

Reviewer Comments and Proponent Responses

Project: CZN Prairie Creek Mine
 Board: Mackenzie Valley Land and Water Board
 Organization: CanZinc Corporation (CZN)

No.	Topic	Reviewer Comment	Reviewer Recommendation	Proponent Response
Acho Dene Koe First Nation (ADKFN) - Scott Mackay				
1	Information Response 3	<p>There is significant reason to believe that total zinc will be higher than background based on effluent and downstream effluent observed on several instances of exceedance in the past (see https://registry.mvlwb.ca/Documents/MV2019L2-0006/MV2019L2-0006%20-%20CZN%20-%20CZN%20Letter%20re%20EQC%20Exceedance%20and%20Non-Compliance%20-%20Sept22-19.pdf). Further, as per section 4 of the Waters Act “Nothing in this Act, the regulations or a licence authorizes a person to contravene or fail to comply with another Act or a regulation or order made under that Act, except as provided in that other Act, regulation or order.”</p> <p>The MVLWB cannot establish criteria which are less strict than that of other applicable federal regulations, including those identified in the Metals and Diamond Mining Effluent Regulations (MDMER). By this definition, whether explicitly found in the terms of an eventual water licence or implied by their existence in the MDMER, all parameters outlined in Table 1 of Schedule 4 of the MDMERs must be respected as minimum effluent quality limits.</p>	<p>The terms of any eventual water licence authorizing effluent discharge by the Prairie Creek Mine and Milling project should explicitly identify EQC criteria for all chemical or water quality parameters which are reasonably expected to contribute to receiving waters. This includes but is not limited to total zinc, total lead, of which are direct products of the mine, as well as total nickel, Radium-226 and unionized ammonia.</p>	See our response to GNWT 3.
2	Information Response 3	<p>CZN states: “The inclusion of parameters as EQC that are not expected to be elevated in effluent likely means an unnecessary sampling and testing burden as part of the SNP.”</p> <p>Burden aside, there is every reason to apply a cautious approach to monitoring parameters which are potentially detrimental to the health of the downstream environment. This is especially true since the proposed treatment approach allows for treatment to be performed on an as needed basis, which may allow for the undetected discharge of total or non-dissolved fractions of zinc and lead, as well as unionized ammonia.</p>	<p>EQC for total zinc is important in the event that differences between effluent pH (or other characteristics) differ from receiving Prairie Creek waters which may result in zinc shifting from being in a state of precipitate to a bioavailable fraction.</p> <p>Lead (which is to be</p>	See our response to GNWT 3.

			<p>processed by the mine), and unionized ammonia should be included as EQCs, as fractions of both are influenced by the environment they are found (specifically the pH) and both exist in notable quantities in effluent. Unionized ammonia (NH₃) is noted to be a more toxic fraction than ionized ammonia (NH₃+N). Given the relative ease for ammonia to shift between ionized and unionized with changes in pH it is prudent that both ionized and unionized fractions of ammonia be included as EQCs.</p>	
3	Information Response 3	<p>Insufficient information is available on Prairie Creek background and effluent concentrations of Radium 226.</p>	<p>In absence of evidence demonstrating Radium 226 is not reasonably likely to exist in mine site effluent, we request that an EQC be developed following the maximum allowable concentrations outlined in the MDMERs.</p>	<p>See our response to GNWT 3.</p>
4	Information Response 3	<p>CZN states: "We do not believe it is the role of the MVLWB to be a 'one-stop shop' for all legislation. Environment and Climate Change Canada (ECCC) administer federal legislation, and proponents can interact with ECCC directly in this regard. It is our understanding that federal environmental effects monitoring (EEM) and Fisheries Act requirements are not normally included in Water Licences. MDMER requirements should be no different."</p>	<p>We disagree with this view of the role of the board and its authorization of projects. CZN appear to concede that the MDMERs are relevant, however, argue that application and enforcement of these parameters should exist outside of the MVLWB</p>	<p>See our response to GNWT 3.</p>

