1. Purpose

The purpose of this Report is to present to the Mackenzie Valley Land and Water Board (MVLWB/the Board):

a) An Effluent Treatment Plan (ETP) Version 2 (V2) submitted by Canadian Zinc Corporation (CZN) to fulfill Part E, Condition 4 of Water Licence (Licence) MV2019L2-0006; and

b) A Minewater Treatment Contingency Plan (MTCP) Version 2 (V2) submitted by CZN to fulfill Part E, Condition 5 of Water Licence MV2019L2-0006.

2. Background

- September 9, 2019 – Issuance of Licence MV2019L2-0006;
- April 2, 2020 – Board Update to CZN regarding status of the ETP V2 and MTCP V2;
- April 27, 2020 – ETP V2 and MTCP V2 submitted to the Board;
- April 28 –ETP V2 and MTCP V2 review commenced;
- May 26, 2020 – Reviewer comments and recommendations due and received;
- June 9, 2020 – Responses due and received; and
- June 25, 2020 – ETP V2 and MTCP V2 presented to the Board for decision.

3. Discussion

Project History

On September 9, 2019, the Board issued Licence MV2019L2-0006 (attached). This authorization replaced Licence MV2001L2-0003 for mineral exploration activities at Prairie Creek Mine. The activities authorized under MV2019L2-0006 include the development of a second underground decline, and treatment of mine water emanating from an existing portal at the mine. The original Licence was issued in 2003 and was subject to Environmental Assessment (EA) EA01-003. CZN currently holds several active authorizations for activities related to the Prairie Creek Mine.
Authorization Requirements

The ETP and MTCP are required by Part E, condition 4 and 5 of the Licence, respectively:

*The Licensee shall comply with the Effluent Treatment Plan, once approved. The Plan shall outline options to meet the Effluent Quality Criteria requirements from Part E, Condition 16 for the water discharged from SNP Station 3-4. This plan shall be implemented before discharge of water to Prairie Creek, Harrison Creek, or the Catchment Pond.*

*The Licensee shall comply with the Minewater Treatment Contingency Plan, once approved. The Plan shall be in accordance with the requirements of Schedule C, Condition 1.*

The requirements for the MTCP as per Schedule C, Condition 1 are as follows:

- a) contingencies for the treatment of Minewater in the event it does not meet discharge criteria;
- b) a description of the risk of the Minewater exceeding the Polishing Pond freeboard limit;
- c) the process and facilities for the collection and management of surface runoff generated on site;
- d) details of monitoring, including a rationale for each component of the Water management system;
- e) a description of the Response Framework that will be implemented by the Licensee to link the results of monitoring to those corrective actions necessary to ensure that the objectives listed in Part D Item 11 are met including:
  - a. definitions, with rationale for Action Levels applicable to the performance of the Polishing Pond with respect to geotechnical stability, thermal characteristics, seepage quality and quantity, and run off; and
  - b. for each action level, a description of how exceedances of the Action Level will be assessed and what actions may be taken if the Action Level is exceeded.

In the Board’s Reasons for Decision (RFD) for MV2019L2-0006 (attached), the Board clarified that the ETP V1 and MTCP V1 were approved on an interim basis, and CZN was required to revise and re-submit the Plans within 90 days of issuance of the Licence according to comments and recommendations made during the public review of MV2019L2-0006 for Board staff confirmation of conformity. On November 28, 2019 CZN submitted a five-month extension request for the resubmission of the management plans associated with the issuance of MV2019L2-0006 and the associated Permit MV2019C0011 (attached). The Board approved the extension request on February 13, 2020 (attached).

On January 23, 2020, the Government of Northwest Territories Environment and Natural Resources (GNWT-ENR) sent a non-compliance letter to CZN regarding Licence MV2019L2-0006 (attached). The letter communicated the exceedance of effluent quality criteria (EQC) at Prairie Creek Mine from August to October 2019. Specifically, GNWT-ENR noted there were nine instances of non-compliance with the maximum zinc concentration EQC set in the Licence. Subsequently, on April 2, 2020, the Board sent CZN a letter explaining that, in light of the non-compliance Effluent Discharge events in 2019, the Board felt that approval of the ETP V2 and MTCP V2 was beyond the scope of Board staff confirmation of conformity, as had been indicated in the September 9, 2019 RFD (attached). The letter required that the ETP V2 and MTCP V2 be resubmitted for public review and Board decision. CZN submitted ETP V2 and MTCP V2, that was in conformity with the requirements of Licence MV2019L2-0006, to the Board by April 27, 2020 (attached).
4. Public Review

By May 26, 2020 comments and recommendations on the ETP V2 and MTCP V2 were received from four reviewers and Board staff:

- Acho Dene Koe First Nation (ADKFN)
- Environment and Climate Change Canada (ECCC)
- Government of Northwest Territories Environment and Natural Resources (GNWT-ENR)
- Racher Consulting, on behalf of Łı́ıdlı́ı̨ł First Nation and Nahę́ Dehé Dene Band

CZN responded by June 9, 2020. The Review Summary and Attachments (attached) presents the concerns identified through this review.

Main Issues Raised during the Review

The following summarizes the main issues raised during the review:

(a) Liability at Prairie Creek Mine

In both the ETP V2 and the MTCP V2 CZN argued that CZN’s current liability for the site is limited due to Surface Lease #95F/10-5 held on Territorial land. The Surface Lease had originally been issued to Procan Exploration in 1987 by Indian and Northern Affairs Canada (now called Crown-Indigenous Relations and Northern Affairs Canada). It is indicated in the ETP V2 and MTCP V2 that while CZN does intend to eventually proceed with mine operations, CZN believes that “it is clear from the terms of the Lease that the majority of site liability would revert to the Crown unless mine operations proceed” and that an Abandonment and Restoration Plan attached to the Lease as a schedule defines the restoration actions and responsibilities of the Lessee. CZN highlighted that as per the Lease they are “not required to address mine water discharge”. Further, in section 3.3. of the ETP V2 CZN discussed the water treatment system:

While CZN is committed to improving the system as needed, the question remains as to who is currently responsible for managing water from the old mine workings which has been the cause of non-compliance events.

GNWT-ENR commented on CZN’s argument of limited site liability in the ETP V2 and MTCP V2 (GNWT-ENR, comment 2). Specifically, GNWT-ENR argued that the management of water that emanates from the previous underground workings or the decline that was developed by CZN in 2007 does fall within the scope of the water licence for exploration, and is the responsibility of CZN. GNWT-ENR listed evidence from EA01-002, the proceeding from Water Licence MV2001L2-003 (the previous exploration water licence), and the Developer’s Assessment Report from EA0809-002 that provided evidence that CZN had previously been directed to, or committed to, treating the water from the 870 portal. With regards to all water emanating from the underground workings at the 870 portal being CZN’s responsibility. In response, CZN stated that they “respectfully disagree. However, we note that the current Water Licence does not distinguish between mine water sources”.

Although the liability at Prairie Creek Mine was discussed in the MTCP V2 and ETP V2, Board staff are of the opinion that it should not impact the content of the Plans. The Board has previously and repeatedly noted that the disagreement between CZN and GNWT regarding the liability of the old mine workings do not involve the Board as the Surface Lease is administered by GNWT. Therefore, Board staff believe that the disagreement of liability does not change requirements of the MTCP and ETP or CZN’s responsibility to be in compliance with its Water Licence. The Water Licence EQC that the Board approved in Water Licence MV2019L2-0006 on September 9, 2019 applies to water measured at Surveillance Network Program (SNP) station 3-4, which is water discharged from a Polishing Pond following water treatment
(see Figure 1). As CZN indicated in response to GNWT-ENR, the EQC in the Licence is based on all water that is discharged from the mine site, and CZN is required to treat this water. According to the Licence, the ETP is to outline options to meet site EQC.

![Figure 1. Prairie Creek Mine. Water is treated at a culvert at the 870 Level Portal (labelled with the number 14). The Polishing Pond is labelled with the number 5. The Catchment Pond is labelled with the number 6.](image)

(b) Water Quality downstream of Prairie Creek Mine

In response to comments, CZN submitted a letter to the Board (see Review Summary and Attachments). CZN discussed and attached a memo that was submitted by Racher Consulting, on behalf of Łı́ı́dlı̨ı̨ł First Nation and Nahé Dehé Dene Band. The memo includes an analysis of water quality downstream of Prairie Creek Mine. In the memo, Racher Consulting had indicated that the memo had been prepared to “help us understand if the levels of Zinc in effluent discharges from the mine site are negatively affecting aquatic life in Prairie Creek”. Racher Consulting used water quality data since 2003 from stations operated by ECCC 1.6 km downstream of Prairie Creek Mine, as well as CZN’s SNP data for station 3-11, which is located 250 m downstream of the mine site. The data analysis by Racher Consulting suggests that zinc levels in Prairie Creek downstream of the mine are likely not negatively affecting aquatic life in the area. However, Racher did acknowledge that there was a limitation of the analysis due to lack of data at SNP 3-11. At the end of the letter submitted by CZN that discussed the results of the memo by Racher Consulting, CZN stated that “while it is important to strive to meet Water Licence criteria, in this case there appears to be a low significance in terms of effects of not being able to”.

Site Facilities:
1 - Mill
2 - Accommodations
3 - Offices
4 - Workshops
5 - Polishing Pond
6 - Catchment Pond
7 - Prairie Creek
8 - Harrison Creek
9 - Tank Farm
10 - Sewage Treatment Plant
11 - Ore Stockpile
12 - Flood Protection Boom
13 - Parts Warehouse
14 - 870 Level Portal
15 - 930 Level Portal

Figure 1-2. Photo of the Prairie Creek Mine
Racher Consulting also provided review comments that referenced the memo, which had also been submitted to the Board along with the review comments. Racher Consulting indicated that based on the analysis completed, while the concentrations for zinc downstream of Prairie Creek Mine are within the most recent Canadian Council of Ministers of the Environment (CCME) Guidelines for dissolved zinc, there is uncertainty about the water quality closer to the mine (Racher, comment 4). The EQC values approved for total zinc in Water Licence MV2019L2-0006 were based on values used in the previous Licence (MV2001L2-0003), and Racher Consulting recommended that CZN consider applying for an amendment to Water Licence MV2019L2-0006 to align with the current CCME Guidelines for dissolved zinc. CZN indicated agreement to this suggestion unless their water treatment system is updated (see (f) Minewater Treatment Contingency – Secondary Treatment discussion below). Board staff note that CCME Guidelines often change when more data becomes available. The Board set EQC in the Licence with data that was available to it at the time. CZN is still required to meet its approved EQC in its Licence regardless of the changes to CCME Guidelines. Racher Consulting also suggested CZN take additional samples at SNP station 3-11 during discharge season to better understand the water quality data closer to the mine (Racher, comment 5). CZN agreed to the additional monitoring recommended by Racher Consulting and committed to including the details in the MTCP. Board staff propose a Board Directive for the MTCP that requires CZN to update the MTCP to include the sampling details for SNP 3-11. The proposed Board Directive is included as item 6 in Table 2.

Board staff note that the memo provided by Racher Consulting during the public review was not submitted at a time that allowed other reviewers to comment on the analysis of water quality downstream of Prairie Creek Mine. Therefore, while Board staff acknowledge the analysis, it is unknown whether other reviewers agree with the conclusions about water quality downstream of Prairie Creek Mine. Regardless of water quality downstream of Prairie Creek Mine, CZN is still required to meet EQC as per Water Licence MV2019L2-006, and the intent of the ETP is to outline options to meet EQC. According to the Board’s Water and Effluent Quality Management Policy, the EQC at Prairie Creek Mine for the Licence was set based on the Board’s objectives that waste to the receiving environment be minimized, as opposed to setting the EQC to meet a maximum concentration of a parameter downstream of the point of discharge in accordance with a guideline. Based on CZN’s letter that states that “there appears to be a low significance in terms of effects of not being able to [meet Water Licence criteria]”, Board staff feel that it could be appropriate for the Board to remind CZN in the decision letter that:

1. CZN’s water management should be in accordance with the Board’s Policy which is to minimize waste to the environment, as opposed to a “pollute-up-to” method.
2. The fact that the downstream water quality is lower than the most recent CCME Guidelines does not have bearing on CZN’s obligation to be in compliance with its currently approved EQC in their Licence.

(c) Total Petroleum Hydrocarbons

A comment from ECCC, and CZN’s subsequent response, revealed that the last SNP Report submitted by CZN to the Board on January 20, 2020 (attached) included the incorrect unit for the total petroleum hydrocarbon (TPH) parameter. Board staff suggest that the Board could remind CZN in the decision letter to ensure that future SNP Reports include the correct unit for TPH.

