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Responses to Information Request 31

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IR 31 – Wetlands Directly and Indirectly Affected by the Project

References:

EIS Guidelines, Section 2.7.2.7
EIS, Section 2.7.2.7

Related comments:

CEAR # 292 (Environment Canada)

Rationale:

In Section 2.7.2.7 (p. 51), the EIS Guidelines stipulate that the proponent "assess the potential effects of the Project on wetland habitat and functions for wetlands in the project area with consideration of hydrology, biochemical cycling, wildlife habitat for migratory birds, SARA-listed species, COSEWIC-listed species, and climate"

This element of the Guidelines is relevant to the assessment of the environmental effects of the project as the wetland functions assessment is important for establishing a baseline from which to assess any future restoration (habitat compensation) success.

Section 2.7.2.7 of EIS (p. 1006-1016) provides a general overview of wetlands functions; however, it does not provide any specific information regarding habitat functions of the Project-area wetlands. The EIS broadly describes the wetlands functions in the mine site using three categories:

- Hydrological
- Biogeochemical, and
- Habitat.

According to Environment Canada the lack of specific information regarding habitat function is of particular importance in areas where, for example, the Wetland Policy goal of no-net-loss applies. A more detailed assessment of impacts to wetland functions should be achievable given the availability of baseline field data.

Information Requested:

With regards to project specific wetlands habitat function assessment, the Panel requests that Taseko:

a. Provide a more detailed project-specific habitat functions assessment, along with a description of the methodology applied. The assessment should focus on wetlands directly and indirectly affected by the Project, making use of field data to identify, for migratory birds and species at risk, specific species' use (breeding, staging, moulting) of the different wetland types.

With regards to the wetlands hydrological function and the capacity of wetlands to store, moderate, and release water in a watershed, the Panel requests that Taseko:

b. Explain the project effects on wetlands hydrological functions within the Fish Lake ecosystem, including an assessment of the significance of the effects and proposed mitigation measures.

Information Request #31a

With regards to project specific wetlands habitat function assessment, the Panel requests that Taseko:

Provide a more detailed project-specific habitat functions assessment, along with a description of the methodology applied. The assessment should focus on wetlands directly and indirectly affected by the Project, making use of field data to identify, for migratory birds and species at risk, specific species' use (breeding, staging, moulting) of the different wetland types.

Response Summary

Direct effects to wetland functions are due to the loss of wetlands through clearing, grading and construction of Project features in the mine site. The assessment indicates 311[1] ha of wetlands will be lost at post-closure compared to baseline, but the mitigation measures applied will reduce this area. These wetlands support habitat for mammals (including moose, grizzly bear, black bear, muskrat, otter, long-tailed weasel, mink, beaver and bats), migratory birds (including mallard, lesser scaup, bufflehead and American coot), and amphibians. These losses can be rendered reversible with reclamation, and with appropriate on- and off-site wetland habitat compensation.

The pit may affect surface base flows in Fish Creek downstream of the pit and indirect loss of wetlands or change in their function. Indirect effects associated with the loss of hydrological functions contain some degree of uncertainty warranting monitoring to determine actual effects. Successful implementation of the water management plan as described in the 2012 EIS is the main mitigation measure for minimizing loss of hydrological functions of wetlands located upstream of Fish Lake. Temporal loss of wetland functions can be minimized through early implementation of habitat compensation (as opposed to implementing at post-closure).

With commitments to reclamation, monitoring and early habitat compensation, the combined residual effect of the Project on wetland function is predicted to be not significant.

Assessment of wetland habitat function, including species' use taken from the 2009 and 2012 EIS, is provided below.

Discussion

This response for an assessment focuses on wetland functions pertaining to habitat and wetland-hydrology. Cross-references with the results of field data and conclusions from other disciplines

[1] Note: this is an overestimate of Project effects on wetlands. See response to IR 1 for Project effects on wetlands using baseline updated for recent logging and mountain pine beetle infestations.

(e.g. wildlife; soils; and water quality and quantity) contained elsewhere in the prior reports (2009 technical data reports, 2009 EIS, and 2012 EIS) are reiterated.

