line on 115 KV making contact with conductor	28,900	27,000	01/12/1998	0	1	20
1998		05-Dec	28	115 KV line fault 67N	28,100	11,900	05/12/1998	0	1	28
1998		16-Dec	37	115 KV line fault 67N	34,900	34,900	16/12/1998	0	1	37
1999	2	10-Mar	7	MSO	32,400	30,300	10/03/1999	0	1	7
1999		24-Mar	14	Contractor magna 4	28,100	28,100	24/03/1999	0	1	14
2000	10	15-Feb	31	Tech in STS,100 sub closing	36,100	36,100	15/02/2000	0	1	31
2000		29-May	59	HI Line Trip 67n unknown	30,000	30,000	29/05/2000	0	1	59
2000		09-Jun	21	T-4 Lockout Raven @ JLS	34,000	34,000	09/06/2000	0	1	21
2000		11-Jul	42	Lightning 67N	35,000	35,000	11/07/2000	0	1	42
2000		21-Jul	12	Lightning, Problem closing @ 600	25,600	25,600	21/07/2000	0	1	12
2000		27-Jul	53	Lightning, Problems @600	33,000	33,000	27/07/2000	0	1	53
2000		30-Sep	15	HI Line Trip 21	30,000	30,000	30/09/2000	0	1	15
2000		17-Nov	30	HI Line Raven @ JLS Sub	31,700	31,700	17/11/2000	0	1	30
2000		24-Nov	75	HI Line Frost 21z	30,000	30,000	24/11/2000	0	1	75
2000		08-Dec	53	Hi line frost.	38,900	34,700	08/12/2000	0	1	53
2001	4	07-Jun	33	Operator error	30,000	30,000	07/06/2001	0	1	33
2001		20-Jun	32	Unknown	33,000	33,000	20/06/2001	0	1	32
2001		09-Jul	14	Lightning SR cascading outage occurred	27,700	26,700	09/07/2001	0	1	14
2001		28-Jul	3	Lightning SR line 67N	20,300	16,400	28/07/2001	0	1	3
2002	6	24-Jan	238	highline failure	39,700	39,700	24/01/2002	0	1	238
2002		23-May	30	(Guy wire failure) SF to SR line	29,800	29,800	23/05/2002	0	1	30
2002		19-Jun	10	SF insulator damage cause line fault	26,500	26,500	19/06/2002	0	1	10
2002		19-Jun	7	SF insulator damage cause line fault	27,800	27,000	19/06/2002	0	1	7
2002		22-Jun	24	Lightning near Rae {total}	30,300	30,300	22/06/2002	0	1	24
2002		26-Jul	8	Lightning	32,300	32,300	26/07/2002	0	1	8
2003	5	04-Jan	20	SK line fault	34,900	28,000	04/01/2003	0	1	20
2003		10-Feb	28	Line Fault	38,000	38,000	10/02/2003	0	1	28
2003		01-Aug	141	Lightning	29,100	29,000	01/08/2003	0	1	141
2003		14-Sep	37	T19 Trip Low oil 115 kV trip	21,900	21,900	14/09/2003	0	1	37
2003		23-Nov	37	SF Transformer fault Highline trip	32,600	32,500	23/11/2003	0	1	37
2004	3	11-Jul	32	Lightning	23,400	23,400	11/07/2004	0	1	32
2004		17-Jul	50	Lightning	21,600	19,000	17/07/2004	0	1	50
2004		29-Jul	64	Lightning	25,800	25,800	29/07/2004	0	1	64
2005	4	30-May	50	Lightning	26,500	26,500	30/05/2005	0	1	50

Nothwest Territories Power Corporation L199 T Line Ooutages 1990-2009

2005		07-Jun	67	Lightning	26,800	26,800	07/06/2005	0	1	67
2005		21-Aug	48	Lightning	17,200	16,400	21/08/2005	0	1	48
2005		06-Sep	67	Lightning	24,100	24,100	06/09/2005	0	1	67
2006	14	02-Jan	567	Structure Failure	27,000	12,500	02/01/2006	0	1	567
2006		04-Jan	45	Snare Falls Govenor Failure	22,000	22,000	04/01/2006	0	1	45
2006		07-Feb	75	Structure Failure	28,100	28,100	07/02/2006	0	1	75
2006		14-Feb	39	Snare Falls Headgate Failure	29,400	29,400	14/02/2006	0	1	39
2006		19-May	74	Snare Rapids Static Exciter Failure	20,600	20,600	19/05/2006	0	1	74
2006		24-May	54	L193 - Lightning arrestor failure	21,600	21,600	24/05/2006	0	1	54
2006		27-Jun	30	Lightning	20,400	20,400	27/06/2006	0	1	30
2006		03-Jul	37	Lightning	19,400	19,400	03/07/2006	0	1	37
2006		03-Jul	34	Lightning	24,900	24,900	03/07/2006	0	1	34
2006		03-Jul	35	Lightning	20,900	20,900	03/07/2006	0	1	35
2006		23-Jul	38	Lightning	22,100	22,100	23/07/2006	0	1	38
2006		23-Jul	223	Lightning	20,600	20,600	23/07/2006	0	1	223
2006		13-Aug	90	Lightning	16,800	16,800	13/08/2006	0	1	90
2006		13-Aug	80	Lightning	17,100	17,100	13/08/2006	0	1	80
2007	9	14-May	33	L199 Line Fault	24,600	24,600	14/05/2007	0	1	33
2007		31-May	49	Lightning	25,500	25,500	31/05/2007	0	1	49
2007		20-Jul	58	Lightning	26,300	26,300	20/07/2007	0	1	58
2007		20-Jul	56	Lightning	25,100	25,100	20/07/2007	0	1	56
2007		20-Jul	20	Lightning	25,100	25,100	20/07/2007	0	1	20
2007		20-Jul	48	Lightning	15,900	15,900	20/07/2007	0	1	48
2007		31-Jul	39	Lightning	15,800	15,800	31/07/2007	0	1	39
2007		04-Aug	18	Lightning	22,700	22,700	04/08/2007	0	1	18
2007		06-Aug	33	Lightning	18,600	18,600	06/08/2007	0	1	33
2008	14	02-Jan	64	L199 line fault	19000	19000	02/01/2008	0	1	64
2008		28-Jan	88	T5 Gas trip	31200	28300	28/01/2008	0	1	88
2008		10-Mar	49	Raven	26800	24400	10/03/2008	0	1	49
2008		29-Mar	58	Raven	26600	26600	29/03/2008	0	1	58
2008		02-Jun	23	Lightning	24500	24500	02/06/2008	0	1	23
2008		02-Jun	24	Lightning	24400	24400	02/06/2008	0	1	24
2008		02-Jun	19	Lightning	20400	20400	02/06/2008	0	1	19
2008		02-Jun	21	Lightning	20400	20400	02/06/2008	0	1	21
2008		28-Jun	229	Lightning	16200	16200	28/06/2008	0	1	229
2008		10-Aug	36	Lightning	20800	20800	10/08/2008	0	1	36
2008		11-Aug	19	Lightning	20600	20600	11/08/2008	0	1	19
2008		11-Aug	23	Lightning	15700	15700	11/08/2008	0	1	23
2008		11-Aug	20	Lightning	15200	15200	11/08/2008	0	1	20
2008		15-Sep	59	Bluefish line fault	23400	23400	15/09/2008	0	1	59
2009	6	05-Jan	322	L199 line fault	27000	27000	05/01/2009	0	1	322
2009		20-Jun	49	Bluefish line fault	22300	22300	20/06/2009	0	1	49
2009		02-Jul	21	Bluefish line fault	22600	22600	02/07/2009	0	1	21
2009		03-Jul	50	Lightning	25100	25100	03/07/2009	0	1	50
2009		11-Jul	150	Lightning	24900	23600	11/07/2009	0	1	150
2009		12-Jul	23	Lightning	20400	20400	12/07/2009	0	1	23

Nothwest Territories Power Corporation L199 T Line Ooutages 1990-2009

	Summer outage count	Winter outage count	Summer outage minutes	Winter outage minutes	Total outage minutes	Forced outage rate
1990	8	0	154	0	154	0.000293
1991	9	0	47	0	47	8.9422E-05
1992	11	0	103	0	103	0.00019597
1994	6	2	174	89	263	0.00050038
1995	4	1	88	3	91	0.00017314
1996	14	1	442	62	504	0.0009589
1997	6	3	72	299	371	0.00070586
1998	4	4	162	98	260	0.00049467
1999	0	2	0	21	21	3.9954E-05
2000	6	4	202	189	391	0.00074391
2001	4	0	82	0	82	0.00015601
2002	5	1	79	238	317	0.00060312
2003	2	3	178	85	263	0.00050038
2004	3	0	146	0	146	0.00027778
2005	4	0	232	0	232	0.0004414
2006	10	4	726	695	1421	0.00270358
2007	9	0	354	0	354	0.00067352
2008	10	4	473	259	732	0.00139269
2009	5	1	293	322	615	0.00117009
mean					220.538462	0.00041959
standard deviation					150.183563	0.00028574
standard error of mean (stdev divided by square root of observations)					41.6534259	7.9249E-05
mean plus one standard error					262.191887	0.00049884

Northwest Territories Taltson Outage Data 2003 to 2008

Taltson Outage Data 2003 to 2008

2007/08

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Taltson	18/04/2007	0.33	2	100%
Taltson	03/06/2007	56.00	3	5%
Taltson	30/06/2007	92.00	5	5%
Taltson	01/07/2007	0.03	5	5%
Taltson	03/07/2007	32.00	7	5%
Taltson	03/07/2007	0.03	5	5%
Taltson	04/08/2007	0.03	5	6%
Taltson	18/08/2007	4.00	3	6%
Taltson	20/08/2007	15.00	7	6%
Taltson	09/09/2007	11.00	1	100%
Taltson	10/09/2007	28.00	1	6%
Taltson	14/09/2007	23.75	6	100%
Taltson	27/10/2007	0.33	2	100%

Outage Cause Code

1	Loss of Production
2	Loss of Supply
3	Scheduled
4	Lightning
5	Weather
6	Human
7	External
8	Unknown

2006/07

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Taltson	15-Jun-06	15	7	100%
Taltson	14-Jul-06	0	8	4%
Taltson	22-Aug-06	2	4	100%
Taltson	18-Oct-06	0	8	100%
Taltson	12-Jan-07	36	8	8%

2005/06

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Talston	21-Apr-05	0.5	2	100%
Talston	29-Jun-05	0.5	5	100%
Talston	05-Jul-05	0.3	8	100%
Talston	07-Jul-05	0.3	5	100%
Talston	09-Jul-05	0.3	4	100%
Talston	03-Aug-05	6.0	7	100%
Talston	03-Aug-05	27.0	8	9%
Talston	07-Aug-05	0.3	4	100%
Talston	09-Sep-05	76.0	3	100%
Talston	14-Sep-05	108.0	4	100%
Talston	22-Sep-05	109.0	8	7%

2004/05

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Taltson	22-Apr-04	48.0	5	100%
Taltson	16-May-04	0.3	1	100%
Taltson	30-May-04	0.3	8	100%
Taltson	02-Jun-04	19.0	4	86%
Taltson	11-Jun-04	28.0	7	9%
Taltson	20-Jun-04	4.0	7	10%
Taltson	06-Jul-04	21.0	7	7%
Taltson	23-Jul-04	16.0	7	65%
Taltson	30-Jul-04	26.0	4	100%
Taltson	06-Oct-04	31.0	7	100%
Taltson	10-Oct-04	18.0	5	100%
Taltson	24-Dec-04	25.0	8	100%
Taltson	23-Jan-05	27.0	3	11%
Taltson	14-Feb-05	250.0	1	98%
Taltson	22-Mar-05	0.0	8	7%

Northwest Territories Taltson Outage Data 2003 to 2008

2003/04

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Talston System	21-Apr-03	17.0	2	100%
Talston System	03-Nov-03	91.0	2	100%
Talston System	04-Nov-03	25.0	2	100%
Talston System	23-Nov-03	0.3	2	100%
Talston System	25-Jun-03	0.3	3	100%
Talston System	15-Jun-03	7.0	4	100%
Talston System	02-Jul-03	0.3	4	100%
Talston System	11-Jul-03	0.3	4	100%
Talston System	17-Jul-03	0.3	4	100%
Talston System	22-Jul-03	0.3	4	100%
Talston System	22-Jul-03	0.3	4	100%
Talston System	28-Jul-03	0.3	4	100%
Talston System	01-Aug-03	70.4	4	100%
Talston System	15-May-03	0.3	4	100%
Talston System	05-Aug-03	15.0	6	100%
Talston System	11-Feb-04	0.0	7	13%
Talston System	14-Jul-03	193.0	7	4%
Talston System	18-Apr-03	0.4	8	100%
Talston System	19-Apr-03	0.3	8	100%
Talston System	15-May-03	11.0	8	100%
Talston System	15-May-03	0.0	8	100%
Talston System	01-Jul-03	10.0	8	100%
Talston System	19-Jan-04	59.0	8	8%
Talston System	29-Dec-03	10.0	8	100%

Taltson Outage Data Summary 2003-2008		
	Number of O	Average Duration (Minutes)
2007/08	13	20.19
2006/07	5	10.67
2005/06	11	29.84
2004/05	15	34.24
2003/04	24	21.34

COMMITMENT # 27 & 28

Subject: Fish Habitat

Request:
Commitment 27:
Dezé to point the Review Board to document regarding a reasonableness test conducted as part of the review of the weighted usable area model.

Commitment 28:
Dezé to provide a copy of a document entitled "A Research and Goal Priorities for Fish Habitat Management, Science Support Requirements for Implementing the Fish Habitat Protection Provisions of the Fisheries Act".

Response:
Commitment 27:
The reasonableness test review of the Trudel Creek habitat is attached, and its application to the habitat effects assessment is discussed in Commitment 21.

Commitment 28:
The document, entitled "A Research and Goal Priorities for Fish Habitat Management, Science Support Requirements for Implementing the Fish Habitat Protection Provisions of the Fisheries Act" by Walks et al., 2008 is located here: http://www.dfo-mpo.gc.ca/Library/332039.pdf and attached to these commitments.

Attachments:
Cambria Gordon Ltd. 2008 Trudel Creek Fish and Fish Habitat Effects Assessment WUA Curve Reasonableness Tests Excerpt

Walks et al. 2008. A Research and Goal Priorities for Fish Habitat Management, Science Support Requirements for Implementing the Fish Habitat Protection Provisions of the Fisheries Act

COMMITMENT # 29

Subject: Bypass Spillway

Request:
In regards to the discussions about Trudel Creek and the concerns, Dezé provide written benefit document comparing and contrasting the option, and more formally, presenting why Dezé came to their conclusion.

Response:
The question may be rephrased as: What spillway alternatives did Dezé investigate, and how was the preferred concept selected? The following design concepts have been considered in the development of the preferred concept as presented in the DAR:

1. Controlled and uncontrolled bypass spillway into South Gorge for 1000 year return period flood (900 m^3/s) – five different arrangements.

2. Controlled bypass spillway into South Gorge for 75 – 150 m3/s

3. Controlled bypass spillway into South Gorge for 30 m3/s

4. Controlled bypass spillway into pool above Elsie Falls from Power Canal for 30 m3/s

5. Controlled bypass release through submerged valve system in new powerhouse for 30 m3/s

A brief description and benefit/issue summary for each arrangement is provided below.

1. Major Controlled or Uncontrolled South Gorge Spillway for 900 m^3/s
Gated and ungated arrangements have been considered. Both are considered technically feasible. The selected option was an ungated side-channel spillway on the basis of overall reliability and simplicity. All arrangements studied required raising the allowable headpond level to the top of the dam core during high flood events, and raising the existing South Valley Spillway and side channel inverts by approximately 2.3 m. Issues that would require further evaluation for such an option include the dam safety-related considerations (precedent and hazard assessment), issues associated with energy dissipation at the discharge point, the possibility of rock slope failure in the South Gorge, and the in-stream works requirements.

With respect to the side-channel spillway arrangement developed for evaluation, the following summary applies.

Benefits:
- No further unregulated flows into Trudel Creek

Issues:
- Requires raise of headpond levels during flood period by some 2.3 m to pass flow into spillway, approaching the top of the existing dam core.
- Requires raise of South Valley Spillway and side channel inverts by 2.3 m by rockfill and membrane, concrete, or other means.

- Requires significant in-stream works, channel development work and possible alteration/rock support of South Gorge by blasting to accommodate flows downstream of the channel.
- Does not respond quickly to outages, thereby leaving stream sections dewatered during both minor and major outages.
- Does not assist in avoiding major ramping flows on the Taltson River d/s of Elsie Falls
- Results in higher tailwater levels at existing plant, reducing energy output.
- Will likely cause major erosion of left bank of Taltson River across from Elsie Falls during operations.
- Other operational risks (winter releases over ice affecting plant) or rockfall blockage
- Minimum release structure at SVS still required, but now more expensive.
- Adds significant cost and schedule duration to the project so as to make the project very much less economic.

2. Controlled bypass spillway into South Gorge for 75 – 150 m3/s

Benefits:

- Can make up full unit output flow and discharge at a logical point without major alterations required to South Gorge, and passage at current normal headpond operating level.
- Can be made synchronous or semi-synchronous with a unit outage, and assist to some degree with balancing ramping flows.
- Reduces unregulated discharges into Trudel Creek and assists with ramping on Trudel Creek and on the Taltson River below Elsie Falls.

Issues:

- Fairly major instream works requirement to get flow into channel without raising headpond level.
- Cost and schedule duration impact remain substantial.
- Higher inflows and more major outages still routed through Trudel Creek.

3. Controlled bypass spillway into South Gorge for 30 m^3/s

Benefits:

- Can make up partial unit output flow and discharge at a logical point without alterations required to South Gorge.
- Can be made synchronous or semi-synchronous with a unit outage, and has a small positive impact on ramping flows on startup.
- Reduces unregulated discharges into Trudel Creek a modest amount

Issues:

- Some instream works requirement to get flow into channel without raising headpond level.
- Cost and schedule duration impact fairly minor – project can support this mitigation measure and associated economic impact.

4. **Controlled bypass spillway into pool above Elsie Falls from Power Canal for 30 m3/s**

Benefits:

- Can make up partial unit output flow and discharge fairly close to the existing plant to keep Elsie Falls from dewatering
- Can be made synchronous or semi-synchronous with a unit outage, and has a small positive impact on ramping flows on startup.
- Reduces unregulated discharges into Trudel Creek a modest amount
- Cost and schedule duration impact fairly minor – project can support this economic impact if the technical issues are resolved.

Issues:

- No instream works at the headpond, but energy dissipation of the flow entering the river above the falls may cause significant impacts.
- Only feasible if a rock channel exists to contain the flow – this has not been confirmed by comprehensive geotechnical investigation.

5. **Controlled bypass release through submerged valve system in new powerhouse for 30 m3/s**

Benefits:

- Can make up partial unit output flow and discharge at the new plant tailrace to maintain minimum flows in the Taltson River below the new tailrace.
- Can be made synchronous or semi-synchronous with a unit outage, and has a small positive impact on ramping flows on startup.
- Reduces unregulated discharges into Trudel Creek a modest amount
- Cost and schedule duration impact fairly minor – project can support this mitigation measure and economic impact if the technical issues are resolved.

Issues:

- Does not keep existing South Gorge and Elsie Falls watered up during any outage of the existing unit.
- Complicates powerhouse and penstock design, and bypass valve systems are not as fail-safe as spillways.

Key attributes are summarized in Table 1.

Table 1 Spillway Attribute Summary Table

Concept	Trudel Creek Regulation Benefits	Reliability of Operations	Other Operating Risks (Dam safety, geotech, energy dissipation	Ramping Benefit	Overall mitigation of Downstream effects such as dewatering	Instream Works requirements and related effects	Cost	Overall Benefit/Cost
Major uncontrolled spillway into South Gorge	High	Very Good	Moderate to High	Slow on outage, None on startup	Poor	High	Very High	Low, due to very high cost
Intermediate size controlled spillway into South Gorge	Modest	Good	Low	Offsets one complete unit on outage and restart	Moderate	Moderate	High	Moderate
Small bypass spillway into South Gorge (30 m^3/s)	Low	Good	Low	Offsets partial unit on outage and startup	Good for river reach below dam	Low	Low	Highest, with reasonable benefit and reasonable cost
Bypass facility from Canal (30 m^3/s)	Low	Good	Low	Offsets partial unit on outage and startup	Low	Low	Low	Moderate – less benefits, but reasonable cost
Bypass facility from Powerhouse (30 m^3/s)	Low	Fair	Low	Offsets partial unit on outage and startup	High	None	Low	Low – least benefits, but reasonable cost

Based on the benefits and issues noted above, the 30 m^3/s gated bypass has been proposed in the DAR as a mitigative facility that is technically feasible, reliable, and can be accommodated in the project economics.

COMMITMENT # 30

Subject: Basin Model Hydrology Data Presentation

Request:
Dezé to provide flows and levels of Nonacho Lake, then where the flow diverges, flow to the Tronka Chua Gap versus flow into Taltson Lake. Then when the flow is recombined again in Lady Grey, and then levels in the Forebay, and then again the split of flow between Gorges versus SVS, and when they recombine.

Response:
The question is rephrased as: Provide a high level summary of Taltson Flow Model results. A summary of the Taltson Flow Model results are provided in the table below.

Taltson Flow Model Annual Summary of Model Results for Points of Interest

Location	Zone	Mean Annual			Units
		Baseline	36 MW	56 MW	
Nonacho Lake	Nonacho	323.20	322.91	322.52	level, masl
Nonacho Dam	Zone 1	75.00	78.00	87.86	flow, m^3/s
Tronka Chua Gap	Zone 2	14.00	11.65	3.14	flow, m^3/s
Lady Grey Lake	Zone 1	100.34	101.57	103.49	flow, m^3/s
Taltson D/S Tazin	Zone 3	170.65	171.92	173.87	flow, m^3/s
Twin Gorges	Zone 3	248.09	247.66	247.58	level, masl
Power Plant	Zone 3	43.34	151.57	162.95	flow, m3/s
South Valley Spillway	Zone 5	130.90	23.98	14.57	flow, m^3/s
Taltson D/S Twin Gorges	Zone 3	174.32	175.65	177.63	flow, m^3/s

COMMITMENT # 31 & 32

Subject: HEC-Ras Model

Request:
Commitment #31
Dezé to show observed data of calibration of the hydraulic model for Trudel Creek.

Commitment #32
Dezé to advise if they used any additional independent observed data to validate the HEC-Ras model, and was the validation aspect described elsewhere.

Response:
A series of 18 cross sections and benchmarks were first set-up along Trudel Creek in September, 2006. Water levels were tied into the terrestrial benchmarks at each cross section and a flow of 230 m^3/s was measured below the SVS. The cross section data was used to build the HEC-Ras model, manning's n values were estimated based on literature sources, and the model was initially calibrated using the observed water levels. The model was validated using a second set of water levels and flow (146 m^3/s) measured in May, 2007 as summarized in a technical memorandum dated July 16, 2007.

Attachments:
Rescan Environmental Services Ltd. 2007. HEC-Ras Model Memo July 16_07

COMMITMENT # 33

Subject: Power Outages

Request:
Dezé to provide a summary of expected lengths and occurrence probabilities of outages.

Response:
The data used in the DAR estimates of outages has been presented and described in the response to Commitment #26 and duplicated below.

Two sets of data have been utilized in the outage assessment estimates reported in the DAR:

Data Set 1: 1990 – 2009 (excluding 1993) outage summary for the Snare Hydro system, which includes four plants and 216 km of 115 kV transmission line to Yellowknife;

Data Set 2: 2003-2008 outage summary for the Taltson System, including the existing plant and the 150 km of 115 kV transmission line, as well as the lower voltage lines to Hay River.

The following criteria and broad assessment of the data has been used to support the estimates provided in the DAR for outages and effects.

For the Expansion Project, the following effect assumptions are made in terms of a partial or full outage:

- Outage Type 1: Outages of a few seconds to about five minutes will have no impact on the flow regime either upstream or downstream of the plant.
- Outage Type 2: Outages of five minutes to perhaps twenty minutes will cause decreases in flows below the plant, and dewatering in the immediate areas below the plant. The bypass system will be opened during this period such that dewatering does not occur.
- Outage Type 3: Outages of up to approximately 60 minutes would be contained in the forebay without significant spill over the South Valley Spillway into Trudel Creek. Restart can be made with synchronized closure of the bypass system. These are considered to have minor effects on flows along Trudel Creek.
- Outage Type 4: Significant outages are those lasting several hours and upwards, where the headpond level has increased and flows have risen substantially in Trudel Creek. Depending on the period of outage, these scenarios may require consideration of ramping on restart.
- Outage Type 5: Very significant outages are those lasting more than about 6 hours, where it is anticipated that close to the full pre-outage flows, less the bypass spill, will be routed into Trudel Creek.

An analysis of the available data indicates the following:

For the Snare Hydro System, some 144 outages of various durations are noted over a period of 18 years. Approximately half of the outages are of relatively minor duration. A total of 26 outages occur which are noted to last longer than 60 minutes, and about 9 are considered reasonably major outages. Of these, approximately 4 would be considered very significant outages lasting longer than four hours. The longest recorded outage is approximately nine hours. At 4 major outages over a period of 18 years, a major outage return period of 5 years would appear a reasonable estimate of performance of a multi-unit, single line system in the northern environment. The total outage period per year over the record is highly variable, but averages about 5.6 hours – this is considered very low.