(d) Toxicity Test Results

ECCC commented that toxicity testing is required twice annually at SNP station 3-4 as per the Licence, but the final SNP Report submitted by CZN for 2019, including results from September to November (attached), did not include toxicity testing results (ECCC, comment 3). CZN replied that “Toxicity testing was done in 2019, just not in the particular SNP period (October)”. Board staff note that CZN did not provide additional details of the toxicity tests in their response to the comment, and that it could be helpful to discuss results of the toxicity tests in the ETP. CZN did present toxicity test results for SNP station
3-5 (Catchment Pond discharge; see Figure 1) in the 2019 Annual Water Licence Report submitted to the Board May 21, 2020 (attached), but is unclear to Board staff if CZN collected toxicity tests for SNP station 3-4 as per the Licence. Board staff propose a Board Directive requiring CZN to update the ETP V2 to discuss toxicity results from SNP station 3-4, and any associated implications. This Board Directive is included in Table 1 as item 1.

(e) Minewater Treatment Contingency – Primary Treatment

Reviewers brought up concerns regarding the content of the MTCP. In a letter submitted to the Board on the Online Review System (see Review Summary and Attachments), ADKFN stated concerns with the risk of metals in the effluent from Prairie Creek Mine and the potential for bioaccumulation and biomagnification in fish and wildlife species downstream which could migrate into ADKFN’s territory. ADKFN further commented that CZN did not discuss the possibility that contingency measures would be necessary for the actual effluent treatment system. Water is treated at the 870 level culvert (see Figure 1) and in the MTCP CZN had indicated that “the water treatment system is not prone to inundation from excess flows” and did not provide contingency measures if the mine water system were to become inundated following precipitation events. ADKFN argued that because of the lack of contingency options presented in the instance that this primary treatment is inundated or stops operating due to other reasons (such as lack of available treatment chemicals), they are “very concerned that Can Zinc is not taking Mine Water Contingency Planning seriously”. CZN’s response to ADKFN was outlined in their letter attached to the Board’s Online Review System (see Review Summary and Attachments). CZN argued that contingencies are not provided for the primary treatment system because CZN pro-actively increases chemical doses before the metal ‘load’ arrives. CZN argued that past problems with water treatment has not been the primary treatment and the conversion of dissolved zinc to total zinc (which occurs at the culvert at the 870 Level Portal through the addition of sodium sulphide chemical), but the secondary treatment to settle the particles causing the elevated total zinc in final discharge. CZN also indicated that “contingencies for this problem [secondary treatment] are the focus of the revised MTCP”.

Board staff note that in a SNP Report submitted to the Board on September 24, 2019 with SNP data from August 3-29, 2019, CZN had indicated that at the end of July 2019 torrential rainfall lead to excessive infiltration and the portal culvert receiving the water overflowed (attached). Further, the SNP Report indicates that clogging of treatment chemical delivery lines occurred later in the month, resulting in higher concentrations of total zinc concentration in the Polishing Pond discharge. Board staff believe that these events could be examples of instances where a contingency option may have to be employed by CZN, as was pointed out by ADKFN. Board staff propose a Board Directive requiring CZN to update the MTCP to include a section to discuss contingency options that could be employed during primary treatment. This potential Board Directive is included in Table 2 as item 1.

(f) Minewater Treatment Contingency – Secondary Treatment

ECCC commented that effluent quality results from Prairie Creek Mine have been variable over the years since 2012, with zinc levels exceeding licence limits to various extents in all years except 2015 (ECCC, comment 1). ECCC acknowledged that, as outlined in the ETP V2, Applied Water Treatment Inc. had visited the site in August 2019 and provided further treatment recommendations, including to improve flocculation and reconfigure the Polishing Pond baffles to improve settling. Applied Water Treatment Inc. indicated that, if these changes do not result in criteria being met, a sand filter should be installed after the spillway of the Polishing Pond. ECCC further pointed out that CZN indicates in the MTCP that:

if the average total zinc concentration in effluent discharge exceeds requirements after two consecutive months, and that the treatment system was otherwise operating normally, then additional sediment filtering be adopted by way of a sand filter or other
suitable device. If the average total zinc concentration in effluent discharge still exceeds requirements after two further consecutive months, then CZN will have to accept that the sulphide treatment system cannot yield compliant effluent because it is not feasible to sufficiently settle the resulting sediment. If that proves to be the case, then CZN will convert the existing treatment plant to a lime-based system.

ECCC recommended that CZN clarify a timeline for commissioning the alternative treatment system, and if it could be ready to treat water by 2021 if necessary. GNWT-ENR also commented on CZN’s proposed steps for minewater treatment contingency, stating that the timing of the response does not appear to be sufficient, as non-compliant water would be discharged for up to 4 months prior to conversion to a lime based system, and this is unacceptable (GNWT-ENR, comment 4). GNWT-ENR indicated that they believe that as soon as sampling indicates an average total zinc concentration result indicating non-compliance, additional treatment measures should be implemented (i.e. sediment filtering) (GNWT-ENR, comment 4), and after another four weeks conversion to a lime-based system should commence if results indicate that water is still non-compliant (GNWT-ENR, comment 5).

In response to ECCC and ENR’s comments, CZN agreed that the Company does need to be more pro-active in seeking additional treatment enhancements if initial results are not promising. However, CZN argued that the intent of the response was to base contingency action on several, representative samples, and that decline activities that are due to commence in September 2020 “will likely lead to compliant discharge” due to increased turbidity that could lead to more efficient settling in the Polishing Pond. CZN also indicated in the comment responses that they are not contemplating conversion to a lime-based system in 2020 due to practical problems, but plan to evaluate treatment plant changes, and collect further data which would possibly support a future amendment application to change the zinc EQC from total concentration to dissolved concentration (see *(b)* Water Quality downstream of Prairie Creek Mine for rational on CZN’s proposal).

Board staff agree with ENR regarding the necessity for CZN to implement contingency actions sooner, so effluent is not out of compliance for up to four months and acknowledge CZN’s response to be more pro-active about treatment. Board staff recommend a Board Directive requiring CZN to update the MTCP to include details about being more proactive in seeking additional treatment enhancements instead of waiting two months. This has been captured in Table 2 as item 2. Board staff also believe that a Board Directive should require CZN to update a future version of the MTCP to outline the new proposed plan for minewater treatment contingencies, as discussed in response to GNWT-ENR, comment 4; this is included in Table 2, item 3.

*(g) Minewater Treatment and COVID-19*

On May 13, 2020 CZN sent the Board a memorandum that discussed the status of Prairie Creek due to the COVID-19 pandemic (attached). CZN discussed safety concerns associated with transporting workers to Prairie Creek Mine from outside of territory. During the Public Review of the ETP V2 and MTCP V2, Racher Consulting asked CZN about water treatment in 2020 given COVID-19 related restrictions, and if NWT-based personnel could carry out water treatment as planned (Racher, comment 2). Racher Consulting also referenced a CBC article that indicated CZN may not get to site to treat water in 2020 (attached). Racher Consulting recommended that CZN indicate what contingency plans will be employed, and what environmental impacts on Prairie Creek could CZN expect, if the Company is not able to get to site in 2020 to treat minewater. In reply, CZN indicated that they are “awaiting a response from local communities as
to their comfort with CZN’s COVID-19 mitigation plans for 2020 water treatment work”. They also reiterated their position that discharge from the site does not appear to have a significant impact on Prairie Creek, as the memo from Racher Consulting suggests.

Board staff note that if CZN cannot get to the site to treat water this summer, it is presumed that CZN also would not be able to collect additional samples, as agreed to by CZN in response to a different comment by Racher Consulting (Racher, comment 5). If this is the case, it seems that CZN’s approach, as described in response to GNWT-ENR’s comments, may have to change due to lack of data to evaluate the conversion to a lime-based system or apply for an EQC amendment. If changes to the MTCP are warranted, CZN would have to submit the revised Plan to the Board a minimum of 90 days prior to the proposed implementation date for the changes, as per Part B, Condition 10 of MV2019L2-0006.

(h) Other Outstanding Items

During the review, CZN responded “OK” or agreed to update the ETP V2 or MTCP V2 based on some of the reviewer comments. These updates should be reflected in a future ETP and MTCP. Board staff have summarized these comments in Table 1 and Table 2 for the ETP V2 and MTCP V2, respectively.

**Table 1: Recommended Board Directives Effluent Treatment Plan**

<table>
<thead>
<tr>
<th>Item</th>
<th>Outstanding items requiring updating</th>
<th>Review comment reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Update the ETP to discuss toxicity results from SNP 3-4 and any associated implications.</td>
<td>ECCC-3</td>
</tr>
<tr>
<td>2.</td>
<td>Update section 3.5 Reporting to indicate that a revised Effluent Treatment Plan would be revised and resubmitted to the MVLWB for approval.</td>
<td>MVLWB-9</td>
</tr>
<tr>
<td>3.</td>
<td>Update the order of Appendix A and Appendix B so that the references in text are correct.</td>
<td>MVLWB-10</td>
</tr>
</tbody>
</table>

**Table 2: Recommended Board Directives Minewater Treatment Contingency Plan**

<table>
<thead>
<tr>
<th>Item</th>
<th>Outstanding items requiring updating</th>
<th>Review comment reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Update the MTCP to include a section that discusses contingency options that could be employed during primary treatment. This could include a discussion of how the portal culvert overflow event and clogging of treatment chemical delivery lines were mitigated in 2019.</td>
<td>ADKFN-1</td>
</tr>
<tr>
<td>2.</td>
<td>Update with details on how CZN will be more proactive in seeking additional treatment enhancements if initial results are not promising (i.e. not waiting two months).</td>
<td>ENR-4</td>
</tr>
<tr>
<td>3.</td>
<td>Update based on the understanding that conversion to lime treatment will not occur in 2020, but an evaluation of treatment plant changes will occur, along with collecting data to possibly support a future application to change the zinc EQC from total to dissolved.</td>
<td>ECCC-1; ENR-5</td>
</tr>
<tr>
<td>4.</td>
<td>Update to correctly reference the Effluent Treatment Plan.</td>
<td>MVLWB-3</td>
</tr>
<tr>
<td>5.</td>
<td>Update section 3.2 Water Quality to indicate that a revised Effluent Treatment Plan would be revised and submitted to the MVLWB for approval if conversion to a lime-based treatment system is to occur.</td>
<td>MVLWB-6</td>
</tr>
<tr>
<td>6.</td>
<td>Update to include details of biweekly sampling at SNP station 3-11 for pH, hardness, dissolved organic carbon, dissolved zinc, and total zinc during the discharge season.</td>
<td>Racher-5</td>
</tr>
</tbody>
</table>
5. **Conclusion**

Board staff conclude that further information was provided by CZN in their responses to reviewer comments; however, reviewers requested additional information be provided, which could be submitted in future versions of the Plans.

Based on CZN’s responses to review comments, Board staff are concerned that if CZN does not have an approved ETP and MTCP in place for the summer, this may result in further delays to water treatment at Prairie Creek Mine, on top of delays associated with COVID-19. Board staff conclude that the Board could approve the ETP V2 and MTCP V2 in the current form and require CZN to submit an updated ETP V3 and MTCP V3 to the Board, for approval, by **October 25, 2020**. The Board could require the updated MTCP V3 and ETP V3 to address the items compiled in Table 1 and Table 2 in response to comments made during this review if they are still relevant, and any other changes as required. This approach will keep the Board and reviewers informed of water treatment and contingency actions taken at Prairie Creek Mine over the 2020 discharge season and will allow an opportunity for reviewers to provide input for the 2021 discharge season.

6. **Recommendation**

a) Board staff recommend the Board **make a motion to approve the Effluent Treatment Plan Version 2** as required by Water Licence MV2019L2-0006;

b) Board staff recommend the Board **make a motion to approve the Minewater Treatment Contingency Plan Version 2** as required by Water Licence MV2019L2-0006; and

c) Board staff recommend the Board **make a motion to require Canadian Zinc Corporation to submit an Effluent Treatment Plan Version 3 and Minewater Treatment Contingency Plan Version 3 by October 25, 2020**. The Effluent Treatment Plan Version 3 and Minewater Treatment Contingency Plan Version 3 should address comments and commitments made during this review.

A draft decision letter is attached. Board staff recommend that the Board include the following wording in the decision letter:

The Board would like to remind CZN that:

- CZN’s water management should be in accordance with the Board’s Policy of minimizing waste to the environment, as opposed to a “pollute-up-to” method.
- The fact that the downstream water quality is lower than the most recent CCME Guidelines does not have bearing on CZN’s obligation to comply with its currently approved EQC as per Licence MV2019L2-0006. Meeting EQC is required, regardless of downstream impacts.
- Ensure that future Surveillance Network Program Reports submitted to the Board include the correct unit for total petroleum hydrocarbons (TPH).