			<p>purview. Unless CZN believes that the monitoring requirements are less stringent under the MDMER, they should have no preference to whether or not EQC equivalent to obligatory requirements under the MDMER are placed as a condition of their Water Licence or as an independent regulation enforced elsewhere.</p>	
5	Information Request 4: The Prediction Model	<p>The prediction model utilizes the calculation for identifying zinc guidelines which is presented in the Canadian Council on Ministers of the Environment Guideline for the Protection of Aquatic Life for dissolved zinc. The authors of this guideline note that the equation is only valid between pH 6.5 and 8.13. Prairie Creek has been observed to have a pH consistently above 8.13. CZN argue that a value of 8.13 should be used to identify the guideline in instances where observed pH is greater than 8.13. We disagree with this approach, noting that a precautionary approach be used to derive any guideline using this equation where pH is out of range, is necessary.</p>	<p>Unless a more appropriate method of deriving a dissolved zinc guideline in alkaline waters is identified, observed pH values, including those which are out of range should be used in the equation. This approach will yield a more conservative guideline value rather than using a fixed 8.13 value. We believe a more conservative approach is appropriate given the unknown applicability of the equation at pH values greater than 8.13.</p>	<p>We believe we applying the equation correctly in limiting values to the stated range of applicability.</p>
6	Information Request 4: Upstream Water Quality Data Outliers	<p>We agree that statistical outliers should be removed from the dataset, when there is insufficient information provided to describe the approach used to remove outliers. In review of the two datasets (full data and outliers removed) it appears that values were excluded arbitrarily based on an "eyeball test". For some parameters, it is likely this approach would yield a similar result to one which identifies statistical outliers, as they are clearly</p>	<p>CZN should utilize a statistical method of removing outliers (such as excluding values beyond 3 standard deviations of the median) or provide rationale as to how the approach utilized does not</p>	<p>See our response to GNWT 4. We agree the September result of 30 ng/L Hg should have also been excluded, however it does not affect the resulting 90th percentile.</p>

		one-off instances of exceptional values elevated for any number of reasons. However, for parameters such as cadmium, copper, iron and to a lesser extent mercury, there are several instances of high values which were excluded as outliers based on the approach used by CZN. This is concerning as repeatedly high values indicate a trend rather than an anomaly. Further, there does not appear to be consistency in what is considered an outlier. For example, for August mercury results, samples of 31 ng/L and 19 ng/L are thrown out of the analysis, however, a September sample with a value of 30 ng/L remains in the dataset.	introduce bias into the calculation of 90th percentiles.	
No.	Topic	Reviewer Comment	Reviewer Recommendation	Proponent Response
Racher Consulting - Kathy Racher				
1	Joint submission of ŁÍDLJ KÚĘ FIRST NATION (LKFN) and NAHA DEHÉ DENE BAND (NDDB)	Note the KRacher Consulting is submitting these comments on behalf of the LKFN and the NDDB.		
2	General comment	We have reviewed the information provided by CZN and have no questions at this time. We will consider this evidence in closing arguments.	N/A	
No.	Topic	Reviewer Comment	Reviewer Recommendation	Proponent Response
GNWT-ENR - EAM (Environmental Assessment and Monitoring) - Erin Goose				
1	IR#1	In response to IR#1, CZN has provided the requested information in an Excel document noting that “the maximum effluent discharge flow for all three pipe lengths is 560 L/s (560.53 L/s to be precise).” GNWT notes that this value does not appear in the presumed required monthly effluent discharge flow in Row 9 “Combined L/s” on the “65 avg WQ” tab on any of the three spreadsheets outlining model outputs for the 2 m/1.5 m, 4.8 m/4.8 m and 8 m/6 m exfiltration trench scenarios. It is therefore	GNWT recommends that CZN clarify how the excel spreadsheets provided in response to IRs #1-4 support the 560.63 L/s maximum effluent discharge rate. GNWT recommends that CZN clarify why bypass seepage	The maximum effluent flow was not determined previously by the Board using the mixing models. The method of derivation is explained in the 2013 MV2008L2-0002 Reasons for Decision, Appendix 1, p. 30. The maximum rate at that time was claculated by dividing a creek flow of 10,650 L/s by a flow ration of 43, producing 247 L/s. We used the same approach, dividing 10,650 L/s by 19. This is why the