For the existing Taltson system, some 45 outages of various durations are noted over a period of 5 years. Approximately half of the outages are of a very minor duration. A total of 5 significant outages occur in the record, with only 2 due to unscheduled loss of production (unit off-line – 1 outage was scheduled), and 2 major line outages. Outage of a single unit or line would be considered a partial outage in the Expansion system. Extrapolating these figures to multiple units (3 total) and two independent lines for the Expansion Project, it is estimated that a multiple line or plant outage would be expected about once every 5 years.

In terms of return periods for various outages, a basic tabulation assessment of the data would provide the following estimates for a partial outage (either one plant or one line) for the Expansion Project:

Outage Type 1 (up to 5 minutes):	2 – 3 per year
Outage Type 2 (5 to 20 minutes):	2 – 3 per year
Outage Type 3 (20 – 60 minutes):	3 – 4 per year
Outage Type 4 (60 – 240 minutes):	1 – 2 per year
Outage Type 5 (>240 minutes):	1 in 4 – 5 years

Assuming these estimates of occurrence would apply to either of the two plants or two lines with equal probability would double those partial outage occurrence estimates for the Expansion Project, but these remain partial outages. The full outage scenario discussed in the DAR would require simultaneous outage of both plants, for which we believe the likelihood is much lower. However, for that estimate, we have maintained the return period of about 1 in 5 years based on the existing records.

Attachments:

Data Set 1: 1990 – 2009 (excluding 1993) outage summary for the Snare Hydro system, which includes four plants and 216 km of 115 kV transmission line to Yellowknife.

Data Set 2: 2003-2008 outage summary for the Taltson System, including the existing plant and the 150 km of 115 kV transmission line, as well as the lower voltage lines to Hay River.

Northwest Territories Power Corporation L199 Transmission Line Outages 1990-2009
Table YK/FT.SMITH NTPC-16

Year	# of Transmission Outages affecting the L199	Date	Duration	Cause	Total Load at time of Transmission Outage (kW)	Load Lost (kW)	Date	Summer	Winter	Duration
1990	8	17-Jun	21	Lightning	21,000	11,200	17/06/1990	0	1	21
1990		26-Jun	7	Lightning	36,200	16,200	26/06/1990	0	1	7
1990		11-Jul	17	High Line Voltage	30,600	30,600	11/07/1990	0	1	17
1990		22-Jul	28	High Line Voltage drop – SF	26,500	26,500	22/07/1990	0	1	28
1990		12-Aug	28	Lightning	24,800	24,100	12/08/1990	0	1	28
1990		04-Sep	11	Raven 700 Sub	29,600	27,500	04/09/1990	0	1	11
1990		06-Sep	21	Complete Town and Nerco	32,700	21,200	06/09/1990	0	1	21
1990		07-Sep	21	Ground Fault Nerco Line	29,700	14,000	07/09/1990	0	1	21
1991	9	15-May	3	Lightning	31,800	29,800	15/05/1991	0	1	3
1991		20-May	3	Lightning	18,600	18,600	20/05/1991	0	1	3
1991		20-May	12	Lightning	16,400	16,400	20/05/1991	0	1	12
1991		20-May	3	Lightning	19,600	18,100	20/05/1991	0	1	3
1991		28-Jul	4	Lightning	27,100	27,100	28/07/1991	0	1	4
1991		15-Aug	9	Lightning	26,000	26,000	15/08/1991	0	1	9
1991		15-Aug	5	Lightning	18,000	18,000	15/08/1991	0	1	5
1991		18-Aug	4	L199 Line fault	12,100	12,100	18/08/1991	0	1	4
1991		06-Oct	4	High Line – Unknown	22,700	22,700	06/10/1991	0	1	4
1992	11	27-Apr	11	Voltage swings on transmission line	22,500	21,500	27/04/1992	0	1	11
1992		27-May	14	Ground fault on Giant line	21,000	19,000	27/05/1992	0	1	14
1992		08-Jun	3	Ground fault on Giant line	25,900	20,600	08/06/1992	0	1	3
1992		16-Jun	11	SR 52-1 shorted out	27,500	23,800	16/06/1992	0	1	11
1992		23-Jun	7	Over current on Giant line	24,700	24,700	23/06/1992	0	1	7
1992		02-Jul	7	Over current on Giant line	22,700	20,400	02/07/1992	0	1	7
1992		30-Jul	4	NUL watering entering cable at transformer at 100 su	26,100	24,800	30/07/1992	0	1	4
1992		08-Aug	15	Fault on Giant line, no control at 100 sub	24,100	24,100	08/08/1992	0	1	15
1992		10-Aug	34	Ground fault at 200 sub, raven	31,000	27,600	10/08/1992	0	1	34
1992		16-Aug	4	Phase to Phase on Giant line	16,200	9,100	16/08/1992	0	1	4
1992		27-Aug	4	Ground switch found closed on old 115 KV line	28,400	15,200	27/08/1992	0	1	4
1993	Incomplete data						31/12/1992	0	1	0
1994	8	19-Jan	57	Truck hit line at Giant T-4 86 relay	NA	NA	19/01/1994	0	1	57
1994		24-Jan	32	Possible line fault - S.K. high line	NA	NA	24/01/1994	0	1	32
1994		18-Jun	89	Lightning strikes, ring bus split, town on diesel	NA	NA	18/06/1994	0	1	89
1994		17-Jul	3	Lightning strikes, arrester damage @ B.H.	NA	NA	17/07/1994	0	1	3
1994		17-Jul	4	Lightning strikes	NA	NA	17/07/1994	0	1	4
1994		18-Jul	2	Lightning strikes	NA	NA	18/07/1994	0	1	2
1994		10-Aug	7	Phase relay on high line operated	NA	NA	10/08/1994	0	1	7
1994		11-Aug	69	P.T. fuse blown J.L.S. sub	NA	NA	11/08/1994	0	1	69
1995	5	15-Jul	1	Unknown; 67n,21z1	31,300	5,500	15/07/1995	0	1	1
1995		02-Aug	3	Ring bus split, system unstable, dumped hydro	30,100	6,200	02/08/1995	0	1	3
1995		11-Aug	54	Paralleling transformers	33,200	33,200	11/08/1995	0	1	54
1995		11-Aug	30	T2 lockout on gas alarm	25,100	25,100	11/08/1995	0	1	30
1995		26-Dec	3	High line, 21z1,59T.L.	33,000	22,200	26/12/1995	0	1	3
1996	15	26-May	71	Lightning strike on highline/hunting during diesel - hy	33,400	33,400	26/05/1996	0	1	71
1996		29-Jun	119	Lightning strike relay 67N & 59TL	31,200	31,200	29/06/1996	0	1	119
1996		02-Jul	26	50. I relay possible lightning strike	36,500	36,500	02/07/1996	0	1	26
1996		02-Jul	34	Separating 34.5 ring bus	36,500	36,500	02/07/1996	0	1	34
1996		02-Jul	11	Lightning strike on highline	36,500	36,500	02/07/1996	0	1	11
1996		08-Jul	7	67N relay on BH infeed	33,100	33,100	08/07/1996	0	1	7
1996		10-Jul	7	Ring bus separating 34.5	24,500	15,300	10/07/1996	0	1	7

1996		11-Jul	10	Unknown 27G &81G	32,100	32,100	11/07/1996	0	1	10
1996		01-Aug	24	Lightning BH Line	34,200	34,200	01/08/1996	0	1	24
1996		09-Aug	40	Raven 700 sub- town z protection	35,200	35,200	09/08/1996	0	1	40
1996		12-Aug	11	Lightning highline	37,000	37,000	12/08/1996	0	1	11
1996		12-Aug	8	Lightning	34,400	34,400	12/08/1996	0	1	8
1996		31-Aug	12	Westinghouse maintenance at BH tripped plant	29,100	17,800	31/08/1996	0	1	12
1996		21-Sep	62	Raven @BH	26,100	26,100	21/09/1996	0	1	62
1996		23-Nov	62	50G BH Infeed	38,500	37,500	23/11/1996	0	1	62
1997	9	06-Jan	139	High line fault	33,300	33,300	06/01/1997	0	1	139
1997		08-Feb	116	High line fault	32,200	32,200	08/02/1997	0	1	116
1997		08-May	19	Snare Fall governor oil system failed	25,000	25,000	08/05/1997	0	1	19
1997		30-Jun	8	Snare Cascades tripped (shaft seal water flow) causi	22,000	14,500	30/06/1997	0	1	8
1997		05-Jul	19	Line to ground fault on Giant protection	23,500	21,500	05/07/1997	0	1	19
1997		11-Jul	3	T4 LTC limiting	24,400	7,900	11/07/1997	0	1	3
1997		23-Sep	7	Raven Bluefish line	26,400	12,100	23/09/1997	0	1	7
1997		24-Sep	16	Raven Bluefish line	24,500	13,200	24/09/1997	0	1	16
1997		20-Dec	44	Snare Falls trip. Went from partial to full outage due t	32,000	15,000	20/12/1997	0	1	44
1998	8	29-Apr	71	Fault at Royal Oak	30,800	27,000	29/04/1998	0	1	71
1998		13-Jul	8	Lightning, no control over 500/700 subs	27,400	27400	13/07/1998	0	1	8
1998		15-Sep	72	Insulator at SF sub blew apart (37 & 35)	26,700	26,700	15/09/1998	0	1	72
1998		25-Oct	11	T # 4 gas detection trip at JLS	28,500	28,500	25/10/1998	0	1	11
1998		23-Nov	13	SF Gov. oil s/d	28,300	28,300	23/11/1998	0	1	13
1998		01-Dec	20	Static line on 115 KV making contact with conductor	28,900	27,000	01/12/1998	0	1	20
1998		05-Dec	28	115 KV line fault 67N	28,100	11,900	05/12/1998	0	1	28
1998		16-Dec	37	115 KV line fault 67N	34,900	34,900	16/12/1998	0	1	37
1999	2	10-Mar	7	MSO	32,400	30,300	10/03/1999	0	1	7
1999		24-Mar	14	Contractor magna 4	28,100	28,100	24/03/1999	0	1	14
2000	10	15-Feb	31	Tech in STS,100 sub closing	36,100	36,100	15/02/2000	0	1	31
2000		29-May	59	HI Line Trip 67n unknown	30,000	30,000	29/05/2000	0	1	59
2000		09-Jun	21	T-4 Lockout Raven @ JLS	34,000	34,000	09/06/2000	0	1	21
2000		11-Jul	42	Lightning 67N	35,000	35,000	11/07/2000	0	1	42
2000		21-Jul	12	Lightning, Problem closing @ 600	25,600	25,600	21/07/2000	0	1	12
2000		27-Jul	53	Lightning, Problems @600	33,000	33,000	27/07/2000	0	1	53
2000		30-Sep	15	HI Line Trip 21	30,000	30,000	30/09/2000	0	1	15
2000		17-Nov	30	HI Line Raven @ JLS Sub	31,700	31,700	17/11/2000	0	1	30
2000		24-Nov	75	HI Line Frost 21z	30,000	30,000	24/11/2000	0	1	75
2000		08-Dec	53	Hi line frost.	38,900	34,700	08/12/2000	0	1	53
2001	4	07-Jun	33	Operator error	30,000	30,000	07/06/2001	0	1	33
2001		20-Jun	32	Unknown	33,000	33,000	20/06/2001	0	1	32
2001		09-Jul	14	Lightning SR cascading outage occurred	27,700	26,700	09/07/2001	0	1	14
2001		28-Jul	3	Lightning SR line 67N	20,300	16,400	28/07/2001	0	1	3
2002	6	24-Jan	238	highline failure	39,700	39,700	24/01/2002	0	1	238
2002		23-May	30	(Guy wire failure) SF to SR line	29,800	29,800	23/05/2002	0	1	30
2002		19-Jun	10	SF insulator damage cause line fault	26,500	26,500	19/06/2002	0	1	10
2002		19-Jun	7	SF insulator damage cause line fault	27,800	27,000	19/06/2002	0	1	7
2002		22-Jun	24	Lightning near Rae {total}	30,300	30,300	22/06/2002	0	1	24
2002		26-Jul	8	Lightning	32,300	32,300	26/07/2002	0	1	8
2003	5	04-Jan	20	SK line fault	34,900	28,000	04/01/2003	0	1	20
2003		10-Feb	28	Line Fault	38,000	38,000	10/02/2003	0	1	28
2003		01-Aug	141	Lightning	29,100	29,000	01/08/2003	0	1	141
2003		14-Sep	37	T19 Trip Low oil 115 kV trip	21,900	21,900	14/09/2003	0	1	37
2003		23-Nov	37	SF Transformer fault Highline trip	32,600	32,500	23/11/2003	0	1	37
2004	3	11-Jul	32	Lightning	23,400	23,400	11/07/2004	0	1	32
2004		17-Jul	50	Lightning	21,600	19,000	17/07/2004	0	1	50
2004		29-Jul	64	Lightning	25,800	25,800	29/07/2004	0	1	64
2005	4	30-May	50	Lightning	26,500	26,500	30/05/2005	0	1	50

Nothwest Territories Power Corporation L199 T Line Ootages 1990-2009

2005		07-Jun	67	Lightning	26,800	26,800	07/06/2005	0	1	67
2005		21-Aug	48	Lightning	17,200	16,400	21/08/2005	0	1	48
2005		06-Sep	67	Lightning	24,100	24,100	06/09/2005	0	1	67
2006	14	02-Jan	567	Structure Failure	27,000	12,500	02/01/2006	0	1	567
2006		04-Jan	45	Snare Falls Govenor Failure	22,000	22,000	04/01/2006	0	1	45
2006		07-Feb	75	Structure Failure	28,100	28,100	07/02/2006	0	1	75
2006		14-Feb	39	Snare Falls Headgate Failure	29,400	29,400	14/02/2006	0	1	39
2006		19-May	74	Snare Rapids Static Exciter Failure	20,600	20,600	19/05/2006	0	1	74
2006		24-May	54	L193 - Lightning arrestor failure	21,600	21,600	24/05/2006	0	1	54
2006		27-Jun	30	Lightning	20,400	20,400	27/06/2006	0	1	30
2006		03-Jul	37	Lightning	19,400	19,400	03/07/2006	0	1	37
2006		03-Jul	34	Lightning	24,900	24,900	03/07/2006	0	1	34
2006		03-Jul	35	Lightning	20,900	20,900	03/07/2006	0	1	35
2006		23-Jul	38	Lightning	22,100	22,100	23/07/2006	0	1	38
2006		23-Jul	223	Lightning	20,600	20,600	23/07/2006	0	1	223
2006		13-Aug	90	Lightning	16,800	16,800	13/08/2006	0	1	90
2006		13-Aug	80	Lightning	17,100	17,100	13/08/2006	0	1	80
2007	9	14-May	33	L199 Line Fault	24,600	24,600	14/05/2007	0	1	33
2007		31-May	49	Lightning	25,500	25,500	31/05/2007	0	1	49
2007		20-Jul	58	Lightning	26,300	26,300	20/07/2007	0	1	58
2007		20-Jul	56	Lightning	25,100	25,100	20/07/2007	0	1	56
2007		20-Jul	20	Lightning	25,100	25,100	20/07/2007	0	1	20
2007		20-Jul	48	Lightning	15,900	15,900	20/07/2007	0	1	48
2007		31-Jul	39	Lightning	15,800	15,800	31/07/2007	0	1	39
2007		04-Aug	18	Lightning	22,700	22,700	04/08/2007	0	1	18
2007		06-Aug	33	Lightning	18,600	18,600	06/08/2007	0	1	33
2008	14	02-Jan	64	L199 line fault	19000	19000	02/01/2008	0	1	64
2008		28-Jan	88	T5 Gas trip	31200	28300	28/01/2008	0	1	88
2008		10-Mar	49	Raven	26800	24400	10/03/2008	0	1	49
2008		29-Mar	58	Raven	26600	26600	29/03/2008	0	1	58
2008		02-Jun	23	Lightning	24500	24500	02/06/2008	0	1	23
2008		02-Jun	24	Lightning	24400	24400	02/06/2008	0	1	24
2008		02-Jun	19	Lightning	20400	20400	02/06/2008	0	1	19
2008		02-Jun	21	Lightning	20400	20400	02/06/2008	0	1	21
2008		28-Jun	229	Lightning	16200	16200	28/06/2008	0	1	229
2008		10-Aug	36	Lightning	20800	20800	10/08/2008	0	1	36
2008		11-Aug	19	Lightning	20600	20600	11/08/2008	0	1	19
2008		11-Aug	23	Lightning	15700	15700	11/08/2008	0	1	23
2008		11-Aug	20	Lightning	15200	15200	11/08/2008	0	1	20
2008		15-Sep	59	Bluefish line fault	23400	23400	15/09/2008	0	1	59
2009	6	05-Jan	322	L199 line fault	27000	27000	05/01/2009	0	1	322
2009		20-Jun	49	Bluefish line fault	22300	22300	20/06/2009	0	1	49
2009		02-Jul	21	Bluefish line fault	22600	22600	02/07/2009	0	1	21
2009		03-Jul	50	Lightning	25100	25100	03/07/2009	0	1	50
2009		11-Jul	150	Lightning	24900	23600	11/07/2009	0	1	150
2009		12-Jul	23	Lightning	20400	20400	12/07/2009	0	1	23

Nothwest Territories Power Corporation L199 T Line Ooutages 1990-2009

	Summer outage count	Winter outage count	Summer outage minutes	Winter outage minutes	Total outage minutes	Forced outage rate
1990	8	0	154	0	154	0.000293
1991	9	0	47	0	47	8.9422E-05
1992	11	0	103	0	103	0.00019597
1994	6	2	174	89	263	0.00050038
1995	4	1	88	3	91	0.00017314
1996	14	1	442	62	504	0.0009589
1997	6	3	72	299	371	0.00070586
1998	4	4	162	98	260	0.00049467
1999	0	2	0	21	21	3.9954E-05
2000	6	4	202	189	391	0.00074391
2001	4	0	82	0	82	0.00015601
2002	5	1	79	238	317	0.00060312
2003	2	3	178	85	263	0.00050038
2004	3	0	146	0	146	0.00027778
2005	4	0	232	0	232	0.0004414
2006	10	4	726	695	1421	0.00270358
2007	9	0	354	0	354	0.00067352
2008	10	4	473	259	732	0.00139269
2009	5	1	293	322	615	0.00117009

mean	220.538462	0.00041959
standard deviation	150.183563	0.00028574
standard error of mean (stdev divided by square root of observations)	41.6534259	7.9249E-05
mean plus one standard error	262.191887	0.00049884

Northwest Territories Taltson Outage Data 2003 to 2008

Taltson Outage Data 2003 to 2008

2007/08

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Taltson	18/04/2007	0.33	2	100%
Taltson	03/06/2007	56.00	3	5%
Taltson	30/06/2007	92.00	5	5%
Taltson	01/07/2007	0.03	5	5%
Taltson	03/07/2007	32.00	7	5%
Taltson	03/07/2007	0.03	5	5%
Taltson	04/08/2007	0.03	5	6%
Taltson	18/08/2007	4.00	3	6%
Taltson	20/08/2007	15.00	7	6%
Taltson	09/09/2007	11.00	1	100%
Taltson	10/09/2007	28.00	1	6%
Taltson	14/09/2007	23.75	6	100%
Taltson	27/10/2007	0.33	2	100%

Outage Cause Code

1 Loss of Production
2 Loss of Supply
3 Scheduled
4 Lightning
5 Weather
6 Human
7 External
8 Unknown

2006/07

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Taltson	15-Jun-06	15	7	100%
Taltson	14-Jul-06	0	8	4%
Taltson	22-Aug-06	2	4	100%
Taltson	18-Oct-06	0	8	100%
Taltson	12-Jan-07	36	8	8%

2005/06

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Talston	21-Apr-05	0.5	2	100%
Talston	29-Jun-05	0.5	5	100%
Talston	05-Jul-05	0.3	8	100%
Talston	07-Jul-05	0.3	5	100%
Talston	09-Jul-05	0.3	4	100%
Talston	03-Aug-05	6.0	7	100%
Talston	03-Aug-05	27.0	8	9%
Talston	07-Aug-05	0.3	4	100%
Talston	09-Sep-05	76.0	3	100%
Talston	14-Sep-05	108.0	4	100%
Talston	22-Sep-05	109.0	8	7%

2004/05

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Taltson	22-Apr-04	48.0	5	100%
Taltson	16-May-04	0.3	1	100%
Taltson	30-May-04	0.3	8	100%
Taltson	02-Jun-04	19.0	4	86%
Taltson	11-Jun-04	28.0	7	9%
Taltson	20-Jun-04	4.0	7	10%
Taltson	06-Jul-04	21.0	7	7%
Taltson	23-Jul-04	16.0	7	65%
Taltson	30-Jul-04	26.0	4	100%
Taltson	06-Oct-04	31.0	7	100%
Taltson	10-Oct-04	18.0	5	100%
Taltson	24-Dec-04	25.0	8	100%
Taltson	23-Jan-05	27.0	3	11%
Taltson	14-Feb-05	250.0	1	98%
Taltson	22-Mar-05	0.0	8	7%

Northwest Territories Taltson Outage Data 2003 to 2008

2003/04

Plant	Outage Date	Outage Duration Real Time (Minutes)	Outage Cause Code	Percetage of System
Talston System	21-Apr-03	17.0	2	100%
Talston System	03-Nov-03	91.0	2	100%
Talston System	04-Nov-03	25.0	2	100%
Talston System	23-Nov-03	0.3	2	100%
Talston System	25-Jun-03	0.3	3	100%
Talston System	15-Jun-03	7.0	4	100%
Talston System	02-Jul-03	0.3	4	100%
Talston System	11-Jul-03	0.3	4	100%
Talston System	17-Jul-03	0.3	4	100%
Talston System	22-Jul-03	0.3	4	100%
Talston System	22-Jul-03	0.3	4	100%
Talston System	28-Jul-03	0.3	4	100%
Talston System	01-Aug-03	70.4	4	100%
Talston System	15-May-03	0.3	4	100%
Talston System	05-Aug-03	15.0	6	100%
Talston System	11-Feb-04	0.0	7	13%
Talston System	14-Jul-03	193.0	7	4%
Talston System	18-Apr-03	0.4	8	100%
Talston System	19-Apr-03	0.3	8	100%
Talston System	15-May-03	11.0	8	100%
Talston System	15-May-03	0.0	8	100%
Talston System	01-Jul-03	10.0	8	100%
Talston System	19-Jan-04	59.0	8	8%
Talston System	29-Dec-03	10.0	8	100%

Taltson Outage Data Summary 2003-2008

	Number of O	Average Duration (Minutes)
2007/08	13	20.19
2006/07	5	10.67
2005/06	11	29.84
2004/05	15	34.24
2003/04	24	21.34

COMMITMENT # 34

Subject: Socio-Economics

Request:
1. Please provide an analysis on NWT businesses that have the capacity to successfully compete for opportunities related to the Taltson Hydroelectric Expansion Project.

2. What percentage of procurement may be sourced from NWT businesses? Please explain how this percentage was calculated and how much of the total cost of contracts will be made available to NWT businesses.

3. Please provide additional information on the efforts Dezé will make to ensure NWT businesses are aware of business and procurement opportunities?

Response:
1. Dezé commits to analyzing the potential for the business sector in the communities of Fort Smith, Fort Resolution, Hay River and Lutsel K'e to compete for opportunities related to the Project. This will include an inventory of all businesses with applicable products and services that could be involved in the project. Dezé will also utilize publicly available information such as the Northwest Territories Aboriginal Business Association database to estimate the broader business potential for other regions of the NWT to participate in the project.

2. Dezé commits to quantifying potential procurement from the communities of Fort Smith, Fort Resolution, Hay River and Lutsel K'e; and, to establishing targets for contracts with Northern aboriginal businesses and Preferred Parties within this region during the construction period, on an annual basis. Targets and outcomes will be reported annually during construction phase. Dezé will also estimate the procurement potential from communities in the broader NWT region and report results on an annual basis, during the construction phase.

3. Page 20.5 and 20.6 of the DAR (the Table of Commitments) detail Dezé's commitments to employment and to communicating business opportunities.

COMMITMENT # 35

Subject: Socio-Economics

Request:
Dezé to advise what percentage of procurement will be sourced from NWT businesses. Please explain how this percentage was calculated, and how much of the total cost of contracts will be made available to NWT businesses.

Response:
The following sections of the DAR outline Dezé's contracting and procurement policy framework:

- Page 3.4 (Chapter 3) - outlines the framework for Dezé's Project Procurement Policy.
- Page 6.5.51 (Chapter 6) – outlines the approach to Contracting during construction.

Dezé commits to providing a final version of the Business Employment and Training Policy Framework for the Project prior to public hearings in January, 2010. In the interim, the project team will continue to work with the GNWT to try and clarify issues and expectations with respect to monitoring and reporting on employment and procurement for the construction and operations phases of the project, and to arrive at a mutually agreeable solution.

COMMITMENT # 36 & 37

Subject: Blasting

Request:

Commitment 36

If Dezé hears from Environment Canada that they do need the information re minimum setbacks as part of the EA process, to provide some general numbers for Environment Canada to look at and decide if that is satisfactory by October 31, 2009.

Commitment 37

Dezé will incorporate a 50 kPa overpressure threshold for instream blasting, a reduction from the published Canadian Guidelines.

Response:

Commitment 36

Dezé has discussed with the design team, potential setback distances from water bodies for use of water resistant explosives. Four sites are identified that would involve in-stream or near stream blasting. These are the North Gorge inlet and tailrace, and the Nonacho control structure canal inlet and outlet. These four locations were all selected because of their rock formation, providing stable rock for the canal walls and floor. Engineering proposes a minimum set back of 10 metres from the edge of water, as this will provide adequate rock separation between the water body and use of non-water resistant explosives for containment and isolation.