7. **Attachments**

- [Licence MV2019L2-0006](#)
- [Reasons for Decision MV2019L2-0006](#)
- [CZN’s November 27, 2020 Extension Request for resubmission of management plans for MV2019L2-0006 and MV2019C0011](#)
- [Board’s February 13, 2020 letter to CZN regarding the Extension Request](#)
- [GNWT-ENR’s January 23, 2020 non-compliance letter for MV2019L2-0006](#)
- [Board’s April 2, 2020 letter to CZN regarding the Effluent Treatment Plan and Minewater Treatment Contingency Plan](#)
- [Effluent Treatment Plan Version 2](#)
• **Minewater Treatment Contingency Plan Version 2**
• **CZN’s SNP Report for September to November 2019**
• **CZN’s 2019 Annual Report for MV2019L2-0006**
• **CZN’s SNP Report for August 3-29, 2019**
• **CZN’s May 13, 2020 Prairie Creek COVID-19 Status and Logistics Update May 11, 2020**
• **CBC News Article from May 20, 2020: Water treatment might not be possible at Prairie Creek Mine during COVID-19, NorZinc CEO says**
• **Review Summary and Attachments**
• **Draft Decision Letter from the Board**

Respectfully submitted,

Kimberley Murray  
Regulatory Specialist

Jacqueline Ho  
Regulatory Specialist

Katherine Harris  
Senior Technical Advisor
| Board: | MVLWB |
| Review Item: | Canadian Zinc Corporation - Mineral Exploration, Prairie Creek Mine - Effluent Treatment Plan and Minewater Treatment Contingency Plan (MV2019L2-0006) |
| File(s): | MV2019L2-0006 |
| Proponent: | CanZinc Corporation |
| Document(s): | Minewater Treatment Contingency Plan (266.55 KB)  
Effluent Treatment Plan (2.42 MB) |
| Item For Review Distributed On: | Apr 28 at 10:52 Distribution List |
| Reviewer Comments Due By: | May 26, 2020 |
| Proponent Responses Due By: | June 9, 2020 |
| Item Description: | Canadian Zinc Corporation (the Applicant) submitted its Effluent Treatment Plan and Minewater Treatment Contingency Plan on April 27, 2020. The Effluent Treatment Plan and Minewater Treatment Contingency Plan are required by Licence MV2019L2-0006, Part 4, condition 4 and 5, respectively. Both Plans were also required under the Applicant’s previous Licence for Mineral Exploration at Prairie Creek Mine (MV2001L2-0003). The Reasons for Decision for Licence MV2019L2-0006 indicated that a revised Effluent Treatment Plan and Minewater Treatment Contingency Plan would be considered approved upon written confirmation of conformity from Board staff. However, on April 2, 2020 the Board sent the Applicant a letter indicating that, due to non-compliant Effluent Discharge events in 2019, the Effluent Treatment Plan and Minewater Treatment Contingency Plan would be distributed for public review and presented to the Board for decision. Using the Online Review System (ORS), reviewers are invited to submit comments and recommendations on the documents linked below by the review comment deadline specified. Reviewers may also wish to consider providing an overarching recommendation regarding whether the Board should approve the submission, to provide context for the comments and recommendations and assist the Board with its decision. If reviewers seek clarification on the submission, they are encouraged to correspond directly with the Applicant prior to submitting comments and recommendations. All documents that have been uploaded to this review are also available on our public Registry. If you have any questions or comments about the ORS or this review, please contact Board staff identified below. |
| Contact Information: | Jacqueline Ho 867-766-7455  
Kim Murray (867) 766-7458 |
## CanZinc Corporation (Proponent)

<table>
<thead>
<tr>
<th>ID</th>
<th>Topic</th>
<th>Reviewer Comment/Recommendation</th>
<th>Proponent Response</th>
<th>Board Staff Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CZN cover letter</td>
<td>Comment [doc] CZN cover letter</td>
<td></td>
<td>Board staff note CZN’s discussion in the cover letter regarding data on downstream Prairie Creek water. Board staff acknowledge that the total Zn concentrations downstream have not often exceeded the water quality objective included in the 2013 operations Water Licence. However, Board staff remind CZN that regardless of the water quality downstream of the Mine, CZN has a legal obligation to meet EQC under MV2019L2-0006. This EQC was set to minimize Waste to the Receiving Environment, as outlined in the Board’s Water and Effluent Quality Management Policy.</td>
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## Acho Dene Koe First Nation: Scott Mackay

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<tr>
<th>ID</th>
<th>Topic</th>
<th>Reviewer Comment/Recommendation</th>
<th>Proponent Response</th>
<th>Board Staff Analysis</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>General File</td>
<td>Comment [doc] Letter of response from Acho Dene Koe First Nation</td>
<td></td>
<td>Board staff note ADKFN’s concerns about the potential for bioaccumulation and biomagnification in</td>
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</table>
fish and wildlife species downstream of Prairie Creek Mine.

Regarding ADKFN’s concern about the omission of mercury, ammonia, or hydrocarbon water testing in Section 3.1.2 (Solution Analysis) Board staff agree with CZN that the purpose of the tests was to better understand treatment to remove metals of concern. Mercury, ammonia, and hydrocarbons are monitored under the SNP. Further, as CZN indicated, monthly SNP reports submitted to the Board by CZN are posted on the Public Registry.

ADFKN commented that CZN is dismissive of the possibility that contingency measures would be necessary for their effluent treatment system given the statement that “the water treatment system is not prone to inundation from excess flows”. CZN responded that the problem has not been primary
treatment, but secondary treatment to settle the particles causing elevated total zinc in discharge. Board staff would like to point out, however, that the SNP report submitted to the Board on September 24, 2019 indicated at the end of July 2019 torrential rainfall lead to excessive infiltration, and the portal culvert receiving the water overflowed. Further, this SNP Report indicates clogging of treatment chemical delivery lines later in the month of July. Board staff propose a Board Directive requiring CZN to update the MTCP to discuss the noted events from 2019 and how CZN responded to these events.

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<tr>
<td>2</td>
<td>General File</td>
<td>Comment (doc) Letter of response from Acho Dene Koe First Nation. Recommendation</td>
<td>See comment above (same letter).</td>
<td>Environment and Climate Change Canada: Russell Wykes</td>
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<tr>
<td>4</td>
<td>General File</td>
<td>Comment (doc) ECCC Cover Letter Recommendation</td>
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<td>Effluent Treatment Plan April 2020 Appendix C Memo from Applied Water Treatment Inc. dated Feb. 27, 2020 CZN Letter re EQC Exceedance and Non-Compliance Sept. 22, 2019 Attachment 2 Memo from Applied Water Treatment Inc. dated Sept. 5, 2019 Minewater Treatment Contingency Plan Section 3.2 Water Qu</td>
<td>Comment</td>
<td>June 3: Please refer to our advice and responses to ENR 4 and 5. Our revised approach is generally along the lines proposed by Racher on behalf of her clients whereby CZN will continue to seek and implement improvements during 2020, but a decision whether to revert to lime, or apply for a dissolved zinc EQC instead of total, would be made over the 2020/21 winter. Regarding some of the commentary, compliance in 2015 was not due to dilution by decline water, it was because turbidity in that decline water provided an effective medium for post-primary treatment settling. ECCC is correct in stating that 2017 testing did not provide conclusive results of sand filtration effectiveness, however we believe this was because that testing was performed on a sample that had very little suspended matter, and thus was not representative of the site situation. Professional water treatment wisdom is that sand filtration is effective in reducing suspended sediment levels in water with elevated suspended sediment.</td>
<td>See Board staff analysis to ENR-5.</td>
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<td>1</td>
<td>In spite of the treatment reviews and test work conducted since 2012, effluent quality results have been variable over the years, with zinc levels exceeding licence limits to various extents in all years (except for the portion of 2015 when Decline water was being added to the flow and diluted concentrations). Most recently, CZN had implemented recommendations from 2018’s treatment review and was not able to optimize system performance to the point that effluent quality criteria were consistently met in 2019. Applied Water Treatment Inc. visited the site August 2019 and provided further treatment recommendations in memos dated Sept. 5, 2019 and Feb. 27, 2020, specifically, to improve flocculation and to reconfigure the Polishing Pond baffles to improve settling. The Feb. 27, 2020 memo states that if these changes didn’t result in criteria being met, a sand filter should be installed after the spillway. The 2017 bench testing of sand filtration produced inconclusive results; it is not clear that this would be an effective contingency. In the Minewater Treatment Contingency Plan CZN proposes: &quot;...that if the average total zinc concentration in effluent discharge exceeds requirements after two consecutive months, and that the treatment system was</td>
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otherwise operating normally, then additional sediment filtering be adopted by way of a sand filter or other suitable device. If the average total zinc concentration in effluent discharge still exceeds requirements after two further consecutive months, then CZN will have to accept that the sulphide treatment system cannot yield compliant effluent because it is not feasible to sufficiently settle the resulting sediment. If that proves to be the case, then CZN will convert the existing treatment plant to a lime-based system." (page 6). ECCC notes that past optimization efforts have not brought the desired results, and concurs that if this final improvement of effluent treatment within the existing system is not successful, an alternative treatment method is needed. CZN does not provide a timeline for upgrading to a lime-based system in the event this is needed, and it is not clear whether this could be implemented for the 2021 discharge season.

**Recommendation**

ECCC recommends that CZN provide a timeline for obtaining and commissioning the alternative treatment system, and identify when that decision would need to be made in order to treat effluent to licence criteria in 2021.

2

<p>| Section 2.2 Effluent Treatment Plan Revised 2019 SNP | <strong>Comment</strong> | <strong>June 3:</strong> The TPH results in the SNP report are not reflected properly. They are in fact in ug/L. Therefore, the 0.1 mg/L | Noted. Board staff confirm that the Hydrocarbon results as per the ALS Environmental |</p>
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<tr>
<td></td>
<td>Report dated Jan. 20, 2020</td>
<td>Table 1</td>
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<td>Hydrocarbons (TPH)</td>
<td>DL is considerably less than EQC.</td>
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<td>presented in the 2019 SNP data do not conclusively show this. The licence limits for TPH are a maximum average of 5 mg/L, and a maximum grab of 10 mg/L. Results are presented in mg/L. The TPH results are shown as &lt;100 mg/L, except for Sept. 10, which was 140 mg/L. This indicates a detection limit of 100 mg/L for TPH. Detection limits need to be lower than the discharge criteria for parameters. The significant exceedance of 140 mg/L needs to be reviewed. <strong>Recommendation</strong> ECCC recommends that detection limits for TPH be used that will allow comparison with discharge criteria, and that will conclusively validate/refute the conclusions in the Effluent Treatment Plan.</td>
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<td>Revised 2019 SNP Report dated Jan. 20, 2020</td>
<td><strong>Comment</strong> Toxicity testing is required twice annually at Surveillance Network Program (SNP) Station 3-4, as per Water Licence 2019L2-006 Annex A. The final SNP Report for toxicity testing did not include results. It appears that testing was not conducted in 2019. Toxicity testing provides a supporting indication of whole effluent quality, and results should be included as a treatment metric. <strong>Recommendation</strong> ECCC recommends that toxicity testing be done in accordance with the Water Licence requirements, and that results be reviewed in the context of treatment efficacy.</td>
<td>June 3: Toxicity testing was done in 2019, just not in that particular SNP period (October).</td>
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<td>3</td>
<td>Revised 2019 SNP Report dated Jan. 20, 2020 Water Licence 2019L2-006, Annex A</td>
<td></td>
<td>Board staff note that in CZN’s 2019 Annual Report it indicates that a bulk sample was collected for toxicity testing at the Catchment Pond discharge (Station 3-5); the results of that test are attached to the Annual Water Licence Report. ECCC is correct; Water Licence 2019L2-0006 requires toxicity testing twice per year during open water at SNP station 3-4. The</td>
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Analytical Report attached to the SNP reports indicate that Hydrocarbons (EPH10-19 and EPH19-32) are measured in ug/L not mg/L. Board staff suggest that the Board could remind CZN in the decision letter to ensure that SNP Reports going forward include the correct unit for TPH in the tables summarizing SNP station data.
previous exploration WL (MV2001L2-0003) also required CZN to sample SNP station 3-4 two times a year during open water for acute toxicity. It is unclear from CZN’s response if two toxicity samples were taken at SNP station 3-4 in 2019.

Board staff propose a Board Directive requiring CZN to update the Effluent Treatment Plan to discuss toxicity results at 3-4 and any associated implications.

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<tr>
<td>7</td>
<td>General File</td>
<td>Comment [doc] ENR Letter with Comments and Recommendations</td>
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**Comment**: All updated version of plans made to the Board should include a concordance table which identifies changes that have been made to the Plan. This should include highlighting relevant sections with detail on how the changes address previous direction from the Board. **Recommendation**: 1) ENR recommends that, in future, all updated plans submitted by CZN to the Board include a concordance table.

**June 3**: While this is for the Board to decide, we sympathize with the comment. However, in order to end up with a plan that is suitable for end users, we suggest that a concordance table, if requested, be provided separate from the plan, so it is not included in the final.

