

The Technical Advisory Committee (TAC) for the Elk Valley Water Quality Plan (the “Plan”) held their 3rd meeting on November 25-26, 2013. This document is a record of the technical advice received at this meeting.

The TAC process is structured around a review of work packages submitted to the TAC in advance of their meetings by Teck. These work packages relate to the analytical process that Teck is undertaking to inform decisions around the selection of water quality targets, management scenarios, and any additional monitoring and studies that will be included in the Plan. The advice in this table relates primarily to work packages that were reviewed and discussed at TAC Meeting #3.

The focus of TAC Meeting #3 was a review of Work Package #6a, which provided information on Teck’s Water Quality Planning Model. This model is being used to estimate future water quality conditions in the Elk Valley under a range of management scenarios. Each management scenario is a combination of different mitigation measures that could be applied to improve water quality conditions. An additional focus of the meeting was Work Package #5, which provided information on the mitigation measures that Teck is considering for the Plan.

Summary Table			
Category	#	Description of “Technical Advice” from Mtg	Rationale (to be filled in by Originator)
Values and Components	3-1	<p>Recommend assessment of the impact of current and predicted future water quality conditions on other current and potential future water uses (e.g. agriculture, wildlife watering, cultural, etc.) during the development of the EVWQP.</p> <p><i>For additional context refer to MacDonald letter (dated October 31, 2013)</i></p>	<p>This information is needed to fully evaluate the effects on water uses associated with current water quality conditions and to determine how actions taken under the EVWQP will protect or restore these other water uses. This information will also be useful for identifying and assessing the trade-offs that will need to be considered during development of the EVWQP.</p>
Protection of Human Health	3-2	<p>Recommend consideration of all the pathways connected to human health (e.g. plants, invertebrates, animals, groundwater, surface water, etc.).</p>	<p>To address concerns and perceptions of safety with KNC community members.</p>
WP 6A Water Quality Planning Model	3-3	<p>Recommend that Teck develops a more robust approach towards water-quality modeling and geochemical source term characterization in the Elk River watershed. Ultimately such an endeavor will provide a better understanding of watershed pollutant fate and transport processes and will better inform management and remediation strategies with respect to both the watershed and its receiving waters (i.e., Lake Koocanusa). We have created a separate memo documenting our specific technical comments with respect to the modeling approach. Due to the extent of these comments, we recommend that a strong adaptive management approach be included which at a minimum should include the procedure for future model updates, how incorporation of R+D program findings, a</p>	<p>Either an enhanced empirical model, or alternatively a process-based mechanistic model, is needed to provide a more detailed representation of the hydrologic and geochemical processes in the Elk River watershed. In particular, this is necessary with respect to the evaluation of management scenarios which alter system hydrology (i.e., net percolation within the spoil piles) and/or site geochemistry. Currently, the model does not have the capability due to its empirical nature and an enhanced approach would allow better evaluations of possible future scenarios resulting from changes in hydrology, land cover, treatment plants, etc.</p>