Commitment 37

Dezé will incorporate a 50 kPa overpressure threshold for instream blasting, a reduction from the published Canadian Guidelines.

COMMITMENT # 38, 39, 40, & 41

Subject: Waste Management, Incinerators

Request:
Commitment 38
Dezé commits to following the GNWT open burning policies.

Commitment 39
Dezé commits to making reusable materials available to local communities.

Commitment 40
Dezé to commit to having an approved incinerator that meets regulatory guidelines that emissions and the incinerator itself would be permitted at the regulatory stage.

Commitment 41
Dezé to provide, in writing by October 30th, 2009, clarity on whether or not Dezé commits to follow the information provided in the technical document for batch-waste incinerators.

Response:
Commitment 38
Dezé will follow the GNWT open burning policies

Commitment 39
Dezé will make re-useable materials available to local communities.

Commitment 40
Dezé will have an approved incinerator at camps that meets regulatory guidelines and is permitted as required.

Commitment 41
Dezé and Environment Canada have come to an agreement on the mitigation, monitoring and effects from incinerators, as contained in the October 21, 2009 Meeting Report forwarded to MVEIRB. Dezé commits to following the Environment Canada guidelines as presented in the technical document Executive Summary and 6 Step Process. Dezé also commits to developing an Incineration Management Plan with annual reports.

COMMITMENT # 42

Subject: Cultural Impacts

Request:
Dezé to advise in writing how it may be considering any offsite cultural mitigations to bigger cumulative impacts that are not physical mitigations that deal directly with how close they are to Our Lady of the Falls.

Response:
Dezé is considering various offsite cultural mitigation options specific to the Lady of the Falls on the Lockhart River that contribute to their vitality and significance by supporting:

- Annual gatherings;
- Arts; and
- Cross-cultural experiences.

Annual Gatherings
Dezé Energy is open to supporting Łutsel Ké's ceremonies and celebrations at the "Lady of the Falls" by contributing to feasts, dances, opening and closing ceremonies with services such as temporary enclosures for kitchen, shower and laundry facilities.

Arts and Culture
Dezé is willing to discuss creation of a fund to support Łutsel K'e writers, storytellers and publishers, in the hope that this will encourage the artistic development of established and emerging writers and storytellers. This may include efforts to collect traditional ecological knowledge or legends of the Lady of the Falls area, or to transcribe existing information into more accessible formats.

Cross-Cultural Initiatives
Dezé is willing to discuss a contribution to the development of cultural experiences, tied directly to the Lady of the Falls, which are organized and willingly shared with visitors to the area, or promoting culture-based education and mentorship initiatives specific to the Lady of the Falls and the Lockhart River. Further, Dezé Energy would consider a contribution towards a National Parks exhibition of the Lady of the Falls and the Lockhart River.

COMMITMENT # 43

Subject: Blasting

Request:
Dezé to indicate the amount of explosives that will be used and how much nitrogen will be residual afterwards that may enter the aquatic environment.

Response:
As presented in the transcripts of the technical session, the quantity of explosives to be used is located in Section 6.5.4.5 of the DAR and in Table 6.5.5. Explosive quantity will be approximately 160,000 kilograms of Ammonia Nitrate Fuel Oil (ANFO), and approximately 1,000 kg of stick explosives. In addition, as a result of on-going discussions with engineering, Dezé proposes to use a packaged product, such as an emulsion, for instream blasting, which will reduce the risk of escaped nitrates.

There are three ways nitrates from explosives can enter the environment: spillage during handling, leaching of explosives from blast holes prior to detonation, and incomplete detonation of explosives.

There are many types of explosives. The most common construction explosive is Ammonium Nitrate Fuel Oil (ANFO). Use of ANFO can lead to nitrate contamination via all three pathways discussed above. Dezé proposes to use a modified explosive in or in close proximity to water where risk of contamination is high, to significantly reduce the potential for nitrate contamination via the above pathways.

Note that there is no difference in the vaporization percentage between ANFO, water-resistant ANFO, or other nitrate-based explosive products. All will vaporize completely under ideal conditions. Thus Dezé has not selected a modified explosive to improve vaporization; the explosive product that Dezé has committed to will minimize the release of nitrates into the environment by eliminating or marginalizing the three pathways of contamination.

Spillage – explosives can be spilled during handling. Typically, ANFO used for construction blasting comes in prill form. If spilled and left to environmental exposure (i.e. not cleaned up), the prills dissolve and can lead to release of nitrates. Dezé has committed to using an explosive product for in-stream blasting that comes in a package, either in the form of a stick or sausage, depending on the product. Packaged explosives contain the explosive material in durable packaging that is designed for easy handling and can simply be picked up should one be dropped. Thus the use of packaged explosives will reduce spillage.

Leaching of Explosives – Nitrate-based explosives can leach nitrites into the environment between deployment and detonation if they are exposed to water for various periods of time, depending on the product and the packaging. For instream works, Dezé has committed to using a packaged, water-resistant explosive to reduce the amount of nitrate that could leach during deployment and detonation; Table 1 (reproduced from Revey, 1996) shows percent reduction of leached nitrates for three different water-resistant explosive products.

Table 1 Percentage of nitrates leached from explosive*				
Time, hr	**ANFO**	**WR ANFO**	**WaterGel**	**Emulsion**
0.1	~25	-	-	-
1	>50	~25	-	-
6	-	-	24.6	0.6
144	-	-	>75	1.2
* When 25% of the nitrates are dissolved, the explosive is probably no longer detonable.				

The final product selection is the responsibility of the blaster, who will determine which product or combination of products is best suited to the rock type, detonation requirements, and duration of potential exposure to water, if any.

Incomplete Detonation – sometimes, blast holes don't detonate as planned, typically due to migration of unconfined product away from the blast zone during deployment, or due to the configuration of explosive material in the loaded blast holes. If a hole does not detonate as intended, some explosives could be lost to the environment and over time, leach nitrate. Dezé's use of packaged explosives for instream works would reduce the potential for lack of detonation due to the package confinement which eliminated potential migration of product, and enables the blaster greater product controls when loading holes.

Dezé's commitment to using water-resistant, packaged explosives near and in water will reduce the three sources of nitrate contamination that can occur while using typical construction ANFO product, and basically negate the potential of residual nitrogen.

Reference:

Revey, G.F. 1996. Practical methods to control explosives losses and recue ammonia an nitrate levels in mine water. Mining Engineering, July 1996. 61-64.

COMMITMENT # 44

Subject: Greenhouse Gas

Request:
Provide estimates of the emissions from truck traffic as a result of transporting less fuel to the mines.

Response:
Greenhouse gas reductions for truck traffic as a result of transporting less fuel to the mines were not included in the calculations provided in the *Developer's Assessment Report* as it is believed that increased ice road capacity will be replaced by other essential materials for existing and proposed mines. However, a loaded Super B transport truck with a fuel consumption estimate of between 625-750 litres is equivalent to 3000-4000 t CO2e annually. This is based on the average number of round trips per winter road season from Yellowknife to Lac De Gras. Assuming that the trucks are not replaced with other essential materials, the 3000-4000 t CO2e would add an additional 1.8 to 2.4 % reduction to the overall 3.3 million tonnes offset, over a twenty-year period.

References:
Erik Madsen, Director, Winter Road Operations Joint Venture Management Committee, personal communications attributed to Robinson Trucking Ltd., Tli-Cho Lantran, and ARS Trucking

COMMITMENT # 45 & 46

Subject: Greenhouse Gas

Commitment:
Provide the numbers for the production of new materials for transmission lines, tree harvesting and fuel consumption, throughout construction, contained in the life cycle assessment.

Response:
Taltson Project: Greenhouse Gas Reduction/Emission Calculations Methodology

Reductions
To calculate the greenhouse gas reductions, it was assumed that diesel-fired power plants would be used at the mines as a Project alternative to provide electricity to the Gahcho Kué, Snap Lake, Diavik and Ekati mines. Environment Canada (2008) conversion factors estimate that one litre of diesel emits 2.63 kilograms (kg) of carbon dioxide (CO_2) or 2.79 kg of CO_2 equivalent. Diesel consumption factor of 0.251litres per kWh was provided by the NWT Power Corporation.

Emissions
Right-of-Way brushing, fuel used during construction, and tower and conductor production were assumed to be the major sources of greenhouse gas emissions resulting from the Project.

Based on the National Forest Carbon Monitoring, Accounting and Reporting System results, the undisturbed forests of NWT were estimated to remove approximately 1tonne CO_2 per hectare annually. Brushed and decaying forest emits approximately 5 t CO_2 per hectare annually (Dymond, C., personal communication). Therefore, the net change in greenhouse gas balance would be a total of 6 t CO_2/ha, which is equivalent to 600 t CO_2 /km^2 annually (the brushed forests are not acting as greenhouse sinks while emitting GHG from decay). For the calculation of greenhouse gas emissions from fuel used during construction, it was assumed that fuel consumption was the same as total storage capacity presented in Table 6.5.3 of the Developers Assessment Report.

Emission factors of 2.79 kg of CO_2 equivalent per litre of diesel and 2.45 kg of CO_2 equivalent per litre of helicopter fuel were obtained from Environment Canada Report (2008) and the BC ministry of Finance (2009). These factors were similar to the ones obtained from CAPP (2003) of 2.85 g of CO_2 emissions per litre of diesel and 2.44 kg of CO_2 emissions per litre of aviation gas. CO2 equivalent conversion factors of 3.9 t of CO_2 emissions per tonne of steel were obtained from the National Renewable Energy Laboratory. Similar conversion factors (3.5t of CO_2 emissions per tonne of steel) were obtained from Dorchies (2008). Aluminum conversion factors of 1.55 t of CO_2 emissions per tonne) were obtained from Metz (2007). As conductors were composed of steel and aluminum, the more conservative factor was used. A conservative estimate of 5 % sag was estimated to calculate length of the conductor.

References:
Environment Canada. 2008. National Inventory Report: Greenhouse Gas Sources and Sinks in Canada,1990-2006.Availableat: http://www.ec.gc.ca/pdb/ghg/inventory_report/2006_report/tdm-toc_eng.cfm.

BC Ministry of Finance. 2009. How the Carbon Tax Works. Available at: http://www.fin.gov.bc.ca/scp/tp/climate/A4.htm.

National Renewable Energy Laboratory. 2009. Life-Cycle Inventory Database. Available at: http://www.nrel.gov/lci/database/default.asp.

Natural Resources Canada. 2009. National Forest Carbon Monitoring, Accounting and Reporting System. Available at: http://carbon.cfs.nrcan.gc.ca/index_e.html

CAPP (Canadian Association of Petroleum Producers). 2003. Guide to Calculating Greenhouse Emissions. April 2003.

Dorchies, P.T. 2008. The environmental road of the future: Analysis of energy consumption and greenhouse gas emissions. Annual Conference of the Transportation Association of Canada, Toronto, Ontario Environment Canada. March 2004. Aluminum Production-Guidance Manual for Estimating Greenhouse Gas Emissions. Available at http://www.ec.gc.ca/pdb/ghg/guidance/protocols/2005_metal_mining/aluminium/toc_e.cfm.

Environment Canada. 2004. Primary Iron and Steel Production - Guidance Manual for Estimating Greenhouse Gas Emissions. Available at: http://www.ec.gc.ca/pdb/ghg/guidance/protocols/2005_metal_mining/iron_steel/toc_e.cfm.

Metz, B. 2007. Climate Change 2007 – Mitigation of Climate Change. Intergovernmental Panel on Climate Change. Working Group III

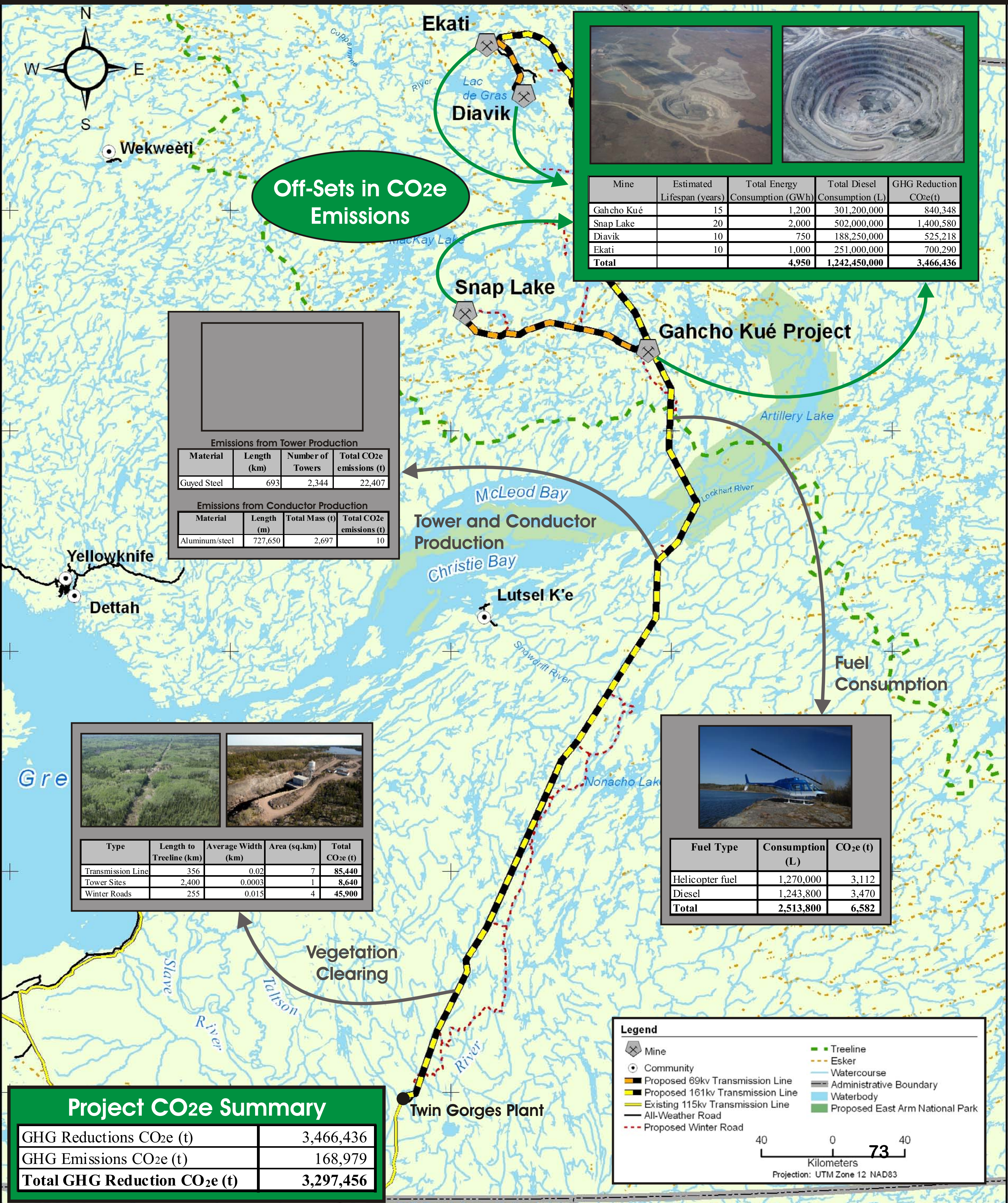
Personal Communications:
Dymond, C. Forest Carbon and Climate Change Researcher, personal communication, June 2009

Attachments:
Dezé Energy Corporation. 2009. Taltson Greenhouse Gas Reduction/Emission Assessment Methodology Memo

Dezé Energy Corporation. 2009. Taltson Greenhouse Gas Reduction/Emission Lifecycle Assessment Poster

Taltson Hydroelectric Project
Greenhouse Gas Reduction/Emission Lifecycle Assessment
(3 Years of Construction and 20 Years of Operation)

Dezé energy



Mine	Estimated Lifespan (years)	Total Energy Consumption (GWh)	Total Diesel Consumption (L)	GHG Reduction CO2e(t)
Gahcho Kué	15	1,200	301,200,000	840,348
Snap Lake	20	2,000	502,000,000	1,400,580
Diavik	10	750	188,250,000	525,218
Ekati	10	1,000	251,000,000	700,290
Total		**4,950**	**1,242,450,000**	**3,466,436**

Emissions from Tower Production

Material	Length (km)	Number of Towers	Total CO2e emissions (t)
Guyed Steel	693	2,344	22,407

Emissions from Conductor Production

Material	Length (m)	Total Mass (t)	Total CO2e emissions (t)
Aluminum/steel	727,650	2,697	10

Fuel Type	Consumption (L)	CO2e (t)
Helicopter fuel	1,270,000	3,112
Diesel	1,243,800	3,470
Total	**2,513,800**	**6,582**

Type	Length to Treeline (km)	Average Width (km)	Area (sq.km)	Total CO2e (t)
Transmission Line	356	0.02	7	**85,440**
Tower Sites	2,400	0.0003	1	**8,640**
Winter Roads	255	0.015	4	**45,900**

Project CO2e Summary

GHG Reductions CO2e (t)	3,466,436
GHG Emissions CO2e (t)	168,979
Total GHG Reduction CO2e (t)	**3,297,456**

DezéEnergy

AkaitchoEnergy Corporation MétisEnergy Company Ltd. NWTEnergy Corporation (03)Ltd.

Dezé energy 206, 5102 - 50th Avenue, Yellowknife, NT X1A 3S8 Phone: (867) 669-3390 Fax: (867) 669-3395

October 16th, 2009

Taltson Project: Greenhouse Gas Reduction/Emission Calculations Methodology

Reductions

To calculate the greenhouse gas reductions, it was assumed that diesel-fired power plants would be used as a Project alternative to provide electricity to the Gahcho Kué, Snap Lake, Diavik and Ekati mines. Based on the Environment Canada Report (2008) conversion factors, one litre of diesel was assumed to emit 2.63 kg of CO_2 or 2.79 kg of CO_2 equivalent. Diesel consumption factor of 0.251L/kWh was provided by the NWT Power Corporation.

Emissions

Forest clearing, fuel used during construction, and tower and conductor production were assumed to be the major sources of greenhouse gas emissions resulting from the Project.

Based on the National Forest Carbon Monitoring, Accounting and Reporting System results, the undisturbed forests of NWT were estimated to remove approximately 1t CO_2/ha annually. The same area of forest, when cleared and left decaying, would emit approximately 5 t CO_2/ha annually (C. Dymond, Forest Carbon and Climate Change Researcher, personal communication, June 2009). Therefore, the net change in greenhouse gas balance would be a total of 600 t CO_2/km^2 annually (the cleared forests are not acting as greenhouse sinks while emitting GHG from decay). Similar conversion factors were obtained from a number of on-line greenhouse gas calculators (2.6 t/acre or 642 t/km^2 annually).

For the calculation of greenhouse gas emissions from fuel used during construction, it was assumed that fuel consumption was the same as total storage capacity presented in Table 6.5.3 of Developers Assessment Report. Emission factors of 2.79 kg of CO2 equivalent per litre of diesel and 2.45 kg of CO2 equivalent per litre of helicopter fuel were obtained from Environment Canada Report (2008) and the BC ministry of Finance website. These factors were similar to the ones obtained from the Guide to Calculating Greenhouse Gas Emissions (2003) of 2.85 g of CO_2e per litre of diesel and 2.44 kg of CO_2e per litre of aviation gas.

CO_2 equivalent conversion factors of 3.9 t of CO_2e per tonne of steel were obtained from the National Renewable Energy Laboratory. Similar conversion factors (3.5t of CO_2e per tonne of steel) were obtained from Dorchies (2008). Aluminum conversion factors of 1.55 t of CO_2e per tonne) were obtained from Metz (2007). As conductors were composed of steel and aluminum, the more conservative factor was used. A conservative 5 % sag was estimated to calculate length of the conductor.

Reductions Not Included in DAR GHG Reduction Numbers– Transportation of Diesel Fuel to the Diamond Mines

Greenhouse gas reductions for truck traffic were not included in the numbers stated in the Developers' Assessment Report as it is believed that increased ice road capacity will be replaced by other essential materials for the mines. However, a loaded Super B transport with a fuel consumption estimate of between 625-750 litres is equivalent to 3000-4000 t CO_2e annually. This is based on the average number of round trips per winter road season from Yellowknife to Lac De Gras (Erik Madsen, Director, Winter Road Operations Joint Venture Management Committee, personal communications attributed to RTL Robinson Trucking Ltd., Tli-Cho Lantran, and ARS Trucking). Assuming that the trucks are not replaced with other essential materials, the 3000-4000 t CO_2e would add an additional 1.8 to 2.4 % reduction to the overall 3.3 million tonne offset.

References

Environment Canada. 2008. National Inventory Report: Greenhouse Gas Sources and Sinks in Canada, 1990-2006. Available at: http://www.ec.gc.ca/pdb/ghg/inventory_report/2006_report/tdm-toc_eng.cfm.
BC Ministry of Finance website. Available at: http://www.fin.gov.bc.ca/scp/tp/climate/A4.htm.
National Renewable Energy Laboratory. Life-Cycle Inventory Database. Available at: http://www.nrel.gov/lci/database/default.asp.
Natural Resources Canada. 2009. National Forest Carbon Monitoring, Accounting and Reporting System. Available at: http://carbon.cfs.nrcan.gc.ca/index_e.html
Canadian Association of Petroleum Producers. Guide to Calculating Greenhouse Emissions. April 2003.
Dorchies, P.T. 2008. The environmental road of the future: Analysis of energy consumption and greenhouse gas emissions. Annual Conference of the Transportation Association of Canada, Toronto, Ontario
Environment Canada. March 2004. Aluminum Production- Guidance Manual for Estimating Greenhouse Gas Emissions. Available at: http://www.ec.gc.ca/pdb/ghg/guidance/protocols/2005_metal_mining/aluminium/toc_e.cfm.
Environment Canada. March 2004. Primary Iron and Steel Production - Guidance Manual for Estimating Greenhouse Gas Emissions. Available at: http://www.ec.gc.ca/pdb/ghg/guidance/protocols/2005_metal_mining/iron_steel/toc_e.cfm.
Metz, B. 2007. Climate change 2007 – Mitigation of Climate Change. Intergovernmental Panel on Climate Change. Working Group III.

COMMITMENT # 47

Subject: Bypass Spillway

Request:
Dezé to provide information in terms of the alternatives they looked at and why the one in the design was selected re bypass.

Response:
The following design concepts have been considered in the development of the preferred concept as presented in the DAR and are a duplication of the response given for Commitment # 29.

6. Controlled and uncontrolled bypass spillway into South Gorge for 1000 year return period flood (900 m^3/s) – five different arrangements.

7. Controlled bypass spillway into South Gorge for 75 – 150 m3/s

8. Controlled bypass spillway into South Gorge for 30 m3/s

9. Controlled bypass spillway into pool above Elsie Falls from Power Canal for 30 m3/s

10. Controlled bypass release through submerged valve system in new powerhouse for 30 m3/s

A brief description and benefit/issue summary for each arrangement is provided below.

1. Major Controlled or Uncontrolled South Gorge Spillway for 900 m^3/s
Gated and ungated arrangements have been considered. Both are considered technically feasible. The selected option was an ungated side-channel spillway on the basis of overall reliability and simplicity. All arrangements studied required raising the allowable headpond level to the top of the dam core during high flood events, and raising the existing South Valley Spillway and side channel inverts by approximately 2.3 m. Issues that would require further evaluation for such an option include the dam safety-related considerations (precedent and hazard assessment), issues associated with energy dissipation at the discharge point, the possibility of rock slope failure in the South Gorge, and the in-stream works requirements.

With respect to the side-channel spillway arrangement developed for evaluation, the following summary applies.

Benefits:
- No further unregulated flows into Trudel Creek

Issues:
- Requires raise of headpond levels during flood period by some 2.3 m to pass flow into spillway, approaching the top of the existing dam core.
- Requires raise of South Valley Spillway and side channel inverts by 2.3 m by rockfill and membrane, concrete, or other means

- Requires significant in-stream works, channel development work and possible alteration/rock support of South Gorge by blasting to accommodate flows downstream of the channel.
- Does not respond quickly to outages, thereby leaving stream sections dewatered during both minor and major outages.
- Does not assist in avoiding major ramping flows on the Taltson River d/s of Elsie Falls
- Results in higher tailwater levels at existing plant, reducing energy output.
- Will likely cause major erosion of left bank of Taltson River across from Elsie Falls during operations.
- Other operational risks (winter releases over ice affecting plant) or rockfall blockage
- Minimum release structure at SVS still required, but now more expensive.
- Adds significant cost and schedule duration to the project so as to make the project very much less economic.

2. <u>Controlled bypass spillway into South Gorge for 75 – 150 m3/s</u>

<u>Benefits:</u>

- Can make up full unit output flow and discharge at a logical point without major alterations required to South Gorge, and passage at current normal headpond operating level.
- Can be made synchronous or semi-synchronous with a unit outage, and assist to some degree with balancing ramping flows.
- Reduces unregulated discharges into Trudel Creek and assists with ramping on Trudel Creek and on the Taltson River below Elsie Falls

<u>Issues:</u>

- Fairly major instream works requirement to get flow into channel without raising headpond level.
- Cost and schedule duration impact remain substantial.
- Higher inflows and more major outages still routed through Trudel Creek.