Board staff note that Part B, Condition 6 of MV2019L2-0006 requires the Licensee to include a conformity statement or table which identifies where the requirements of the License, or other directives from the Board, are addressed.
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<th>Topic: Liability</th>
<th>Comment</th>
<th>June 3:</th>
<th>Board staff suggest the Board could remind CZN to include a conformity table in future versions of the ETP and MTCP, and to identify where changes have been made in the Plan.</th>
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<td>2</td>
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<td>ENR notes the following comment from CZN on both p.1 of the Minewater Treatment Contingency Plan and p.1 of the Effluent Treatment Plan: &quot;During permitting, CZN undertook to also manage mine water emanating from the existing workings during the exploration Decline project. The expectation at the time of the commitment was that the settling of sediment may be required. Upon receipt of a Water Licence with Effluent Quality Criteria (EQC), it was then clear that treatment of mine water would be required to meet EQC, specifically to remove zinc. Water treatment had not occurred on the property prior to 2006. CZN currently holds NWT Surface Lease #95F/10-5, originally issued to Procan Exploration in 1987 by Indian and Northern Affairs Canada (now AANDC). CZN assumed responsibility for the Lease when it acquired Procan’s interest in the property. CZN's current liability in connection with the site is limited by the terms of the Lease and the Abandonment and Restoration Plan (ARP) attached to it as a schedule.</td>
<td>Regarding &quot;all water emanating from the underground workings at the 870 portal are CZN's responsibility&quot;, we respectfully disagree. However, we note that the current Water Licence does not distinguish between mine water sources.</td>
<td>Regarding &quot;all water emanating from the underground workings at the 870 portal are CZN's responsibility&quot;, we respectfully disagree. However, we note that the current Water Licence does not distinguish between mine water sources.</td>
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This plan defines the required restoration actions and responsibilities of the Lessee. For example, the Lessee has the option to remove buildings and equipment, or to leave them on-site. Also, the Lessee is required to barricade the mine openings, but is not required to address mine water discharge. The existing ore stockpile is to be capped with clay and left in-place. Therefore, CZN's current liability for the site is limited. It is clear from the terms of the Lease that the majority of site liability would revert to the Crown unless mine operations proceed. CZN has every intention of eventually proceeding with mine operations and assuming all site liability. Since the completion of the first Decline project, CZN has continued to manage water from the Decline and the old workings, although the Company believes it is not responsible for continuing to manage water from the old workings. Flows from the Decline are directed into a pipe for delivery to the 870 portal. This water does not require treatment to meet EQC. Water from the old underground workings flows along the adit to the portal. This water requires treatment due to elevated dissolved zinc." As well, in Section 3.3 of the Effluent Treatment Plan, CZN notes: "While CZN is committed to improving the system as needed, the question remains as to who is currently responsible for
managing water from the old mine workings which has been the cause of non-compliance events." ENR has previously submitted its position on the record in this regard, including in a March 23, 2018 letter to the MVLWB regarding an amendment to the previous Water Licence MV2001L2-0003 in which it was stated: "ENR's review of all available information and background documents for this Water Licence amendment application indicates that the management of any water emanating from either the previous underground workings or the more recent decline established by CZN falls within the scope of the current Water Licence MV2001L2-003 and therefore is the responsibility of CZN. CZN has directly committed, or been directed, as detailed in documents excerpted below from environmental assessment EA01-002, subsequent regulatory processes related to Water License MV2001L2-0003, and environmental assessment EA0809-002, to treating water discharged from the 870 portal. 1) Report of EA01-002 The original Report of Environmental Assessment (EA) for EA01-002, underlying Water Licence MV2001L2-0003, was returned by the federal Minister which resulted in an Information Request from the Mackenzie Valley Review Board to CZN. In a letter dated January 31, 2003, CZN provided further
commitments, specifically including treatment of discharge from the 870 portal, and these commitments were included in the April 4, 2003 updated EA decision. CZN then built the polishing pond and commenced treating and management of water from the 870 portal using the polishing pond. 2) Water Licence MV2001L2-003 In the MVLWB's Reasons for Decision for Water Licence MV2001L2-003 dated October 30, 2003: Under Part B, Item 4(d) there is a discussion on the 870 portal - the item requires reporting by CZN of all of the water coming from the 870 portal. It states: "In order for the Board to effectively regulate the treatment and disposal of this water [from the 870 portal], the Board requires information about the volume of water draining from the 870m portal. As such the Licensee is required to report the monthly and annual quantities of minewater discharging from the 870 m portal." Part D, Item 4 also speaks to water in the 870 portal and requires that an SNP station must be established and that all water from the 870 portal must be discharged "only to the polishing pond or pilot plant where it can undergo treatment." This wording indicates that all water from the 870 portal will be managed through this Water Licence and that treatment is required. As well, under Part B, Item 3 of Water Licence
MV2001L2-003 it states: The Licensee shall adhere to all commitments as outlined in the following:
a) Attachments 1 and 2 of the Mackenzie Valley Environmental Impact Review Board's Attachments to Reasons for Decision; and
3) Developer's Assessment Report from EA0809-002CZN's: CZN notes on p. 62 of the Developer's Assessment Report (DAR) that "as part of the underground Decline Development project, CZN undertook during EA to treat the mine water discharging from the 870 level portal. This flow pre-dated CZN's operations on site. Thus, CZN planned to treat mine water from the existing workings in addition to water pumped from the new Decline." CZN notes on p. 63 of the DAR that "CZN fully complied with an extensive list of commitments made for the Decline and Pilot Plant projects. As part of Decline development, CZN undertook to treat all water discharging from the mine, including drainage from the existing 870 level portal and that from the new Decline. CZN originally planned to create a new portal for the Decline. However, the Decline was developed from the existing 870 level, the starting point being approximately 1 km from the 870 level portal. Flows from the Decline
discharge to the 870 level. The combined mine water flow is treated at the point where it exists the 870 level portal." ENR also notes that under Part B, Item 18 of Water Licence MV2019L2-0006 it states: 18. The Licensee shall adhere to all commitments as outlined in the following: a) Attachments 1 and 2 of the Mackenzie Valley Environmental Impact Review Board’s Attachments to Reasons for Decision; and b) The new commitments made by the Licensee in their January 31, 2003 response to the Mackenzie Valley Environmental Impact Review Board’s information request. As such, ENR maintains its position that all water emanating from the underground workings at the 870 portal are CZN’s responsibility and are explicitly within the scope of Water Licence MV2019L2-0006 and so should be managed and treated appropriately by CZN to ensure compliance with the conditions of that Water Licence. In addition, ENR maintains the position that any water entering and leaving surface water management infrastructure owned by CZN for discharge to the receiving environment under the Water Licence is the responsibility of CZN and must meet EQCs outlined in the Water Licence. 

**Recommendation** 1) All water emanating from the underground workings at the 870 portal are CZN’s
responsibility and are explicitly within the scope of Water Licence MV2019L2-0006 and so should be managed and treated appropriately by CZN to ensure compliance with the conditions of that Water Licence.

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<th></th>
<th>None</th>
<th><strong>Comment</strong> None</th>
<th><strong>Recommendation</strong> 2) Any water entering and leaving surface water management infrastructure owned by CZN for discharge to the receiving environment under the Water Licence is the responsibility of CZN and must meet EQCs outlined in the Water Licence.</th>
<th><strong>June 3:</strong> CZN’s responsibilities are defined in the Surface Lease and the Water Licence. Regarding &quot;must meet EQC&quot;, this applies to discharge from the Polishing Pond.</th>
<th>See Board staff response to ENR-2.</th>
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<tr>
<td>3</td>
<td>None</td>
<td><strong>Comment</strong> As an addition to the new version of the Minewater Contingency Plan, CZN has included additional response steps to implement should discharge water from the polishing pond not be compliant: &quot;We propose that if the average total zinc concentration in effluent discharge exceeds requirements after two consecutive months, and that the treatment system was otherwise operating normally, then additional sediment filtering be adopted by way of a sand filter or other suitable device. If the average total zinc concentration in effluent discharge still exceeds requirements after two further consecutive months, then CZN will have to accept that the sulphide treatment system cannot yield compliant effluent because it is not feasible to sufficiently settle the resulting sediment. If that proves to be the case, then</td>
<td><strong>June 3:</strong> CZN has discussed this further with ENR. CZN has agreed that the Company needs to be more pro-active in seeking additional treatment enhancements if initial results are not promising i.e. not waiting 2 months. Our intent, though, is to base our response on several, representative samples. In addition, we propose, on commencement of treatment, to collect a mine water sample and send it for testing to verify the treatment approach and flocculant dose. We will also evaluate the addition of sand filtration so as to be ready for implementation if initial representative samples are not promising. However, it is also worth noting that the proposed decline activities that are due to commence in September will likely lead to compliant discharge. This is because we observed during the 1st decline work that the</td>
<td>Board staff agree with ENR and acknowledge CZN’s response to be more pro-active and not wait 2 months prior to seeking additional treatment enhancements if initial results are not promising.</td>
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<td>4</td>
<td>Topic: Adaptive Management</td>
<td><strong>Comment</strong> Board Staff recommend a Board Directive requiring CZN to update the MTCP based on the agreement with ENR about the Company being more proactive in seeking additional treatment enhancements if initial results are not promising (i.e. not waiting 2 months).</td>
<td>Board Staff agree with ENR and acknowledge CZN’s response to be more pro-active and not wait 2 months prior to seeking additional treatment enhancements if initial results are not promising.</td>
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CZN will convert the existing treatment plant to a lime-based system. Lime is known to be effective in removing dissolved metals, especially zinc, and is also known to be an effective coagulant, resulting in effluent with low suspended solids. Treatment tests using lime were conducted previously and confirmed that compliant effluent can be obtained (CEMI, 2007 (Appendix A). Lime was not adopted because the Prairie Creek Mine site is currently only accessible by air, and new equipment as well as the lime, which is heavy, would have to be flown in. If conversion to a lime-based treatment system is to occur, the Effluent Treatment Plan will be revised and submitted for review."

While ENR appreciates the additional information provided by CZN, the timing of responses does not appear to be sufficient. Based on the above reference, non-compliant water would be discharged for two months prior to the adoption of additional sediment filtering and water could still be in non-compliance for additional two months prior to the conversion to a lime based system. The potential for discharge of non-compliant water to the environment for four months is unacceptable.

**Recommendation**

1) ENR recommends that as soon as sampling indicates an average total zinc concentration result indicating non-compliance, additional treatment is required. High turbidity in influent mine water leads to efficient settling after primary treatment, such that elevated total metals concentrations did not occur. In fact, we tried to artificially duplicate these conditions after the decline work but were unsuccessful.
measures should be implemented (e.g. additional sediment filtering).

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<td>5</td>
<td>None</td>
<td><strong>Comment</strong> None <strong>Recommendation</strong> 2) Once a similar sampling period has elapsed with the additional measures in place (i.e. an additional four weeks), should the water still indicate that concentrations are non-compliant, conversion to a lime-based system should commence.</td>
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<td>June 3: We pointed out to ENR that conversion to lime treatment mid-season poses practical problems. The existing plant would have to be disassembled for the conversion, and there would be a 'gap' in treatment. Other factors to consider are the contingencies described in our reply to ENR 4, the likelihood of compliant discharge once 2nd decline work starts, and based on Racher's analysis of historical dissolved zinc concentrations in Prairie Creek, mine water discharge is not causing significant impacts. For these reasons, CZN is not contemplating conversion to lime in 2020. We plan to evaluate treatment plant changes, and simultaneously collect data with which to possibly support a future application to change the zinc EQC from total to dissolved. Over the course of the 2020/21 winter, we would, if necessary, decide whether to convert to lime or make the EQC change application. We accept that CZN must comply with the current Licence requirements, only we believe the above considerations should provide some latitude in applying and evaluating the described contingencies before a further significant change (lime or dissolved zinc EQC) is made. ENR indicated concurrence with this approach on our call, but we encourage the Board to independently verify this.</td>
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<td>Board staff recommend a Board Directive requiring CZN to update the MTCP based on the understanding with ENR (i.e. that conversion to lime treatment will not occur in 2020, but an evaluation of treatment plant changes will occur). Regarding CZN’s comment that “ENR indicated concurrence with this approach on our call”: Board staff note that the Board cannot consider evidence that is not submitted to the Board for public review.</td>
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Section 3.2 of the Effluent Treatment Plan notes that water quality results in 2019 were poorer than 2018 and as such a return to the 2018 flocculant is being recommended. ENR notes that the 2019 had several irregularities which contributed to poorer water quality such as: Heavy rainfall in June and July resulting in overflow of the portal culvert, an occurrence that CZN indicated had not been observed previously in their August 2019 SNP Report. As per a September 22, 2019 letter from CZN detailing non-compliance events during the summer, it was noted that treatment of mine water was interrupted in July as a result of lack of supply of the main treatment chemical and that there were several instances of treatment plant malfunction. As such, it was not immediately clear if the water quality results from 2019 are related to the above noted operational shortcomings at site or the new flocculant. On May 12, 2020, ENR staff had a discussion with CZN staff regarding this point. CZN staff noted that water quality issues in 2019 were not limited to the periods of irregularity noted by ENR and were consistent throughout the year. As such, while not noted specifically in the Effluent Treatment Plan, there was awareness of the points noted by ENR when making the decision to return to the 2018 flocculant. As such, the
additional information reconciled ENR’s issue on that point and no additional information is required. **Recommendation N/A**

