1. Purpose

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

a) A Geochemical Verification Program (the GVP) submitted by Canadian Zinc Corporation (CZN) to fulfill Part E, Condition 6 of Water Licence (Licence) MV2019L2-0006; and

b) An administrative update to Licence MV2019L2-0006.

2. Background

- September 9, 2019 – Issuance of Licence MV2019L2-0006;
- March 20, 2020 – Geochemical Verification Program received;
- March 24, 2020 – Geochemical Verification Program deemed complete and review commenced;
- April 21, 2020 – Reviewer comments and recommendations due and received;
- May 5, 2020 – Responses due and received;
- May 28, 2020 – Geochemical Verification Program and administrative update presented to the Board for decision; and
- September 8, 2026 – Expiration of Licence MV2019L2-0006.

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 EA01-003. CZN currently holds several active authorizations for activities related to the Prairie Creek Mine. On March 20, 2020 CZN submitted a Geochemical Verification Program (GVP) pursuant to Part E, Condition 6 of MV2019L2-0006 (attached).
Authorization Requirements

The Geochemical Verification Program is required by Part E, Condition 6 of the Licence:

90 days prior to depositing Waste Rock, the Licensee shall submit to the Board, for approval, a Geochemical Verification Program. This plan shall detail how the Licensee will verify geochemical test results of Waste Rock, quality of seepage from the Waste Rock Pile, and quality of new inflow to the mine workings. The Plan shall meet the objectives listed in Part E, Condition 1 and be in accordance with Schedule C, Condition 2.

The Geochemical Verification Program is required to be in accordance with Schedule C, Condition 2:

The Geochemical Verification Program, referred to in Part E of this Licence, shall meet the objectives listed in Part E, Condition 6 and include, but not be limited to:

a) Criteria for defining PAG, non-PAG and Metal Leaching materials with supporting rationale;
b) Criteria for defining high, moderate, and low risk Waste Rock with supporting rationale;
c) Sampling and testing methods for the Geochemical Verification Program (including Waste Rock, Waste Rock Pile Seepage, and any new inflow to the mine workings) with supporting rationale;
d) Sampling locations and collection methodology for follow-up verification testing with supporting rationale;
e) Sampling;
f) Timing and frequency of verification sampling;
ga) Quality assurance and quality control measures; and
h) A contingency plan in the event of increasing trends in Metal Leaching or acid generation potential.

4. Public Review

By April 21, 2020, comments and recommendations on the GVP were received from five reviewers:

- Acho Dene Koe First Nation (ADKFN)
- Government of the Northwest Territories (GNWT) Department of Environment and Natural Resources (ENR)
- GNWT Lands (Dehcho Region) Inspector
- Board staff
- Racher Consulting, on behalf of Łı́ı́dlı́ł Kų́ę́ First Nation (LKFN) and NahɁaɂ Dehé Dene Band (NDDB)

CZN responded by April 29, 2020. The Review Summary and Attachments (attached) presents the concerns identified through this review. The GNWT Lands Inspector had indicated that they had no comments for the document.

Main Issues Raised during the Review

The following summarizes the main issues raised during the review:

(a) Waste Rock Contingency

Reviewers asked CZN to further clarify the contingency planned for potentially acid generating (PAG) or metal leaching (ML) waste rock that will be extracted for the development of the decline. Specifically, ENR recommended that CZN clarify if the only contingency planned for PAG/ML waste rock was to take this rock back underground for storage in a blind heading, as was indicated in the GVP (ENR-1). In CZN’s response, they noted that it was highly unlikely that space underground would be an issue because there are several blind headings that could be used for storage, if applicable. CZN
also listed additional contingencies for the waste rock, including: transferring the waste rock from the underground to a pre-existing Waste Rock Pad for storage located north-west of the 870 Level Portal mine access (see Figure 1) and capping the waste rock in place with clay cover; and taking the material into the decline after decline activities are complete, to allow the material to be submerged as the decline is flooded following mining. In response to Racher-6, CZN provided further details about the contingency to store rock in the blind headings.

In response to ENR and Racher Consulting’s comments, CZN highlighted that it had not been necessary to employ the discussed contingencies for the development of the first decline that occurred under the previous Licence (MV2001L2-0003), and argued that the potential for encountering PAG/ML material is low based on the results from the first decline. Board staff suggest that the additional information CZN provided in response to the review comments regarding waste rock contingencies would be beneficial in an updated GVP, and reviewers should have the opportunity to comment on the additional contingencies presented by CZN. Board staff have added a potential Board Directive to Table 1 (item 1) to address this recommendation.