3. <u>Controlled bypass spillway into South Gorge for 30 m^3/s</u>

<u>Benefits:</u>

- Can make up partial unit output flow and discharge at a logical point without alterations required to South Gorge.
- Can be made synchronous or semi-synchronous with a unit outage, and has a small positive impact on ramping flows on startup.
- Reduces unregulated discharges into Trudel Creek a modest amount

<u>Issues:</u>

- Some instream works requirement to get flow into channel without raising headpond level.
- Cost and schedule duration impact fairly minor – project can support this mitigation measure and associated economic impact.

4. **Controlled bypass spillway into pool above Elsie Falls from Power Canal for 30 m3/s**

Benefits:

- Can make up partial unit output flow and discharge fairly close to the existing plant to keep Elsie Falls from dewatering
- Can be made synchronous or semi-synchronous with a unit outage, and has a small positive impact on ramping flows on startup.
- Reduces unregulated discharges into Trudel Creek a modest amount
- Cost and schedule duration impact fairly minor – project can support this economic impact if the technical issues are resolved.

Issues:

- No instream works at the headpond, but energy dissipation of the flow entering the river above the falls may cause significant impacts.
- Only feasible if a rock channel exists to contain the flow – this has not been confirmed by comprehensive geotechnical investigation.

5. **Controlled bypass release through submerged valve system in new powerhouse for 30 m3/s**

Benefits:

- Can make up partial unit output flow and discharge at the new plant tailrace to maintain minimum flows in the Taltson River below the new tailrace.
- Can be made synchronous or semi-synchronous with a unit outage, and has a small positive impact on ramping flows on startup.
- Reduces unregulated discharges into Trudel Creek a modest amount
- Cost and schedule duration impact fairly minor – project can support this mitigation measure and economic impact if the technical issues are resolved.

Issues:

- Does not keep existing South Gorge and Elsie Falls watered up during any outage of the existing unit.
- Complicates powerhouse and penstock design, and bypass valve systems are not as fail-safe as spillways.

Key attributes are summarized in Table 1.

Table 1 - Spillway Attribute Summary Table

Concept	Trudel Creek Regulation Benefits	Reliability of Operations	Other Operating Risks (Dam safety, geotech, energy dissipation	Ramping Benefit	Overall mitigation of Downstream effects such as dewatering	Instream Works requirements and related effects	Cost	Overall Benefit/Cost
Major uncontrolled spillway into South Gorge	High	Very Good	Moderate to High	Slow on outage, None on startup	Poor	High	Very High	Low, due to very high cost
Intermediate size controlled spillway into South Gorge	Modest	Good	Low	Offsets one complete unit on outage and restart	Moderate	Moderate	High	Moderate
Small bypass spillway into South Gorge (30 m^3/s)	Low	Good	Low	Offsets partial unit on outage and startup	Good for river reach below dam	Low	Low	Highest, with reasonable benefit and reasonable cost
Bypass facility from Canal (30 m^3/s)	Low	Good	Low	Offsets partial unit on outage and startup	Low	Low	Low	Moderate – less benefits, but reasonable cost
Bypass facility from Powerhouse (30 m^3/s)	Low	Fair	Low	Offsets partial unit on outage and startup	High	None	Low	Low – least benefits, but reasonable cost

Based on the benefits and issues noted above, the 30 m^3/s gated bypass has been proposed in the DAR as a mitigative facility that is technically feasible, reliable, and can be accommodated in the project economics.

COMMITMENT # 48

Subject: Transmission Line Wind Noise

Request:
For Dezé to consider the point of the conductor line causing a whistling noise in windy conditions and the disturbance it may cause.

Response:
Aeolian noise is noise caused by the wind movements around structures, man-made or natural. The wind in trees is a type of aeolian noise. For transmission towers and lines, turbulence from the wind moving through the structures and the lines can generate aeolian noise that is audible on the ground. The amount of noise generated is dependent on the speed and direction of the wind, with the highest amount of noise generated in high wind speeds that are perpendicular to the wires. Generally this noise is not an issue as wind on the ground will also increase background noise levels. This type of noise would be expected to occur at levels similar to ambient, and generally in the vicinity of the right-of way.

Under specific wind conditions an Aeolian vibration or resonance can be induced in transmission wires, which is a more intense version of Aeolian noise. Some insulators can generate wind induced sound due to a dish shape to the insulator. This results in a sound like blowing over a bottle.

There is evidence in the scientific literature that transmission lines and right of ways can cause changes to wildlife behaviour and distribution, summarized in the DAR. Unfortunately, no information was identified regarding the effects of wind noise to wildlife. Further, it is difficult to speculate on the relative effect of the various mechanisms and sensory disturbance that may affect wildlife (such as visual disturbance, corona noise, wind noise, vegetation changes, smells, vibrations, etc.) and how wildlife responds to each.

COMMITMENT # 49

Subject: Ice on Nonacho Lake

Request:
For Dezé Energy to provide a detailed response on how changing levels in Nonacho Lake affect ice and snow on the lake and how that may affect caribou on the lake

Response:
Section 13.6 of the DAR specifically discusses the alteration of ice structure in the Taltson River Watershed (including both lake and river ice), resulting from changes to hydrology. To summarize, changes in flow patterns within the Taltson River are expected to have a limited effect on ice formation on larger lakes and very deep or slow river sections, where flow velocities would be low under baseline and post-development conditions. The main effects are expected to be seen on river sections and in Nonacho Lake, where there would be the largest change in water levels during the winter months as water is progressively discharged to supply the power generation plant. This drawdown of the Nonacho Lake over the winter months may cause the ice cover to further settle along the shoreline as the ice drops with the water. Currently, Nonacho Lake level normally falls by almost 0.3 m over a winter season, and ice thickness approaches 1 m by the end of the winter. The 36 MW expansion scenario would increase this drop to approximately 0.9 m by the end of winter, while the 56 MW expansion scenario would increase it to approximately 0.6 m.

Under the 36 MW scenario, Nonacho Lake levels would remain close to baseline conditions from October through to December. After this, the lake level would begin to drop from the baseline level. By April, the average expected lake level would be approximately 0.6 m lower than baseline, which represents the worst case drop in water level of the two expansion scenarios.

This drop in water levels over winter has the potential to create a rougher ice surface at the lake edges. The falling water levels in the reservoir also have the potential to create a hanging ice surface with air under the thermal ice cover. The bearing strength of the ice would be reduced in this situation as water would not be in direct contact with the ice in some areas. Considering that 2.5 cm of ice may support 450 kg (Treasury Board of Canada 1993) and that caribou would only be present in the Nonacho Lake area from approximately November through to May (Thomas et al. 1998), when ice thickness would be at least this much, bearing capacity of the ice would be sufficient for caribou.

With respect to caribou, there is some relevant information from the James Bay hydroelectric projects. In winter, the water level in Caniapiscau reservoir may vary by several metres. The drop in water level causes the ice to break up around the edge. It was observed that the caribou have no trouble reaching nearly all the reservoir banks (Doucet et al. 1992).

Considering that barren-ground caribou migrate over 1,000 km annually, and encounter many lakes, rivers, valleys, eskers, hills and cliffs during this migration, and in late winter are exposed to snow of over 1 m in depth, it seems unlikely that an ice ledge of up to 1 m in height along the shore of Nonacho Lake would present a noticeable impediment to their movements. The onset of freezing of Nonacho Lake is not anticipated to be affected by the Project, thus there is no linkage to snow depth or structure on Nonacho Lake.

References:

Doucet, G.J.,D. Messier, M. Julien and G. Hayeur. 1988. Compatibility between reservoir downstream flow regime and caribou ecology in northern Québec. In Proceedings of the Third North American Caribou Workshop, Wildlife Technical Bulletin No. 8, Alaska Department of Fish and Game. 173–184.

Thomas, D.C., H.P.L. Kiliaan and T.W.P. Trottier. 1998. Fire-caribou relationships: (III) Movement patterns of the Beverly herd in relation to burns and snow. Tech. Rep. Series No. 311. CWS, Edmonton, AB. 176pp.

Treasurey Board of Canada. 1993. Safety Guidelines for Operations over Ice. http://www.tbs-sct.gc.ca/pubs_pol/hrpubs/tbm_119/chap5_3-1-eng.asp

COMMITMENT # 50

Subject: Caribou

Request:
Dezé to provide an analysis of the probability of caribou from the Ahiak and the Beverley Herd encountering the project. How will this change over time considering the historic winter distribution of barren-ground caribou?

Response:
The DAR contains a summary of the number of collared caribou that have crossed the proposed Taltson transmission line alignment (Table 9.5.7 in the DAR). This data indicates that none of the eight collared Beverly caribou have crossed the transmission line (based on sporadic collar data from 1995 to 2007), while seven of the 16 collared Ahiak caribou crossed the transmission line. Table 1 provides a breakdown of the caribou number, date of crossing and duration of collar data for each of the seven Ahiak collared caribou that have crossed the proposed transmission line. Collars were in multiple sessions between March 2001 and March 2005, usually deployed between January and April. These data are not sufficient to generate a quantitative encounter probability, but they do indicate that the probability of encountering the project is low for Beverly, and moderate for Ahiak caribou. With regards to the Bathurst herd, encounter rates have been much higher (Table 9.5.7). The post-calving and summer dispersal season had the highest encounter rate, where 77% of the 74 collared caribou have crossed the proposed transmission line. The DAR concludes that most of the Bathurst herd would cross the transmission line annually, and the effects assessment is based on this conclusion (see Section 12.5.2.2 of the DAR)

Table 1 Movements of Ahiak caribou across the proposed transmission line.

Caribou number	Year of crossing	Date after crossing*	Season	Operating from	Operating to	Months in operation
132	2001	Apr-21	Winter	March 2001	August 2002	17
134	2001	Apr-21	Winter	March 2001	July 2001	4
139	2002	Mar-31	Winter	March 2002	October 2003	19
139	2002	Apr-05	Winter	"	"	"
139	2002	Apr-25	Winter	"	"	"
139	2002	Apr-30	Winter	"	"	"
143	2002	May-25	Spring	March 2002	September 2004	30
146	2002	May-10	Spring	March 2002	August 2002	5
146	2002	May-15	Spring	"	"	"
146	2002	May-20	Spring	"	"	"
148	2002	Mar-31	Winter	March 2002	December 2002	9
148	2002	Apr-05	Winter	"	"	"
174	2006	Dec-08	Winter	March 2005	December 2006	21
174	2006	Dec-09	Winter	"	"	"
174	2006	Dec-13	Winter	"	"	"
174	2006	Dec-18	Winter	"	"	"

* Collar location data is not collected daily; the date of the first location after the transmission line crossing is provided.

There is the added question of how caribou ranges may change over time, and how this may affect caribou interactions with the Project in the future. Thomas et al. (1995) conducted studies into the effects of forest fires on caribou winter range, from 1982 through 1988. Studies were initiated in part because of concerns raised by hunters from Fort Smith following forest fires northeast of Fort Smith in 1979. Nonacho and Thekulthili Lakes (both in the Taltson River basin) were included in the study area, considered by Thomas et al. (1995) to be in the core of the Beverly herd winter range. Pellet counts indicated regular use of these areas by caribou, and that use correlated with the forest age. Caribou were found to prefer stands aging 151 to 250 years, and little use was made of stands younger than 60 years, although some caribou activity was noted for stands aging 41 to 60 years.

More specific to the Taltson River, Thomas et al. (1998) have reported on winter aerial surveys conducted in this area between 1980 and 1987. A series of maps within this report show the winter distribution of caribou, as observed during aerial surveys. Although collars were not used in the study, large areas were surveyed, including much of the Taltson River basin. Thomas et al. (1998) documented that the extents of caribou distribution along the Taltson River only extended south of Nonacho Lake once between the winters of 1980-81 and 1986-87 (i.e., one winter in six). During the winter of 1985-86, caribou were observed approximately 50 km, or less, of Nonacho Lake, in the area of Taltson Lake. In all years between the winters of 1980-81 to 1986-87, the winter range of Beverly caribou were within the area assessed in the DAR with respect to the Taltson River (Chapter 12, Figure 12.1.1 in the DAR).

Thomas et al. (1998) summarizes Beverly caribou winter ranges from previous authors. According to these earlier studies, the winter range of the Beverly herd regularly extended south and west of the winter range area assessed in the DAR. In particular, extreme ranges from 1935-60 extended as far south and west as the Slave River and Wood Buffalo National Park, encompassing the entire Taltson Watershed (Kelsall 1968 and Banfield 1954, cited in Thomas et al. 1998).

Zalatan et al. (2006) used trampling scars on black spruce roots to create a long-term index of caribou abundance. Four of the study sites (named the Southeast sites) used were selected to represent the late summer range of the Beverly herd. These sites were approximately 100 to 150 km west of the eastern arm of Nonacho Lake. The index effectively extended back to approximately 1900. Scar frequency indicated abundance peaks in the Southeast sites in the 1940s, and low abundance in the 1910s and 1990s to 2000.

Reports documenting the winter range of the Ahiak herd from sources other than satellite collar data were not identified. The observations of Beverly caribou winter range documented above indicate that the areas were suitable habitat for barren-ground caribou in general.

Extrapolating from these three lines of evidence (i.e., aerial surveys, pellet counts and trampling scars), it can be concluded that the winter range of central Canadian barren-ground caribou was once larger than suggested by the satellite collar data collected from 1996 to 2007. This range contraction in the Taltson River basin is likely a result of extensive forest fires in 1979. Based on the findings of Thomas et al. (1995), caribou may return to these areas in the next 10 to 30 years, although it may not become a preferred area for another 120 years.

References

Thomas, D.C., S.J. Barry and G. Alaie. 1995. Fire-caribou-winter range relationships in northern Canada. Rangifer 16 (2) 57–67.

Thomas, D.C., H.P.L. Kiliaan and T.W.P. Trottier. 1998. Fire-caribou relationships: (III) Movement patterns of the Beverly herd in relation to burns and snow. Tech. Rep. Series No. 311. CWS, Edmonton, AB. 176pp.

Zalatan, R., A. Gunn and G.H.R. Henry. 2006. Long-term abundance patterns of barren- ground caribou using trampling scars on roots of Picea mariana in the Northwest Territories, Canada. Arctic, Antarctic and Alpine Research, 38, 624-630.

COMMITMENT 51, 52, 53, & 62

Subject: Access

Request:
Commitment 51
Dezé Energy to provide more details on the success of mitigation using gates to control access from elsewhere.

Commitment 52
Dezé Energy to provide any more information on the probability that access mitigation will control snowmobile as well as truck access.

Commitment 53
Dezé Energy provide additional information on gate access restrictions success and a document that identifies all the mitigation measures that Dezé has proposed, that Dezé clearly articulates all access and mitigation in succession from Fort Smith to Twin Gorges, the success of the proposed mitigation, and proposed monitoring of access. In addition to monitoring, to provide management alternatives to different scenarios that the monitoring indicates.

Commitment 62
Dezé Energy to include the temporary construction access trails in the re-evaluation of a new road from Twin Gorges northward.

Response:
To provide a single comprehensive reply, the response to Commitments 51, 52, 53 and 62 have been consolidated into the singe response, below.

Description of New and Existing Access in the Southern Sector
New access for the Taltson Project in the Southern Sector (i.e., originating from Fort Smith, Figure 1), will require:

- re-opening the existing winter road between Fort Smith and Twin Gorges;
- the construction of a new winter haul road from Twin Gorges to Nonacho Lake (providing access to the seven proposed staging camps); and,
- temporary access trails from the staging camps to the transmission line right of way, and along the right of way.

Figure 1 provides a map of the proposed access and construction methods. The temporary access trails will be the primary means of installing the transmission towers and conductor cable. Sections of the right of way surrounding the Indian Shack staging camp would not have access trails, due to difficult topography in that area. In this area, construction will be entirely by helicopter (see Figure 1). Winter roads will be used for the three year construction period, following which they will be closed and blocked. Further details on the proposed winter roads are provided in Sections 6.5.2.2, 6.5.2.3 and 15.5.1.1 of the DAR.

As these winter roads originate on the far shore of the Slave River from Fort Smith, access is predicated on the Slave River being frozen. The Slave River is typically frozen and navigable by snow machine between mid-November and mid-April (W. Starling, personal communication). Access in the summer months would be difficult, and would likely require transporting an ATV across the Slave River by boat. As the old winter road alignment from Fort Smith to Twin Gorges is currently accessible in winter by snowmobile, the Project would only augment snowmobile access for the regions beyond Twin Gorges, approximately 60 km drive from Fort Smith. Currently, very few hunters from Fort Smith travel as far as Nonacho Lake to hunt caribou (less than 5%, K. Mercredi, personal communication), and caribou are present at Nonacho Lake once every four to five years (T. Lockhart, personal communication).

Proposed Access Mitigation

Currently, plans to limit access to the Project focus on winter access, by truck and snow machine. As indicated above, access to the Southern Sector winter roads in the summer is difficult. With regards to ATV travel, the existing trail to Twin Gorges may be slightly improved by the re-opening of the winter road, but access beyond Twin Gorges is beyond the range of ATV travel. Mitigation to limit use of the winter road are as follows:

- The winter road from Fort Smith to Nonacho Lake would be closed with locked gates in two locations (Slave River and Twin Gorges), and only Project vehicles would be permitted to use the road.
- Fencing will extend from the gates into the adjacent forest/shrub to inhibit detouring around the gate.
- The gate would be closed and locked at the end of each hauling season.
- At the end of the final winter road season (i.e., February or March 2013), the start of the Fort Smith to Twin Gorges winter road would be permanently blocked with a combination of slash windrows (i.e., piled trees and other vegetation cleared for construction), by falling trees across the road, or blocking the road with boulders.
- Environmental monitors will record public use of the roads, and evidence of land use, such as hunting, fishing, camping or firewood harvesting.

Efficacy of Access Mitigation

Very little empirical data exists on the effectiveness of mitigation. The most applicable information identified were reviews based on interviews. A summary of the findings of these reviews relevant to winter roads follows.

A review of physical access control measures in use in British Columbia and surrounding jurisdictions was completed by Axys (1995) as a component of the Access Management Initiative in northeastern British Columbia. This review included determining the types of physical access control measures in use, the relative frequency of their use and their relative effectiveness. Data was primarily collected through the use of interviews with government and personnel from the petroleum industry. It was noted that almost all respondents qualified their rankings of effectiveness by stating that access control measures are most effective when properly placed to eliminate the possibility of people detouring around the access control point and when people respect the intent of the access control (Axys 1995).

Golder (2005) conducted telephone interviews to obtain expert opinion on the use and effectiveness with mitigation measures applied within caribou ranges. Interviewees included representatives from the oil and gas industry, forest industry, provincial government land managers (i.e., Alberta Sustainable Resource Development, Land and Forest Division; British Columbia Ministry of Water, Land and Air Protection; Saskatchewan Environment), the National Energy Board (NEB), the Caribou Range Restoration Project, academia, and consultants involved in caribou mitigation practices. All information obtained was considered representative (i.e., industry, academic and government) and was pooled across representatives.

Within the access control measures review, manned gates were ranked as providing negligible to high effectiveness at preventing access, with a moderate mean rank by Axys (1995). Respondents indicated that the presence of an attendant at the gate is a particularly effective deterrent to those individuals who may wish to use the road for illegal (e.g., poaching) or mischievous (e.g., vandalism) purposes, as vehicle and personal descriptions can be registered by the attendant (Axys 1995). Manned gates were considered overall to provide high effectiveness by Golder (2005). A total of 79% of oil and gas respondents indicating they use manned gates, although one respondent indicated that manned gates can be a liability issue if people become trapped inside the gate (Golder 2005).

Unmanned gates were similarly ranked as providing moderately effective access control by Axys (1995). The strategic location of a gate (i.e., placed in conjunction with natural features which prevent trails from developing around the actual gate structure), and the importance of ensuring that fencing extend sufficiently into the adjacent tree/shrub cover to increase difficulty in detouring around the gate were considerations stressed by respondents when using gates (Axys 1995). In the more recent survey (Golder 2005), unmanned gates were rated by respondents as providing a low to moderate effectiveness at reducing access. Respondents identified that unmanned gates can be compromised, are only effective if they are locked and access beside the gate is restricted (e.g., using felled trees), and need to be kept up to ensure no access points around the gate have been created. As a result, several respondents indicated that they avoid the use of unmanned gates (Golder 2005), although one respondent did indicate that unmanned gates can be extremely effective at creek crossings.

Legislation/policy had a mean ranking of moderate effectiveness from respondents in the Axys (1995) report and were identified as being poorly utilized as an access management tool and the majority of respondents gave legislated/policy an effectiveness rating of low in the Golder (2005) report as well. Issues identified with the legislation/policy measure included insufficient enforcement power to ensure that any existing legislation was followed and that the existing legislation was not powerful enough to limit access, particularly for off-road vehicles (i.e., ATVs and snowmobiles). Respondents indicated that the “traditional access” policy which exists in Alberta, and similar policies exist in the Yukon, the NWT and BC, is a huge barrier to access control and that it is difficult to police recreational users. One respondent identified that legislation or policy on access control needs to be used more frequently, but that it must be strengthened and better defined when it is used.

Slash windrows (i.e., piles of trees and other vegetation remaining from construction) of sufficient lengths (e.g., 400 m or greater) and tree size, placed at intervals every several hundred meters were documented to provide an effective obstacle to vehicles (Axys 1995). Rollback was reported to provide ‘low-moderate’ to ‘very high’ effectiveness for controlling access and scored the highest mean rank for effectiveness during the Axys (1995) review. Examples of effective rollback techniques included ensuring the rollback is dense, consisting of all stripping, stumps, slash and large lumps of debris. However there were, several potential land management problems when implementing rollback including: having timber salvaging requirements waived by local Forestry authorities to ensure sufficient quantities of large material for rollback; concern over potential for increased fire hazard as a result of rollback; the need for increased workspace to store slash; the potential for rollback to inhibit revegetation particularly when applied in a quantity to reduce access; breakdown of rollback over time; rollback precludes ground-based monitoring work by operators; rollback may not be effective at deterring snowmobiles if completely covered by snowpack; and in some northern regions with only small diameter tree growth, there may not be adequate slash supplies for effective rollback. Respondents also indicated that rollback decomposes over time, and that in areas of high traffic people can find ways to traverse the rollback down so that it is no longer a deterrent (Golder 2005). Monitoring of rollback is recommended to ensure high effectiveness is maintained.

Other access control measures identified within Axys (1995) included signage, custodians or patrols, access management plans, and public education. Respondents identified signs as providing negligible access control but they were considered more effective when used in association with other access control methods, such as gates, to provide the public with information on the importance of access closure. No effectiveness ratings were provided for field patrols, access management plans, public education or natural washouts.

Golder 2005 indicated that line blocking (i.e., blocking the road by tree felling) can provide moderate to high effectiveness at blocking access. Although line blocking is a relatively new procedure, it was deemed to be extremely effective for blocking human access. Effectiveness was considered to be increased if the setback distances are longer to account for elevation changes (i.e., so that roads are not conspicuous from the nearest access point), and if habitat around the line blocking has large enough trees to prevent easy access around the line blocking. The only negative association with line blocking is that there may be issues with blocking traditional access routes. Consultation with area trappers and local users is therefore recommended.

Similar concerns were raised during two environmental assessments in the Yukon, where new winter roads were proposed that could create new access to caribou (YESAB 2009). In both examples, the following mitigation was recommended (YESAB 2009):

- Proponent shall erect an appropriate locked gate, and only authorized employees will be able to open the gates.
- Proponent shall erect appropriate barriers to deter circumventing of the gate.
- Proponent shall conduct periodic monitoring and maintenance of access control structures (i.e., the locked gate and associated barriers) to ensure integrity of these structures for the duration of the winter road.
- When the winter roads are decommissioned the proponent shall ensure that this is done in a manner that prevents access and use of the road right-of-way by unauthorized persons.

Proposed Monitoring

To monitor the efficacy of access mitigation, and access that does occur, Dezé has proposed to hire environmental monitors during the Project construction phase, preferably from surrounding communities. The primary role of these environmental monitors will be to track issues as they arise, and to suggest subsequent adaptive management. To test the effectiveness of the proposed mitigation, unauthorized use of the proposed winter roads from Fort Smith to Twin Gorges and from Twin Gorges to Nonacho Lake would be documented by the environmental monitors. Further, any evidence of wildlife harvesting, ice fishing, recreational snowmobiling, firewood harvesting, camping, or any other such activities would be recorded. Similar monitoring is conducted by ENR on the Tibbitt to Contwoyto winter road (see Ziemann 2007). Should the proposed mitigation practices or structures prove insufficient, improvements and/or new mitigation will be implemented.

References:

Axys Environmental Consulting Ltd. 1995. A compendium of physical access control measures for roads and other rights-of-way. Prepared for the Access Management Initiative in Northeastern B.C. by Axys Environmental Consulting Ltd. Calgary and Vancouver. 26 pp. + appendices.

Golder Associates Ltd. 2005. Audit of Oil and Gas Mitigation Measures Employed Within Woodland Caribou Ranges. Prepared for Canadian Association of Petroleum Producers by Golder Associates Ltd. Edmonton, Alberta.

YESAB (Yukon Environmental and Socio-Economic Assessment Board). 2009. Decision reports for project numbers 2006-0237 and 2007-0219. Access from the YESAB public registry, www.yesab.tzo.com/wfm/launch/YESAB. Accessed 2 October, 2009.