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<tr>
<td>1</td>
<td>Minewater Treatment Contingency Plan and Effluent Treatment Plan: Section 1.0 Introduction</td>
<td><strong>Comment</strong> Text on p.1 states that water from the underground mine workings requires treatment because of elevated dissolved zinc concentrations; however, the EQC are based on concentrations of total zinc. As a result, compliance with the current EQC set out in WL MV2019L2-0006 requires comparison to total zinc concentrations at station SNP 3-4 regardless of what proportion is accounted for by the dissolved fraction. Until CZN applies for an amendment to the the EQC for the Board’s consideration and decision, CZN is required to be compliant with the total zinc EQC. <strong>Recommendation</strong> None.</td>
<td><strong>June 3:</strong> The comment regarding dissolved zinc is made to indicate that treatment, in order to reduce dissolved concentrations which in turn reduce total concentrations, is required, with treatment meaning more than simple settling which would not reduce dissolved concentrations. The important context here is that, when the decline development was being considered, only simple settling was expected to be necessary.</td>
<td>Noted.</td>
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<td>2</td>
<td>Minewater Treatment Contingency Plan: Section 1.0 Introduction &amp; Section 3.2 Water Quality, Effluent Treatment Plan: Section 1.0 Introduction</td>
<td><strong>Comment</strong> Information is provided regarding CZN’s position on liability being limited by the terms of the Lease and the Abandonment and Restoration Plan (ARP). Specifically, these terms state CZN is not responsible for managing mine water originating from the underground mine workings, but CZN has been managing and treating this water and assumed the costs associated with these activities. The current point of compliance</td>
<td><strong>June 3:</strong> Yes, we’re aware of this. For further clarity, in this period of inactivity underground, water from the decline is carried in a pipeline separate from water from the old mine workings, and the two mingle at the 870 portal.</td>
<td>Noted.</td>
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<td>Minewater Treatment Contingency Plan: Section 1.0 Introduction</td>
<td><strong>Comment</strong></td>
<td>Reference is made to an Effluent Treatment Options Plan, but this title was changed during the water licence renewal proceeding. The correct title should be Effluent Treatment Plan as per the Part E, condition 4.</td>
<td>June 3: Ok</td>
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<td>Minewater Treatment Contingency Plan: Section 2.0 Minewater Treatment</td>
<td><strong>Comment</strong></td>
<td>Text on p.3 states that monitoring of zinc concentrations in mine water after treatment is performed on-site using a portable ultraviolet spectrophotometer. Field meters cannot be accredited and analysis of samples at an accredited laboratory is a requirement. In the absence of an approved Quality Assurance/Quality Control Plan, which remains an outstanding water licence requirement, could CZN confirm these field readings are in addition to samples submitted to an accredited laboratory?</td>
<td>June 3: Yes, they are in addition, and as the text says, are used as a guide for chemical dosing. We also note elsewhere in the plan that compliance with EQC can only be determined using laboratory results.</td>
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<td>concentrations using a portable ultra-violet spectrophotometer is in addition to submitted samples to an accredited laboratory for analysis.</td>
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<td>5</td>
<td>Minewater Treatment Contingency Plan: Section 3.2 Water Quality</td>
<td><strong>Comment</strong> CZN states that due to the limitations of colourmetric analysis, it is not possible to know if effluent is in fact compliant until the results of laboratory analysis are received. What are the limitations and if they are sufficient to preclude determination of compliance then could further information be provided to explain the purpose of this field testing? Information on testing methods are provided in the Effluent Treatment Plan, but this does not include a description of limitations. <strong>Recommendation</strong> CZN to provide additional information regarding limitations of colourmetric testing and the determination of effluent compliance.</td>
<td><strong>June 3:</strong> The colourimetric method, which is explained in an appendix, appears to produce a result between actual dissolved and total concentrations. It seems the method causes only partial dissolution of suspended matter, which then reports to the colourimetric result. As noted in our reply to MVLWB 4, the purpose of the field testing is to act as a guide for chemical dosing. We accept it isn’t perfect.</td>
<td>Noted.</td>
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<td>6</td>
<td>Minewater Treatment Contingency Plan: Section 3.2 Water Quality</td>
<td><strong>Comment</strong> CZN indicates that a lime-based treatment system is still a potential contingency, which may occur when all other potential mitigations have been implemented (e.g., enhanced flocculant mixing, revised baffle orientation). CZN notes if this does occur a revised plan would be submitted for review. Board staff would like to remind CZN that this plan would also require Board approval prior to implementation. <strong>Recommendation</strong> Update the Plan to indicate that the Plan would be submitted to the</td>
<td><strong>June 3:</strong> That’s what we meant.</td>
<td>Board staff propose a Board Directive requiring CZN to update the MTCP according to the review comment.</td>
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<td>Board for review and approval.</td>
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<td>7</td>
<td><strong>Minewater Treatment Contingency Plan: Section 4.1 Geotechnical Stability</strong></td>
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<td><strong>Comment</strong> There is reference to annual inspections being completed on the Polishing Pond dykes and if issues were identified a geotechnical engineer would be consulted. Who is completing the annual inspections if it is not a geotechnical engineer? <strong>Recommendation</strong> CZN to clarify the qualifications required of individuals completing annual inspections on the Polishing Pond dykes.</td>
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<td><strong>June 3:</strong> The pond is a relatively small, simple structure. Inspections are carried out by Site Managers who are technologists with construction experience. The managers are considered suitably qualified and able to detect any cracking, movements or other distress which would then prompt consultation with a geotechnical engineer. This has not been necessary for the 14 years the pond has been present.</td>
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<td>Board staff note that inspections on dams will be reviewed through the Operations Licence Renewal proceeding.</td>
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| 8 | **Minewater Treatment Contingency Plan: Section 4.4 Monitoring**  |
|   | **Comment** Total suspended solids need to be analyzed by a laboratory; however, has CZN considered establishing a TSS-turbidity curve, which could enable the use of a handheld turbidity meter to be used as a coarse indicator for settling efficiency? This may be useful for identifying potential issues sooner than laboratory results may be available. **Recommendation** CZN to provide additional information regarding the potential use of a handheld turbidity meter. |
|   | **June 3:** Laboratory results indicate that TSS concentrations are generally not well correlated with total zinc results, hence turbidity readings would not be useful as settling efficiency measured by turbidity or TSS would not be a good predictor of total zinc concentrations. The correlations, or lack thereof, are shown in figures provided in a cover letter with these responses. |
|   | Noted. |

<p>| 9 | <strong>Effluent Treatment Plan: Section 3.5 Reporting</strong>  |
|   | <strong>Comment</strong> CZN has indicated that adjustments to the treatment system will be implemented (e.g., enhanced flocculant mixing, revised baffle orientation) and additional changes may be considered in the future depending on results. CZN notes that if further changes are required that an updated ETP will be submitted to the MLVWB. Board staff would |
|   | <strong>June 3:</strong> Again, that's what we meant. |
|   | Board staff propose a Board Directive to update the Plan according to the comment. |</p>
<table>
<thead>
<tr>
<th>Page 10</th>
<th>Effluent Treatment Plan: Appendices</th>
<th><strong>Comment</strong></th>
<th>There is an error in the order of appendices. On p.4, reference to Decline water quality results provided in Appendix A should be Appendix B. On p.6, reference to total and dissolved metals results provided in Appendix B should be Appendix A. In addition, only total and dissolved zinc concentrations are provided in Appendix A rather than a more comprehensive list of metals. <strong>Recommendation</strong></th>
<th>CZN to update the appendices accordingly.</th>
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<td>June 3: OK</td>
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<td>Board staff propose a Board Directive requiring CZN to update the appendices accordingly.</td>
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| Page 11 | Effluent Treatment Plan: General | **Comment** | CZN has included information related to changes in chemical dosing and flocculant and the resulting effects on the effluent quality. What has not been included in the ETP is an explanation of the implications of the interruption of mine water treatment during July 3-7, 2019 due to a lack of supply of the main treatment chemical, as well as the several instances of treatment plant malfunction that occured in July and August. In a letter sent to the MVLWB on 22 September 2019, CZN stated that these issues resulted in effluent discharge exceeding EQC for total zinc. The information provided in this June 3: Figure 1 in our revised SNP report for Oct 1-Nov5, dated Jan 19, 2020 shows that even when treatment was occurring normally in 2019, total zinc concentrations were inferior to those in 2018. The changes noted in the Sep 22 letter were to address the malfunctions. The changes being proposed in the revised ETP are to address the non-compliance during 'normal' treatment. |
| --- | --- | --- | --- | --- |
| Noted. | | | |
letter did not indicate an issue with the chosen flocculant. **Recommendation** CZN to provide additional information pertaining to the treatment plant interruption and malfunctions in July and August 2019 and how these relate to the increased total zinc concentrations that exceeded EQC vs the change in flocculant.

### Racher Consulting: Kathy Racher

<table>
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<tr>
<th>ID</th>
<th>Topic</th>
<th>Reviewer Comment/Recommendation</th>
<th>Proponent Response</th>
<th>Board Staff Analysis</th>
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<tbody>
<tr>
<td>6</td>
<td>General File</td>
<td><strong>Comment</strong> (<a href="#">doc</a>) Memo from KRacher Consulting to accompany LKFN and NDDB comments. <strong>Recommendation</strong></td>
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<tr>
<td>1</td>
<td>Joint submission of LIIDLII KUÁ ‘EÁ’ FIRST NATION (LKFN) and NAHA DEHE DENE BAND (NDDB)</td>
<td><strong>Comment</strong> Note the KRacher Consulting is submitting these comments on behalf of the LKFN and the NDDB. <strong>Recommendation</strong> None</td>
<td></td>
<td>Noted.</td>
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<td>2</td>
<td>Effect of travel restrictions</td>
<td><strong>Comment</strong> In the short term, the communities' primary concern regarding water treatment is the impact of COVID-19 related restrictions. It is not clear to the communities whether water treatment can be carried out as planned with NWT-based personnel, and/or with Southern travelers who are subjected to isolation restrictions. Recent news reports on CBC indicate that it may not be possible given the reliance on people from outside the territory to carry out the necessary work. <strong>Recommendation</strong> If the</td>
<td><strong>June 3:</strong> Following discussions with GNWT, CZN is awaiting a response from the local communities as to their comfort with CZN’s COVID-19 mitigation plans for 2020 water treatment work. We have noted on many previous occasions that discharge from the site, even before water treatment commenced in 2006, does not appear to have had any significant impact on Prairie Creek. The authors’ dissolved zinc analysis is further evidence of this.</td>
<td>Noted. Board staff note that if CZN cannot get to the site to treat water this summer, it is presumed that CZN would also not be able to get to the site to collect additional samples, as agreed to by CZN in response to Racher-5. If this is the case, it seems that CZN’s approach, as described in response to ENR-5, may have to change</td>
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<td>current travel restrictions are in place for the duration of the summer season, what contingency plans will NZC employ, and what environmental impacts on Prairie Creek does NZC expect as a result?</td>
<td>due to lack of data to evaluate the conversion to a lime-based system or apply for an EQC amendment. If changes to the MTCP are warranted, Board staff reminds CZN to submit the revised Plan to the Board a minimum of 90 days prior to the proposed implementation date for the changes, as per Part B, Condition 10 of MV2019L2-0006.</td>
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<td>3</td>
<td><strong>Schedule for treatment contingencies</strong></td>
<td><strong>June 3:</strong> See our responses to ENR 4 and 5. Flocculation based treatment will be further evaluated through the 2020 season, and if still found wanting, either lime will be adopted for 2021 or an application will be made to change the total zinc EQC to dissolved zinc.</td>
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<td><strong>Comment</strong> If access to the site is available throughout the summer, the communities are supportive of NZC trying another attempt at flocculation-based treatment to reduce zinc levels in the effluent discharge, test the success of the most recent recommendations of their consultants at Applied Water Treatment Inc (Appendix C of the Effluent Treatment Plan) in a reasonable timeframe, and subsequently commit to lime treatment if EQC exceedances continue <strong>Recommendation</strong> Can the company provide a detailed schedule for the trial and evaluation of flocculation-based treatment, and if unsuccessful, the implementation of lime treatment?</td>
<td><strong>See Board staff analysis to ENR-5.</strong></td>
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<td>4</td>
<td><strong>Potential need to amend the EQC</strong></td>
<td><strong>June 3:</strong> Agreed, unless we switch to lime.</td>
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</table>
|  | **Comment** The communities’ openness to further trial is based on a preliminary review of the available water quality | **Noted.** Board staff acknowledge the
record, which indicates that, at sampling stations downstream of the mine, water quality continues to be protective of aquatic life despite EQC exceedances (see attached memo from KRacher Consulting). Based on this analysis, the water quality at the downstream stations are within the most recent CCME 2018 guidelines for zinc. As noted in the memo, however, there is some uncertainty about the water quality closer to the mine, since detailed time series of the relevant data are not currently collected.

**Recommendation** If EQC exceedances persist through this coming summer, the communities recommend that NZC consider applying for an amendment to the exploration water license's zinc EQC to align with CCME 2018 guidelines. Analysis document submitted by Racher and CZN's argument that water quality downstream of the mine is protective of aquatic life. Board staff note, however, that the analysis by Racher has not undergone public review with other reviewers having the opportunity to comment.