Figure 1. Map of Prairie Creek Mine that shows the location of the Waste Rock Pad, located north-west of the 870 Level Portal mine access.
(b) **Metal Leaching Evaluation of Waste Rock**

To determine if rock is likely to be PAG, a ratio called the Neutralization Potential Ratio (NPR) can be determined based on geochemical testing methods. As outlined in CZN’s GVP, the Mine Environment Neutral Drainage (MEND) guidelines indicate that a sample with an NPR value of less than 1 is classified as PAG or high risk, and a sample with an NPR value greater than 2 is classified as low risk for acid rock drainage (ARD) potential. In the GVP it was described that if testing revealed that rock could be PAG or high risk as per the MEND guidelines, a further testing method, known as shake flask extraction analysis (SFE) will be used to determine ARD potential.

Racher Consulting noted (comment Racher-4) that, based on the GVP the SFE analysis, which would also indicate ML characteristics, would only be performed on rock samples that are deemed to be high-risk for ARD. Racher suggested CZN clarify if “there is no need to evaluate metal leaching characteristics of other representative waste rock samples even if they are determined to be non-potentially acid generating?” In response, CZN re-iterated that samples with an NPR<1 would be subject to SFE analysis, but not samples with an NPR>2. Board staff are of the opinion that CZN did not provide an answer to address the intent of the reviewer comment. It appears that the review comment was pointing out that Metal Leaching can still occur in non-ARD rock. Board staff propose a Board Directive requiring CZN to update the GVP indicating how CZN will verify that this will not be an issue. Board staff suggest this could be achieved through reference to historical data and sampling a subset of waste rock to confirm that Metal Leaching will not occur. A proposed Board Directive is included as item 13 in Table 1.

(c) **Shake Flask Analysis Results and Waste Rock Management**

In the GVP, CZN indicates that geochemical testing of discrete waste rock piles on the Waste Rock Pad (see Figure 1) will occur and be compared to the MEND guidelines, as discussed above. If this testing reveals that further testing is required, SFE analysis will be performed on samples and results will be compared against the British Columbia Approved Water Quality Guidelines short-term guidelines and the Canadian Council of Ministers of the Environment environmental quality guidelines for the protection of freshwater aquatic life.

During the review, ENR asked CZN to “clarify the goals of the SFE analysis, and how the results will be used to manage waste rock with uncertain ARD potential” (ENR-4). CZN indicated that the goal of the SFE analysis is to “assist with assessment of leachability compared to water quality guidelines and effects assessment”. Board staff note that what CZN indicated in their response to ENR (i.e. that the results would be used to compare with guidelines) was clearly laid out in the GVP, but what was not clear was how the results would actually be used to manage waste rock. CZN indicated in the GVP that further investigation of waste rock could occur based on SFE analysis results, but did not specify what that investigation could be, or how the investigation could actually influence management decisions; this was pointed out by Racher Consulting (Racher-7). In response to Racher-7, CZN did provide some additional information about what the further investigation may entail. Board staff recommend a Board Directive that requires CZN to provide further information regarding the use of SFE results for waste rock management in response to ENR and Racher Consulting’s comments. Board staff believe reviewers should have an opportunity to review these updates in an updated version of the GVP. A proposed Board Directive is included in Table 1 (item 4).

Racher Consulting had a comment about CZN’s comparison of the water quality guidelines to SFE analysis results (Racher-5). The review comment pointed out that CZN had indicated in their GVP that “Elemental concentrations which exceed the water quality guidelines by less than one order of
magnitude are interpreted not to pose a specific risk to the receiving environment”. Racher Consulting asked the basis for the criteria presented. CZN responded:

*The author of this advice is Tetra Tech, 2019 (Phase 1 PWR GVP). We believe the basis for it is that SFE results are widely assumed to over-estimate seepage concentrations due to the 3:1 liquid to solid ratio in the tests.*

Board staff note that the Geochemical Verification Program for the Phase 1 Pioneer Winter Road (PWR) that CZN referred to in the response was submitted under the authorizations for the Prairie Creek All Season Road (MV2014F0013, MV2014L8-0006, MV2019L8-0002) and was interim approved by the Board on February 18, 2020. The PWR Geochemical Verification Program requires a further public review when it is re-submitted before approval; consequently, Board staff are of the opinion that referencing the PWR Geochemical Verification Program does not resolve this comment.

