



KEEWATINOOW CAMP MEMORANDUM

Subject: Keewatinoow Construction Camp Waste Water: Screening of Sewage Effluent Discharge.

To: Pat McGarry
Manitoba Hydro

From: Kurt Mazur
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Date: February 2, 2012

Introduction

The following provides a screening of the potential effects of sewage effluent discharge on water quality and fish habitat in proposed receiving watercourse, Creek Sixteen, and the Nelson River. This screening is based upon the conceptual design of the waste water system and existing information regarding the receiving waters.

Water Quality

Methods and Data Sources

The subsequent screening was prepared using the following available information:

- Creek Sixteen Discharge: range of discharge data collected by Manitoba Hydro (Table 1);
- Effluent Discharge Rate and Discharge Regime: an effluent discharge rate of approximately 2,848 m³/day was used. This rate was calculated based on the design flow discharge of 59,813 m³ released over a three week period (i.e., 21 days). This design accounts for a camp of 750 people producing 275 L/person/day of wastewater over a 290 day period. It was assumed that if less wastewater is produced (i.e., fewer people and/or shorter storage period) that this discharge rate would remain the same and that the discharge would be of shorter duration; and,

- Effluent Quality: The target effluent quality of the proposed lagoon (Table 2; AECOM *pers. comm.*). Since a target for pH was not available, it has been assumed that the pH of the effluent will be within range of the MWQSOGs for the protection of aquatic life (6.5 – 9.0; MWS 2011).

Results

As the effects of discharge of effluents on water quality in any receiving environment inherently depend upon effluent discharge rate, effluent quality, background water quality in the receiving environment, and the discharge of the stream receiving the effluent, any combination that reduces the overall contribution of effluent constituents to the receiving environment is favourable. Due to the occurrence of low flows in the open-water period in Creek Sixteen - and the effective absence of flows during some periods, the receiving environment would not have the capacity to assimilate effluent under all conditions.

Under the current design plans, effluent would be discharged once or twice a year depending on the camp population and therefore the amount of wastewater produced. If there is only one discharge per year it would occur in the fall, if twice a year, there would be one small discharge in the spring (75 days storage) and a larger one in the fall (290 days storage). Under this scenario, the majority of the wastewater produced would be discharged in the fall. According to the data available (Table 1) discharge rates in Creek Sixteen are virtually non-existent at this time of year; therefore, the ability of the creek to assimilate the effluent would be poor with the effluent in effect constituting all of the flow within Creek Sixteen. Although not directly appropriate, a comparison of the effluent quality to the MWQSOGs for PAL shows that, as would be expected, exceedences in TSS, TP, and ammonia would occur under this scenario (Tables 2 and 3).

Fish Habitat

Methods and Data Sources

Fish habitat in Creek Sixteen was assessed using existing information, including the following:

- A review of the Keewatinoow Converter Station & Bipole III Aski Keskentamowin Report, Fox Lake Cree Nation, 2011;
- Results from Conawapa environmental baseline studies on groundwater and brook trout surveys of Creek Sixteen (North/South unpublished data);
- Results from key person interviews (Don MacDonald, Regional Fisheries Manager, Manitoba Water Stewardship, Thompson, MB);
- Interpretation of digital ortho imagery (DOI) of the creek; and
- The description of the waste water outfall described by AECOM (2011, 2012).

Fish habitat was assessed according to criteria outlined in DFO (1998) and the DFO Risk Assessment Framework was applied.

Results

The main channel of Creek Sixteen originates as a narrow, shallow, and soft-bottomed channel within a saturated area upstream of the Conawapa Access Road crossing, with a mapped groundwater upwelling 200 m upstream of the road (Appendix 1). The channel becomes slightly wider (approx. 3 m) and more defined downstream of the road, and flows southeast to the Nelson River. A short branch, originating on the southeast side of the Conawapa Access Road near the site of lagoon cell #2, joins the main creek channel approximately 300 m upstream of the confluence of Creek Sixteen and the Nelson River. Creek Sixteen channel connection to the Nelson River is undefined where the channel becomes braided and eventually flows occur as a broad area of saturated ground prior to reaching the Nelson River. Riparian vegetation consists predominately of willow and grasses/sedges. Hydrological information for Creek Sixteen indicates that flow is restricted to spring freshet with low to zero flow throughout the remainder of the year.