Methodology Applied

Assessing wetland functions requires an integration and interpretation of results of field surveys and models from multiple related disciplines such as vegetation, wildlife, soils and hydrology.

First the wetlands are mapped and classified according to established sources. Section 5.3.2.2 of Volume 5 of the 2009 EIS describes the approach to wetland ecosystem classification (based on *Wetlands of BC*) and mapping using standard provincial resource inventory methods (i.e., RIC standards) for Terrestrial Ecosystem Mapping (TEM).

Mapping is supported and verified by TEM field surveys and targeted wetland field surveys. The methods and results of the targeted wetland field surveys are provided in Appendix 5-5-1 of Volume 5 of the 2009 EIS. See Section 6.2.2.2 of the 2009 EIS for a complete list of baseline wildlife field programs including surveys for: bats, raptors, breeding birds, migratory birds, and amphibians.

The subsection within Section 2.7.2.7 of the 2012 EIS titled, “Effects Assessment Methods for Wetland Ecosystems,” describes how wetland functions were assessed using the existing data (wetland mapping and field surveys) to identify biophysical attributes of each wetland class or site association, which indicate the wetland’s potential to provide a given function. Reference to the use of *Wetland Ecological Functions Assessment: An Overview of Approaches* by Hanson et al. 2008 is stated in this section.

As indicated in its title, Hanson et al. (2008) is not a singular wetlands functional assessment method per se; however, it informed the overall approach to the assessment of wetland functions by providing the following elements:

- wetland functions to be considered;
- information requirements for conducting an assessment of wetland functions in the context of EA (EIS);
- an approach to effects-assessment pertaining to wetland functions;
- a review of recommended wetland functions assessment methods; and,
- technical appendices summarizing pertinent information such as specific information requirements, functions according to wetland class, generic potential effects and typical mitigations.

Hanson et al. (2008), and various sources cited therein, refer to a “tiered assessment framework.” With respect to this framework, the assessment of wetland functions in the 2012 EIS contains elements of both “Level 1” and “Level 2” assessments. The TEM and subsequent GIS spatial analyses are analogous to a Level 1 – assessment, because they are conducted on the landscape scale (of an entire watershed) using aerial photo interpretation of key attributes used to describe ecosystems (including wetlands). In the TEM this includes geomorphological and surficial materials, and their expression and processes, ecosystem identification and vegetation community mapping with successional status. This information is presented on a standard Terrain Resources Inventory Mapping (TRIM) hydrographic base. The TEM identifies wetland ecosystems, wetland type/classes, and their associated structural stage. This information is used to assess the abundance of various wetland types within the RSA, and provide the relative location and distribution of wetlands within the landscape (watershed). These data partially inform the assessment of wetland functions and form the essential basis for the subsequent spatial analysis of potential Project effects to wetland functions.

The field surveys associated with TEM targeted wetland surveys. Baseline wildlife surveys constitute data that is collectively analogous to a Level 2 assessment, on par with the information requirements of various state rapid-assessment methods (i.e. Wisconsin or Washington State). These surveys can be deemed Level 2 assessments because they included site-specific, ground-level sampling and observations of vegetation community composition and structure, surface and ground water attributes, soils and wildlife utilization. Appendix A in Hanson et al. (2008) is based on the State of Wisconsin Rapid Assessment method and provides a checklist format of the type of information to be included in a rapid assessment of wetland functions. The majority of information listed in Appendix A can be derived from the data collected during these baseline field surveys.

The data was reviewed to determine the potential for prospectively-affected wetlands to provide select functions. The general approach of the Washington State Methods for Assessing Wetland Functions (Hruby et al. 1999) was adapted for this project and location. The Washington State method provides a list of field indicators (attributes) of wetlands (within a given hydrogeomorphic class) that correspond with the wetland’s potential to provide particular wetland functions. Qualitative ratings (i.e., high, moderate, low potential to provide a given function) were determined based on the absence, presence, and extent of these indicators within the prospectively affected wetlands in the mine site.

The wetland functions assessment in Section 2.7.2.7 of the 2012 EIS presents the key attributes of wetlands that indicate the ability of a given wetland to provide specific wetland functions. Discussions within each category of wetland functions provide the rationale for applying the qualitative rating to each wetland site-association.