Board staff further believe that CZN should provide additional justification to support the rational that elemental concentrations which exceed the water quality guidelines by less than one order of magnitude are not interpreted to pose a specific risk to the receiving environment. This could be supported, for example, with evidence from previous studies that shows SFE results over-estimate seepage concentrations due to the 3:1 liquid to solid ratio in tests. This further justification should be updated in the GVP and reviewers should have the opportunity to respond to CZN’s justification. Board staff propose a Board Directive accordingly, which is represented as item 14 in Table 1.

**(d) Sampling Requirements**

Reviewers requested CZN provide further details on sampling under the GVP, and how sampling results would be reported. In MVLWB-3 Board staff commented that in CZN’s GVP it had been indicated that sampling for the rock pile seepage in a sump, and decline drainage water, would occur at the same time and using the same methods (including QA/QC) as sampling for the Water Licence Surveillance Network Program (SNP). Given that there are many requirements that CZN may have been referring to in this statement, Board staff recommended that CZN clarify which requirements from the Reporting Requirements from the Licence SNP will be followed for sampling the rock pile seepage and decline drainage water. Based on CZN’s response, Board staff believe that CZN did not understand the recommendation. They indicated that “The reporting requirements referred to were related to sampling, not reporting”. Board staff note that the section being referring to from the SNP for MV2019L2-0006 (called Part A: Reporting Requirements) does include requirements related to sampling as well (items 3-8) that may be applicable to the sampling outlined in the GVP. Board staff recommend a Board Directive requiring CZN to update the GVP with the list of relevant items from Part A of the SNP (related to sampling) that will be incorporated into the GVP. This recommendation is included in Table 1 as item 9.

Regarding sampling of decline water, CZN had indicated in the GVP that only dissolved metals analysis would occur and not total metals concentrations, because total metals concentrations would be adversely skewed by high suspended sediment. ENR recommended that CZN should be required to sample for both total and dissolved metals analysis to fully characterize the water quality. While ENR did recognize that total metals concentrations would be skewed by suspended sediment, they still believe that having results from both total and dissolved metals in the decline water would results in a better understanding of water quality across the site, and could allow for water treatment to be adjusted for expected water quality (ENR-5). ENR also pointed out that the site Effluent Quality Criteria under the Licence are for total and not dissolved metals concentrations. In response, CZN re-
iterated their position that the results for total metals concentrations would not be meaningful because of the high total suspended solids in the water that would interfere with the results. CZN further argued that the sampling stations required through the Licence SNP were adequate regarding total metals analysis.

Upon reviewing the section of the GVP about decline water management, ENR’s comment, and CZN’s response, the sampling location for decline water became unclear to Board staff, as CZN had indicated in the GVP the potential to sample in two different locations depending on the location of drainage discharge, but did not provide a rational as to why the points of drainage discharge would vary. Consequently, it was also unclear to Board staff which discharge point ENR’s comment and CZN’s response was referring to, or if the comment and response were referring to both discharge points. Board staff propose a Board Directive requiring CZN to clarify the proposed different sampling locations for decline water, as indicated in Table 1, item 5.

Regarding ENR’s suggestion for CZN to sample total metals concentrations, Board staff believe that confirmatory sampling for total metals could be helpful to fully characterize the decline water, as ENR indicated. CZN indicated in the GVP that elevated metals concentrations in the Decline is highly unlikely, but Board staff believe that this statement should be verified with confirmatory sampling, including for total metals when necessary. Board staff suggest that CZN could consider including total metals sampling, along with dissolved metals, as a response to a noticeable change (which would have to be defined in the GVP) to total metals at SNP station 3-7 (which is where final mine water is discharged), in order to better understand a potential noticeable change and to further assess water quality of the second decline. Board staff propose a Board Directive for CZN to consider the proposed option and update the GVP with the appropriate details, as necessary. If CZN maintains that total metals should not be sampled, CZN should update the GVP with further rational as to why sampling for total metals is not necessary to fully characterize the water quality from the decline. This potential Board Directive is included as item 6 in Table 1.

