Keeyask Generation Project
Request to Release Impounded Water with TSS Concentrations Greater than 25 mg/L in Spring 2017

Manitoba Hydro, in its delegated authority to manage construction of the Keeyask Generation Project on behalf of the Keeyask Hydropower Limited Partnership, is requesting to:

- Release water, impounded behind cofferdams, directly to the Nelson River if the Total Suspended Solids (TSS) concentration is < 50 mg/L until approximately May 15.

The management of runoff and melt water during the spring melt reduces the risk of having insufficient capacity in the containment areas for spring precipitation events.

This request is independent of the longer term plan regarding concentrations of TSS in impounded water that is being developed and will be submitted in the near future.

Background

The Keeyask Generation Project Environmental Protection Plan (EnvPP) states:

> *Impounded water will be tested for total suspended solids (TSS) before release. If TSS concentration is < 25 mg/L, the water can be released directly to the Nelson River. If the water does not meet these criteria, it will be treated prior to release.*

In the spring of 2015 and 2016, the TSS of impounded water released directly the Nelson River was less than 25 mg/L. When TSS was > 25 mg/L, the pumps were either shut off or water was diverted to vegetation or containment areas. TSS levels in the water are determined in the field based upon turbidity measurements and the relationship between turbidity and TSS that is provided in the Sediment Management Plan for In-stream Construction.

In winter 2016/17, large quantities of snow accumulated within the dewatered work areas behind the Keeyask cofferdams. In particular, the blizzard in early March caused drifting that left snow banks in excess of 15 to 20 feet in areas of the old riverbed inside the cofferdams. Snow has been cleared from areas that are accessible, but there are many areas within the cofferdams that cannot be cleared (e.g. areas not accessible by vehicles, side slopes of haul roads). The site water management plan includes directing runoff water away from the work areas, where feasible. However, it is expected that there will be large volumes of water to manage that cannot be entirely directed away from the work areas this year. There is a risk that TSS concentrations in the water that accumulates behind the cofferdam will be greater than 25 mg/L.

Based on the existing snow volumes, the settling ponds and quarry used to manage water could hold the water volume from spring melt but they would be at or near capacity. If subsequent precipitation events occur and the TSS concentration in this water is greater than 25 mg/L, it could not be released directly to

the Nelson River and the settling ponds would be full. Turning off the pumps to wait for TSS to drop below 25 mg/L will not likely be feasible as there is continual seepage through the cofferdams. If the pumps are shut off, there is the risk that work areas and equipment will be impacted by the elevated water levels. This situation also creates the potential for contamination of the water with other less desirable substances that may present in the construction areas.

To address the above issues, a request is being made to release impounded water with TSS of up to 50 mg/L to the river during the spring melt period to ensure there is capacity in the containment areas for spring precipitation events. The location of the pump stations into the Nelson River are shown in the memo from Wil DeWit. Management of the runoff water from upland areas reduces the risk of not having sufficient capacity in the containment areas for subsequent spring precipitation events.

Potential Environmental Effects

Water Quality

See attached memo from Wil DeWit to Carolyne Northover.

Assessment of Biological Effects

See attached memo from North South Consultants Inc..

Monitoring and Reporting

Monitoring water quality will continue to be performed by Manitoba Hydro Environmental Inspectors and the Contractor's environmental and water management team. Pump stations are sampled twice per day, more frequent sampling will occur if TSS is greater than 25 mg/L. Real-time monitoring of TSS cannot occur, therefore the relationship between turbidity and TSS that is provided in the Sediment Management Plan for In-stream Construction will be utilized which is:

TSS (mg/L) = 0.79 Tu (NTU) – 2.86

A summary table indicating when TSS concentration exceeded 25 mg/L will be provided in the Environmental Protection Plan Annual Report. Alternatively, a report can be provided on an as requested basis.

Summary of Potential Effects

The very high river flow causes rapid mixing at each discharge location. The continuous discharge of water with TSS concentrations up to 50 mg/L is expected to have no adverse effect even at the discharge site, due to the rapid mixing as a result of high river flows this spring.

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MANITOBA HYDRO

INTEROFFICE MEMORANDUM

FROM Wil DeWit, M.Sc., P.Eng
Sediment & Erosion Studies Engineer
Ice & Environmental Engineering
Water Resources Engineering
Generation & Wholesale

TO Carolyne Northover
Senior Environmental Specialist
Major Projects & Protection Programs
Environmental Licensing & Protection
Generation & Wholesale

DATE 2017 04 04

FILE 243980-0500 Environmental Protection & Regulatory

SUBJECT **KEEYASK GENERATION PROJECT – SEDIMENT PLUME MODELING OF POTENTIAL HIGH TSS DISCHARGES DURING SPRING PUMPING (REV 0)**

In winter 2016/17, large quantities of snow accumulated within the dewatered work areas behind the Keeyask cofferdams. In particular, the snowstorm in early March caused a lot of drifting and accumulation. Snow has been cleared from areas that are accessible, but there are many areas within the cofferdams that cannot be cleared. The large amount of snow behind the cofferdams could result in large volumes of runoff that need to be pumped to the river during the spring melt. Based on the Environmental Protection Plan, water having a TSS concentration less than 25 mg/l will be discharged to the Nelson River. TSS levels in the water are determined based upon turbidity measurements and the relationship between turbidity and TSS that is provided in the *Sediment Management Plan for In-stream Construction*.