Other than groundwater mapping and a visual survey for brook trout, as part of the Conawapa environmental baseline studies, no existing information on fish and fish

habitat was found. The brook trout visual survey during the fall 2011 found no brook trout near the mapped groundwater site. More detailed fish use studies are not available but considering the similarity in size and location of Creek Sixteen and Creek Fourteen fish use is likely similar between the two creeks. During two sampling periods, spring and fall, fish were not found in Creek Fourteen (see Bipole III Aquatic Environment Technical Report). It was concluded that Creek Fourteen does not directly support fish and provides indirect fish habitat in the form of water, nutrients and food (lower trophic levels) to the Nelson River.

Creek Sixteen is a small, ephemeral tributary with an undefined downstream connection to the Nelson River. The creek is slightly larger (i.e. greater length) than Creek Fourteen and contains ground water input. Considering these two factors, and the absence of detailed fish and fish habitat studies, fish habitat is rated as Marginal, with the possibility of seasonal fish use, particularly forage fish. However, the main function of Creek Sixteen would be similar to Creek Fourteen, in providing water, nutrients and food (lower trophic levels) to the Nelson River.

Effects Assessment

The potential effects of the construction and operation of a sewage effluent outlet structure in Creek Sixteen was assessed following the *Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff* (DFO 2010). AECOM (2011) described the waste water outlet as a pipe that discharges to “natural drainage ditches” that connect to the Nelson River via a stream. Immediately southeast of lagoon cell #2 and the outfall location lies a short branch of Creek Sixteen. It is assumed that this tributary is the natural drainage ditch where the outfall will be located.

The effluent outlet pipe will discharge to the small branch of Creek Sixteen with the pipe terminating away from the stream bank where effluent will flow via gravity to the stream (AECOM 2011). The pipe will discharge through metal mesh and then onto rip rap before flowing over land to the creek (AECOM 2012). Therefore there will be no excavation of the creek channel. The scale of negative effect for the outlet is rated as Low (Table 5). The fish and fish habitat sensitivity was rated as Low for the Creek Sixteen as outlined in Table 6. Overall there is a Low Risk of a HADD for construction of an effluent outlet structure at the Creek Sixteen.

Downstream Effects

The confluence of Creek Sixteen and the Nelson River occurs within a straight section of the River with no backwater bays or off-current areas. The absence of backwater areas at the confluence will aid in the rate of mixing of effluent with Nelson River water which is expected to occur rapidly considering the flow rate of the Nelson River (effluent discharge rate 0.03 m³/sec and Nelson River mean discharge rate 2,400 m³/sec). The confluence of Creek Eighteen with the Nelson River lies approximately 1 km downstream of the Creek Sixteen confluence on the same bank. The mouth of Creek Eighteen is a known fish bearing stream; however, considering the anticipated rate of mixing and the distance from Creek Sixteen, full assimilation of the effluent is expected before it reaches Creek Eighteen.

Conclusions

Creek Sixteen is an ephemeral stream that lacks defined channel connection to the Nelson River. The creek is rated as Marginal fish habitat primarily functioning in providing indirect fish habitat in the form of water, nutrients and food to receiving waters. Considering its small size and short period of flow, the contribution of water, food and nutrients to the Nelson River is minimal.

Construction of the outlet structure near Creek Sixteen will have no effect to the stream bank or channel proper as the outlet and rip rap will be away from the bank.

Discharge of waste water effluent to Creek Sixteen will result in exceedences of the MWQSOGs for PAL for TSS, TP and ammonia within the creek. However, as the toxicity of ammonia to aquatic life varies with pH; the pH of the effluent will be treated as required such that the effluent would not be acutely toxic to remain in accordance with Section 36 of the *Fisheries Act*. Additionally, as this creek is considered Marginal fish habitat and expected to function primarily as indirect fish habitat, fish will likely not be directly affected. Given its relative small volume, waste water effluent is expected to be rapidly assimilated once entering the Nelson River and therefore no downstream effects are expected.