(e) Reporting Requirements

Reviewers asked CZN about reporting for the GVP. Specifically, ADKFN reiterated the importance of routine and timely water quality reporting from CZN, and requested information about CZN’s waste rock management plans, as they are developed or adapted, based on the GVP results (ADKFN-1). ADKFN further recommended that CZN provide water quality reports on a quarterly basis. CZN replied that: “Water quality sample results will be reported to the MVLWB who will post the results publicly. This will include any necessary waste rock management plans”. Racher Consulting also asked CZN to clarify how and when the monitoring information from the GVP would be shared with the Board and with LKFN and NDDB (Racher-8). In response to these questions and a question from Board staff about reporting (MVLWB-3), CZN indicated that monitoring of decline activities will involve both rock and water sampling, and therefore they propose to report results separate from the Licence SNP. CZN indicated that reporting frequency would depend on results and activities.

Board staff recommend that CZN’s reporting approach for the GVP be clarified in the GVP, and that CZN submit reports to the Board according to the (potential future) approved GVP thereafter. CZN should clarify the timing for the submission of results. For instance, CZN may propose a monthly update with results if applicable, or an update each month to indicate no results, as the case may be. This would result in a similar frequency of reporting to the SNP requirements for the Licence. CZN could propose, as suggested by ADKFN, quarterly updates, or possibly submitting a report 90 days...
following a sampling event. Board staff recommends the requirement for CZN to update the GVP with the reporting frequency be a Board Directive, as outlined in Table 1, item 10.

Part B, Condition 19 of MV2019L2-0006 requires CZN to submit an Annual Water Licence Report to the Board and an Inspector each year, to be in accordance with the requirements listed in Schedule A, Condition 1. Board staff note that the current Annual Water Licence requirements do not include a requirement for CZN to include a summary of activities conducted in accordance with the approved Geochemical Verification Program, although this requirement is included for other management plans required under the Licence (specifically the Engagement Plan, Effluent Treatment Plan, Spill Contingency Plan, and Closure and Reclamation Plan). Board staff believe that including a requirement for CZN to summarize activities made under the GVP each year in the Annual Water Licence Report, including sampling, results, and management decisions according to contingency methods, would be beneficial for reviewers, the Inspector, and the Board. Specifically, including the GVP in the Annual Water Licence Report will provide clarity and summarize information about the GVP, and further provide reviewers the opportunity to submit comments, observations, feedback, and questions, as necessary. Board staff propose an administrative update to MV2019L2-0006 Schedule A, Condition 1, item j) to include a requirement for CZN to outline activities conducted under the GVP in the Annual Water Licence Report. Board staff specifically propose the following wording for item j) of the Annual Water Licence Report:

A summary of activities conducted in accordance with the approved Geochemical Verification Program, required in Part E of this Licence, including:

i. A summary and interpretation of results from sampling performed under the Geochemical Verification Program; and

ii. Any actions carried out as per the contingency plan in the event of increasing trends in Metal Leaching or acid generation potential.

(f) Outstanding Items
During the review, CZN responded “OK”, agreed to update the GVP, or provided information that would make the GVP more understandable, based on the reviewer comments. These comments should be reflected in a revised GVP. In some instances, Board staff believe that CZN did not respond adequately to review comments and Board staff responded with suggestions that could make the GVP stronger. Board staff have summarized the comments and suggestions in Table 1 below. Board staff recommend the Board require CZN to submit a revised GVP in accordance with Table 1.

Table 1: Recommended Board Directives Geochemical Verification Program

<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 section 3. Waste Rock Monitoring to include the additional contingency options, as discussed in response to the review comments, for rock determined to be potentially acid generating/metal leaching based on test results.</td>
<td>ENR-1; Racher-6</td>
</tr>
<tr>
<td>2.</td>
<td>Update section 3. Waste Rock Monitoring to include clarification as to the weight of waste rock samples to be collected and submitted as a composite for analysis, as described in response to the review comment.</td>
<td>ENR-2</td>
</tr>
<tr>
<td>3.</td>
<td>Update section 3. Waste Rock Monitoring to clarify that SFE analysis will be conducted on “high risk” material (NPR&lt;1).</td>
<td>ENR-3</td>
</tr>
</tbody>
</table>
4. Update section 3. Waste Rock Monitoring to provide further information regarding the use of SFE results for waste rock management.  
   ENR-4; Racher-7