		<p>unclear how the 560.53 L/s maximum flow was derived.</p> <p>Further, GNWT notes that the Row 26 “Flow Ratio (creek/effluent)” on the “65 avg In-Stream-Seasonal” used to evaluate the resulting dilution in the mixing zone and compliance with water quality objectives (WQOs) does not include bypass seepage. The formula used in Row 26 specifically excludes bypass seepage from the calculations. While it is understood that the bypass seepage enters Prairie Creek indirectly (i.e., not through the exfiltration trench), it is still a component of project effluent and should be included in the project effluent to creek ratio calculations. CZN appears to acknowledge this understanding as the receiving environment concentrations presented on the “65 avg In-Stream-Seasonal” tab in Rows 5 through 23 include the influence of bypass seepage chemistry and volume.</p>	<p>was excluded from the calculations presented in Row 26 “Flow Ratio (creek/effluent)” on the “65 avg In-Stream-Seasonal” tab used to evaluate the resulting dilution in the mixing zone and compliance with WQOs.</p>	<p>maximum effluent flow calculation is not in the mixing model spreadsheets, which model expected effluent flows. Bypass seepage is not included in flow ratio calculations because it's not an effluent that will discharge via the exfiltration trench and be subject to direct control. Bypass seepage does contribute to predicted water quality at the edge of the IDZ, and is included for this purpose when assessing compliance with WQO and an appropriate flow ratio that is consistent with that compliance. In more simple terms, we assume bypass seepage exists always, no matter the effluent discharge and flow ratio. The flow ratio regulates effluent discharge so that WQOs are met when that effluent and bypass seepage combine. This is also how the Board modelled it in 2013 (Appendix 1, p. 28, first part of equation 10).</p>
2	IR#2	<p>In response to IR#2, CZN notes that “Predictions are the same across pipe length scenarios because the monthly effluent discharge volumes are the same. The assumed effluent quality varies.” Additional context to the response that increasing the volume of effluent diverted through the Water Treatment Plant (WTP) is acceptable rationale, however GNWT notes that the velocity of effluent discharged through the different exfiltration lengths will vary.</p> <p>CZN further notes that the “Effluent discharge includes all water released via the exfiltration trench, and includes Mill Ditch water. It does not include Bypass Seepage, although Bypass Seepage does contribute to the predicted IDZ concentrations.” As indicated in the previous comment, it is unclear why the bypass seepage was not included in the creek to effluent ratio calculations. Again, it is acknowledged that the bypass seepage will not be discharged through the exfiltration trench but still contributes to the volume of effluent within Prairie Creek. This volume may be particularly important in November, “the ‘barometer’ month”, where bypass seepage is expected to contribute approximately 3.5% of the site</p>	<p>Reiterating the previous recommendation, GNWT recommends that CZN clarify why bypass seepage was excluded from the calculations presented in Row 26 “Flow Ratio (creek/effluent)” on the “65 avg In-Stream-Seasonal” tab used to evaluate the resulting dilution in the mixing zone and compliance with WQOs.</p>	<p>See our response to GNWT 4.</p>

		effluent reaching Prairie Creek with concentrations of zinc that exceed EQC.		
3	IR#3	<p>In response to IR#3, CZN notes that it has “not proposed, and is not proposing, EQC for total lead, total nickel, total zinc, Radium-226, and unionized ammonia.” Despite acknowledging that the Metal and Diamond Mine Effluent Regulations (MDMER) apply to the project, CZN does “not agree that EQC should be included for any of the listed parameters that are not otherwise identified as parameters of potential concern through the MVLWB’s standard screening process.”</p> <p>GNWT reiterates its statement from day 3 of the Public Hearing that the issuance of a licence by the Board that does not contain effluent limits that are at least as stringent as the parameters regulated under MDMER, would contravene subsection 27(5) of the Waters Act (2014). It is the GNWT’s position that the absence of EQC would be less stringent than the MDMER as no enforceable limit would be included in the licence. Further, not including EQC would mean there is no licence condition for the deposit of waste that meets provisions (i.e. limits) in the MDMER. GNWT also notes that more stringent limits for parameters regulated by MDMER may be included as EQC. For example, the more stringent EQC that were identified for the scenario that a 2 m/1.5 m exfiltration trench is constructed.</p> <p>Finally, during day 3 of the Public Hearing, in response to a question from CZN, GNWT clarified that if a water licence includes limits in compliance with federal legislation, in the event the federal legislation is amended the licence is deemed to be automatically amended to the extent necessary to comply with the federal legislation (subsection 27(7) of the Waters Act).</p>	GNWT recommends at minimum, the licence include EQC for all parameters regulated by the MDMER with corresponding limits that are at least as stringent as MDMER.	The basis of our IR response was that we did not see why the Licence needed to be a 'catch-all' for other legislation. We were not suggesting that effluent limits should be less stringent than MDMER. We were opposed to including limits from the MDMER that are not specific to our project, which would lead to unnecessary SNP sampling. In the mean time, we have learnt that the Government of Canada and the GNWT have negotiated a proposed equivalency agreement which would allow Canada to stand down the MDMER in NWT for those mines that are subject to both federal (MDMER) and territorial requirements, such as Prairie Creek. NWT has laws and regulations for managing mine effluent that provide controls equivalent in effect to those under the federal MDMER. Standing down the MDMER would reduce regulatory duplication. We recognize this efficiency, and that to do this, a licence must include MDMER provisions. Therefore, we accept that licence EQC need to include the additional parameters in order to achieve MDMER equivalency, once enacted. However, we ask that SNP sampling requirements be kept at a minimum to comply with MDMER for those parameters that are not specific to our project.
4	IR#4	In response to IR#4, CZN has outlined how the EQC derivation spreadsheets function and their suggested interpretation. CZN further lists the outliers that have been removed from the dataset stipulating that while they did not have a large influence on EQCs derived with consideration of the 65th percentile of water quality concentrations measured in Prairie Creek, additional	GNWT recommends that CZN clarify how the Q _{eff} of 560 L/s was derived. GNWT recommends that CZN provide the methodology used to identify outliers in the	Re Q _{eff} , see our response to GNWT 1. Re outliers, see the attached memo. Re bypass seepage, we see now that the GNWT is referring to the volume of bypass seepage. This volume is not part of the Q _{eff} calculation, so would not affect it. Bear in mind that the calculated Q _{eff} is so far above the expected