Wetland functions pertaining to the provision of wildlife habitat are assessed for five faunal groups (aquatic invertebrates, amphibians, fish, migratory birds, and mammals) noting any provincially or federally listed species supported by wetlands within each faunal group.

Functions pertaining to biogeochemical and hydrological functions are grouped together by wetland classes with further discussion regarding each site association (wetland community). Wetlands within each class are typically governed by a similar hydrologic and nutrient regime (e.g. bog, fen, swamp), while the unique vegetation structure of various site associations further influence a wetland's potential to perform select hydrological functions (e.g. graminoid vs. shrubby fen).

Project-Specific Direct Effects to Wetlands and Wetland Functions

Effects to wetland functions at operations and post-closure are based on spatial-overlay analysis of Project features and disturbances to determine both direct and indirect effects.

Direct effects to wetland functions are due to the loss of wetlands through clearing, grading and construction of Project features in the mine site. No permanent residual loss of habitat is anticipated along the transmission right-of-way as Taseko is committed to avoiding wetlands during detailed planning and design, including finalizing the alignment and selecting pole placement sites, and adopting environmentally sensitive construction practices (see IR 34b).

Where wetland areas are permanently lost, the attendant functions will be lost in these same areas. The direct effects to wetlands provided in Table 2.7.2.7-11 of the 2012 EIS indicate that 311[1] ha of wetlands will be lost at post-closure compared to baseline. These losses are without consideration of reclamation or habitat compensation. The wetlands predicted to be lost are tabulated in Table 31A-1.

Table 31A-1. Potential Direct Project Effects to Wetland Ecosystems at Closure – Mine Site

Wetland Class	Wetland Ecosystem	Estimated Area (ha)
Fen	Water sedge - Beaked sedge	125.4
	Willow - Scrub birch – Sedge	85.0
Swamp	Sxw - Horsetail – Crowberry	51.2
	Sxw - Horsetail - Glow moss	11.9
	Sxw - Labrador tea – Willow	2.9
	Drummond's willow – Sedge	2.1
Shrub-Carr	Grey-leaved willow - Glow moss	31.8
Shallow open water	Open Water	0.8
Total		***311[1]***

A summary of wetland functions associated with the wetland ecosystems directly affected by permanent Project features in the mines site is provided in the section below. The area of wetlands with moderate to high potential to provide a given function is summarized for each function. Wetlands types with low or no potential to provide a given function are not added to this sum.

Project effects on the habitat function of wetlands within the mine site are as follows:

- *Loss of 211.1 ha of wetlands with moderate to high potential to provide amphibian breeding habitat (for western toad)* This total is based on the two fen wetland ecosystems plus the open water wetland class. Field surveys indicated that amphibian breeding habitat was particularly associated with these classes. Field surveys observed western toad (Schedule-1 special concern) within the mine site. Amphibians were frequently detected wherever open water was present; however, amphibian breeding habitat was particularly associated with water sedge - beaked-sedges, shallow open water, and willow –scrub birch sedge fens. Other shrub /tree dominated wetlands were not found to be productive amphibian habitat due to the dryness of the units (refer to the 2009 EIS, Volume 5, Appendix 5-6-A Wildlife Data Report 1997 – 1999).

Great Basin spadefoot toad (Schedule 1 -threatened) was not observed in the mine site, although the portions of the mine site RSA located within the Montane Spruce BEC zone overlap with the potential range of this species and suitable breeding habitat exists (breeding habitat is as described above for western toad).

- *Loss of 2.1 ha of wetlands with moderate to high potential to support fish habitat* While any of the wetland classes that are connected to fish bearing waters through surface-water connections could potentially contribute to this function, the Drummond's willow –sedge swamp is distinctly characterized by fluvial sediments due to its proximity to flowing surface water, indicating this wetland type's close proximity to watercourses and therefore potential to contribute to shade, cover, food and nutrients.

- *Loss of 311[1] ha of wetlands with moderate to high potential to support migratory bird habitat* Since the category, 'migratory birds' includes a number of guilds that collectively utilize various habitats for different life stages; all 311[1] ha of wetlands are included.