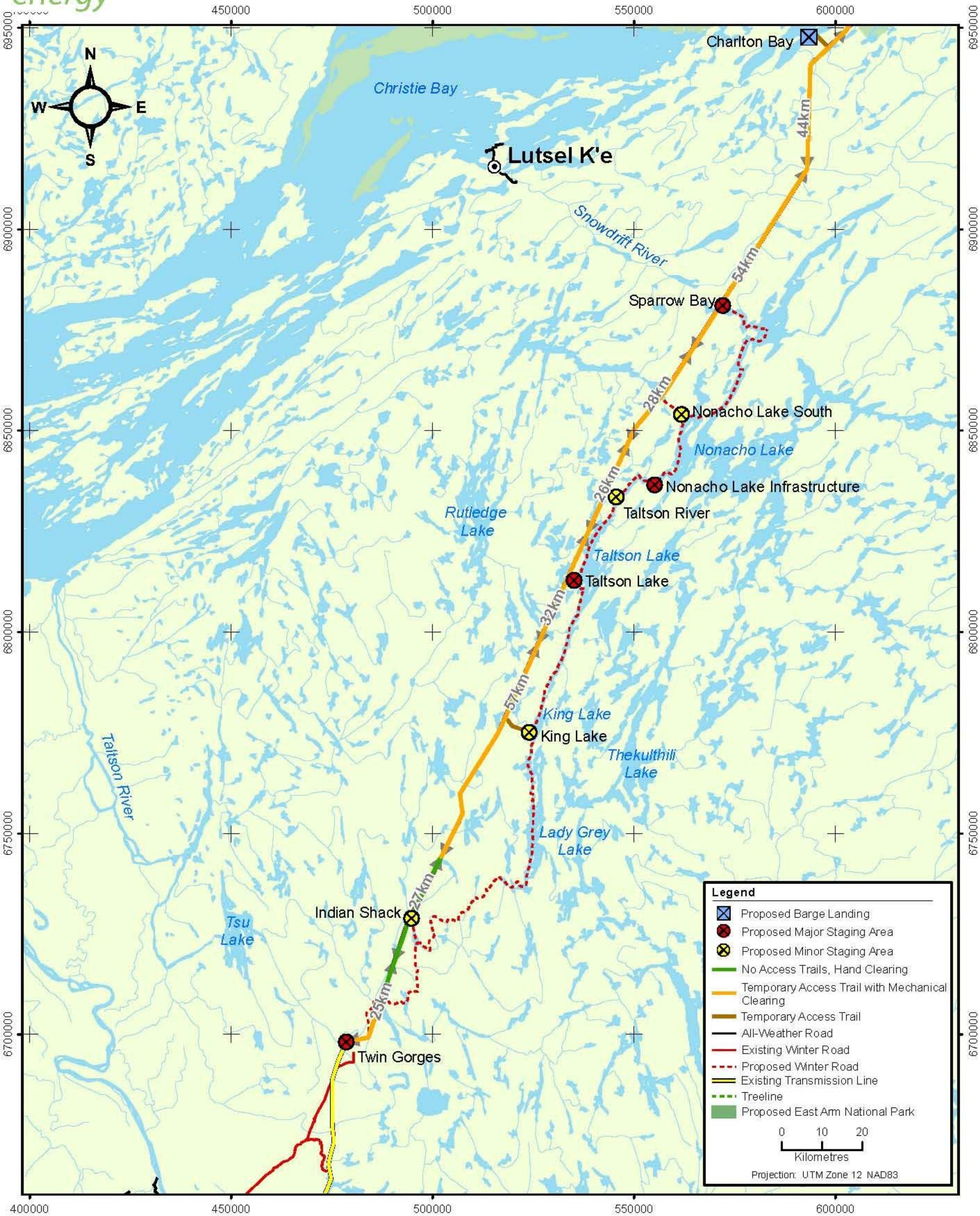
Ziemann J., 2007. Tibbitt Lake to Contwoyto Winter Road Monitoring Station Report. ENR, Government of the Northwest Territories. Manuscript No. 173.

Personal Communications

Lockhart, Tom. Renewable Resource Officer, ENR, GNWT. Telephone communication, 15 June 2009.

Mercredi, Ken. Renewable Resource Officer, ENR, GNWT. Telephone communication, 25 June 2009.

Starling, Wayne. Water Resources Officer, INAC. Telephone communication, 30 June 2009.



TALTSON Hydroelectric Expansion Project	**Developer's Assessment Report November 2008**	**Transmission Line Construction Methods Southern Section**	**Figure** 1

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COMMITMENT # 54

Subject: Caribou

Request:
Dezé to provide more information justifying the use of a boreal caribou information in relation to predator avoidance compared to how barren-ground caribou, their strategies to avoid predation and how that relates to your buffering of areas.

Response:
The structure of the existing forest was first considered within the assessment when predicting changes in barren-ground caribou predation rate as a result of the Project. Specifically, the temporary access trails, transmission line right-of-way (ROW), and Twin Gorges to Nonacho Lake winter road were identified as Project infrastructure which may improve the mobility of wolves during the winter in the boreal regions. This was based on the assumption that wolves are able to travel more quickly within an open ROW where there is less vegetation. As the majority of the Project footprint lies over water, exposed rock, and open forest, it was predicted that, given the existing forest structure, the Project ROW may not lead to the removal of enough vegetation to cause a notable change in wolf behaviour. Only 28% of the Project footprint within the current Bathurst range is within forest habitats, and only 4% is within closed forest habitats. This indicates that there are currently few natural impediments to wolf travel within the Project study areas.

Table 12.3.10 and Table 12.3.11 of the DAR present the zones of influence and disturbance coefficients which were used within the modeling to predict barren-ground caribou changes in habitat use (avoidance) around roads and transmission lines (open ROWs). These Zone of Influences (ZOI) and Disturbance Coefficients (DC) were used within the winter habitat selection model and were derived from studies conducted on woodland caribou inhabiting forested habitats during the winter (Dyer 1999). Dezé Energy concurs that the relevance of these studies is questionable, considering the slightly different predator avoidance strategies (e.g., barren-ground caribou often retreat to open areas (such as lakes) between feeding, likely to make it more difficult for predators to approach undetected) and different habitat (homogenous conifer forests) of woodland caribou as compared to barren-ground caribou. However, for the purposes of the DAR, the best available quantitative data on caribou was gathered to determine the effect (ZOI and DC) of open ROWs on predation risk within forested habitats.

As outlined above, the Taltson Project roads and ROW may not provide noticeable advantages to wolves. As such, it is possible that the zone of influence assigned to the Taltson Project road and transmission line over-estimate the effects on predation risk to barren-ground caribou. Regardless, this fit with the general approach used in the DAR when such uncertainties were identified, to proceed with a worst-case-scenario.

References:
Dyer, S. J. (1999). Movement and Distribution of Woodland Caribou (Rangifer tarandus caribou) in Response to Industrial Development in Northeastern Alberta. Master of Science Thesis, University of Alberta

COMMITMENT # 55

Subject: Extreme Events to Caribou

Request:
Dezé provide a probability effects analysis that best addresses Anne Gunn's request, and also identify how the project works to ensure there's a clear understanding of how the project is operated in order to understand where the effects would arise from. And in terms of any other worst-case scenario possibilities regarding caribou, including the probabilities.

Response:
What is the risk to caribou from a ramping event, assuming that climate change will lead to greater precipitation, that barren-ground caribou populations recover and expand their range to include Trudel Creek?

Ramping is an increase or decrease in flows in Trudel Creek and the Taltson River downstream of Twin Gorges following a shutdown or restart of one or more of the turbines at Twin Gorges. This may occur as a result of scheduled maintenance, or from a malfunction leading to an unscheduled closure. Scheduled shutdowns will be managed to minimize flow changes in Trudel Creek and the Taltson River. A worst-case scenario would be the shutdown of all turbines during peak flows, the implications of which are discussed in Section 17.4. The frequency of unscheduled shutdowns was conservatively estimated at once every five years, for the purposes of the effects assessment.

There are a number of reasons why an unscheduled ramping event is unlikely to affect caribou, which are listed below.

- The effects of full flow increases are only realized within Trudel Creek, a stretch of river approximately 30 km in length, a relatively small area on the landscape.
- Neither Trudel Creek nor the Taltson River downstream of Taltson Lake is currently within the range of barren-ground caribou due to extensive forest fires. Based on research outlined in Commitment 50, caribou may begin to return to the area within 10 to 30 years, although it is unlikely to be a preferred area for another 120 years (i.e., 150 years after a fire).
- Historically, the area was part of the barren-ground caribou winter range, indicating that caribou would only be present from approximately November through to May, when flow levels are at their lowest.
- Surveys of the Beverly caribou herd between 1982 and 1987, and a review of historical limits of the Beverly herd dating back to 1850 (Thomas et al. 1998) indicated that Twin Gorges, Trudel Creek and the Lower Taltson are on the outer limits of the Beverly range, and that their presence in these areas has been irregular.
- The hydrological history of the Taltson River basin suggests that flows are driven by freshet, not by precipitation. The large and numerous lakes in the system have the effect of buffering the effects of storms and precipitation.
- A worst-case ramping scenario would lead to a 2.7 m increase in water levels in Trudel Creek. Because of the storage capacity of the Twin Gorges Forebay, and the distance between Twin Gorges and the South Valley Spillway, ramping would not lead to a sudden rise in water levels in Trudel Creek. Rather, Trudel Creek would increase gradually over approximately eight hours. Return to pre-

ramping flows would be more gradual, as turbines would be re-started in sequence.

- If ramping occurred in winter, water levels could potentially shift ice cover and cause blockages in narrows or lake zones, although this potential exists under current conditions as well.

Section 17.4.8 assessed the effect of ramping to moose. The pathway was considered to be invalid, because moose have the option of moving the few metres to safety if there is a change in water levels. The risks faced by caribou and moose are slightly different, and may be higher for caribou. While moose are present in the Trudel Creek area throughout the year, and often graze on riparian vegetation, caribou travel in groups and are forced to cross rivers to complete their migration. Further, there are documented cases of caribou drowning while crossing rivers (Kendrick et al. 2005, Thorpe et al. 2001, Berkes 1988).

Although the Limestone Falls event provides a warning for hydroelectric development in migratory caribou ranges, an event of that scale would be exceedingly unlikely to occur, for several reasons. First, the Taltson Project has a relatively small reservoir (Nonacho Lake), located approximately 200 km upstream of Twin Gorges, and between Nonacho Lake and Twin Gorges, the Taltson River is fed by many uncontrolled sources, most notably the Tazan River. Ramping events can only occur as a result of outages at the powerhouse (Twin Gorges); ramping cannot occur at Nonacho Lake. As such, management of the Nonacho Lake reservoir has a limited effect on the hydrology of the Taltson River as a whole. Further, Trudel Creek, where water level changes of the greatest magnitude are realized, is on the outer limits of barren-ground caribou distribution (not on an important migration route, as was the Caniapiscau River). To access the Taltson River and Trudel Creek, barren-ground caribou would intercept other large rivers such as the Coppermine, Lockhart Snowdrift and Thelon rivers, where they also face a risk of drowning. Thus, the pathway to caribou drowning from normal operations, scheduled or unscheduled ramping events is a minor pathway.

In a discussion of the environmental and social and environmental effects realized from the James Bay hydroelectric developments, Berkes (1988) points out the difficulty in predicting impacts in a dynamic system. Berkes argues that predicting such events would have been unlikely even with an improved and more holistic understanding of the environment, but that a sound monitoring program will assist in detecting and responding to unexpected events.

References:

Berkes, F. 1988. The intrinsic difficulty of predicting impacts: Lessons from the James Bay Hydro Project. Environmental Impact Assessment Review. 8, 201-220.

Kendrick, A., Lyver, P. O. & LKDFN (Łutsel K'e Dene First Nation). (2005). Denésoliné (Chipewyan) knowledge of barren-ground caribou (Rangifer tarandus groenlandicus) Movements. Arctic, 58, 175-191.

Thomas, D.C., H.P.L. Kiliaan and T.W.P. Trottier. 1998. Fire-caribou relationships: (III) Movement patterns of the Beverly herd in relation to burns and snow. Tech. Rep. Series No. 311. CWS, Edmonton, AB. 176pp.

Thorpe, N., N. Hakongak, S. Eyegetok and the Kitikmeot Elders. 2001. Thunder on the Tundra. Inuit Qaujimajatuqangit of the Bathurst Caribou. Published by the Tuktu and Nogak Project.

COMMITMENT # 56

Subject: Extreme Events Caribou

Request:
Dezé Energy commit to getting probability numbers of an event such as the Quebec ice storm and that probability cross-referenced with the timing of caribou migration.

Response:
Dezé was requested to assess the probability of an icing event downing the transmission line and the impact such an event would have on caribou. How does Dezé propose to limit the probability of line failure and minimize impacts to caribou if line failure occurs?

Determining the probability of icing and wind event that would lead to transmission line failure is extremely difficult, but considered to be very low. The US Army Corps of Engineers (Jones 2003) estimated that ice thicknesses recorded in the 1998 St. Lawrence Valley storms has a return period of 250 years, while a storm of that magnitude has a 2,200 year return period.

Structurally, the proposed transmission towers would not be susceptible to icing, as they will not use ground wires, and the conductor lines create sufficient heat that there is limited ice build-up. Further, recent Canadian Standards Association (CSA) Design Criteria for Overhead Transmission Lines do incorporate lessons learned from the 1998 ice storms (CSA 2006). The Project would be bound by these standards.

Sections of the transmission line within the vicinity of the East Arm of Great Slave Lake would seem to have the highest probability of experiencing icing events. Icing events are most likely to occur in the fall as temperatures drop to and below $0^{o}C$ but the lake remains ice free. This area is within the rutting and winter range (ranging from early September to late April), but caribou presence in this area is irregular (Kendrick et al. 2005).

Should the transmission line collapse, the likelihood of caribou entanglement with the conductor wire is very low. The conductor lines are approximately 26 mm in diameter, weigh over 1.3 kilograms per metre, and are under tension, making them very difficult to lift or loop. In such an event, the electrical current would be shut down, removing any electrical hazards.

If line failure occurs, there would be a rapid response to repair the transmission line and restore electrical flow, as Dezé is liable for costs incurred by its clients due to interruptions in power from the Taltson Project.

Should the transmission line collapse due to environmental conditions, the greatest impact to caribou would likely be from the same environmental conditions, possibly leading to reduced access to forage, either through ice over the ground or through fallen trees.

References:

CSA (Canadian Standards Association). 2006. Design Criteria for Overhead Transmission Lines. CAN/CSA-C22.3 No. 60826.

Jones, K. 2003. Ice Storms in the St. Lawrence Valley Region. US Army Corps of Engineers Technical Report ERDC/CRREL TR-03-1. Available at http://www.crrel.usace.army.mil/library/technicalreports/TR03-1.pdf

Kendrick, A., P. Lyver, and Łutsel K'e Dene First Nation. 2005. Denesoline (Chipewyan) Knowledge of Barren-Ground Caribou Movements. Arctic 58(2):175-191.

COMMITMENT # 57

Subject: Pathways for Caribou

Request:
Dezé to re-look at the category of invalid pathways and to see if those ones which are in that category because they're actual effects, even if minor, that depends on mitigation, that they consider putting those into the minor effects pathway; specifically timing of freeze-up and breakup

Response:
The DAR considered the pathway of 'Changes in the Timing of Freezing and Break-up Leading to Injury or Mortality to Individual Animals and Altered Movement and Behaviour (Section 12.2.2.1 of the DAR) to be invalid, because the frequency of either injury or mortality of individual animals, as well as altered movement and behaviour from changes in the freezing and break-up, are anticipated to be within the range of natural variation. The definition of an invalid pathway is one that does not exist, is removed by mitigation, or results in no detectable change, and pathway validity is assessed at the population level.

Considering that changes to ice are anticipated to be within the range of natural variability, and that the associated effects to caribou are anticipated to be within the range of natural variability, and that caribou are only present in the Taltson River area during winter (i.e., they are not present when the freeze-up and break-up occurs) the classification of the pathway as invalid to the population is appropriate.

The validity of this pathway does not depend on mitigation, as minimizing changes to hydrology is not mitigation, but a design parameter included in the Taltson Project since conception of the Project.

The other invalid pathway for caribou, Hazardous Substance Spills May Affect Caribou Health, should also remain invalid, based on the proposed mitigation and experience from other developments within the Bathurst caribou range.

COMMITMENT # 58

Subject: Caribou

Request:
Original Request
Dezé Energy to provide more information on the assumptions underpinning your choice of the population model, i.e., brief account of its strengths and weaknesses relative to the scale of variation in the demographic parameters as they relate to phases of increase and decrease and low numbers in a caribou herd.

Response:
Dezé has been asked to provide further information on the rationale for selection of the demographic parameters and temporal change in those parameters that were applied in the Population Viability Analysis (PVA).

The intent of the PVA for Bathurst caribou was to utilize the best information available to produce population simulations of the current declining phase of the herd. Population simulations (trajectories) included effects from changes in habitat from the Project, harvesting, extreme weather events, and natural variation in survival and reproduction (fecundity). The PVA was then used to compare the relative differences among population trajectories, and predict the effects from the Project on the Bathurst herd (Brook et al. 2002). Weaknesses in the model are primarily associated with small sample size (i.e., the small number of collared caribou relative to the total population), and uncertainty regarding the mortality agents driving survival rates (i.e., caribou may die from factors such as wolf harvest, human harvest, disease, drowning or old age, but the relative contribution of each is unknown). These are limitations commonly associated with all population models. A review of the rationale used for the selection of demographic parameters is provided below, for both the demographic and temporal parameters.

Demographic Parameters: Given that demographic rates for the Bathurst caribou herd are available only for adults, we used data from the Porcupine herd (see Boulanger and Gunn 2007). Calf survival rate estimates of 0.56 and 0.71, and a yearling survival rate estimate of 0.93 were used in simulations. Survival rates for female caribou, excluding hunting mortality were estimated by Boulanger and Gunn (2007) to vary between 0.63 and 0.95 (Table 1). Fecundity was predicted by the same authors to vary between 0.79 and 0.90, which would equate to an approximate production rate for female calves of 0.40 and 0.45, assuming an equal sex ratio for calves at birth (Boulanger and Gunn 2007). These values represent the range of parameters used in the Taltson PVA simulations.

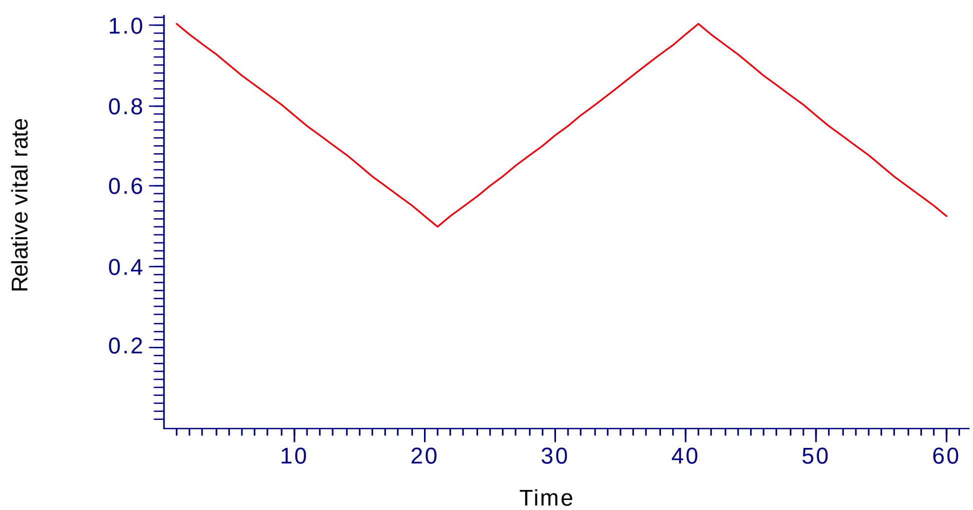
Table 1. Survival Rates for Female Bathurst Caribou (Boulanger and Gunn 2007).

Year	Survival Rate (hunting mortalities included)	Survival Rate (hunting mortalities excluded)
1996	0.79	0.79
1997	0.75	0.75
1998	0.60	0.64
1999	0.81	0.81
2000	0.85	0.85
2001	0.58	0.63

Year	Survival Rate (hunting mortalities included)	Survival Rate (hunting mortalities excluded)
2002	0.76	0.76
2003	0.69	0.78
2004	0.77	0.85
2005	0.73	0.73
2006	0.89	0.95
geometric mean	*0.74*	*0.77*

Temporal Parameters: The PVA explicitly accounted for temporal changes in fecundity and survival (DAR Section 12.3.4.1.1.1). Bathurst caribou are known to follow a roughly 40 to 60 year cycle in population size (ENR 2009, Zalatan et al. 2006). For the PVA, initial survival rates were set as the maximum reported by Boulanger and Gunn (2007), and assumed to represent the maximum survival rates in the 60 year cycle. Maximum fecundity was set as 0.42, which is between the low and high values reported by Boulanger and Gunn (2007). Change in survival and fecundity rates over time were incorporated into population simulations by linearly decreasing vital rates such that they decreased to 50% of maximum values every 20 and 60 years of the simulation (Figure 1; DAR Figure 12.3.3).

Figure 1 Temporal Trend (years) in the Relative Rate of Calf Survival and Fecundity for Female Bathurst Caribou



The simulation more closely represents natural cycles by altering the fecundity and survival rates of caribou over time. This approach was conservative in that over the 60-year simulation period, average demographic rates were considerably less than those reported in the literature. For example, the average fecundity rate for production of female calves used in the PVA was 0.32 (Table 2), which is lower than the low estimate of fecundity (0.40) used by Boulanger and Gunn (2007). The average survival rate for calves used in the PVA was 0.53, which was also lower than the minimum estimate of 0.56 used by Boulanger and Gunn (2007). For yearling survival, no range was reported in the literature, and so the value available for the Porcupine herd (0.93) was used as the maximum rate, which resulted in an average rate of 0.70 used in the PVA. A wide range of values were reported for adult survival (Table1). From the unharvested population, an average adult survival rate of 0.77 was calculated. However, an average of 0.71 was used in the

PVA, with rates ranging from 0.48 at the low end of the cycle to 0.95 at the peak of the cycle. Harvest rate was represented separately in the PVA as a 4% annual harvest. This is greater than the rate of about 3% suggested by the empirical data (Boulanger and Gunn 2007).

Table 2. The Range of Vital Rates Used in the PVA

Vital Rate	Cyclical Minimum	Cyclical Maximum	Average
fecundity (female calves)	0.21	0.42	0.32
calf survival	0.36	0.71	0.53
yearling survival	0.47	0.93	0.70
adult survival	0.48	0.95	0.71

Uncertainty is always present in estimates of survival and fecundity rates. Due to this uncertainty, the general consensus among population ecologists is that relative results of PVA, either from sensitivity analyses or comparisons among landscape scenarios, are more reliable for assessing effects than absolute estimates of abundance at particular points in time (McCarthy et al. 2003; Schtickzelle et al. 2005). Uncertainty in demographic rates was explicitly explored in sensitivity analyses, where vital rates within the PVA were decreased by an additional 5 to 10% (DAR Section 12.3.4.1.1.4). The result of sensitivity and effects analysis was that the estimated effects from the Project on caribou were very small, and less than the stochasticity implicit in the structure of the PVA.

References:

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Schtickzelle, N., M. F. Wallis De Vries, and M. Baguette. 2005. Using Surrogate Data in Population Viability Analysis: The Case of the Critically Endangered Cranberry Fritillary Bitterfly. Oikos 109: 89-100.

Zalatan, R., A. Gunn, and G. H. R. Henry. 2006. Long-term Abundance Patterns of Barren-ground Caribou Using Trampling Scars on Roots of Picea mariana in the Northwest Territories, Canada. Arctic, Antarctic & Alpine Research 38(4): 624-630.

COMMITMENT # 59

Subject: Caribou

Request:
Dezé to spell out the assumptions that they included that relate to the environmental trends.

Response:
Dezé was asked to explain how climate change was incorporated into the cumulative effects assessment for barren-ground caribou.

The potential effects of climate change were not included in the cumulative effects assessment for barren-ground caribou. The current state of knowledge regarding the effects of climate change on barren-ground caribou is insufficient to consider such influences in cumulative effects analyses. Aspects of climate change may hinder or help caribou populations, but the final direction and strength of the net effect is unknown. Possible effects through changes in snowfall and temperatures and related mechanisms are briefly explored below.

Climate change may increase snowfall in winter, which would increase mobility costs, reduce access to forage, and may increase vulnerability to wolf predation (Brotton and Wall 1997). However, snow may not fall until November in some areas, which could greatly facilitate migration to winter ranges and result in greater fat stores for animals facing winter (Brotton and Wall 1997).

Climate change may increase temperatures, as well as variability in temperatures in late winter. Such changes could result in early melting of snow, which could re-freeze and make the underlying vegetation inaccessible (Brotton and Wall 1997, Thorpe et al. 2001, Tews et al. 2007). Winters with extended periods of both ice coating the ground and heavy snow cover have been associated with die-offs of Peary caribou (Tews et al. 2007).

The predicted warming temperatures and increasing precipitation have been predicted to increase forage biomass production, which may result in a net benefit (Tews et al. 2007). Indeed, increased vegetation productivity on the tundra has already been observed (Thorpe et al. 2001). Intuitively, an earlier spring should benefit caribou as an earlier spring may result in the availability of high quality forage being available sooner after the winter.

However, an earlier spring may mean that the high quality forage of the initial spring flush is not available for the energetically demanding time of calving, which could lower fecundity rates. Further, the benefits of increased vegetation productivity may not be realized if there is a gradual succession on the tundra from lichen-dominated communities to vascular plants (Olthof et al. 2008).