References

- AECOM. 2011. Keewatinoow Converter Station Lagoon Conceptual Design – Technical Memorandum. Prepared by AECOM Canada Ltd. For Manitoba Hydro. December 2011. 19 pp.
- AECOM. 2011. Keewatinoow Converter Station Lagoon for Construction Camps, Lagoon Site Plan. Prepared by AECOM Canada Ltd. For Manitoba Hydro. January 23, 2012.
- FISHERIES AND OCEANS CANADA (DFO). 1998. Habitat Conservation and Protection Guidelines. 21 pp.
- FISHERIES AND OCEANS CANADA. (DFO) 2010. Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff Version 1.0. August 2010.
- FOX LAKE CREE NATION. 2011. Keewatinoow Converter Station & BiPole III Aski Keskentamowin Report. December 16, 2011. Prepared by Wendy Ross, Research Assistant, Fox Lake Cree Nation – Negotiations Office. 86pp.
- MANITOBA WATER STEWARDSHIP. 2011. Manitoba Water Quality Standards, Objectives, and Guidelines. Water Science and Management Branch, Manitoba Water Stewardship Report 2011-01, July 4, 2011. 68 pp.

Tables

Table 1. Creek Sixteen discharge measured by Manitoba Hydro.¹

Month	Date	Discharge (m ³ /s)
May	5/27/1992	0.28
	5/27/1995	0.05
	5/16/2005	0.01
	5/4/2006	Non-Meterable
	5/15/2007	0.06
	5/26/2008	0.05
June	6/12/2005	0.00
	6/6/2007	0.01
July	7/6/2005	0.00
	7/15/2006	Non-Meterable
	7/3/2007	0.02
	7/2/2008	0.02
August	8/12/2005	0.01
	8/11/2006	Non-Meterable
	8/1/2007	0.00
	8/29/2007	0.01
	8/8/2008	0.00
September	9/5/2004	0.01
	9/12/2005	0.02
	9/26/2006	Non-Meterable
	9/15/2008	0.00
October	10/16/2009	0.02
Spring (May-June)	Min	0.00
	Max	0.28
Fall (September-October)	Min	0.00
	Max	0.02

¹ Data obtained from eroom: Conawapa EIS > 1.4.3.3.2 - Physical Environment > 1.4.3.3.2.4_Water_Regime > 09_04_03_17_Data_Requests > support to creek studies. File dated February 11, 2011.

Table 2. Effluent quality of the proposed lagoon (AECOM, *pers comm*).

Parameter	Value
TP	<1 mg/L
BOD	25 mg/L
TSS	25 mg/L (excluding growing algae)
Fecal Coliform	200 / 100 mL
Total Coliform	1500 / 100 mL
Ammonia	15 mg/L
Organic Nitrogen	10 mg/L
Nitrates	1 mg/L
TKN	25 mg/L
TN ¹	26 mg/L
pH	6.5 - 9.0 ²

¹ calculated as the sum of TKN and nitrate/nitrite.

² the pH of the effluent is unknown, but is assumed to be within range of the MWQSOGs for PAL.

Table 3. MWQSOGs for the protection of aquatic life and recreation (MWS 2011).

Water Usage	pH	TSS (mg/L)	Ammonia (mg N/L)	Nitrate (mg N/L)	Faecal Coliform Bacteria (CFU/100/mL)
Protection of aquatic life	6.5-9.0	5 mg/L increase above background (where background TSS is ≤25 mg/L) for a 30-day averaging duration. 25 mg/L increase above background (where background TSS is ≤250 mg/L) for a 1-day averaging duration. ¹	Objectives are dependent upon water temperature, pH, cool-water vs. cold-water species, and presence/absence of early life stages (e.g., 0.49-48.8 mg N/L at 5°C and 0.25-48.8 mgN/L at 25°C)	13.0	-
Recreation	5.0-9.0	-	-	-	200

¹Or 10% increase above background where background TSS > 250 mg/L.

Table 4. Manitoba Municipal Wastewater Effluent Standards (MWS 2011).

Parameter	Units	Value
Total Phosphorus	(mg/L)	1
Faecal Coliform Organisms	(#/100 mL)	200
Biological oxygen demand (BOD)	(mg/L)	25
Total Suspended Solids (TSS) - excluding growing algae	(mg/L)	25

Table 5. Scale of negative effect rating for the effluent outlet structure.