  During the 2006 aerial surveys of migratory waterfowl, 15 species were recorded (within all Project components; Appendix 5-6-C 2009 EIS). The most prominent species included mallard, lesser scaup, bufflehead and American coot. Late season moulters were observed on several wetlands throughout the Project area suggesting these wetlands are used for all stages of the life cycle (breeding, moulting/pre-migratory staging and migration). Broods of the following species were observed within wetlands in the mine site (Appendix 5-6-C 2009 EIS):

  - bufflehead,
  - Canada goose
  - common loon
  - goldeneye sp.
  - mallard
  - ring-necked duck, and
  - scaup sp.

  Forty-seven species of waterbirds (ducks, geese, wading birds, shorebirds and seabirds) and 137 species of passerines were recorded during field programs (within all project components; Section 6.2.3.5 2009 EIS). Table C-4 (Appendix 5-6-C 2009 EIS) provides a list of waterfowl observed during 2006 aerial surveys and the number of wetlands with

the species. Table C-6 (Appendix 5-6-C 2009 EIS) provides the abundance and composition of waterfowl in each wetland that was sampled.

Migration stand surveys in 2006 recorded 12 species of non-passerine birds. Wetland-associated species among these included the sandhill crane and northern harrier (Appendix 5-6-C 2009 EIS).

- *311[1] ha of wetlands with moderate to high potential to support wetland-associated mammal habitat* Field data indicate that the following wetland-dependent mammal species have been observed within the mine site: moose, grizzly bear, black bear, muskrat, otter, long-tailed weasel, mink, and beaver (Section 6:Wildlife and Appendix 5-6-E in 2009 EIS). All wetlands classes are included in this total due to the variety of mammal species observed and the diverse requirements of each species (e.g., sedge fens provide bear forage habitat, treed-swamps provide beaver forage and shelter-material, and shrub-swamps provide browse for moose).

  In addition, bat species typically feed on flying insects, which tend to be abundant over open water and wetlands. In 1997, field inventories in the Fish Lake area identified six species of bat, while the 2006 bat inventory program detected three species in the mine site, *Myotis* spp., long-eared myotis and a third larger species (either big-brown bat or silver-haired bat), though none were captured (Appendix 5-6-B in 2009 EIS). Four little brown myotis were detected in 2006 and this species has recently been listed as endangered by COSEWIC.

  Table 2.7.2.7.2.8-10 in the 2012 EIS presents the local population predictions for wildlife species in reference to the mine site. Loss of 311[1] ha of wetlands is included in the calculation considerations for moose, grizzly bear, black bear, great blue heron, Barrow's goldeneye, mallard and amphibians.

Project-Specific Indirect Effects to Wetland Function

Indirect-effects to wetland functions can result from changes in surface or groundwater hydrology or water quality. Figure 2.7.2.7.2.6-12 in the 2012 EIS shows the estimated area of changes to groundwater at operations. Section 2.7.2.7.2.6 in the 2012 EIS describes the potential for the water table north and south of the open pit to be lowered during operations due to pit-dewatering and during the subsequent 50 year period of rebound until near-surface groundwater elevations are restored. During this time, indirect effects to wetlands due to lower groundwater may occur. As such, wetland vegetation composition may shift or wetlands may dry substantially, no longer supporting hydrophytic vegetation. Indirect loss of wetlands due to this mechanism would result in the loss or change in functions described above. Monitoring is required in order to determine the actual ecological function and potential effects to wetland ecosystems.

It is estimated that approximately 69 ha of wetlands located outside the mine-site footprint, but within the predicted drawdown area shown in Figure 2.7.2.7.2.6-12 in the 2012 EIS, may be adversely affected by the Project. Table 31A-2 summarizes the potential indirect loss of wetlands.