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		<p>description of model uncertainty, and methodology and frequency for model post-audits (i.e., calibration checks with observed data).</p> <p><i>For additional context refer to Technical Comment Memo supplied by US & MT Governments (dated December 13, 2013)</i></p>	
	3-4	<p>Recommend a more quantitative hydrologic and geochemical approach to support the initial results from the WQ Planning Model. Areas requiring further investigation include: (1) long-term release rates of selenium from the waste rock; (2) solid-phase and(or) laboratory verification of annual selenium release rates suggested by the water-quality planning model; and (3) a quantitative understanding of saturated and unsaturated flow in the waste rock piles, including residence time of dual porosity flow components and a better quantitative understanding of the dominant geochemical processes occurring in the waste rock piles. Work plans should be prepared to address these deficiencies and should include (1) detailed descriptions on how these investigations will be conducted; (2) proposed schedule for completion of individual tasks; and (3) how the results will be integrated into the basin wide water-quality model.</p> <p><i>For additional context refer to Technical Comment Memo supplied by US & MT Governments (dated December 13, 2013)</i></p>	<p>Given the environmental implications associated with past, present, and future mining in the Elk and Fording River valleys, multiple lines of more quantitative hydrologic and geochemical evidence are needed to support the water-quality planning model. Specifically, U.S. and Montana government agencies are concerned about the short- and long-term release of contaminants of concern to Lake Koocanusa. For example, the average selenium release rate of 1.6 mg/m³/year (Table 3; Geochemical Source Term Inputs and Methods for Elk Valley Water Quality Planning Model) from the waste rock results in a very small fraction (0.00085 mg/kg) of the available selenium being mobilized. Assuming a bulk density of 1.85 g/cm³ and a bulk selenium concentration ranging from 1 to 5 mg/kg (p. 3, Geochemical Source Term Inputs and Methods for Elk Valley Water Quality Planning Model), only 0.02 to 0.08 percent of the selenium is mobilized from the bulk spoil material on an annual basis. This suggests that there is a potential for selenium releases to continue for 100s to 1,000s of years into the future to U.S. waters, persisting beyond the operation of the mines and associated treatment plants in the Elk and Fording River valleys.</p>
	3-5	<p>Recommend a comprehensive assessment of the potential effects of mining activities on groundwater be conducted. This assessment should include an evaluation of contaminant pathways and receptors; a review of known aquifers; a scan of all groundwater well information (including construction logs to help assess the quality of the data) and data in the designated area; a preliminary assessment of connectivity between groundwater and surface water in areas of concern (e.g., in areas where contaminants may be in contact with groundwater); and an overall plan for monitoring to fill in gaps where the assessment of pathways has shown a potential concern, and where the information may be important to validate water quality models used in setting targets.</p>	<p>In order to understand the potential movement of contaminants in surface water; to potentially help validate the water quality models; and to ensure groundwater resources are not negatively impacted (i.e., cannot be used for drinking water and to sustain aquatic life), it is important to conduct an assessment to understand groundwater in the designated area. It is recognized that it may not be feasible to conduct a detailed assessment as outlined here, given the time frame for the development of the Plan (i.e., by July). However, a phased approach to assess groundwater effects should be prepared and preliminary steps should be taken, as part of the development of the Plan, to ensure groundwater pathways are evaluated and knowledge of groundwater and connectivity with surface water is characterized in areas of concern.</p>

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Category	#	Description of “Technical Advice” from Mtg	Rationale (to be filled in by Originator)
	3-6	<p>Recommend modeling near term water-quality scenarios for all concentrations of all pollutants of concern (e.g., selenium, nitrate, cadmium, sulfate, phosphorus, etc.) to Lake Koocanusa for the purpose of estimating the short-term (and greatest) effects on water-quality (under the assumption that waste-treatment strategies will be ramping up in the future). Model results should include a time-series of loadings showing the impact of planned mine expansion and treatment options for the next 30 years (i.e., showing the monthly impacts of expansions/treatments as they are planned).</p> <p><i>For additional context refer to Technical Comment Memo supplied by US & MT Governments (dated December 13, 2013)</i></p>	<p>As demonstrated by the measured data, pollutant loadings (e.g., selenium, nitrate, sulfate, cadmium, etc.) have been increasing through time in the Elk River and Lake Koocanusa in direct concert with placement of waste-rock. With new mine expansions, these will undoubtedly increase in the near-term. Although Teck has proposed a series of mitigation options including treatment plants, water management, etc. to buffer these impacts, it appears that many of these treatment options will not be operational for many years. Additionally, these may have unintended consequences (i.e., phosphorus discharge). Due to the fact that, mine expansions will be occurring, and for the U.S. and MT Govt. to adequately evaluate impacts to Lake Koocanusa, we would like estimates of these loadings over time to evaluate the associated response in the reservoir (i.e., with respect to selenium bioaccumulation and eutrophication).</p>
WP 5 Management Scenarios	3-7	<p>Recommend that design criteria for clean water management (diversions) and mine affected water management (conveyance) should be informed by the consequences of a failure.</p>	<p>The capture efficiencies of water diversion and conveyance structures will have an effect on the water quality at the order stations and in the watershed. The ultimate design criteria of these structures must consider a range of climatic and flow scenarios and the potential consequences of failure. For example, overflow could result in flushing additional loadings from waste rock and/or bypassing of contaminant loadings to the receiving environment.</p>

References (if provided):

MacDonald, D. 2013. Letter to Lynn Kriwoken (TAC Chair from MOE) from Donald MacDonald (dated October 31, 2013). MacDonald Environmental Services Ltd (MESL). *Representative on the TAC for Ktunaxa Nation Council*.

US and Montana Governments. 2013. *Memo - Technical Comments for Work Products Supplied for TAC Meeting #3 United States Government and State of Montana* (dated December 13, 2013).