It is likely that climate change will affect barren-ground caribou. However, the high level of uncertainty currently present in climate change outcome predictions makes it very difficult to construct a meaningful cumulative effect assessment with climate change components.

References:

Brotton, J., G. Wall. 1997. Climate change and the Bathurst caribou herd in the Northwest Territories, Canada. Climatic Change 35: 35-52.

Olthof, I., D. Pouliot, R. Latifovic and W. Chen. 2008. Recent (1986-2006) vegetation-specific NDVI trends in northern Canada from satellite data. Arctic 61(4): 381-394.

Tews, J., M.A.D. Ferguson, L. Fahrig. 2007. Potential net effects of climate change on High Arctic Peary caribou: Lessons from a spatially explicit simulation model. Ecological Modelling 207: 85-98.

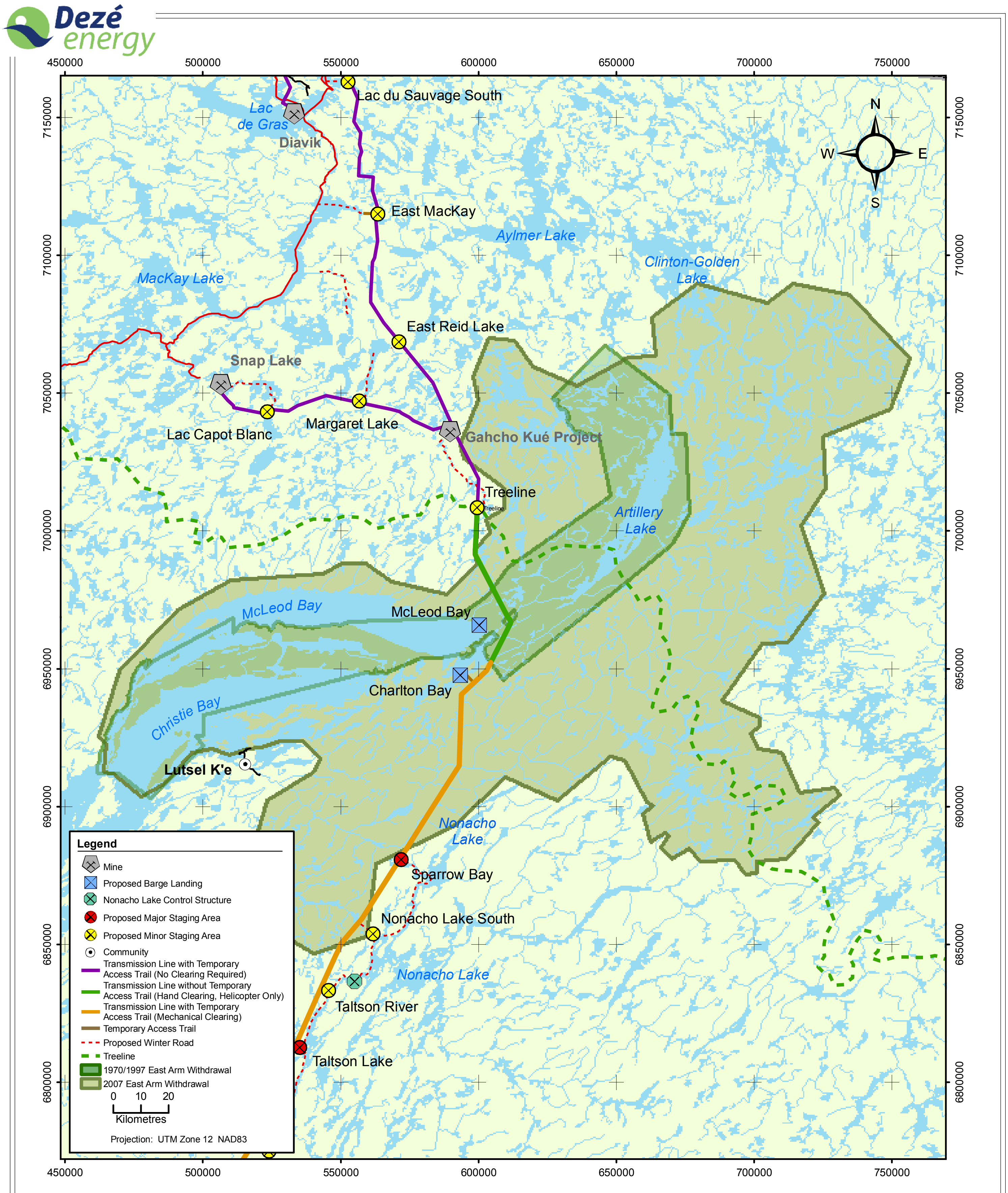
Thorpe, N., N. Hakongak, S. Eyegetok and the Kitikmeot Elders. 2001. Thunder on the tundra: Inuit Qaujimajatuqangit of the Bathurst caribou.

COMMITMENT # 60

Subject: Viewscape

Request:
For Dezé to provide new maps that show the accurate withdrawal area relative to the view shed analysis receptors throughout the East Arm sector, and the access and staging in the East Arm.

Response:
Dezé has prepared two new figures to restate information presented in the Developer's Assessment Report (DAR) relative to the two boundaries associated with the proposed East Arm National Park. Figure 1 shows the proposed transmission line construction methods, while Figure 2 provides greater detail on some of the sites considered for the viewshed analysis, in the vicinity of the East Arm. These figures represent a clarification of information presented in Section 15.10 (Effects to Tourism Potential and Wilderness Character), specifically Figure 15.10.3. Both the 1970/1997 permanent land withdrawal and the 2007 East Arm Park Study Area boundaries are included in the two attached figures.



TALTSON Hydroelectric Expansion Project	Developer's Assessment Report 2009: Supplementary Information	Access and Staging in the East Arm Sector	Figure 1

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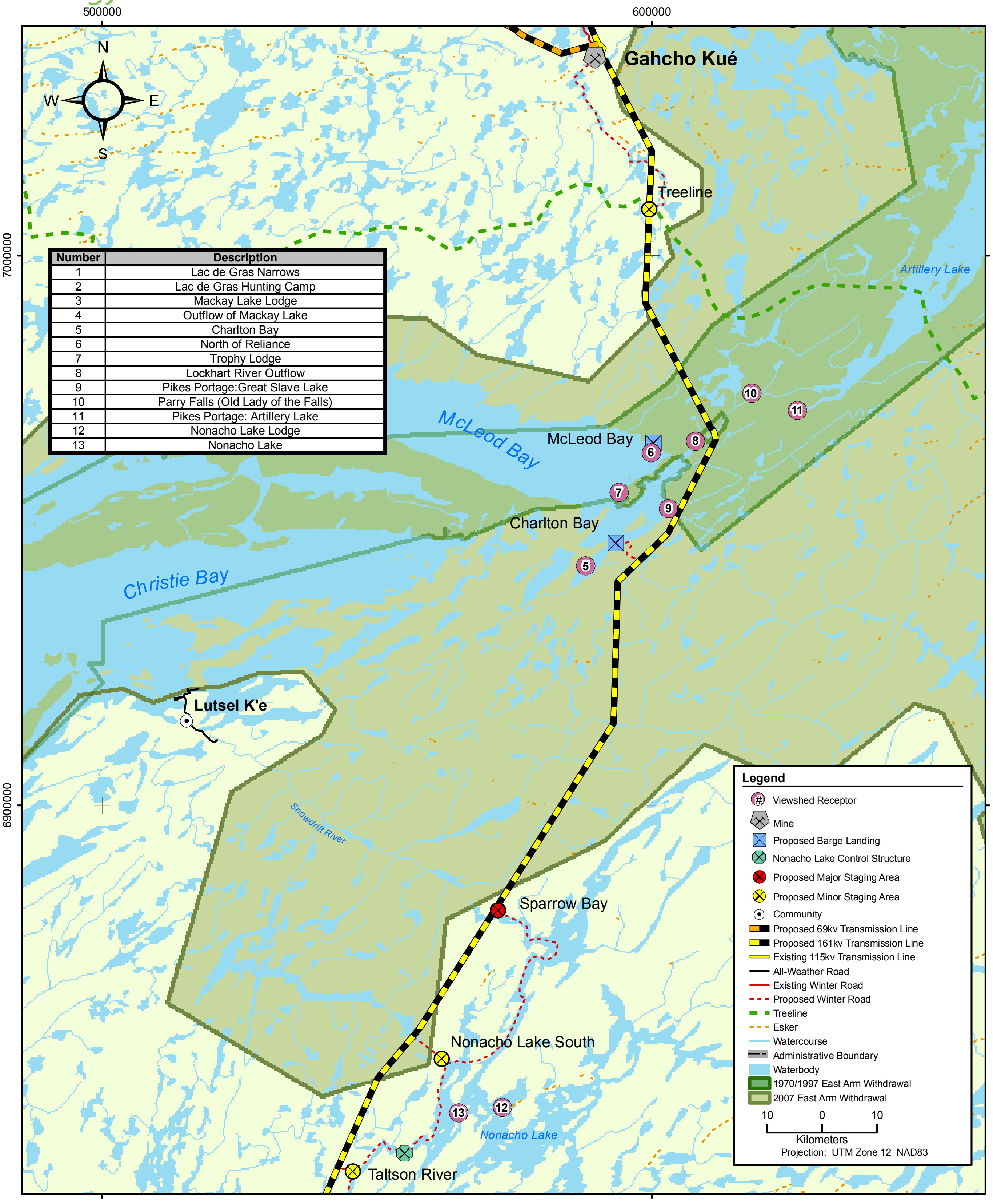
Dezé energy



Number	Description
1	Lac de Gras Narrows
2	Lac de Gras Hunting Camp
3	Mackay Lake Lodge
4	Outflow of Mackay Lake
5	Charlton Bay
6	North of Reliance
7	Trophy Lodge
8	Lockhart River Outflow
9	Pikes Portage:Great Slave Lake
10	Parry Falls (Old Lady of the Falls)
11	Pikes Portage: Artillery Lake
12	Nonacho Lake Lodge
13	Nonacho Lake

TALTSON Hydroelectric Expansion Project	Developer's Assessment Report 2009: Supplementery Information	Location of Viewshed Analysis Receptors in East Arm Sector	Figure 2

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COMMITMENT # 61

Subject: Viewscape

Request:
For Dezé to provide information regarding the different tower types that could be considered to reduce aesthetic effects

Response:
The final arrangement of tower type has not been decided upon, however, several specific configurations are considered most suitable. The tower configuration proposed as a baseline is provided in Chapter 6 of the DAR, Figure 6.4.8. This structure comprises a guyed lattice form identical to the structures used on the existing Snare Hydro and Taltson Hydro lines.

Steel pole structures can also be considered. All structures of this nature would be galvanized steel, and bolted together. However, lattice structures are favoured, as they are easier to climb for maintenance purposes.

Wood pole structures are the other feasible alternative, but only north of the treeline. However, the use of wood poles would significantly reduce the span distance between supports, and therefore increase significantly the number of structures along the line. Wood poles would also require guy wire supports to ground in many instances, though typically only one or two per pole at the small changes in line direction, or where foundation conditions are not ideal. Wood pole design life would be shorter than for steel structures, and maintenance of line condition more difficult.

Other steel pole designs may exist that could potentially assist with reducing negative aesthetic effects, such as towers designed to oxidized (rust). However, Transport Canada maintains standards that may conflict with Parks Canada's intent of reducing aesthetic effects. Standards require that transmission lines be clearly visible in high crossings, as they present a risk to aviation. Typically, transmission towers spanning flight paths must have markers on the transmission line, and occasionally lights on the transmission tower.

Dezé will continue to investigate this issue as the Taltson Project continues into detailed design, and will continue to discuss alternatives with Parks Canada.

COMMITMENT # 62

Subject: Access

Commitment:
Dezé to include the temporary construction access trails in the re-evaluation of a new road from Twin Gorges northward.

Response:
Please see Commitment # 51-53.

COMMITMENT # 63

Subject: Wildlife Impacts to Ptarmigan and Small Game

Request:

For Dezé to provide consideration of potential impacts to ptarmigan and small game resulting from operation of the transmission line.

Response:

Ptarmigan

Birds are known to collide with transmission lines, and this was discussed in Section 15.4.8.4 of the DAR, using waterfowl as the VC of interest. Factors that affect collision rates and mitigation strategies are discussed in the DAR. Birds that are considered to be particularly susceptible to collision with transmission lines are those that fly quickly and have poor manoeuvrability, such as ducks, grebes and grouse (Janss 2000, Bevanger 1998).

Grouse and ptarmigan collisions with transmission lines have been documented and described in Norway (Bevanger 1995). In Norway, there are an estimated 14,570 km of transmission lines within the range of the willow ptarmigan. The total estimated willow ptarmigan mortality due to these transmission lines are 50,000 individuals annually between September and May. As this represents only 9% of the estimated willow ptarmigan harvest, this loss was not considered to be significant to the population (Bevanger 1995), although the author warns against calculating the number of bird mortalities per kilometer of transmission line, as collisions tend to be concentrated in specific areas of the transmission line.

With regards to the Taltson Project, approximately 700 km of transmission line are proposed, within willow and rock ptarmigan range. Generally, willow ptarmigan will winter south of the treeline and migrate to the tundra in the summer to breed, while rock ptarmigan remain north of the treeline throughout the year. Both species are anticipated to be equally susceptible to collisions, although the willow ptarmigan may encounter the transmission line more frequently due to their migrations. At greatest risk would be ptarmigan nesting or wintering near the transmission line, where they may encounter the transmission line regularly throughout the season.

The Taltson Project will undoubtedly lead to willow and rock ptarmigan mortality through collisions. Considering that the mortality of 50,000 willow ptarmigan in Norway is not considered to be detrimental to the population, and that Norway is smaller than the Northwest Territories and with a much longer length of transmission lines(approximately 14,570 km), it is unlikely that the Taltson Project will lead to a noticeable change in ptarmigan abundance to hunters.

Small Mammals

Little information is available in the scientific literature regarding the effects of transmission lines to hare or other small mammals. Most of the available literature concerns birds, specifically, effects from habitat fragmentation, collisions with transmission lines, and electrocutions.

One aspect in which the Taltson transmission line is different from southern transmission lines is the types of habitat it passes through. North of the treeline, vegetation clearing will be minimal, and so no effects are anticipated from changes to vegetation within the transmission line right of way. South of the treeline, the transmission line will pass through the Taiga Shield, which is comprised of a patchwork of exposed bedrock, open forest, close forest, lakes and wetlands. As such, the right of way clearing does not create new habitats, as it would through a continuous and closed forest of the Taiga Plains or a B.C. rainforest. A description of the anticipated habitat changes and their likely effects to wildlife and habitat fragmentation is provided in the DAR, section 15.7.5.2.1

To mitigate effects to small mammals, Dezé plans to conduct selective clearing in the transmission line right of way. In other words, vegetation clearing may not extend out to the full 30 m of the right of way, and may not be continuous if the transmission line can span over valleys, while shrubs less than 3 metres in height will remain intact. Other mitigation is outlined in Section 15.7.4.1 of the DAR.

Some studies have been conducted that give insight into the possible effects of the transmission line right of way. For example, a four-year study of cottontail rabbit (*Sylvilagus floridanus mallarus*) in North Carolina, USA, was conducted to evaluate a seeded and mechanically maintained powerline right of way for its importance as rabbit habitat before and after habitat manipulation (Betsill et al.1981), a much larger degree of habitat change than will occur in the Taltson right of way. The study did not indicate any large differences in population levels between the right of way and control area or an increase in carrying capacity on the right of way after habitat manipulation (Betsill et al.1981). Shreiber and Graves (1977) observed that transmission line right of ways may have created a limited barrier to small mammal movements, but again the habitat changes within the right of ways studied were much greater than that proposed for the Taltson Project.

Efforts to contact trappers who have trapped under the existing Taltson and Yellowknife to Snare Hydro transmission lines have not yet been successful.

Overall, considering the small size of the transmission line right of way (up to 30 metres wide), the heterogeneous and patchy habitat in the Taiga Shield forest, the mitigation proposed, and the selective removal of vegetation, it is unlikely that harvesters operating from Łutsel K'e or Fort Smith (the nearest communities) would notice a difference in small mammal availability as a result of the Taltson Project.

References

Bevanger, K. 1995. Estimates and population consequences of tetraonid mortality caused by collisions with high tension power lines in Norway. Journal of Applied Ecology, 32, 745-753.

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electricity power lines: a review. Biological Conservation 86, 67-76.

Janss, G.F.E. 2000. Avian mortality from power lines: a morphologic approach of a species-specific mortality. Biological Conservation 95, 353-359.

Betsill C, William S. M, Lloyd G. W, Arner D, Tillman R E. Population levels of cottontail rabbits along a powerline right of way before and after modification of management procedures. Proc. Symp. Environmental Concerns in Rights-of-Way Management, 1-56.

RK Schreiber, JH Graves. 1977. Powerline corridors as possible barriers to the movements of small mammals. American Midland Naturalist. American Midland Naturalist 97 Issue 2, p504.

COMMITMENT # 64

Subject: Noise

Commitment:
Dezé to table the relevant numbers from the engineering report regarding corona noise.

Response:
The attached Teshmont 2008 Transmission Line Alternatives Study Excerpt details the relevant numbers regarding corona noise.

Attachments:
Teshmont 2008 Transmission Line Alternatives Study Excerpt

COMMITMENT # 65

Subject: Horned Grebe

Commitment:
In April of 2009 the horned grebe (*Podiceps auritus*, western population) was newly designated a species of special concern by COSEWIC (2009), shortly after the DAR was submitted. As such, the horned grebe was not considered to be a species at risk for the Taltson Project. As this status has changes, Dezé is requested to:

- determine whether the Taltson Hydroelectric Expansion Project is likely to affect Horned Grebe or its habitat;
- identify any adverse effects on the species and its habitat, suggest mitigation to avoid or lessen any adverse effects; and
- suggest whether any monitoring is required.

Response:
In April of 2009 the horned grebe (*Podiceps auritus*, western population) was newly designated a species of special concern by COSEWIC (2009). Rationale for designation by COSEWIC includes population declines with no evidence to suggest that this trend will be reversed in the near future. This species currently has no status under SARA (2009) and is not listed on any of the SARA Schedules. The horned grebe is a secure species in the Northwest Territories (Working Group on General Status of NWT Species 2006), and the NWT population appears stable in the NT despite declining national trends (Fournier and Hines 1999).

In the Taltson study area, the range of the horned grebe includes the boreal forest where it breeds in small wetlands and lake inlets with beds of emergent vegetation and areas of open water (Stedman 2000). Near Yellowknife, Fournier and Hines (1999) found that horned grebes most commonly used wetlands with areas between 0.3 and 2.0 ha.

There have been three surveys for waterbirds during the Taltson Project baseline studies, of which the horned grebe was one of the target species. With respect to the Taltson River, two horned grebes were observed during 64 minutes of aerial surveys along Trudel Creek (Zone 5), one horned grebe was observed at Nonacho Lake during 162 minutes of aerial surveys. None were observed along the Taltson River (Zone 1 and 3) during 30 minutes of aerial surveys (see Appendix 13.10A of the Developers Assessment Report [DAR] for survey methods and results). With respect to the transmission line corridor, no horned grebes were observed during aerial surveys of wetlands along the transmission line corridor in either 2003 or 2008 (see Section 9.5.3.3 of the DAR and Rescan 2004 for survey methods). However, horned grebes cannot be considered absent from the transmission line corridor, as the survey did not include small wetlands which breeding horned grebes are known to prefer (Fournier and Hines 1999).

Although horned grebes are not classified as waterfowl, they share similar habitat requirements to waterfowl, and will be affected by the same pathways that may affect waterfowl (e.g. changes to hydrology). Therefore, horned grebes may be considered as part of the waterfowl (including loons) valued component (VC). Effects to waterfowl are assessed in the following sections of the DAR:

- 13.10 Water fluctuations in the Taltson River Watershed Key Line of Inquiry - Wildlife;
- 14.9 Ecological Changes in Trudel Creek Key Line of Inquiry - Wildlife;

- 15.4 Species at Risk and Key Birds Species Subject of Note;
- 17.4 Accidents and Malfunctions - Ramping Trudel Creek;
- 17.5 Accidents and Malfunctions - Ramping Taltson Basin.

No unique invalid or minor pathways were identified for the horned grebe. Please see the relevant sections in the DAR for discussion of pathway validation for invalid and minor pathways identified for waterfowl.

Valid pathways identified for waterfowl are summarized below with discussion regarding the horned grebe.

Sublethal effect (changes to diet/submerged aquatic plant community) leading to reduced population abundance due to water fluctuations in the Taltson River watershed and Trudel Creek was identified as a valid pathway for dabbling duck and avian aquatic vegetation feeders in Nonacho Lake and Zones 1, 2 and 3 (See Section 13.10.6.1.3.3 and Section 14.9.5.3.3 of the DAR). As the horned grebe's diet includes aquatic arthropods during the breeding season (Stedman 2000), this pathway would also be valid for horned grebes.

Horned grebes, like loons, are particularity sensitive to this effect as their nests are generally built 5 to 10 cm above water level (Stedman 2000). Reduced reproductive success caused by altered water levels within Trudel Creek was identified as a valid pathway as unscheduled full power outage originating from an accident or malfunction of the turbines at Twin Gorges could lead to nests and young being flooded (see Section 14.9.5.3.3 of the DAR). Scheduled outages for routine maintenance will occur in April or May (Section 14.3.3), prior to freshet, and prior to the migratory bird breeding season. Outages that have durations from a few minutes to a few hours would result in minor ramping of flows prior to the restart of the turbines. Unscheduled outages resulting from major equipment failure, major line disruptions, or natural events such as lightening or forest fires would likely be longer in duration; days up to a month. Such an event was conservatively estimated to have a one in five year average recurrence frequency, and the resulting effects to water levels would be confined to the Forebay and Trudel Creek. The pathways of direct mortality and reduced reproductive success (i.e., loss of nests) due to rapid changes in water levels were both considered valid pathways for waterfowl and shorebirds, and would apply also to grebes, and are assessed in Section 17.4.8.5 of the DAR. However, the frequency of such events would be low. Direct mortality to nesting grebes and waterfowl and loss of nests would only result from an unscheduled ramping event during the nesting and early brood rearing season, further reducing the frequency of the effect from the conservative estimate of once every five years. Mitigation to avoid unscheduled outages is outlined in Section 17.4.3 of the DAR.

Sensory disturbance leading to changes in habitat quality for waterfowl was identified as a valid pathway (see Section 15.4.8.2 of the DAR). Residual effects classification for sensory disturbance is presented in Section 15.4.10.2.3.2 of the DAR, while its significance is presented in Section 15.4.11.2.3. Sensory disturbance would occur during both the construction and operation phase. Most construction activity would take place outside of the breeding season, suggesting an effect of low magnitude. There may continue to be some sensory disturbance to waterfowl during operations due to maintenance activity and the presence of the transmission line, but still the effect is anticipated to be low. Overall, effects due to sensory disturbance are considered not significant (see Table 15.4.32 of the DAR).

Collision with the transmission line leading to mortality of waterfowl was identified as a valid pathway (see Section 15.4.8.4 of the DAR). Residual effects classification of transmission line collisions is presented in Section 15.4.10.2.3.4 of the DAR, while its significance is presented in Section 15.4.11.2.3. Waterfowl abundance may be affected by collisions with the transmission lines. This effect is confined to the operations phase. Collisions with the transmission lines is anticipated to have an effect to the population as it leads to direct mortality, occurs for the entire length of the transmission line, and is anticipated to continue until the transmission line is removed. Collision mortalities, while expected to occur, are not anticipated to be at a level that could threaten the viability of the population. The overall effect is anticipated to be low. Effects are confined to the transmission line corridor, leading to a local effect. As the effect is caused by Project operation, it is long-term. Like waterfowl, horned grebes make flights to foraging sites other than the waterbody containing their nest (Stedman 2000). Therefore, horned grebes are susceptible to collisions with the transmission line throughout the breeding season. However, the available information on collision rates, summarized in Section 15.4.8.4 of the DAR, indicates that the overall effect to the population will be low, and not anticipated to be significant (see Table 15.4.32 of the DAR).

In summary, horned grebes occur in the boreal forest section of the Project. Their population appears to be limited but stable (Fournier and Hines 1999). No pathways were identified for the horned grebe that were not assessed for waterfowl. Overall, the effects of the project on horned grebe are anticipated to be not significant. Further baseline surveys will be undertaken to determine the breeding population of horned grebes, loons, and other waterfowl, within the Taltson River and Trudel Creek to further refine the baseline data, and to serve as a basis for mitigation and future monitoring.

References:

COSEWIC. 2009. COSEWIC assessment and status report on the Horned Grebe *Podiceps auritus*, Western population and Magdalen Islands population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 42 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

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Rescan (Rescan Environmental Services Ltd). 2004. Taltson Hydro Expansion Project 2003 Baseline Report - Draft. Rescan Environmental Services Ltd. Yellowknife, NT.

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COMMITMENT # 66

Subject: Ravens

Request:
For Dezé to:
- Evaluate the degree to which ravens will use the towers and other project infrastructure for nesting;
- Assess the probability of increased predation of migratory birds because of increased nesting and roosting sites in the area for ravens and evaluate how this might impact local bird populations;
- Suggest potential mitigation measures to be considered; and
- Suggest monitoring measures to evaluate the effectiveness of mitigation measures and/or to determine if further mitigation might be required.