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<th>5</th>
<th>Additional monitoring this summer</th>
<th><strong>Comment</strong> As noted in the attached memo, additional data is needed for SNP station 3-11 (located in Prairie Creek about 250 m downstream of the mine) in order to properly evaluate whether zinc concentrations are consistently below the CCME Guideline value. Since the CCME Guideline for zinc is dependent on pH, hardness, and dissolved organic carbon, data for these three parameters is needed. Currently, NZC is required to sample at 3-11 once per month and the parameters analyzed do not include dissolved zinc or dissolved organic carbon.</th>
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<td><strong>June 3:</strong> Agreed. It is unclear to Board staff at this time if CZN will be able to go to site to collect additional data due to COVID-19 restrictions. Board staff again remind CZN that they should submit an updated MTCP based on changes that are necessary following summer activities.</td>
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**Recommendation** Due to the uncertainty in how well the minewater treatment will go this summer, we recommend that NZC take samples at station 3-11 biweekly during the discharge season and analyze for pH, hardness, dissolved organic carbon, dissolved zinc and total zinc. At this time, we don't think it is necessary to include these additional sampling requirements in the SNP; instead, the requirements should be in the MTCP. At the end of this discharge season, permanent changes to the SNP can be considered based on the data collected this season. This data may also be useful to NZC if they decide to apply for an amendment to the zinc EQC in future.
May 26, 2020

via online review system

Jacqueline Ho  
Regulatory Specialist  
Mackenzie Valley Land and Water Board  
7th Floor, 4922 48th Street  
P.O. Box 2130  
Yellowknife, NT X1A 2P6

Dear Jacqueline Ho:

RE: MV2019L2-006 – CanZinc Corporation– Prairie Creek Mine – Effluent Treatment Plan and Mine Water Treatment Contingency Plans

Environment and Climate Change Canada (ECCC) has reviewed the information submitted to the Mackenzie Valley Land and Water Board (MVLWB) regarding the above mentioned plan. You will find our comments, attached. If you need more information, please contact Russell Wykes at (867) 669-4743 or Russell.Wykes@Canada.ca.

Sincerely,

[original signed by]

Russell Wykes  
Environmental Assessment Coordinator

Attachment(s): ECCC Comments Excel Sheet

cc: John Olyslager, Head, Environmental Assessment North (NT and NU)
May 26, 2020

Jacqueline Ho
Regulatory Specialist
Mackenzie Valley Land and Water Board
7th Floor – 4910 50th Avenue
P.O. Box 2130
Yellowknife, NT
X1A 2P6

Dear Ms. Ho,

Re: Canadian Zinc Corp. (CZN)
    Water Licence – MV2019L2-0006
    Effluent Treatment Plan and Minewater Treatment Contingency Plan
    Prairie Creek Mine
    Request for Comment

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories has reviewed the plans at reference based on its mandated responsibilities under the Environmental Protection Act, the Forest Management Act, the Forest Protection Act, the Species at Risk (NWT) Act, the Waters Act and the Wildlife Act and provides the following comments and recommendations for the consideration of the Board.

Topic 1: Concordance Tables

Comment(s):

All updated version of plans made to the Board should include a concordance table which identifies changes that have been made to the Plan. This should include highlighting relevant sections with detail on how the changes address previous direction from the Board.

Recommendation(s):

1) ENR recommends that, in future, all updated plans submitted by CZN to the Board include a concordance table.
Topic 2: Liability

Comment(s):

ENR notes the following comment from CZN on both p.1 of the Minewater Treatment Contingency Plan and p.1 of the Effluent Treatment Plan:

“During permitting, CZN undertook to also manage mine water emanating from the existing workings during the exploration Decline project. The expectation at the time of the commitment was that the settling of sediment may be required. Upon receipt of a Water Licence with Effluent Quality Criteria (EQC), it was then clear that treatment of mine water would be required to meet EQC, specifically to remove zinc. Water treatment had not occurred on the property prior to 2006.

CZN currently holds NWT Surface Lease #95F/10-5, originally issued to Procan Exploration in 1987 by Indian and Northern Affairs Canada (now AANDC). CZN assumed responsibility for the Lease when it acquired Procan’s interest in the property. CZN’s current liability in connection with the site is limited by the terms of the Lease and the Abandonment and Restoration Plan (ARP) attached to it as a schedule. This plan defines the required restoration actions and responsibilities of the Lessee. For example, the Lessee has the option to remove buildings and equipment, or to leave them on-site. Also, the Lessee is required to barricade the mine openings, but is not required to address mine water discharge. The existing ore stockpile is to be capped with clay and left in-place. Therefore, CZN’s current liability for the site is limited. It is clear from the terms of the Lease that the majority of site liability would revert to the Crown unless mine operations proceed. CZN has every intention of eventually proceeding with mine operations and assuming all site liability.

Since the completion of the first Decline project, CZN has continued to manage water from the Decline and the old workings, although the Company believes it is not responsible for continuing to manage water from the old workings. Flows from the Decline are directed into a pipe for delivery to the 870 portal. This water does not require treatment to meet EQC. Water from the old underground workings flows along the adit to the portal. This water requires treatment due to elevated dissolved zinc.”

As well, in Section 3.3 of the Effluent Treatment Plan, CZN notes:

“While CZN is committed to improving the system as needed, the question remains as to who is currently responsible for managing water from the old mine workings which has been the cause of non-compliance events.”
ENR has previously submitted its position on the record in this regard, including in a March 23, 2018 letter to the MVLWB regarding an amendment to the previous Water Licence MV2001L2-0003 in which it was stated:

“ENR’s review of all available information and background documents for this Water Licence amendment application indicates that the management of any water emanating from either the previous underground workings or the more recent decline established by CZN falls within the scope of the current Water Licence MV2001L2-003 and therefore is the responsibility of CZN.

CZN has directly committed, or been directed, as detailed in documents excerpted below from environmental assessment EA01-002, subsequent regulatory processes related to Water License MV2001L2-0003, and environmental assessment EA0809-002, to treating water discharged from the 870 portal.

1) Report of EA01-002

The original Report of Environmental Assessment (EA) for EA01-002, underlying Water Licence MV2001L2-0003, was returned by the federal Minister which resulted in an Information Request from the Mackenzie Valley Review Board to CZN. In a letter dated January 31, 2003, CZN provided further commitments, specifically including treatment of discharge from the 870 portal, and these commitments were included in the April 4, 2003 updated EA decision.

CZN then built the polishing pond and commenced treating and management of water from the 870 portal using the polishing pond.

2) Water Licence MV2001L2-003

In the MVLWB’s Reasons for Decision for Water Licence MV2001L2-003 dated October 30, 2003:

Under Part B, Item 4(d) there is a discussion on the 870 portal – the item requires reporting by CZN of all of the water coming from the 870 portal. It states: “In order for the Board to effectively regulate the treatment and disposal of this water [from the 870 portal], the Board requires information about the volume of water draining from the 870m portal. As such the Licensee is required to report the monthly and annual quantities of minewater discharging from the 870 m portal.” Part D, Item 4 also speaks to water in the 870 portal and requires that an SNP station must be established and that all water from the 870 portal must be discharged “only to the polishing pond or pilot plant where it can undergo treatment.” This wording
indicates that all water from the 870 portal will be managed through this Water Licence and that treatment is required.

As well, under Part B, Item 3 of Water Licence MV2001L2-003 it states:

*The Licensee shall adhere to all commitments as outlined in the following:*

- a) Attachments 1 and 2 of the Mackenzie Valley Environmental Impact Review Board's Attachments to Reasons for Decision; and

3) **Developer’s Assessment Report from EA0809-002CZN’s:**

CZN notes on p. 62 of the Developer’s Assessment Report (DAR) that “as part of the underground Decline Development project, CZN undertook during EA to treat the mine water discharging from the 870 level portal. This flow pre-dated CZN’s operations on site. Thus, CZN planned to treat mine water from the existing workings in addition to water pumped from the new Decline.”

CZN notes on p. 63 of the DAR that “CZN fully complied with an extensive list of commitments made for the Decline and Pilot Plant projects. As part of Decline development, CZN undertook to treat all water discharging from the mine, including drainage from the existing 870 level portal and that from the new Decline. CZN originally planned to create a new portal for the Decline. However, the Decline was developed from the existing 870 level, the starting point being approximately 1 km from the 870 level portal. Flows from the Decline discharge to the 870 level. The combined mine water flow is treated at the point where it exists the 870 level portal.”

ENR also notes that under Part B, Item 18 of Water Licence MV2019L2-0006 it states:

18. The Licensee shall adhere to all commitments as outlined in the following:

- a) Attachments 1 and 2 of the Mackenzie Valley Environmental Impact Review Board's Attachments to Reasons for Decision; and
As such, ENR maintains its position that all water emanating from the underground workings at the 870 portal are CZN’s responsibility and are explicitly within the scope of Water Licence MV2019L2-0006 and so should be managed and treated appropriately by CZN to ensure compliance with the conditions of that Water Licence. In addition, ENR maintains the position that any water entering and leaving surface water management infrastructure owned by CZN for discharge to the receiving environment under the Water Licence is the responsibility of CZN and must meet EQCs outlined in the Water Licence.

**Recommendation(s):**

1) All water emanating from the underground workings at the 870 portal are CZN’s responsibility and are explicitly within the scope of Water Licence MV2019L2-0006 and so should be managed and treated appropriately by CZN to ensure compliance with the conditions of that Water Licence.

2) Any water entering and leaving surface water management infrastructure owned by CZN for discharge to the receiving environment under the Water Licence is the responsibility of CZN and must meet EQCs outlined in the Water Licence.

**Topic 3: Adaptive Management**

**Comment(s):**

As an addition to the new version of the Minewater Contingency Plan, CZN has included additional response steps to implement should discharge water from the polishing pond not be compliant:

“We propose that if the average total zinc concentration in effluent discharge exceeds requirements after two consecutive months, and that the treatment system was otherwise operating normally, then additional sediment filtering be adopted by way of a sand filter or other suitable device. If the average total zinc concentration in effluent discharge still exceeds requirements after two further consecutive months, then CZN will have to accept that the sulphide treatment system cannot yield compliant effluent because it is not feasible to sufficiently settle the resulting sediment. If that proves to be the case, then CZN will convert the existing treatment plant to a lime-based system. Lime is known to be effective in removing dissolved metals, especially zinc, and is also known to be an effective coagulant, resulting in effluent with low suspended solids. Treatment tests using lime were conducted previously and confirmed that compliant effluent can be obtained (CEMI, 2007 (Appendix A). Lime was not adopted because the Prairie Creek Mine site is currently only accessible by air, and new equipment as well as the lime, which is heavy, would have to be flown in. If
conversion to a lime-based treatment system is to occur, the Effluent Treatment Plan will be revised and submitted for review.”

While ENR appreciates the additional information provided by CZN, the timing of responses does not appear to be sufficient. Based on the above reference, non-compliant water would be discharged for two months prior to the adoption of additional sediment filtering and water could still be in non-compliance for additional two months prior to the conversion to a lime based system. The potential for discharge of non-compliant water to the environment for four months is unacceptable.

Recommendation(s):

1) ENR recommends that as soon as sampling indicates an average total zinc concentration result indicating non-compliance, additional treatment measures should be implemented (e.g. additional sediment filtering).

2) Once a similar sampling period has elapsed with the additional measures in place (i.e. an additional four weeks), should the water still indicate that concentrations are non-compliant, conversion to a lime-based system should commence.

Topic 4: Water Quality Results

Comment(s):

Section 3.2 of the Effluent Treatment Plan notes that water quality results in 2019 were poorer than 2018 and as such a return to the 2018 flocculant is being recommended. ENR notes that the 2019 had several irregularities which contributed to poorer water quality such as:

- Heavy rainfall in June and July resulting in overflow of the portal culvert, an occurrence that CZN indicated had not been observed previously in their August 2019 SNP Report.
- As per a September 22, 2019 letter from CZN detailing non-compliance events during the summer, it was noted that treatment of mine water was interrupted in July as a result of lack of supply of the main treatment chemical and that there were several instances of treatment plant malfunction.

As such, it was not immediately clear if the water quality results from 2019 are related to the above noted operational shortcomings at site or the new flocculant.

On May 12, 2020, ENR staff had a discussion with CZN staff regarding this point. CZN staff noted that water quality issues in 2019 were not limited to the periods of irregularity noted by ENR and were consistent throughout the year. As such, while
not noted specifically in the Effluent Treatment Plan, there was awareness of the points noted by ENR when making the decision to return to the 2018 flocculant. As such, the additional information reconciled ENR’s issue on that point and no additional information is required.

**Recommendation(s):**

N/A

Comments and recommendations were provided by ENR technical experts in the Water Management and Monitoring Division and the Dehcho Region and were coordinated and collated by the Environmental Assessment and Monitoring Section (EAM), Environmental Stewardship and Climate Change Division.