		<p>consideration of outliers was necessary when considering the 90th percentile as requested by the GNWT.</p> <p>GNWT appreciates the added clarity provided by CZN in how to interpret the spreadsheets used to derive the EQCs. The outlined information supports CZN's position that more stringent EQC are not required for all parameters as the proposed exfiltration length is reduced (i.e., from 8 m/6.5 m to 4.8 m/4.8 m).</p> <p>However, there are a number of remaining concerns with the information provided. First, it is still unclear how the Q_{eff} of 560.53 L/s was derived as this number does not appear in any of the spreadsheets. Second, while the outliers removed from the dataset appear acceptable, CZN has not outlined the approach used to identify them. Finally, it is still unclear why bypass seepage has not been considered in the volume of effluent reporting to the Prairie Creek. GNWT appreciates that the assessment of WQOs at the edge of the mixing zone accounts for bypass seepage, but the volume discharged from the site (i.e., through both the exfiltration trench and bypass seepage) does not. It is not clear whether the proposed maximum allowable discharge volume (Q_{eff}) would change if bypass seepage volume was included in the volume of effluent discharged from site. It is also unclear whether more stringent EQC would be required if the bypass seepage volume was considered in the creek to effluent ratio.</p>	<p>dataset.</p> <p>GNWT recommends that CZN provide rationale as to why bypass seepage was not included in the volume of effluent discharged from the site. CZN to further discuss whether the proposed EQC would need to be modified if bypass seepage volume was considered as part of the overall effluent volume discharged.</p>	<p>maximum Q_{eff} as to not be a significant concern. Regarding relevance to the flow ratio, we see the GNWT's point that perhaps bypass seepage should be included in this calculation, as Q_{up}/Q_{eff} does not reflect the total volume at the edge of the IDZ (Q_{down}). However, the inclusion of bypass seepage in the calculation makes very little difference because the volume is so small relative to creek flow. For example, for the month of November in row 26 of the spreadsheets, a flow ratio of 18.62 is calculated. If we include bypass seepage ((Q_{up}+Q_{by})/Q_{eff}), the number becomes 18.65. This is hardly a significant difference and therefore we retain the proposed ratio of 19.</p>
5	Cover Letter	Comments from WMMD	N/A	
No.	Topic	Reviewer Comment	Reviewer Recommendation	Proponent Response
Environment and Climate Change Canada (ECCC) - Melissa Pinto				
1	IR #1	<p>In the response to IR #1 CZN states, "During operations, the rate of effluent discharge (Q_{eff}) will vary in relation to the flow in Prairie Creek and the prescribed flow ratio". CZN proposes relying on real-time flow monitoring to identify what the rate of effluent discharge can be. This would be based on estimates of input water quality at a given time, and being able to treat effluent to low concentrations of parameters. Under this proposal, effluent quality criteria (EQC) will be fixed (based on the pipe length), and</p>	<p>ECCC recommends CZN include as much conservatism as possible in their planning and assumptions to mitigate the uncertainties of accurate effluent flow and chemistry measurement.</p>	<p>These comments from ECCC are already on the record. We are aware of the need to accurately monitor creek flows, particularly not to over-estimate creek flows. That is why the flow monitoring protocol will include suitable contingencies. We have stated that better on-site testing will be needed for zinc, perhaps for arsenic also.</p>