Response:
The DAR assessed the pathway of transmission tower perching leading to altered predation rates for raptors (Section 15.4.5.2.2.8). This pathway was found to be minor for raptors. Ravens were not included in the definition of raptors. However, ravens may be viewed as functional raptors as they often behave like raptors in many ways, although they are not part of the raptor taxonomic group (Poole and Bromley 1988). Therefore the conclusions reached regarding raptors are also valid for ravens.

During a survey of the transmission line between Yellowknife and Snare Hydro on January 17, 2008, 15 raven nests were observed, of which two nests were occupied. The length of the Snare Hydro line is approximately 140 km with approximately 450 towers, or one nest every 9.3 km or one in 30 towers. Although the timing of the survey would not allow an estimate of the number of active raven nests, the results nonetheless indicate a low density of raven nesting on similar existing transmission lines.

The most relevant information that could be identified in the published literature regarding effects of nest predation by ravens indicated that breeding bird density increased near transmission line towers with raven nests (Tryjanowski 2001). Tryjanowski postulates that breeding birds seek the protection offered by ravens, as nesting ravens will attack other nest predators (including other ravens). In contrast, Liebezeit et al. (2009) found evidence of increased predation of passerines near human development, resulting from increased densities of gulls, jaegers, fox and ravens. However, the predators in this study were benefiting from both availability of food, from landfills and dumpsters, as well as artificial nesting structures. In the case of an operating transmission line, only the latter would be available, although there may be food rewards at the construction camps during the three-year Project construction phase, for which mitigation is proposed in the DAR. Liebezeit et al. (2009) also discussed the difficulty in assessing these effects, and the high degree of spatial and temporal variability.

Due to the lack of information specific to nest predation in the boreal forest and tundra environments (Ball et al., in press), the high variability in nest predation rates (Liebezeit et al. 2009) and the observation that most nest predation is due to red squirrels (i.e., 45% to 84% of nest predations [Ball et al., in press]), the probability of increased migratory bird nest predation near nesting ravens could not be assessed with confidence.

There is no reason to suspect that the presence of transmission towers leads to an increased density of ravens on the landscape. Ravens nest in trees and on cliffs, and also use nests built by other birds. Although ravens may prefer to nest on transmission towers, nesting habitat is unlikely to be a limiting factor. Ball et al. (in press) found that nest predation rates were similar between areas with varying levels of forest fragmentation, indicating that the transmission line right-of-way is unlikely to affect nest predation or success in the NWT. Any effect of the re-distribution of raven nesting would be most pronounced on the tundra, where nesting habitat is limited to cliffs.

A number of options are available to discourage nesting on transmission towers, such as spikes, PVC pipes over the tower cross-arms, and plastic owls, all of which have the intent of making the tower awkward or dangerous for nesting. Unfortunately, these devices are often unsuccessful, and require additional cost and maintenance (APLIC 2006). Specific to the Taltson Project, the steel lattice towers proposed (Figure 6.4.8 in the DAR) are designed to make nesting awkward and to keep birds and nest away from conductor wires, according to the principals described by APLIC (2006).

It is likely that nest predation is of greatest concern in areas where nest predators are maintained at artificially high levels through access to food from humans (Liebezeit et al. 2009). This is not anticipated to be the case on the Taltson transmission line, and careful waste management will be required to ensure that food rewards are not present at the construction camps (see the Human-Wildlife Conflict Management Plan, Chapter 7.5 of the DAR). These factors in conjunction with the low density of nesting ravens on the Yellowknife to Snare transmission line indicate that this would be a minor pathway (i.e., the pathway exists but has a negligible residual effect on the population of the prey species). Monitoring is proposed to track and improve waste management systems at the Project construction camps.

References

APLIC (Avian Power Line Interaction Committee). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC and the California Energy Commission. Washington, D.C.

Ball, J.R., E.M. Bayne, and C.S. Machtans. In press. Video identification of boreal forest songbird nest predation and discordance with artificial nest studies. Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropic.

Liebezeit, J., S. Kendall, S. Brown, C. Johnson, P. Martin, T. McDonald, et al. 2009. Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska. Ecological Applications. 19(6): 1628-1644.

Poole, K. G. and R. G. Bromley. 1988. Interrelationships within a raptor guild in the central Canadian Arctic. Can. J. Zool. 66(10): 2275–2282

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COMMITMENT # 67

Subject: Monitoring Program

Request:
Dezé to submit their monitoring program that includes the monitoring and Adaptive Management Plan by October 30th with the written submissions to the Commitments.

Response:
Dezé has prepared a preliminary draft monitoring program that includes the monitoring and adaptive management plans, submitted to the MVEIRB under separate cover.

Taltson Hydroelectric Expansion Project

Commitments 2009 – Lutsel K'e

October, 2009

COMMITMENT # LK1

Subject: Alternatives, Wildlife, Visual, Decommissioning, EMP, Engagement, Permitting

Request:
Dezé to provide written answer to Steve Ellis' questions, by October 30th, 2009

- More info on the effects of EMF on caribou behaviour
- Cost and description of t-line removal (decommissioning).
- Predator / prey relationship due to cleared r/w: Moose, caribou, muskox
- Visual representation of the line - what will to look like from cultural / frequent use locations?
- More info on winter road construction; camps; etc (this is detailed design & permitting phase)
- Maintenance - how?
- Alternatives analysis -
  - parameters uses and weighting rationale
  - submarine cable costs details

Question 1: Effects of EMF on caribou behaviour
That Dezé Energy provides more information on the effects of electromagnetic fields on caribou behaviour.

Response
Section 9.5.4.5.2 of the DAR outlines the known effects of development to caribou, including that of transmission lines. One difficulty raised in assessing the effect of a transmission line is that it is possible to measure an effect (such as change in behaviour), but not necessarily the mechanism for that effect. For example, studies in Norway have documented avoidance of transmission lines by caribou, but it is unknown whether this avoidance is due to the change in vegetation, noise, electromagnetic fields, the physical structure, smell, electromagnetic fields, other factors, or a combination of these. There is indication that transmission lines with road cause more disturbance than those without, indicating that electromagnetic fields are only part of the issue.

Doherty and Grubb (1998) provide a brief review of the effects of EMF on wildlife. Studies cited include effects of EMF to bird densities, abundance or community structure, crops, meat or milk production, homing behaviour of tree swallows, and reproductive output; none of which were able to detect an effect. Effects have been noted in some areas; Larkin and Sutherland (1977, cited in Doherty and Grubb, 1998) reported that changes in direction or altitude of migrating birds occurred more frequently when the transmission line was operating. Doherty and Grubb (1998) found reduced reproductive success of tree swallows under transmission lines, but not for house wrens. The reason for this was unknown, and the authors make it clear that the EMF was not necessarily the cause of the reduction in productivity, merely that there was a relationship. Burda et al. (2009) found that resting and grazing cattle and roe deer in Europe tend to orient themselves along a north-south axis, but that this behaviour was disturbed in the presence of transmission lines. This behaviour was disrupted within 150 m of high-voltage transmission lines for cattle, and within 50 m for roe deer. Within this zone, orientation during grazing and resting became random. The range or mean voltage of the transmission lines was not reported, nor was any ecological significance attached to this effect by the authors. Considering that the mechanism of this effect was unclear, that caribou likely rely on a range of cues for migration, including memory and existing trails, that the zone of influence was small compared to the migratory movements of caribou (up to approximately 30 km per day, Gunn et al. 2002), it seems unlikely that migratory movements would be affected by any such effects.

Section 9.5.4.5.7 of the DAR discusses physiological effects of EMF to ungulates.

Commitment # 64 provides an estimate of the EMF and corona noise anticipated to be generated by the Taltson Project.

Question 2: Description of Project decommissioning

Is decommissioning planned, and how would it affect the feasibility of the Project?

Response

For large-scale northern developments such as the Taltson Hydroelectric Expansion Project, detailed plans are necessary to mitigate any ecological disturbance caused by either construction, changes in operational strategies, or closure, to the extent possible. Project closure plans are outlined in some detail in Section 6.8 of the DAR. As noted therein, if necessary, Dezé is committed to decommissioning and removing the medium term Taltson Project infrastructure such as the transmission line, to reduce environmental impacts. The generation plant is expected to have an indefinite life, as it will need to continue to serve the existing communities. Planning is required to close the Project as quickly and effectively as possible. There are a number of policies, guidelines and standards that would also apply to the closure of the Taltson Project, and these are outlined in the DAR.

Question 3: Change in predation rate resulting from right-of-way

Will the transmission line right of way lead to changes in predation and hunting of moose, caribou and muskox?

Response

Section 9.5.4.5.6 of the DAR outlines some scholarship on changing predation rates near right of ways. Section 12.3.5 of the DAR considers the effect of increased wolf predation to caribou. The possibility of increased predation and its effects to moose and muskox were not assessed due to a paucity of information, but is likely to be similar to that for caribou.

Question 4: Aesthetic Effects

For Dezé to provide illustrations or descriptions of the transmission line for Łutsel K'e residents to understand the aesthetic effects.

Response

Dezé has been working with Parks Canada on the issue of aesthetic effects, and has made efforts to arrange a site visit with the representatives of Łutsel K'e to address such issues. Section 15.10.5 of the DAR considers the effects of visual aesthetics to enjoyment of wilderness. Recently, Dezé has made commitments to Parks Canada to consider aesthetic effects of the Project within the proposed East Arm Park area. Dezé has committed to compiling a photomontage to illustrate how the transmission line would appear from specific viewpoints, investigating the use of low-visibility transmission towers in specific areas, and to provide new maps showing the viewshed analysis receptor points (i.e., to improve upon Figure 15.10.3 in the DAR). See the response to Commitment 60 and 61 for further details on these commitments. Dezé Energy and Parks Canada will continue to consult with Łutsel K'e on these issues.

Question 5: Permitting

How will the Taltson Project be permitted? Will it be one single land use permit, or a series of different regulatory instruments? How will this affect people's engagement?

Response

Details of permitting have not yet been considered beyond initial planning, as the Taltson Project has not yet entered the permitting phase. This will be initiated following the MVEIRB environmental assessment. It is anticipated that the Akaitcho Screening Board will play an active role in the permitting process, and will provide input into such decisions. The environmental assessment currently underway by the MVEIRB is the most important stage for public engagement.

Question 6: Maintenance of the transmission line

What are the plans to service and maintain the transmission line? If there is a malfunction with the transmission line, how long would it take to repair?

Response

From the DAR, Section 6.6.3:

Transmission line inspection and maintenance would occur by helicopter over the entire transmission line route at least once and possibly twice per year. The crews would be inspecting the line and towers for damage to conductors or insulating hardware, failing guidelines or foundations, potential tree hazards, and any other situation that may influence line reliability. If a repair is noted to be required, crews would then be organized and dispatched in conjunction with a line outage, if required, to carry out the work. The dispatch of crews could occur from the mines or from Twin Gorges, depending on the location of the work to be undertaken. Typically, the transport would be by helicopter.

Given the length of line, spare materials will be stockpiled in a number of the substations for rapid access should a fault occur or a repair be required that requires an outage. Many repairs can be made safely with the line continuing to operate. In the event of a complete tower failure, a new tower would be flown in by helicopter, erected, and the line spliced over the new tower. The length of time this would take depends on many factors such as weather, helicopter and workforce availability, location of failure, etc.

Question 7: Alternatives Assessment

With regards to the alternatives assessment, why were some criteria included and not others? By changing seven of the 50 criteria used by Dezé, the submarine option comes out as the preferred option. The criteria changed included:

- Aboriginal / South Slave Employment
- Distribution of Project Income
- Line Frontage
- Crown Land Withdrawals
- Land Tenure
- Line and Construction Costs
- Fire Exposure

This re-visiting of the alternatives assessment indicated that the submarine option may be the more viable option.

Response

First, the rating criteria were subjective, and intentionally so. It was Dezé's intention that the evaluation process be open, transparent, and repeatable by other parties. Mr. Ellis does bring up some interesting points in his critique of the Alternatives Assessment. We would like to provide some of our logic behind the criteria he questioned.

First, the assessment method used required that each criteria be given a ranking, and 'ties' were not included. So it is entirely justifiable to change some of the rankings and investigate the results.

Caribou were not included as a separate category in the alternatives assessment because all four alignments would cross the post-calving migratory routes in the Lac de Gras and MacKay Lake region, and all four would involve disturbance to caribou wintering grounds.

Furbearers were not included as a separate category because effects to furbearers are anticipated to be of low magnitude and local (see Section 15.7.9 of the DAR). More subjectively, the optimal transmission line route from the perspective of furbearers would be one which disturbed the least amount of Taiga Plains habitat (where the right of way would be more pronounced and where furbearer density is higher), and the one which would have the least overlap with trapping activity.

Withdrawals were included because Dezé perceived these as areas where permanent protection from development was a possibility. These reduced the score of an alternative because there would likely be fewer future customers in these areas. Mr. Ellis is correct that withdrawals do not necessarily create a regulatory impediment to the Project or a particular alignment. However, they do add a level of uncertainty and potential for project delays. Current withdrawals along the east arm alternative provide the least amount of uncertainty and risk of project delays relative to the other alternatives.

The ranking for Line and Construction Costs favours the East Arm route over other options for several reasons. First, the entire northern section of the East Arm route is close to Gahcho Kue and existing winter roads. The submarine route would require a new winter road from Snap Lake to the point on Great Slave Lake where the transmission line goes submarine (around Gros Cap Point), and a winter road from Twin Gorges to the southern landfall of the submarine cable (near the mouth of the Taltson River). These would be extensive winter roads in thick forest with much fewer opportunities to use lakes than the proposed winter road from Twin Gorges to Nonacho Lake.

One factor in the Alternatives Assessment that should be reviewed was the significant reliability risk of the Submarine route. Laying and repairing of submarine cable requires specialized barges that would have to be brought back to Great Slave Lake in the event of an outage. Currently, there is no tested technology or method to repair the cables in an under-ice or thin-ice scenario. Considering the time to transport the barges to Great Slave Lake and the difficulties that would be encountered if ice were present, there would be considerable delays in making repairs. Dezé would be responsible to its clients for the cost of electricity during this time, adding further risk. This risk can be mitigated by having several submarine cables to provide redundancy, but the costs associated with this are considerable.

With respect to fire risk, the area between Twin Gorges and Nonacho Lake was subject to extensive fires in 1979, from which the area is still recovering. As such, the fire risk is particularly low in this area, and construction of the transmission line and winter road is facilitated by the small trees in this area.

In conclusion, the submarine cable is not currently considered a viable option. Unfortunately, the project cannot support a complete assessment of every alternative. However, two independent but very high level studies undertaken by Dezé and the GNWT have shown the submarine route would add significantly to the capital cost of the project, and very likely extend construction schedule by one year. In addition, the operational reliability of the submarine route is difficult to predict in this environment, but is considered to be at much higher risk for a major outage that may last many months and would be unacceptable for any customers. It is Dezé's opinion that this combination of increased capital cost and risk will be unacceptable to the Project funding sources, and therefore the submarine crossing option, while offering benefits in other categories of assessment, is simply not viable.

Again, we would like to thank Mr. Ellis for his thoughtful review of the Alternatives Assessment, and his points will be considered further by Dezé.

References:

Doherty, P.F. and Grubb, T.C. 1998. Reproductive success of cavity-nesting birds breeding under high-voltage powerlines. The American Midland Naturalist. 140: 122-128.

Burda, H., Begall, S., Cerveny, J., Neef, J. and Nemec P. 2009. Extremely low-frequency electromagnetic fields disrupt magnetic alignment of ruminants. Proceedings of the National Academy of Sciences of the USA. http://www.pnas.org/content/106/14/5708

Gunn, A., Dragon, J. & Boulanger, J. 2002. Seasonal Movements of Satellite-collared Caribou from the Bathurst Herd. Final Report. Submitted to the West Kitikmeot Slave Study Society.

COMMITMENT # LK2

Subject: Tradition Knowledge

Commitment:
Status of Traditional Knowledge Studies

Response:
There are two parts to this Information Request response. The first part reports the Dezé Energy Corporation's (Dezé) engagement and consultation initiatives over the past five years, from September 2004 to September 2009. The second part encapsulates Lutsel K'e's publicly available Traditional Knowledge, as it was used in the Developer's Assessment Report.

Of note, Łutsel K'e was legally bound to another hydroelectric energy company to refrain from engaging any other hydroelectric energy company for a specific period of time – most of which coincided with the formulation of the Taltson Expansion Project and the Dezé preparation of the Developer's Assessment Report.
Notwithstanding Łutsel K'e's constraints, Dezé was able to meet with Łutsel K'e community members and elected officials 14 times between September 2004 and January 2008. This included tours of the proposed Project area; community presentations and information sessions; and, efforts to collaborate on transmission line routing. During these meetings, Dezé Energy was able to build relationships within the community, identify the community's areas of concern, and solicit information from local land users.
Table 1 below summarizes Dezé's and Łutsel K'e's engagement initiatives in regards to the Taltson Project. Supporting documentation are available upon request.

Table 1 Summary of Taltson Project related meetings with Lutsel K'e

Date	Event	Supporting documents
24-Sep-04	Elder / Chief and Council Taltson tour	Attendee list
28-Sep-04	Elder / Chief and Council Taltson tour	Attendee list
13-Dec-04	Community meeting	Presentation
12-Jan-05	Information session	Presentation
10-Mar-07	Information session	
15-Mar-07	Information session	Presentation, MVEIRB Report
25-Apr-07	Letter to Chief & Council from Dezé Energy Chair	
22-Jun-07	Taltson Hydro site tour	Attendee list and budget
12-Oct-07	Łutsel K'e Dene School hydro power presentation	
12-Oct-07	Chief, Council, ,& Community meeting	
22-Nov-07	Community information session	Meeting minutes and attendee list
22-Nov-07	Łutsel K'e Dene School hydro power presentation	Presentation
17-Dec-07	Supported Lutsel K'e Dene School concert and feast	
23-Jan-08	Dezé Energy meeting with representatives of Łutsel K'e Council and Łutsel K'e Parks Committee representatives	Minutes
06-Feb-08	Confirmation letter for MVEIRB requested Lutsel K'e Scoping Sessions on Feb 12/08	Letter

Date	Event	Supporting documents
25-Feb-08	Dezé Energy Corporation Letter to Chief	Letter
07-Mar-08	MVEIRB Łutsel K'e scoping session	Minutes and consultant report
30-May-08	Dezé Energy letter to Chief and Council	Letter
02-Jun-08	Community meeting	
28-Oct-08	Dezé Energy Letter Parks Coordinator requesting a meeting to ensure Łutsel K'e Community Involvement in Shaping the Taltson Expansion Project/ assistance from the Thaydene Nene Park Committee	Letter
31-Oct-08	Support for Wildlife, Lands and Environment Committee to attend the Dene National Environment and Water Conference	Letter and email
04-Nov-08	Information Booth at the Dene Nation Environment & Water Conference	
06-Nov-08	Thaydene Nene Working Group Letter to Dezé Energy acknowledgement of meeting request and a tentative meeting date of December 10th and budget	Letter and budget
07-Nov-08	Dezé Energy Letter to Thaydene Nene WG confirming meeting date, budget and welcoming Elder Participation	Letter
15-Dec-08	Supported Lutsel K'e Dene School concert and feast	
23-Jan-09	Łutsel K'e Dene School Hydro Presentation, with GNWT, ITI	Presentation and letter of request for presentation
23-Jan-09	Thaydene Nene Working Group meeting	Presentation, meeting notes, and budget
02-Jun-09	Community meeting	Presentation, minutes, and budget
12-Jun-09	Dezé Energy Letter to Chief and Council requested the appointment of community members to a committee to review options of routing through Łutsel K'e traditional territory	Letter
01-Aug-09	Report on Łutsel K'e Community Support	Consultant report
29-Sep-09	MVEIRB Łutsel K’e Technical Session	MVEIRB Notes, presentation, transcript

Łutsel K’e Traditional Knowledge

The Developer’s Assessment Report makes use of all the publicly available traditional knowledge available, including multiple reports from the community of Lutsel K’e. A summary of the relevant information that was used in the Assessment Report is provided below.

Context

Traditionally, subsistence harvesters in the Łutsel K’e area were nomadic and followed the movements of wildlife. Spring was the time to harvest muskrats. Summer and early fall were often spent in the barren lands harvesting caribou, while fall was spent smoking and drying fish for the winter. During winter, trappers visited the barren lands to harvest all types of fur (LKEAC, 2002).

Even in a more traditional community such as Łutsel K’e, declines in traditional activities such as fishing have been experienced. Łutsel K’e Elders report that fishing used to be a daily necessity in the past, as fish were required to feed a harvester’s dog team (5 to 7 fish per day would be sufficient to feed 7 dogs). With the replacement of dog teams by snowmobiles, fishing is not done as frequently (LKEAC, 2002).

Cultural and Spiritual Sites

During community scoping sessions in Fort Smith in November 2007, concerns were expressed regarding the routing of the transmission line across the Lockhart River (Desnedhe Che) due to the presence of a sacred place at Parry Falls called “The Lady of the Falls” (Ts’ankui Theda), east of Fort Reliance (MVEIRB, 2008a). The legend of the “Old Lady of the Falls” is described in a traditional knowledge study of the Kaché Tué region (LKDFN, 2001). The falls is described as a place where people go to ask for help, and where people give things in return. It is said that the lady in the falls feeds people by providing caribou or moose that have drowned in the river. The Denesołine (Łutsel K’e Dene) believe that the lady in the falls is a spirit that helps all walks of life, including nature and animals. In the past, the site was a common gathering place; people would pass through the area on their way to the barren-grounds. Cabins were once built around the mouth of the Lockhart River, and some were still present in 2001 (LKDFN, 2001). It is a site that is still visited by community members today to pay respects to ancestors. The “Lady of the Falls” legend suggests the holistic view of the land held by the Denesołine; the land is seen as being alive, with human characteristics. The belief in the land as a spiritual or supernatural power that can strengthen, heal and provide hope to people who are not well is also very important to the Denesołine relationship to the "Old Lady of the Falls".

Traditional Knowledge studies conducted with representatives of Fort Resolution (Deninu Kue First Nation) Fort Smith, Hay River, Fort Smith and Łutsel K’e in 2006 helped to identify issues that would need to be addressed by the proposed Project; however, no sites of cultural or spiritual significance were identified by the participants. A review of the MVLWB public registry of Water Licence N1L4-0154 (Taltson Hydro) resulted in the identification of several grave sites that had been submerged as a consequence of the 1960s development of the Taltson Twin Gorges and Nonacho Lake hydroelectric project (Northwest Territories Water Board [NWTWB], 1982).

Fishing

Although fishing has declined somewhat in Łutsel K’e, it is perhaps the most pronounced form of traditional resource harvesting that occurs (LKEAC, 2002). In areas of abundance, subsistence needs are quickly met by gillnetting; on the Snowdrift River, for example, fish are so abundant that nets can be left in for only a day or two before one’s needs are met for an entire season (LKEAC, 2002). In fact, fish resources are often so abundant that fishermen often welcome “snarls” in their nets, as this helps prevent them from catching too much fish. One informant suggested that jackfish can be caught with an old bag or “even with your socks” (LKEAC, 2002), suggesting that this species is particularly easy to catch. Figures 1 and 2 show the location of the prime fishing and netting areas reported by Łutsel K’e.