If end-of-pipe TSS levels are greater than 25 mg/l the water will be directed to existing containment areas (settling ponds and quarry). However, given the amount of snow within the work areas, it is likely that existing containment areas could be at or near capacity. The project work site could then be at risk if subsequent precipitation events occur and TSS is still above the 25 mg/l discharge limit. Turning off the pumps to wait for TSS to drop below the discharge limit will not likely be feasible because of the volume of water that will be present. If the pumps are shut off, there is the risk that work areas and equipment will be impacted. Not only would this be damaging to physical works and equipment, it also creates the potential for contamination of the water with other less desirable substances that may be present in the construction areas. For this reason, there is a desire to discharge water with TSS of up to 50 mg/l to the river during the spring melt period to ensure there is capacity in the containment areas for spring precipitation events. The management of this runoff water reduces the risk of not having sufficient capacity in the containment areas for spring precipitation events.

The Ice and Environmental Engineering Section was asked to run hydrodynamic sediment models to consider the potential effects on TSS in the Nelson River if water with TSS greater than 25 mg/l were pumped during the spring melt period. Water will be discharged to the river from pumping sites at the Powerhouse Cofferdam (PHCD), Central Dam Cofferdam (CDCD) and three locations along the Spillway Cofferdam (SWCD), as shown in Map 1. There is no discharge from the Tailrace Cofferdam (TRCD) location since this area will not be dewatered until later in the year. Pumping

rates observed during construction were reviewed and rates required to handle routine seepage and runoff were identified. For the current analysis, it was assumed the large quantity of snow and potential additional precipitation would make it necessary to pump at a higher rate than required for routine pumping. The routine pumping rates were doubled to produce the following rates used in this analysis:

- PHCD – 0.100 m^3/s
- CDCD – 0.690 m^3/s
- SDCD-PS1 – 0.04 m^3/s
- SDCD-PS2 – 0.110 m^3/s
- SDCD-PS1 – 0.420 m^3/s

The flow in the Nelson River in spring of 2017 is projected to be very high due to current high flows and high volumes of water available within the Nelson River watershed. Spring flows will be at least 6,000 m^3/s and possibly up to 7,000 m^3/s. For sediment modeling purposes the river flow was assumed to be 6,000 m^3/s, recognizing that higher flows would reduce the effects of pumping on in-stream TSS.