		<p>the rate of effluent discharge would vary. To meet water quality objectives (WQOs) at the edge of the initial dilution zone (IDZ) a dilution ratio will have to be achieved consistently. CZN will need to have real-time flow data in a dynamic system to meet the flow ratio, as well as real-time effluent chemistry to manage loadings of regulated and non-regulated parameters and meet the WQOs.</p> <p>ECCC notes that dissolved zinc field measurements have not been well correlated to lab results, and that an accurate method of measuring will be needed. Real-time testing of other parameters will also need to be done on in a reliable manner.</p>		
2	Errata	<p>Table 4-1 and various other places in the Information Request (IR) response package refer to ammonia as NH4. This should be corrected to NH3 (as N), i.e., "NH3-N". The monitoring data and EQC will be for total ammonia, and the un-ionized fraction of NH3 is calculated.</p>	<p>ECCC recommends CZN correct references to ammonia to NH3-N rather than NH4 which refers to the ammonium ion.</p>	<p>Noted.</p>
3	IR #3	<p>For consistency with federal regulations, EQC in the licence could include the Metal and Diamond Mining Effluent Regulations (MDMER) parameters (total Pb, Ni, Zn, Ra-226 and un-ionized NH3). As CZN will be required to measure these parameters anyway, there would be little to no additional burden involved. Having the licence consistent with other requirements brings sampling data together for effective review of data, and can allow confirmation of CZN's predictions of total versus dissolved fractions.</p>	<p>ECCC recommends including the full list of regulated parameters under the MDMER in the Water Licence EQC for consistency and equivalency with concurrent federal requirements.</p>	<p>See our response to GNWT 3.</p>
4	#4 Upstream water quality outliers	<p>In some cases, several data points (as many as 3 of 7) on a given date were considered outliers, and removed from the analysis (e.g. August cadmium data). Given the number of results that were considered outliers, a statistical screening tool would be appropriate to justify removal and provide a consistent basis for screening outliers.</p> <p>Correlation between elevated concentrations and total suspended solids (TSS) levels was noted in some cases, but the relationship was not always clear. The particulate load is a component of the water sample (as opposed to entrainment of bottom sediments</p>	<p>ECCC recommends CZN provide a statistical screening procedure for outlier removal and provide a rationale for removing data when there are higher levels of particulate-associated metals in a sample.</p>	<p>See our response to GNWT 4. Re particulates, we provide rationale in our response. We agree that particulates should be considered for compliance, particularly upstream-downstream comparisons, however we don't think that particulate-biased samples are appropriate for inclusion in an assessment whereby EQC are set.</p>

		for example) and it is questionable whether that is a valid basis to remove data results when measuring a total metal parameter in a sample.		
5	Pipe length	<p>CZN has provided proposed EQC for each of the three pipe length configurations but has not indicated which pipe length is proposed for use. In the response to Technical Session IRs CZN indicated for IR #12 that a Mackenzie Valley Land and Water Board decision would determine which case is appropriate between 4.8 and 8 m.</p> <p>The approach to meeting objectives in the receiving environment involves varying some of the proposed EQC for each length of discharge pipe. Thus a longer pipe will not necessarily provide a higher level of protection, because the proposed EQC for various metals are higher.</p>	ECCC recommends CZN identify whether there are other factors, besides pipe length, which would suggest one pipe length is more environmentally favorable for use than the others.	We are on record as propping that the 8 m pipe length be retained in order to minimize unnecessary water treatment which requires energy and produces waste. It is incorrect to say that a longer pipe will not necessarily provide a higher level of protection because some EQC are lowered. All pipe lengths and related EQC ensure WQO are met. In fact, a longer pipe length is expected to provide a higher level of protection because it provides for greater mixing and therefore reduces the potential for chronic effects, and because, as noted by DFO in their IR response, it provides for the lowest increase in flow velocities and minimizes the potential for effects on migrating fish.