Should you have any questions or concerns, please do not hesitate to contact Patrick Clancy, Environmental Regulatory Analyst at (867) 767-9233 Ext: 53096 or email patrick_clancy@gov.nt.ca.

Sincerely,

Patrick Clancy  
Environmental Regulatory Analyst  
Environmental Assessment and Monitoring Section  
Environmental Stewardship and Climate Change Division  
Department of Environment and Natural Resources  
Government of the Northwest Territories
May 26, 2020

Jacqueline Ho  
Mackenzie Valley Land and Water Board  
4922 48th Street  
Yellowknife, NT X1A 2P6

Ms. Kim Murray  
Mackenzie Valley Land and Water Board  
4922 48th Street  
Yellowknife, NT X1A 2P6

VIA MVLWB Online Review System

Re:  [Can Zinc Corporation – Mineral Exploration, Prairie Creek Mine – Effluent Treatment Plan and Mine water Treatment Contingency Plan (MV2019L2-0006)]

Acho Dene Koe First Nation writes in response to the referral received via the Mackenzie Valley Land and Water Board’s Online Review System on April 28, 2020.

Acho Dene Koe First Nation’s (ADKFN) traditional territory and waters span three jurisdictions: British Columbia (BC), the Yukon Territory and the Northwest Territories (NWT).

Our main community is currently settled in Fort Liard, north of the BC-NWT border, but our members continue to use and occupy our Traditional Territory as a whole. Our members, for example, have cabins throughout our territory, and continue to maintain a small settlement at François Lake in northern BC. As our ancestors did, we hunt, trap, fish and gather for food, social, cultural, and trading purposes throughout our Traditional Territory.

We adhered to Treaty 11, and as such, we have treaty-protected hunting rights. Additionally, we assert Aboriginal rights, including title, throughout our Traditional Territory.

Our rights, and our Traditional Territory, are affected by the proposed decision.

ADKFN’s Treaty and Aboriginal Rights

In 1922, our ancestors adhered to Treaty 11, and these rights are constitutionally protected pursuant to s. 35(1) of the Constitution Act, 1982. Among other things, Treaty 11 protects our right to pursue our usual vocations of hunting, trapping, and fishing. When signing Treaty 11, our ancestors were assured that this liberty would not be taken away or curtailed. Any erosion of our ability to hunt, trap and fish would be a serious infringement of our Treaty rights.
The courts have cast serious doubt on whether Treaty 11 extinguished Aboriginal title to the land. In *Re: Paulette's Application*, the trial judge found that “notwithstanding the language of the two treaties there is sufficient doubt on the facts that aboriginal title was extinguished.”

More recently, the Federal Court recognized that the Federal Government’s failure to set aside reserves for Sambaa K’e First Nation was a fundamental breach of Treaty 11, and Sambaa K’e continued to have a strong *prima facie* case for Aboriginal title, which elevated the Crown’s duty to consult with them. Accordingly, in our view, our Aboriginal rights, including Aboriginal title, have never been ceded, abandoned or extinguished in any part of our Territory.

Aboriginal rights, which include title, are constitutionally protected legal rights, pursuant to s. 35(1) of the *Constitution Act, 1982*. Aboriginal rights include a priority use rights to resources (e.g. fish, wildlife, trees, traditional medicines, and foods). Aboriginal title confers on the rights-holding group the exclusive right to decide how the land is used and the right to benefit from those uses, subject to the restriction that the uses must be consistent with the group nature of the interest and the enjoyment of the land by future generations.

ADKFN holds constitutionally protected Treaty rights, and assert strong Aboriginal rights within our Traditional Territory, and take seriously any infringement of our rights.

**Crown’s Duty to Consult**

Where the Crown has “knowledge, real or constructive, of the potential existence of the Aboriginal right or title and contemplates conduct that might adversely affect it”, the Crown has a duty to consult with the First Nation (*Haida Nation v. British Columbia (Minister of Forests)*, [2004] 3 S.C.R. 511 at para. 35).

ADKFN currently uses, and has traditionally used, our Territory for fishing, hunting, trapping, and gathering. Development and resource exploitation have already significantly impacted and infringed our Treaty and Aboriginal rights and title past, and any new developments will infringe our rights in a compounding manner. An infringement cannot be justified, without meaningful consultation and accommodation, which may include compensation.

Acho Dene Koe First Nation expects and intends to enter full meaningful consultation with government prior to any decision that has the potential to infringe our Treaty or Aboriginal rights. The importance of protection our Treaty and Aboriginal rights, and of preserving natural resources, cannot be overstated.

**Referral Response**

The terms and conditions of Can Zinc’s existing Prairie Creek Mine water license requires the submission of an Effluent Treatment Plan (ETP) and Mine water Treatment Contingency Plan (MTCP). ADKFN has been invited to submit comments and recommendations regarding Can Zinc’s proposed ETP and MTCP.

ADKFN is very concerned with the risk of the discharge of metals in the effluent from the Prairie Creek mine and the consequent potential for bioaccumulation and biomagnification in fish and wildlife species downstream and which may migrate into our territory. Metals such as

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2 *Sambaa Ke Dene First Nation v. Duncan*, 2012 FC 204.
mercury, cadmium, lead, and zinc are known to bioaccumulate in fish and wildlife species which may move or migrate from the immediate area around the mine site to areas within our traditional territory. This includes species which migrate and species with larger home ranges. We rely on these species to exercise our rights as well as for the health and livelihoods of our members.

In MTCP Appendix A Section 3.1.2 (Solution Analysis) Can Zinc has shared results of the feed into the water treatment process, which shows highly elevated concentrations of cadmium and zinc. The table does not include analytical results for mercury. Can Zinc has also not included any ammonia or hydrocarbon water testing results. In MTCP Section 3.1 (Excess Water), Can Zinc is largely dismissive of the possibility that any contingency measures would be necessary for their effluent treatment system, stating “the water treatment system is not prone to inundation from excess flows”. MTCP Section 4.0 (Response Framework) is inadequate in providing contingency measures that Can Zinc would take should the mine water treatment system become inundated or stop operating properly for various reasons (such as a lack of available treatment chemicals). Considering that higher concentrations of metals in the treatment plant influent are associated with increases in water volume after precipitation events (which is exactly when contingency measures are most likely to be necessary), ADKFN is very concerned that Can Zinc is not taking Mine Water Contingency Planning seriously. Results in ETP Appendix A show a frequent inability of Can Zinc to achieve zinc discharge criteria, which is concerning to ADKFN.

Can Zinc add details on specific water treatment contingency measures that demonstrate a preparedness to treat all mine water under all circumstances at the mine. Preparedness should include ensuring processes, design, and equipment can operate optimally across all projected operating conditions; redundancy in equipment at critical failure points; and measures to ensure conveyance and collection systems retain sufficient capacity at all times. We also recommend that Can Zinc provide water quality reports to ADKFN on a quarterly basis which include total and methyl mercury (at ultra-low detection limits), total and unionized ammonia and hydrocarbons along with the current suite of analytes.

If you have any questions concerning our response I would ask that you email our Lands Manager, Meghan Buckham at lands@adkfirstnation.ca

Thank you.

Yours truly,

ACHO DÈNE KOE FIRST NATION
Signed on behalf of Chief Eugene (Gene) Hope

___________________________
Boyd Clark
Advisor/Acting Band Manager

Cc. Chief Eugene Hope
Hana Boye, Legal (Donovan & Co)
Doug McArthur, Advisor (McArthur West Consulting)
Barney Dohm, President & CEO (ADK Holdings Ltd)
Meghan Buckham, Lands Manager (Consultant –Shared Value Solutions)
Scott Mackay, Lands Director (Consultant – Shared Value Solutions)
Council
June 3, 2020

Chris Hotson  
Regulatory Manager  
Mackenzie Valley Land and Water Board  
7th Floor, 4922 48th St.  
PO Box 2130  
Yellowknife, NT  
X1A 2P6

Dear Mr. Hotson:

Re: Prairie Creek Mine, MV2019L2-0006, Effluent Treatment Plan and Minewater Treatment Contingency Plan Review

This letter is in support of our responses to comments by parties on Canadian Zinc Corporation’s (CZNs) draft Effluent Treatment Plan (ETP) and Minewater Treatment Contingency Plan (MTCP), and is additional to the responses made on the On-line Review System (ORS).

Effects on Prairie Creek

A central theme of the plans, and indeed the above-noted and other Water Licences, is the quality of mine water leaving the Prairie Creek Mine (the Mine) site and the actual or potential effects on Prairie Creek. In many previous regulatory processes, CZN has provided evidence to show that Prairie Creek has not been significantly affected by discharges from the Mine site. Previous studies have shown that, despite decades of mine water discharge, including before CZN started treatment of mine water in 2006, the only effect detected on Prairie Creek downstream is a mild nutrient enrichment (Spencer et al., 2007).

Last year, CZN had some issues with water treatment plant malfunctions which we reported in a letter dated September 22, 2019. However, we provided data on downstream Prairie Creek water for that year and previous years that showed that total zinc concentrations have not exceeded a water quality objective (0.035 mg/L) that the Mackenzie Valley Land and Water Board (MVLWB) included in the 2013 operations Water Licence, except for two occasions when total suspended solids were naturally elevated (May 29, 2007 when the total zinc concentration was 0.038 mg/L, and June 2, 2009 when the concentration was 0.036 mg/L).
As part of their review of the ETP and MTCP, Racher Consulting, on behalf of their indigenous clients, performed an analysis (copy attached) of downstream water quality with respect to a relatively new (2018) dissolved zinc guideline issued by the Canadian Council of Ministers of the Environment (CCME) for the Protection of Aquatic Life. Racher found that, for a sampling station 1.6 km downstream from the Mine, “dissolved zinc levels in Prairie Creek have remained below the CCME guideline value between 2003 and March 2019” (the end-point of water quality data used). Further, for a sampling station 250 m downstream, dissolved zinc levels in Prairie Creek have remained below the CCME guideline value between at least 2012 and March 2019. This evidence is consistent with the prior analyses which indicate that historical and current discharges from the Mine site, including before 2006 when no water treatment was occurring, have not and are not causing significant effects on Prairie Creek. Therefore, while it is important to strive to meet Water Licence criteria, in this case there appears to be a low significance in terms of effects of not being able to.

Responses to ADKFN Comments

We were not able to provide responses to a letter from the Acho Dene Koe First Nation (ADKFN) on the ORS, so we provide them here.

ADKFN expressed concern with the discharge from the Mine and the consequent potential for bioaccumulation and biomagnification in fish and wildlife species downstream of the metals mercury, cadmium, lead, and zinc. Of these metals, zinc is the most elevated in discharge, and as noted above, has not resulted in any significant impacts on Prairie Creek immediately downstream. The other metals listed are much less mobile and prevalent in the natural environment.

Regarding mine water treatment testing, the omission of mercury is not considered significant since Surveillance Network Program (SNP) and other results have indicated that mercury is not elevated in mine water, and we also know it is not mobile in the natural environment. Ammonia and hydrocarbons were not included as these analytes are also not elevated in mine water, and the purpose of the testing was treatment to remove metals.

Regarding contingency measures during periods when “higher concentrations of metals in the treatment plant influent are associated with increases in water volume after precipitation events”, contingencies are provided for these by pro-actively increasing chemical doses before the metal ‘load’ arrives. Again, the problem has not been primary treatment and the conversion of dissolved zinc to total zinc, but the secondary treatment to settle the particles causing the elevated total zinc in discharge. Contingencies for this problem are the focus of the revised MTCP.

Regarding reporting, monthly SNP reports can be found on the MVLWB’s registry for the exploration Water Licence.
Turbidity and Total Zinc

The Board asked (MVLWB 8) whether the use of a handheld turbidity meter could be used as an indicator of settling efficiency. Turbidity would then be used as a surrogate for TSS, which then could be useful if TSS is positively correlated with total zinc concentrations. Unfortunately, it isn’t. The attached figures using 2018 and 2019 data show that TSS concentrations are not well correlated with total zinc concentrations.

Sincerely,

David P. Harpley
VP, Environment and Permitting Affairs
KRacher Consulting

To: LKFN and NDDB
From: Kathy Racher
CC: Richard Bargery, Eliot Holland, Greg Empson, Trieneke Gastmeier, Dieter Cazon
Date: May 25, 2020
Re: Analysis of Zinc Concentrations in Prairie Creek Downstream of the Mine Site

ISSUE

The Minewater Treatment Contingency Plan (MTCP, April 2020) and the Effluent Treatment Plan (ETP, April 2020) for MV2019L2-0006 have been distributed by the MVLWB for review.

The requirements for these plans stem from the issues Canadian Zinc has had in the past few years with consistently meeting the effluent quality criteria (EQC) for Total Zinc that is required in their exploration water licence MV2019L2-0006. In response to these issues, CZN has been continually adjusting its treatment process for the minewater coming from the underground. In the most recent submissions, CZN has proposed further adjustments to their water treatment process and are hopeful that the Total Zinc EQC will be met this year.