Table 31A-2. Potential Indirect Project Effects to Wetland Ecosystems at Post-Closure – Mine Site

Wetland Class	Wetland Ecosystem	Estimated Area (ha)
Fen	Water sedge - Beaked sedge	26.4
Fen	Willow - Scrub birch – Sedge	21.6
Swamp	Drummond's willow – Sedge	0.6
Swamp	Sxw - Horsetail - Glow moss	18.0
Shrub-carr	Grey-leaved willow - Glow moss	1.6
Shallow open water	Open Water	0.6
	Total	**68.8**

Information Request #31b

With regards to the wetlands hydrological function and the capacity of wetlands to store, moderate, and release water in a watershed, the Panel requests that Taseko:

Explain the project effects on wetlands hydrological functions within the Fish Lake ecosystem, including an assessment of the significance of the effects and proposed mitigation measures.

Response Summary

Project Effects

Project effects on the hydrological function of wetlands within the mine site area are as follows:

Loss of 311[1] ha of wetlands with moderate to high potential to provide groundwater recharge to either deep aquifer or to augment local surface base flows. All the prospectively affected wetland classes referred to in IR 31a have the potential to contribute to one or the other types of groundwater and/or surface water recharge requirements. Some individual swamps located at slope toe positions may be sites of localized groundwater discharge (i.e. continuous seepage); however, it is not feasible to separate these specific sites from the overall dataset while characterizing wetland functions for the Project at landscape scale. Two-hundred forty one (241 ha) out of the 311[1] ha of wetlands affected by permanent Project features are located upstream of Fish Lake within the Fish Lake watershed (primarily the TSF).

Loss of 279.2 ha of wetlands with moderate to high potential to provide peak flow attenuation and reduced force of erosion. This total includes all the wetland ecosystems prospectively lost at post-closure except the grey-leaved willow –glow moss shrub carr because it is not expected to provide this function effectively due to its typical landscape position within topographic depressions isolated from access to flowing surface waters, and dependence on groundwater rather than surface water sources to support wetland conditions.

Indirect losses below pit. There is a potential loss of hydrological functions of wetlands around and below the pit associated with pit operations. Section 2.7.2.7.2.6 in the 2012 EIS describes the potential for the water table north of the open pit to be lowered during operations due to pit-dewatering and during the subsequent 50 year period of rebound until near-surface groundwater elevations are restored. Monitoring will be required in order to determine the actual effects.

Impact to recharge of deep aquifer above Fish Lake. Figures 2.7.2.7.2.4A-1 through 2.7.2.7.2.4A-8 of the 2012 EIS show conceptual designs of the engineered water management systems that will replace the storage, treatment, and discharge hydrological functions previously provided by these wetlands. These systems will be in place for at least 30 years, (20 years of operations plus 10 years post closure). The pumps recirculating clean water from the outlet of Fish Lake to the portions of Fish Creek below the TSF will operate until such time that water quality within the TSF is suitable to return flows back to the watershed. In the long term, the TSF pond will provide some of the hydrological functions of the wetlands that it replaces: it will provide storage, storm flow-attenuation, sediment retention, and discharge to augment surface and baseflows once suitable water quality objectives are achieved. Due to the fine-textured till beneath the TSF, this water body is not apt to contribute to deep aquifer recharge.

Mitigation Measures

Taseko's measures to mitigate effects on wetland functions within the Fish Lake ecosystem are the following:

- Commitment to monitoring of wetlands predicted to have indirect effects due to groundwater drawdown as described in Section 2.7.2.7 (page 979) of the 2012 EIS.
- Preparation and implementation of a water management plan for replacing hydrological functions of wetlands upstream of Fish Lake
- Preparation and implementation of a wetland habitat compensation plan for lost habitat functions (refer to IR 32 and the draft Habitat Compensation Plan)

Determination of the Significance of Residual Effects

Effects to wetland hydrological functions are adverse, high magnitude, localized in extent, and extend into the far-future time period. Effects associated with the loss of hydrological functions could be rendered reversible through successful implementation of the water management plan; however, the timeframe of this reversal is contingent upon the water quality improvement of the TSF pond.

Given the implementation of the proposed mitigation measures, the combined residual effect of the Project on wetland functions is predicted to be not significant.

[1] Note: this is an overestimate of Project effects on wetlands. See response to IR 1 for Project effects on wetlands using baseline updated for recent logging and mountain pine beetle infestations.