Attribute	Description	Scale
Extent	The direct footprint of the development as well as indirectly affected areas, such as downstream areas.	Low
Duration	The amount of time that a residual effect will persist.	High
Intensity	The expected amount of change from baseline condition.	Low
Overall		Low

Table 6. Sensitivity of fish and fish habitat at the assumed outlet structure location in Creek Sixteen.

Attribute	Description	Rating
Species Sensitivity	Sensitivity of fish species/community to changes in environmental conditions (e.g., suspended sediments, water temperature, oxygen).	Low
Species Dependence on Habitat	Use of habitat by fish species. Some species may have very specific habitat requirements.	Low
Rarity	The relative strength of a fish population or prevalence of a specific habitat type.	Low
Habitat Resiliency	The relative strength of a fish population or prevalence of a specific habitat type.	Low
Overall		Low

Appendix 1. Creek Sixteen Fish Habitat Assessment Booklet

Construction Camp

Creek Sixteen

Location

Datum:	NAD 83
UTM:	Zone: 14N
	Easting: 817369
	Northing: 6294020
Data Source:	DOI

General Morphology

Stream/Lake:	Stream
Pattern:	SI
Confinement:	UN
Stage:	-
Flow Regime:	Ephemeral
Morphology:	-
U/S Drainage:	2.5 km ²
Distance to Receiving Water:	Nelson River 0.46 km



Site Conditions

+ Physical Data

Stage: Moderate

Channel Profile

Channel and Flow

Wetted Width (m)	-
Channel Width (m)	~3

Banks (%)

Right Bank Stability	-
Left Bank Stability	-

Riparian

Floodplain Distance (m)

Right Bank	-
Left Bank	-

Riparian Distance (m)

Right Bank	-
Left Bank	-

Riparian Vegetation Type (Y/N)

None	-
Grasses/sedges	Y
Shrubs	-
Conifers	-
Deciduous	Y
Mixed Forest	-

Canopy Cover (%)

Tr

Cover Types

Total Cover Available (%)

-

Cover Composition (% of Total)

Large Woody Debris	-
Overhanging Vegetation	Y
Instream Vegetation	Y
Pool	-
Boulder	-
Undercut Bank	-
Surface Turbulence	-
Turbidity	-

Habitat Type

Habitat Composition

Pool	-
Run	-
Flat	-
Riffle	-
Rapid	-

Substrate

Substrate Type (dominance)

Fines	-
Small Gravel	-
Large Gravel	-
Cobble	-
Boulder	-



Upstream view of Creek Sixteen 0.2km north of the Conawapa Access Road.



Downstream view of Creek Sixteen 0.2km north of the Conawapa Access Road.

Fish Habitat Classification and Sensitivity

+ Fish Habitat

Fish Habitat Present Yes
DFO Manitoba Agricultural Watershed Classification: -
Fish Habitat Classification: Marginal

Fish Presence: None.

Comments:

In September 2011 a groundwater site in Creek Sixteen, located 200m upstream of the Conawapa Access Road (CAR) was assessed for brook trout spawning. From this assessment it was found that the creek channel was narrow, shallow, and soft-bottomed. No evidence of brook trout spawning was found. From desktop analysis the channel appears to become slightly larger and more defined downstream of the CAR, and to flow southeast to the Nelson River. The channel connection to the Nelson River appears undefined.

Creek Sixteen is considered an ephemeral stream without defined channel connectivity to the Nelson River. Fish use is unknown but Creek Sixteen is similar in size and location to Creek Fourteen in which fish were not captured during two sampling periods (see Bipole III Aquatic Environment Technical Report). However, when considering the presence of ground water in Creek Sixteen and the absence of detailed fish and fish habitat studies, the possibility for seasonal fish use, particularly forage fish cannot be ruled out. Fish habitat is rated as Marginal, with the main function of Creek Sixteen similar to Creek Fourteen, in providing water, nutrients and food (lower trophic levels) to the Nelson River.

+ Habitat Sensitivity

Sensitivity Rating: Low

Comments:

Marginal fish habitat results in a low sensitivity rating.