In the MTCP, CZN has proposed that if within 2-4 months they are unable to meet the Zinc EQC using existing treatment technology, then they will switch to a lime-based treatment which is expensive to implement but certain to work.

To inform the communities’ comments on these plans, this memo has been prepared to help us understand if the levels of Zinc in effluent discharges from the mine site are negatively affecting aquatic life in Prairie Creek.
ANALYSIS

To understand the potential effects of discharging Zinc-containing effluent to the environment, data on zinc concentrations in Prairie Creek downstream of the mine were compared to the Canadian Council Minister of the Environment (CCME) Guideline for the Protection of Aquatic Life for zinc. Each step of this analysis is described below.

Step 1: Obtain water quality data for Prairie Creek

There were two sources of water quality data used for this analysis:

1. Data from stations operated by Environment and Climate Change Canada (ECCC)
   a. ECCC operates several long-term monitoring stations on Prairie Creek.
   b. The closest ECCC station downstream of the Prairie Creek Mine is NW10EC0006. Using Google Earth, I have estimated that this station is about 1.6 km downstream of the Prairie Creek Mine (see Figure 1).
   c. Data has been collected from this station 2-3 times per year since 2003; samples have been taken both during open water season and from under ice. Data for this station was downloaded from the Mackenzie Datastream website (https://mackenziedatastream.ca). The available data was from July 2003 to March 2019.
   d. Data for the following parameters were used in the analysis: Dissolved Organic Carbon (DOC), pH, Hardness, and Dissolved Zinc.

2. Data from CZN’s Surveillance Network Program (SNP)
   a. CZN’s exploration water licence, MV2019L2-0006, requires sampling for water quality at a station about 250 m downstream of the mine site – SNP station 3-11 (see Figure 1).
   b. Sampling at station 3-11 is required “monthly during operations and twice during the summer months after operations have ceased.” Data was available for this site from June 2006 to October 2019.
   c. Parameters analyzed at SNP 3-11 include a select list of total metals, pH, Hardness. There is no Dissolved Zinc or DOC data for this station.
   d. Data was obtained from CZN directly.
Step 2: CCME Guideline for Zinc

- Prior to 2018, the CCME Protection of Aquatic Life (CCME-PAL) guideline for Total Zinc was 0.03 mg/L. In 2018, the CCME replaced the old guideline with a new one that is for the dissolved form of Zinc instead of Total\(^1\) Zinc. According to the CCME factsheet on this Guideline, the most recent research on Zinc shows that both hardness and dissolved organic carbon (DOC) in the water can reduce the toxicity of Dissolved Zinc to aquatic life; toxicity to Dissolved Zinc increases with increasing pH of the water. Based on these observations, the CCME-PAL Guideline for Dissolved Zinc (long-term exposure) is expressed as an equation:

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\(^1\) Metals in the water can be present in either dissolved (soluble) or particulate (insoluble) state. To analyze for a sample for dissolved metals, labs pour part of the sample through a very fine filter to get rid of particulates. Total metal concentrations are measured as the total of both the dissolved and the particular forms of a metal in water.
Importantly, the CCME factsheet states that: “The CWQG equation is valid between hardness 23.4 and 399 mg CaCO₃·L⁻¹, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L⁻¹.”

Because the guideline value varies by pH, Hardness and DOC, we need to know all of those values to determine the guideline for each station for each sampling date.

1. Calculation of Dissolved Zinc Guideline for ECCC’s station NW10EC0006:
   - For each sampling date, measurements of the three Guideline equation variables were available – since the value of each variable changes over time, the calculated Guideline value also changes over time (See Figure 2).
   - With respect to the validity of the equation for each sampling date:
     - All the measured hardness values were between 23.4 and 399 mg/L CaCO₃.
     - None of the measured DOC values were below 0.3 mg/L but 2 out of 46 data points had measured DOC values above 22.9 mg/L. For these two samples, a value of 22.9 mg/L DOC was used in the calculation of the Guideline.
     - None of the measured pH values were below 6.5 but 36 out of 46 data points had measured pH values above 8.13. For these samples, a pH value of 8.13 was used in the calculation of the Guideline.

2. Calculation of Dissolved Zinc Guideline for SNP station 3-11:
   - For each sampling date, only pH and hardness were available for the calculation.
   - For the Guideline calculation in this case, I used the minimum DOC value (0.53 mg/L) measured at SNP station 3-10² (a station upstream of the mine site).
   - Even with a static value for DOC, the calculated Guideline value varies over time because the hardness values vary over time (see Figure 3).
   - With respect to the validity of the equation for each sample:
     - All the measured hardness values were between 23.4 and 399 mg/L CaCO₃.
     - As discussed above, a static value of 0.53 mg/L was used for DOC; this value is within the validity range for the CCME Guideline equation.
     - None of the measured pH values were below 6.5 but 40 out of 41 data points had measured pH values above 8.13. For these samples, a pH value of 8.13 was used in the calculation of the Guideline.

² The current water licence does not require measurement of DOC at SNP 3-10. Measurements of a full suite of parameters, including DOC, were taken at SNP 3-10 from August 2014 to July 2015 as part of CZN’s efforts to better characterize the background water quality in Prairie Creek – a requirement of their mining licence. Data was obtained directly from CZN. The range of concentrations measured for DOC at 3-10 was 0.53 mg/L to 2.4 mg/L. This is comparable to the DOC concentrations at ECCC’s far upstream station NW10EC0010 (about 6.4 km upstream of the mine site on Prairie Creek) which had a range of 0.6 mg/L to 9.3 mg/L and average of 2.2 mg/L.
Step 3: Comparison of CCME Guideline for Dissolved Zinc to measured concentrations of Zinc downstream of the mine site

1. Comparison of CCME Guideline to Dissolved Zinc concentrations at ECCC station NW10EC0006 (approximately 1.6 km downstream of the mine site)

   - Figure 2 shows a graph of the calculated CCME Guideline for Dissolved Zinc versus the measured Dissolved Zinc concentrations at NW10EC0006 between July 2003 and March 2019.
   - Note that in the winter, when there is ice on Prairie Creek, the concentration of many substances increases in the water under ice. This is why the concentration of Dissolved Zinc in the graph keeps going up and down. Since hardness and DOC levels also increase under-ice, the calculated Guideline value for Dissolved Zinc also goes up and down with the seasons.
   - The graph shows that Dissolved Zinc levels in Prairie Creek have remained below the CCME Guideline value between 2003 and March 2019.

Figure 2: Comparison of Measured Total Zinc at SNP 3-11 to CCME Guideline for Dissolved Zinc

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3 Note that the CCME Guideline for Dissolved Zinc has been established for both short-term exposure and long-term exposure. I have used the long-term exposure guideline. The Guideline can be found at: [http://cegg-rcge.ccme.ca/download/en/360](http://cegg-rcge.ccme.ca/download/en/360)

4 Raw data used to generate graph is available upon request.
2. Comparison to CCME Guideline to Total Zinc concentrations at SNP station 3-11 (approximately 250m downstream of the mine site)
   - As discussed above, there is no DOC data available for SNP 3-11 so the Guideline calculation was done with the minimum recorded DOC concentration at SNP 3-10. This is considered a conservative substitution.
   - Note that Dissolved Zinc is not measured at SNP station 3-11, so the estimated Guideline value had to be compared to Total Zinc concentrations at that location. This is a conservative approach since Total Zinc concentrations should, by definition, be higher than Dissolved Zinc concentrations (i.e., if the Total Zinc value is below the Guideline, then we would expect the Dissolved Zinc value would also have been below the Guideline).
   - Figure 3 shows a graph of the calculated CCME Guideline for Dissolved Zinc versus the measured Total Zinc concentrations at SNP 3-11 between June 2006 and March 2019.
   - Note that there is no under-ice data for SNP 3-11, however concentrations of dissolved ions (including Zinc and Hardness) still show some ups and downs over time due to freshet.
   - The graph shows that Total Zinc levels in at SNP 3-11 have remained below the CCME Guideline value between September 2012 and March 2019.

Figure 3: Comparison of Measured Total Zinc at SNP 3-11 to CCME Guideline for Dissolved Zinc

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5 Raw data used to generate graph is available upon request.
DISCUSSION

The data presented above show that Zinc concentrations in Prairie Creek 250 m and 1.7 km downstream of the mine site have been below the calculated CCME-PAL Guideline value for Dissolved Zinc since at least September 2012 and July 2003, respectively. Since CCME-PAL Guidelines are meant to protect all life stages of all aquatic species, therefore, Zinc levels in Prairie Creek downstream of the mine site are not likely negatively affecting aquatic life in that area.

One limitation in this analysis was the lack of DOC data at SNP station 3-11. It would be helpful to have pH, Hardness, DOC and Dissolved Zinc data collected at SNP 3-11 this summer so that we could ensure that the Guideline calculation can be done more accurately. This, in turn, would give us further confidence that the Zinc levels in CZN’s effluent is not negatively affecting Prairie Creek close to the mine site. In addition to more parameters being tested, it would helpful to sample at a frequency greater than once per month – even every two weeks during periods of discharge would be useful. After a summer of data collected in this way, more permanent changes to the SNP in the water licence could be considered.

Lastly, it is important to note that CZN’s current EQC is for Total Zinc, not Dissolved Zinc. The EQC was set that way because at the time the water licence was issued, the CCME only had a Guideline value for Total Zinc. Now that that has changed, CZN may want to consider proposing a new EQC that is based on Dissolved Zinc. If they want to do that, the additional data collection at SNP 3-11 that was suggested above would provide useful evidence to support a new EQC. In addition, CZN may want to consider testing for Dissolved Zinc at SNP stations 3-5 or 3-6 so that we can better understand the dilution of Zinc in the effluent as it goes into Prairie Creek.

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6 The CCME-PAL Introduction states: set “Guideline values are meant to protect all forms of aquatic life and all aspects of the aquatic life cycles, including the most sensitive life stage of the most sensitive species over the long term.” See ceqg-rcqe.ccme.ca/download/en/312
FIGURE 1: TOTAL ZINC AND TSS RESULTS FOR STATION 3-4, 2018 AND 2019

Total Zinc

TSS
FIGURE 2: TOTAL ZINC AND TSS CORRELATIONS FOR STATION 3-4, 2018 AND 2019

2018

2019

TSS

T Zn

2018

2019
ISSUE

The Minewater Treatment Contingency Plan (MTCP, April 2020) and the Effluent Treatment Plan (ETP, April 2020) for MV2019L2-0006 have been distributed by the MVLWB for review.

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To inform the communities’ comments on these plans, this memo has been prepared to help us understand if the levels of Zinc in effluent discharges from the mine site are negatively affecting aquatic life in Prairie Creek.
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\[ \text{Dissolved Zinc} \]

\(^1\) Metals in the water can be present in either dissolved (soluble) or particulate (insoluble) state. To analyze for a sample for dissolved metals, labs pour part of the sample through a very fine filter to get rid of particulates. Total metal concentrations are measured as the total of both the dissolved and the particular forms of a metal in water.
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² The current water licence does not require measurement of DOC at SNP 3-10. Measurements of a full suite of parameters, including DOC, were taken at SNP 3-10 from August 2014 to July 2015 as part of CZN’s efforts to better characterize the background water quality in Prairie Creek – a requirement of their mining licence. Data was obtained directly from CZN. The range of concentrations measured for DOC at 3-10 was 0.53 mg/L to 2.4 mg/L. This is comparable to the DOC concentrations at ECCC’s far upstream station NW10EC0010 (about 6.4 km upstream of the mine site on Prairie Creek) which had a range of 0.6 mg/L to 9.3 mg/L and average of 2.2 mg/L.
Step 3: Comparison of CCME Guideline\(^3\) for Dissolved Zinc to measured concentrations of Zinc downstream of the mine site

1. Comparison of CCME Guideline to Dissolved Zinc concentrations at ECCC station NW10EC0006 (approximately 1.6 km downstream of the mine site)
   - Figure 2 shows a graph of the calculated CCME Guideline for Dissolved Zinc versus the measured Dissolved Zinc concentrations at NW10EC0006 between July 2003 and March 2019.
   - Note that in the winter, when there is ice on Prairie Creek, the concentration of many substances increases in the water under ice. This is why the concentration of Dissolved Zinc in the graph keeps going up and down. Since hardness and DOC levels also increase under-ice, the calculated Guideline value for Dissolved Zinc also goes up and down with the seasons.
   - The graph shows that Dissolved Zinc levels in Prairie Creek have remained below the CCME Guideline value between 2003 and March 2019.

Figure 2\(^4\): Comparison of Measured Total Zinc at SNP 3-11 to CCME Guideline for Dissolved Zinc

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\(^3\) Note that the CCME Guideline for Dissolved Zinc has been established for both short-term exposure and long-term exposure. I have used the long-term exposure guideline. The Guideline can be found at: [http://ceqg-rcge.ccme.ca/download/en/360](http://ceqg-rcge.ccme.ca/download/en/360)

\(^4\) Raw data used to generate graph is available upon request.
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Figure 3: Comparison of Measured Total Zinc at SNP 3-11 to CCME Guideline for Dissolved Zinc

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