5. Update the Geochemical Verification Program to further clarify the two discharge points described under section 5. Decline Water Management (third paragraph). Specifically, CZN is to clarify why the points of discharge would vary and how this would impact the combined stream at SNP station 3-7.  
   ENR-5

6. CZN to consider sampling water from the second Decline for total metals as a response to a (defined) noticeable change in total metals observed at SNP station 3-7, to further assess the water quality of the second Decline. CZN should update the Geochemical Verification Program with the appropriate details. Alternatively, update the Geochemical Verification Program with further rational as to why sampling for total metals is not necessary to fully characterize the water quality from the second Decline.  
   ENR-5

7. Update the “Collection Pond Water Sample” in Attachment 2 to indicate that the data presented represents total concentration.  
   ENR-6

8. Update Figures 3 to 5 to include figure numbers.  
   MVLWB-2

9. Update section 4. Waste Rock Water Management and section 5. Decline Water Management to indicate the specific sampling requirements from MV2019L2-0006 Annex A Surveillance Network Program (SNP), Part A. CZN is referring to in the Geochemical Verification Program when it is indicated that sampling will use the same methods as sampling for the Water Licence SNP.  
   MVLWB-3

10. Clarify the reporting requirements for geochemical results in section 4. Waste Rock Water Management and section 5. Decline Water Management of the Geochemical Verification Program, including the frequency at which results will be submitted to the Board.  
    ADKFN-1; MVLWB-3; Racher-8

11. Update the Geochemical Verification Program to include reference to the Effluent Treatment Plan and Minewater Treatment Contingency Plan, where appropriate.  
    MVLWB-6

12. Update the Geology and Development Rock section in Attachment 1 to reference the collection pond results provided at the end of Attachment 2 for clarity.  
    Racher-2

13. Update section 3. Waste Rock Monitoring to indicate how CZN will verify that metal leaching in non-ARD rock will not be an issue. CZN should consider referencing historical data and sampling a subset of waste rock samples.  
    Racher-4

14. Update section 3. Waste Rock Monitoring with further justification for CZN’s rational that elemental concentrations which exceed the water quality guidelines by less than one order of magnitude are not interpreted to pose a risk to the receiving environment. This should include evidence to support the statement that “SFE results are widely assumed to over-estimate seepage concentrations due to the 3:1 liquid to solid ration in the tests”.  
    Racher-5

5. Conclusion

Board staff conclude that further information was provided by CZN in their responses to reviewer comments; however, some reviewers requested additional information be provided, which could be submitted 60 days prior to CZN depositing Waste Rock, for Board decision.

The GVP should be revised and re-submitted to reflect updates as agreed to during the review; provide more information in response to review comments; and to reflect the scope of the activities as applied
for. Board staff conclude that it is most appropriate if the information requested is submitted and reviewed prior to Board decision.

Board staff conclude that there are no outstanding issues or concerns with the administrative update recommended for MV2019L2-0006.

6. **Recommendation**

Board staff recommend the Board:

a) **Make a motion to deny the Geochemical Verification Program as required by Water Licence MV2019L2-0006.** Canadian Zinc Corporation is required to submit a revised submission in accordance with comments and commitments made during this review 60 days prior to depositing Waste Rock, for Board decision; and

b) **Acknowledge the administrative update to Schedule A Condition 1 of Licence MV2019L2-0006.**

A draft decision letter is attached. If the Board accepts the recommendation to deny the Geochemical Verification Program, Board staff recommend the Board include the following wording in the decision letter:

At this time, the Board is unable to approve the Geochemical Verification Program submitted for the following reasons:

- Further evidence must be presented in an updated Geochemical Verification Program to support CZN’s response to certain review comments and;
- The Geochemical Verification Program should be updated in accordance with comments made during this review, as summarized in Table 1 (attached).

7. **Attachments**

- MV2019L2-0006
- Geochemical Verification Program
- Review Summary and Attachments
- Draft Cover Page Licence MV2014L2-0006
- Draft Licence MV2014L2-0006 Conditions
- Draft Decision Letter from the Board