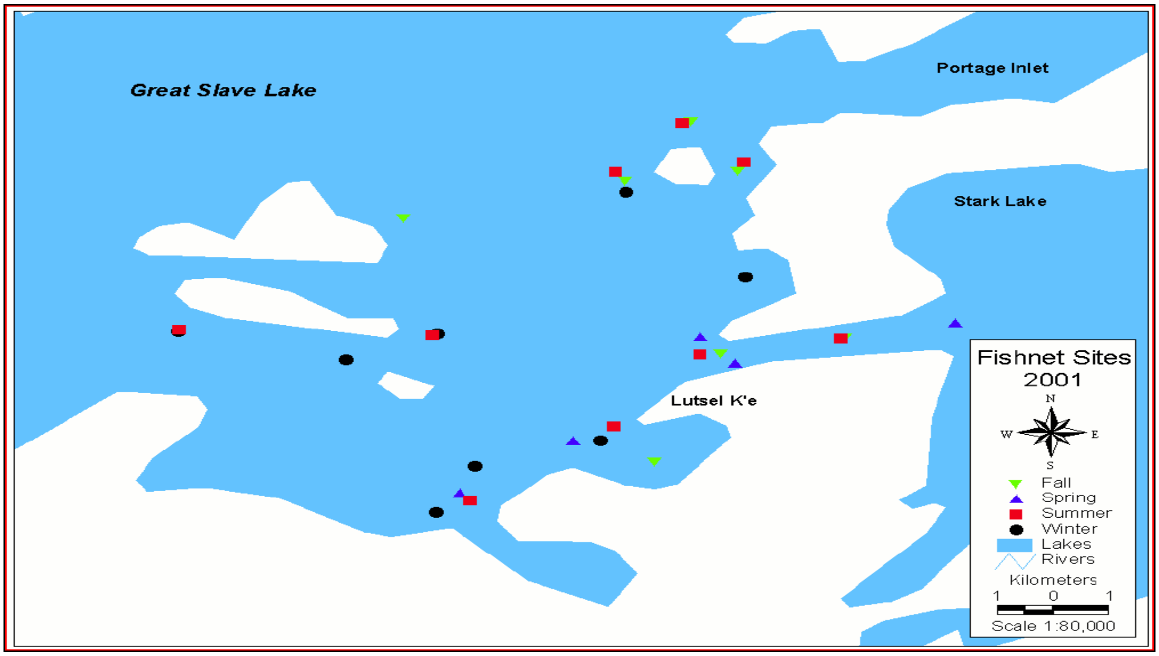

Figure 1 Łutsel K'e Fishnet Sites

Source: (LWLED, 2002)

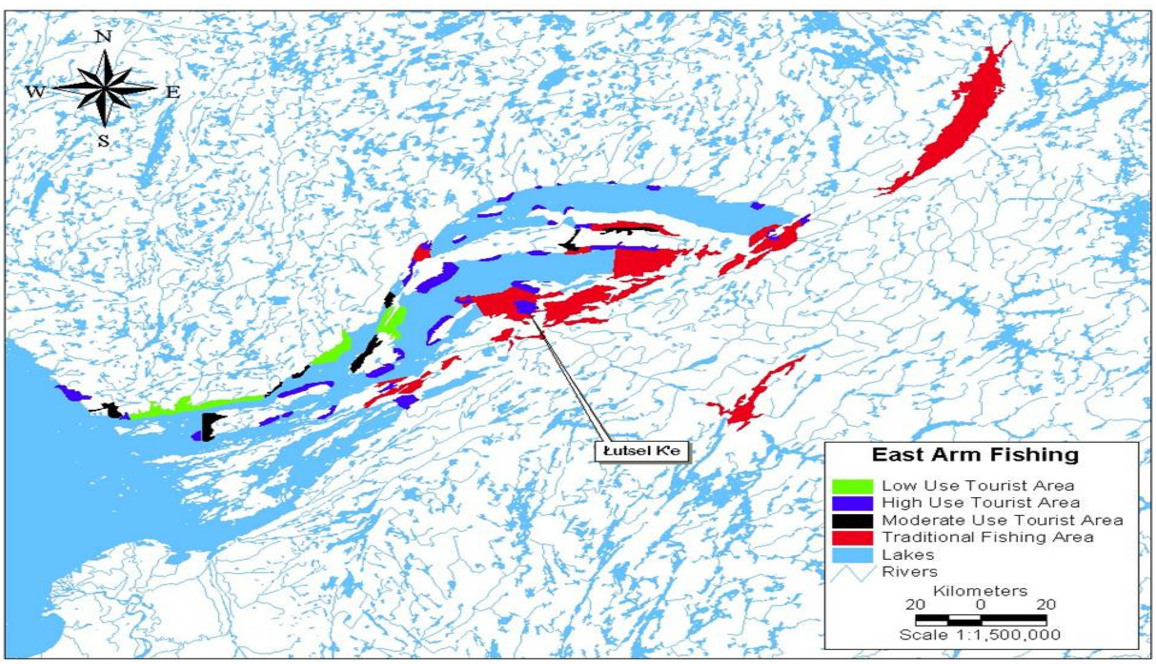

Figure 2 East Arm Fishing Locations Map

Source: LKEAC (2002)

When fishers are angling, whitefish (*Coregonus clupeaformis*) and cisco (*Coregonus artedi*) are often used to bait trout and moria (*Lota lota*) (LKEAC, 2002). Moria (burbot) is a food preferred by Elders and tends to be found in shallow bays and muddy/grassy areas along the shore; this species is rare compared to whitefish and trout, which are typically caught in gillnets set by community members (LKEAC, 2002). In addition to the use of nets and angling, traditional fishing techniques include the use of spears and baited traps (such as hooks rigged inside of a hollow log). In winter, fishers may jig through a single hole (ice fishing) or set gill nets beneath the lake ice by using a series of holes. Recent observations by Johnny Desjarlais, a resident of Łutsel K'e (personal communication, July 2008), and fisheries field guide include:

- Ice is leaving the lake in June. The edges melt faster than the center; during this time, the vegetation around the edges grows extremely fast. Therefore, vegetation is available for pike spawning in June around the lake margins.

- Beaver populations are declining as they can't adapt to the changing (fluctuating) water levels. When water rises in the winter, their homes are flooded and their food stashes are washed away and/or the beavers drown.

- Walleye have historically been caught at the upstream end of Trudel Lake and near the downstream end of Gertrude Lake. In both locations, walleye are located in the deeper waters immediately adjacent to faster flows.

With respect to Nonacho Lake, Johnny Desjarlais (2008) noted that:

- Arctic grayling were abundant in Nonacho Lake before the flooding of Nonacho and the Taltson dam; they cannot find any grayling anymore.

- Lake Trout stay in the shallow waters until July when the water begins to warm and then they use the deeper waters.

- In June, lake trout are caught in the shallower areas at the edge of the drop-off. They are harder to catch as they are spread along the large shoreline.

- In August, lake trout are found in the deepest areas of the lake – they are easy to catch as they congregate in these areas.

- All pike are found along the lake margins – big and small. They are never caught in the open and deeper waters.

Water fluctuates more in recent years than it used to. They say the control of the sluice gates is not done as well as it was in past. High flows are typically in June; this June (2008) the water was lower than typical years.

Hunting and Trapping

As shown in Figure 3, household consumption of harvested meat and fish in Łutsel K'e has declined, as has trapping. Concurrently, the rate of wage employment remained stable, and the percentage of residents hunting or fishing increased. This may indicate less communal hunting and fishing is occurring and that increasingly, individuals are harvesting country food for their own needs, or that comparatively low fur prices during the period may have discouraged trapping and shifted activity to hunting and fishing. There is low certainty regarding what is causing changes to people's meat and fish consumption in Łutsel K'e as significant complex socio-cultural relationships exist that are not captured by statistics.

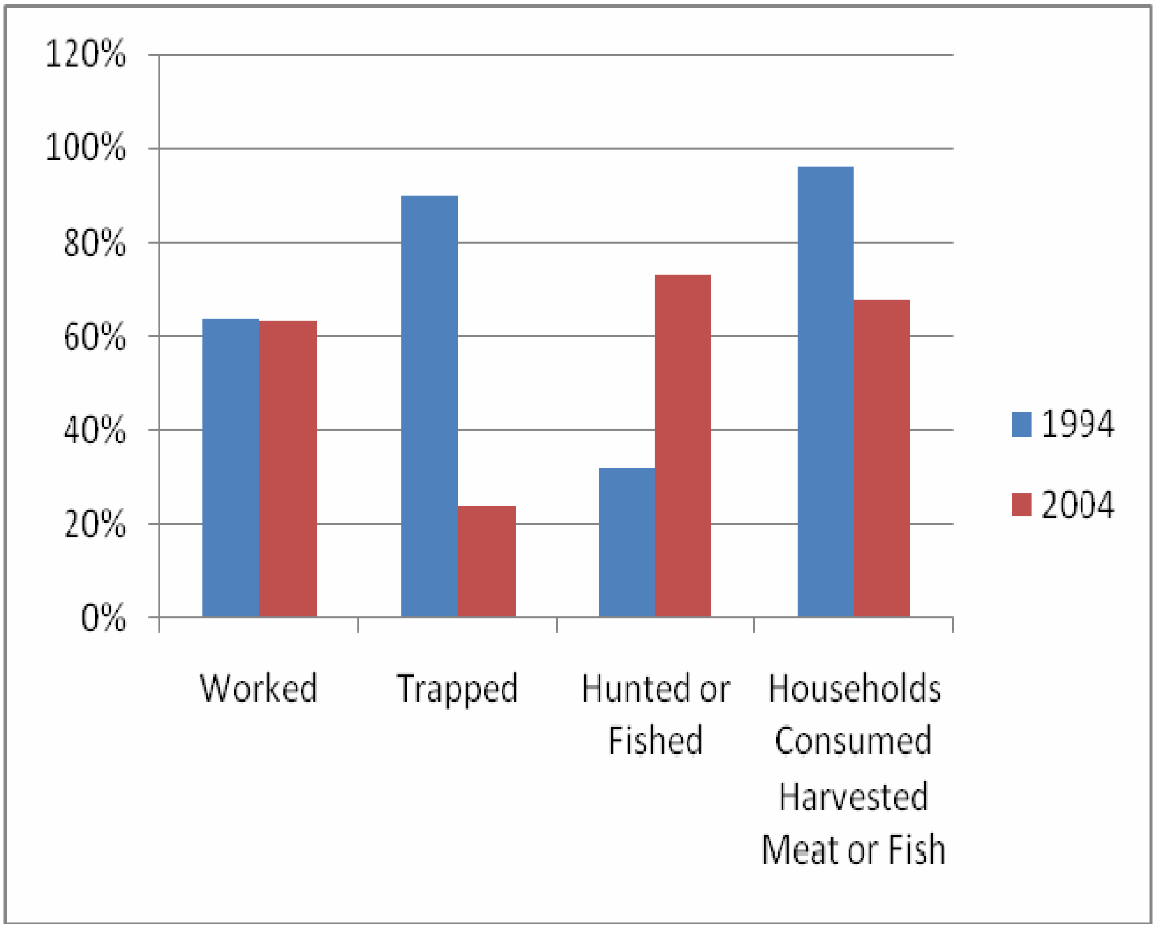

Figure 3 Participation in Traditional Economy (1993 - 2004)

Source: NWT Bureau of Statistics (1994 and 2006)

Income from selling furs was so low for a number of years that it appears to have been reduced to a part-time occupation with total income from furs in the South Slave Region exceeded by the total amount of government grants and contributions. However, it is important to note that trapping is seldom carried out in isolation from other productive harvesting activities. While out on a trapline, a harvester is also quite likely to be hunting and possibly fishing for food. Figure 4 shows the location of traplines emanating from Łutsel K'e. This also provides a glimpse into the spatial extent of trapping undertaken by trappers from Łutsel K'e.

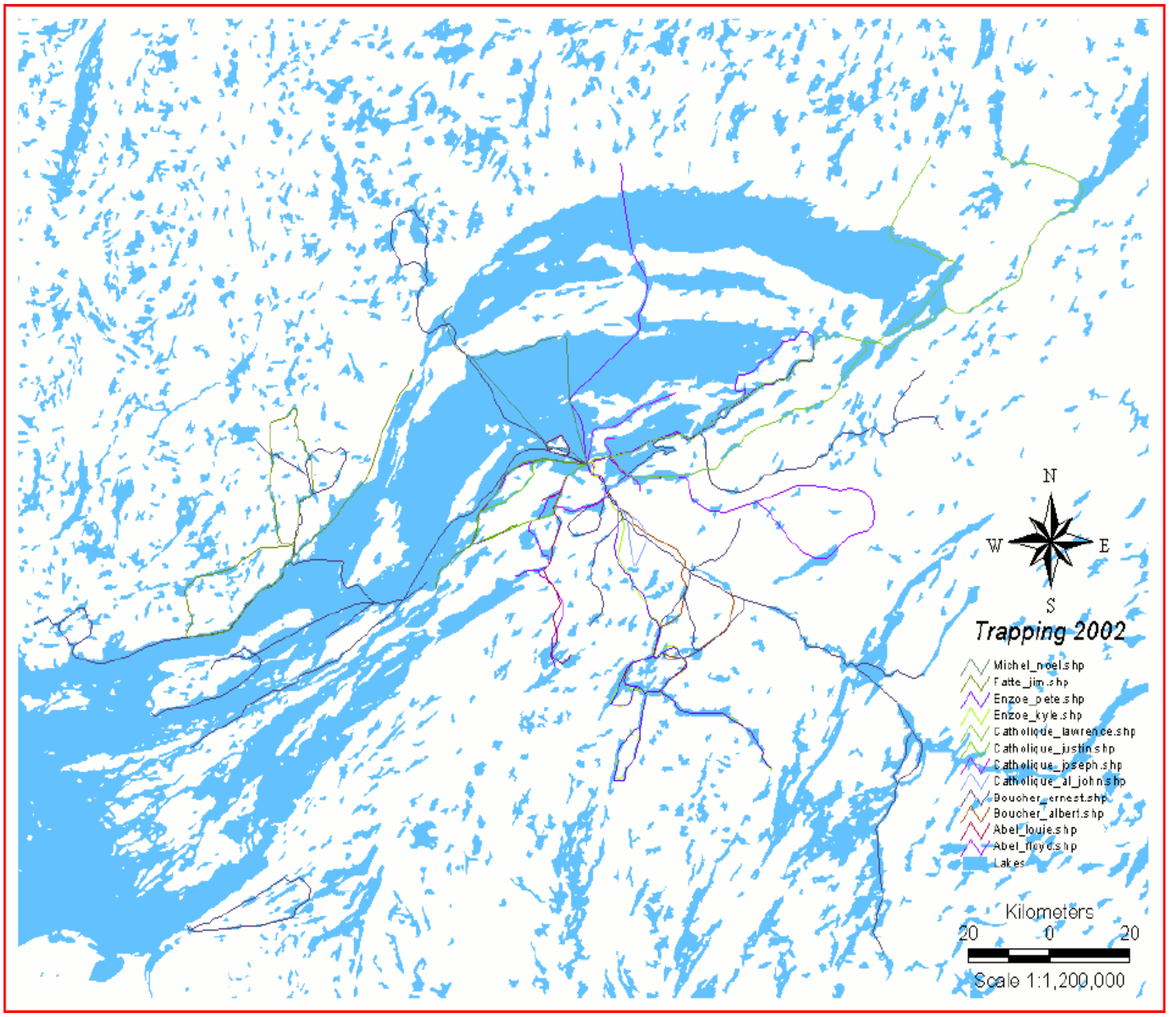

Figure 4 Łutsel K'e Traplines 2002

Source: LWLED (2002)

Country Food Consumption

In 1994, the Centre for Indigenous Peoples' Nutrition and Environment (CINE) at McGill University conducted a dietary survey of 1,012 individuals in 16 Dene/Métis communities. The major finding of the study was that "in no instance was the average contaminant intake above the guidelines for tolerable daily intake" (Receveur et al., 1996). The study results also provide valuable information regarding the relative contribution of country food to nutrition of RSA residents. The survey concluded that caribou, moose, rabbit, beaver, whitefish, trout and grayling were some of the most preferred species in Łutsel K'e. The locations of the fall moose and early winter caribou harvest in 2001 are shown in Figures 5 and 6.

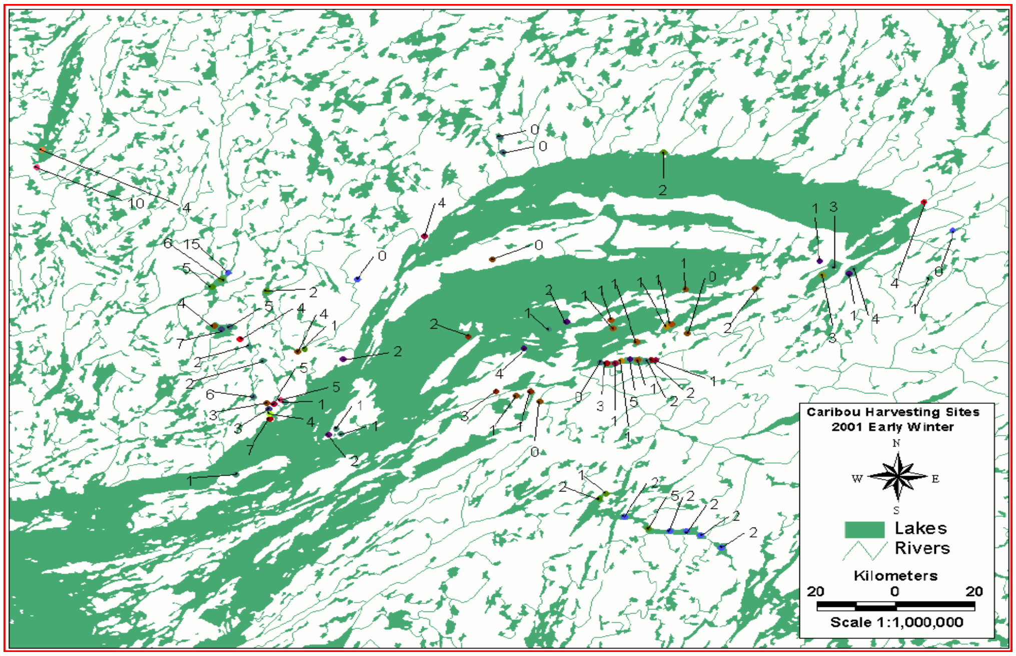

Figure 5 Caribou Harvest Sites 2001 Early Winter Łutsel K'e

Source: LWLED (2002)

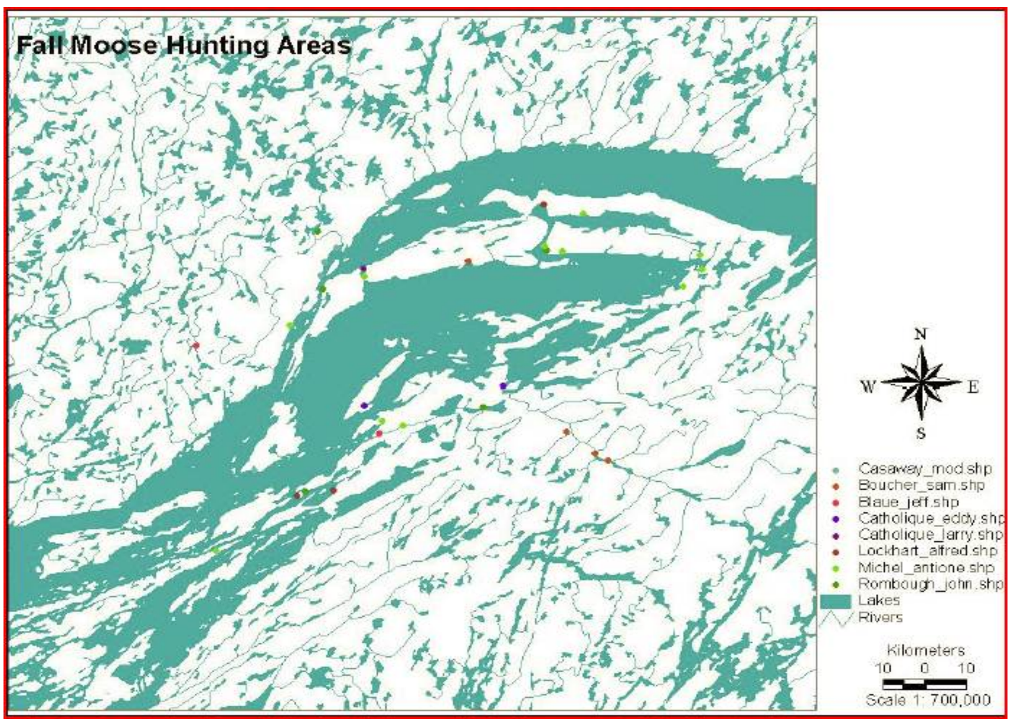

Figure 6 Fall Moose Hunting Areas Fall 2002 Łutsel K'e

Source: LWLED (2003)

Traditional Knowledge of Harvested Resources

Traditional resource harvesters have specific knowledge of the resources they hunt, trap, fish or gather relating to aspects such as where harvested resources can be found and their health or behaviour. This information can be very valuable in the environmental assessment process. This section presents a sampling of information pertaining to Łutsel K'e's Traditional Knowledge of harvested resources as researched, documented and reported by the residents of Łutsel K'e.

Fish

The original hydroelectric project on the Taltson River was seen as the cause of many effects to fish and fish health. For example,

"*Long ago at Nanula Tué before they build the dam there were good fish just like Great Slave Lake fish. Now they have a dam [on Nanula Tue] and fish are different. I remember before they build the dam I trapped around there….when the dam was built there – there were lots of changes. You can't eat the fish now because it's soft [and] skinny (PM 1999).*" (Łutsel K'e Dene First Nation, 2001).

The fish taken from Stark Lake (typically whitefish and trout) are generally known by the residents of Łutsel K'e to be less healthy (with higher levels of disease and parasitism) than fish from other areas (LKEAC, 2002). Community informants mentioned the physical condition (thinness, unusual proportions – "big heads with small tails") and lack of taste, compared to fish from elsewhere. However, limited fishing does occur on this lake because it is the first to freeze in the winter and the first to break up in the spring (it allows for safer harvesting during seasonal transition periods), but harvesters carefully inspect their catch and throw back any questionable fish. LKEAC (2002) notes that Łutsel K'e women often have considerable skill at assessing fish health because after years of processing (drying and smoking) fish, any abnormalities are immediately recognized. In addition to the indicators noted above, odour and the condition of the liver (a small, white liver indicates sickness) also provide points of reference.

At the other end of the spectrum, the large lake trout found in Great Slave Lake (GSL) are often felt to be almost too rich to eat; the preferred "family serving size" is a lake trout of 8 to 12 pounds (LKEAC, 2002). Fish caught near Fort Reliance and along the northern shore of the East Arm have red flesh, good texture (firmness) and are generally considered to taste better than fish caught near the south shore and the community, which have a paler-coloured flesh. There is also a preference for female lake trout and whitefish, explicitly for the enjoyment of the eggs and "tubes" associated with the reproductive system (LKEAC, 2002). Noticeable differences also occur between whitefish in McLean Bay (which are "bigger and different") and the rest of Great Slave Lake. Among the thirty interviews conducted by LKEAC (2002), one harvester reported that since the 1980s the health of trout has declined in the East Arm.

In terms of general harvesting locations, Łutsel K'e elders reported that the wind influences fish movements by generating near-surface lake currents; in strong wind, fish can be found on the leeward (sheltered) side of islands. Lake trout and jackfish (pike) are often found in shallow, grassy bays, and can be speared by harvesters at these locations (LKEAC, 2002). After the spring break-up, trout feed near shore. During the late summer, when the water is at its warmest, large lake trout tend to swim into deeper, cooler water and thus become more difficult to catch (LKEAC, 2002).

In the East Arm of Great Slave Lake, jackfish (*Esox lucius*) spawn in the spring (between late May and early June) whereas lake trout (*Salvelinus namaycush*) tend to spawn in the fall; however, in the Murky Channel area (near Łutsel K'e), trout and jackfish sometimes spawn at nearly the same time (LKEAC 2002). Adult fish in the East Arm can grow to be exceptionally large for their particular species, and for this reason the area is considered to offer world-class sport fishing opportunities.

Caribou

Dragon (2002) noted the temperament (approachability) of individual caribou depends upon the size of the herd and the ambient temperature; the animals tend to be more skittish when in smaller groups or when the temperature is colder than normal (-35°C to -55°C) (Dragon, 2002).

Plants

Traditional-use plants are those plants used by Aboriginal people in the RSA as part of their traditional lifestyle. This includes use as food (e.g., berries), for ceremonial purposes, medicinal purposes, and for shelter and other uses.

The objective of vegetation reconnaissance surveys (performed by Rescan) was to generate a preliminary list of plant associations in the area that would provide information for future field planning. Field work resulted in the surveying of 21 ground plots, as well as numerous aerial surveys of the transmission line (*Taltson Hydro Expansion Project 2003 Baseline Report*. Prepared by Rescan Environmental Services). Plant associations were distinguished primarily by species composition, physical structure, and their geographic location with respect to the treeline. No specific studies to identify the types and distribution of traditional use plants have been completed for the Project. Table 2 provides a general list of traditional plants potentially found in the general area of the Project.

Table 2 Traditional Plants Potential in the NWT

Common Name		Traditional Use	Reference
Trees	Aspen	food, medicine, tools, fuel	Marles et al. 2000
	black spruce	food, medicine, shelter, fuel, tools	Andre and Fehr 2002
	Jack pine	food, medicine, tools, shelter, fuel	Marles et al. 2000
	paper birch	food, medicine, tools, bait	Andre and Fehr 2002
	Tamarack	medicine, fuel	Andre and Fehr 2002
	white spruce	food, medicine, shelter, fuel, tools	Andre and Fehr 2002
Shrubs	Willow (various)	fuel, food, tools, shelter, medicine, tobacco, insect repellent, mothball, fire starter	Andre and Fehr 2002
	black currant (black berries)	Food	Andre and Fehr 2002
	blueberries	food, medicine	Andre and Fehr 2002

Common Name		Traditional Use	Reference
	bog birch (dwarf birch)	Flooring	Andre and Fehr 2002
	cranberries	food, medicine, dye	Andre and Fehr 2002
	crowberries	food, medicine	Marles et al. 2000
	gooseberry	food, medicine	Marles et al. 2000
	green alder	medicine, fuel	Andre and Fehr 2002
	juniper (berries)	Medicine	Andre and Fehr 2002
	kinnikinnick (bear berries)	Food	Andre and Fehr 2002
	Labrador tea	food, medicine	Andre and Fehr 2002
	lingonberry (bog cranberry)	food, medicine, dye	Marles et al. 2000
	raspberries	Food	Andre and Fehr 2002
	rose	food, medicine	Andre and Fehr 2002
Other	cloudberries	food	Andre and Fehr 2002
	bulrushes	food, medicine, baskets	Marles et al. 2000
	liquorice root	food	Marles et al. 2000
	sphagnum (moss)	diapers, cleaner	Andre and Fehr 2002
	Lichen	food, medicine	Marles et al. 2000

The information on traditional plant use provided by Marles et al. (2000) and Andre and Fehr (2002) is consistent with the results of a 1993 research project on traditional Dene medicine completed by a research team composed of Marie Adele Rabesca, Diane Romie, Martha Johnson and Joan (Rabesca et al., 1993).

The analysis of plants that are potentially found within the plant associations that occur both north and south of the treeline in the taiga shield (south of the treeline) that were ranked high in terms of traditional plant potential included Burns, Lichen-rock and Disturbed Sites were ranked low. North of the treeline, the plant associations that were ranked high in terms of traditional plant potential included Esker Complex/Riparian Birch Shrubland and Heath Tundra, while Burn, Wetlands/Snowbanks and Disturbed Sites were ranked low.

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