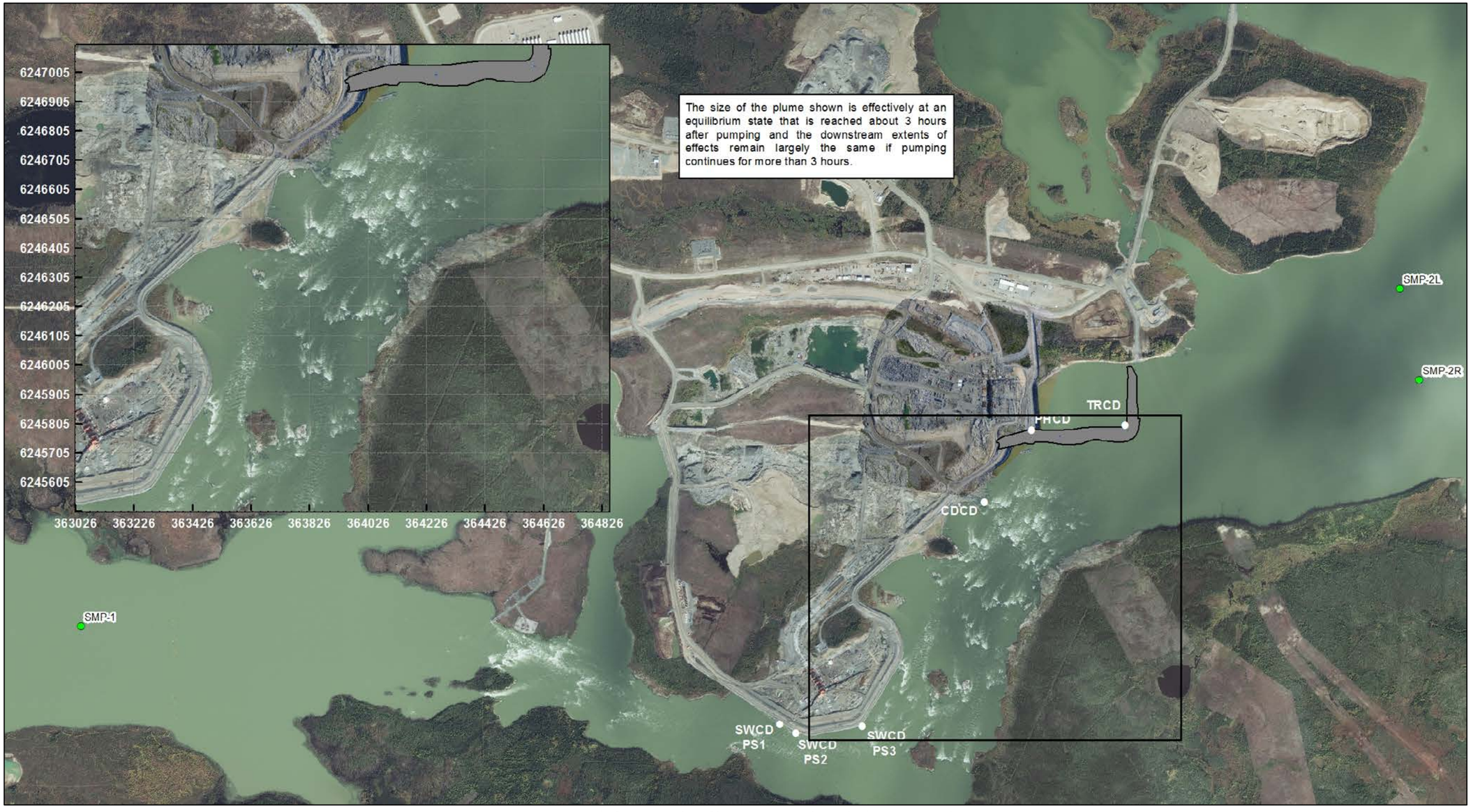
In past years, runoff and seepage water pumped directly to the river was typically less than 25 mg/L and water was diverted to vegetation or containment areas if TSS was higher. End-of-pipe TSS during spring is usually below 50 mg/l. For this reason, the sediment model assumed each of the five discharge points pumped water to the river with an end-of-pipe TSS of 50 mg/l at the flow rates noted above.

The total sediment loading rate to the river from the pump discharges at 50 mg/l is about 4.1 kg/min. Total sediment load in the river is approximately 5,400 kg/min assuming an average in-stream TSS of 15 mg/l (monitoring found an average in-stream TSS of about 16 mg/l in 2014 and 13 mg/l in 2015). Pre-construction and construction monitoring has found Nelson River TSS to typically range from about 5-30 mg/l and average between about 13-19 mg/l.

The very high river flow causes rapid mixing at each discharge location. Thus, even though the end-of-pipe TSS is 50 mg/l and twice the desired limit, the model does not show any discernible areas in the river in which TSS increases by more than 5 mg/l.

/wjd

cc:
Manitoba Hydro: J. Malenchak, J. MacDuff, S. Wakelin
NorthSouth Consultants: F. Schneider-Vieira



Map 1 – Keeyask Construction Site and Pumping Discharge Locations.

KEEYASK GENERATION PROJECT
TECHNICAL MEMORANDUM

Subject: **Discharge of snow meltwater from cofferdams**

To: Carolyne Northover
Manitoba Hydro

From: Friederike Schneider-Vieira
North/South Consultants Inc.

Date: April 4, 2017

Background

The Environmental Protection Plan for the Keeyask Generation Project indicated that impounded water would only be released directly to the Nelson River if the concentration of total suspended solids (TSS) was less than 25 mg/L; if water did not meet these criteria it would be treated prior to release. For the reasons described in the accompanying document, Manitoba Hydro is proposing to discharge water with a TSS of up to 50 mg/L directly to the Nelson River in spring 2017.

Assessment

A hydrodynamic sediment model based on predicted high flows (6,000 m^3/s) and an instream TSS concentration of 15 mg/L (based on historic data) was used to estimate the dimensions and TSS concentrations within the mixing zones at discharge locations. The model assumed the simultaneous discharge of water with a TSS of 50 mg/L at double the rates currently used to control seepage from pumping sites at the Powerhouse Cofferdam, Central Dam Cofferdam and three locations along the Spillway Cofferdam. Model results indicated no detectable plumes (i.e., TSS >5 mg/L above background). Based on the model grid, any plumes would be smaller than 7 m^2. Given the small plume size and rapid mixing, no effect to aquatic biota is anticipated. It should be noted that this conclusion assumes that no other contaminants are present, based on the site water

management plan that separates snowmelt to be discharged to the river from potentially contaminated runoff from work areas.