Respectfully submitted,

Kimberley Murray
Regulatory Specialist

Jacqueline Ho
Regulatory Specialist

Katherine Harris
Senior Technical Advisor
Review Comment Table

| Board:       | MVLWB                        |
| Review Item: | Canadian Zinc Corporation - Mineral Exploration, Prairie Creek Mine - Geochemical Verification Program (MV2019L2-0006) |
| File(s):     | MV2019L2-0006                |
| Proponent:   | CanZinc Corporation          |
| Document(s): | Geochemical Verification Program (811 KB) |
| Item For Review Distributed On: | Mar 24 at 13:25 Distribution List |
| Reviewer Comments Due By: | Apr 21, 2020 |
| Proponent Responses Due By: | May 5, 2020 |
| Item Description: | Canadian Zinc Corporation Ltd. (the Applicant) submitted a Geochemical Verification Program on March 20, 2020. This Program is required by Licence MV2019L2-0006, Part E, condition 6. This Program was required to address uncertainty related to leachate, seepage, or drainage from waste rock associated with the development of a 2nd Decline at the Prairie Creek Mine. |
| Comment Summary | 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. |
| Contact Information: | Jacqueline Ho 867-766-7455  
| | Kim Murray (867) 766-7458 |

<table>
<thead>
<tr>
<th>CanZinc Corporation (Proponent)</th>
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<tbody>
<tr>
<td>ID</td>
<td>Topic</td>
<td>Reviewer Comment/Recommendation</td>
<td>Proponent Response</td>
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<tr>
<td>1</td>
<td>ADKFN Letter</td>
<td>Comment The ADKFN letter item does not allow for a proponent response. Our response is provided in the Recommendation’s section. Recommendation Leachate from decline waste rock is expected to have low metals concentrations. If it does not</td>
<td>Apr 29: See recommendation section.</td>
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meet EQC, it will be treated along with mine water. Water quality sample results will be reported to the MVLWB who will post the results publicly. This will include any necessary waste rock management plans.

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<tr>
<td>1</td>
<td>General File</td>
<td>Comment (doc) ADKFN Letter</td>
<td>Adequate response. See Board Staff Analysis response to MVLWB-3 regarding reporting. Regarding ADKFN's recommendation that CZN verify no PAG waste rock will be used in the future construction of the all-season road: this is not applicable to this GVP or Water Licence. Please see MV2014L8-0006, MV2014F0013, and MV2019L8-0002 for Construction requirements for the All Season Road.</td>
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**GNWT - ENR - EAM (Environmental Assessment and Monitoring): Central Email GNWT**

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<tr>
<td>7</td>
<td>General File</td>
<td>Comment (doc) ENR Letter with Comments and Recommendations Recommendation</td>
<td>Noted.</td>
<td>Noted. Board staff propose a Board Directive requiring CZN to update Section 3 of the GVP to include the additional contingency options, as discussed in response to ENR's comment, for rock determined to be potentially acid generating/metal leaching (PAG/ML) waste rock.</td>
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<tr>
<td>1</td>
<td>Topic 1: Waste Rock Contingency</td>
<td>Comment Section 3 of the Geochemical Verification Program describes that a contingency option for potentially acid generating/metal leaching (PAG/ML) waste rock &quot;could include taking this rock back underground for storage in a blind heading.&quot; ENR notes that the use of the word &quot;could&quot; suggests that this management action may or</td>
<td>Apr 29: First, it's important to note that the potential for encountering PAG/ML material is very low, based on the results from the 1st decline. Second, there are a number of blind headings underground such that it is highly unlikely space would be an issue. Third, even if space was an issue, the material could be managed on the storage pad by</td>
<td>Noted. Board staff propose a Board Directive requiring CZN to update Section 3 of the GVP to include the additional contingency options, as discussed in response to ENR's comment, for rock determined to be potentially acid generating/metal leaching (PAG/ML) waste rock.</td>
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may not occur, or that there may be other options as well. During a phone call between ENR and Canadian Zinc (CZN) on April 6, 2020, CZN stated that other potential options depend on factors such as the amount of material. **Recommendation** 1) ENR recommends that CZN clarify in the text if this is the single contingency planned for PAG/ML waste rock, and if not, describe any other options being considered.

| 2 | Topic 2: Waste Rock Sample Weight | **Comment** Section 3 describes the sampling methodology for waste rock from the 2nd decline development program; however, it does not describe the weight of sample that will be collected from each pile, or the final weight of the composite sample submitted for analysis. CZN agreed to include these weights in the plan during a call on April 6. **Recommendation** 1) ENR recommends that CZN revise Section 3 to clarify the weight of waste rock samples to be collected, and submitted as a composite for analysis. | **Apr 29:** Re recommended sampling approach (defined by MESH) consists of collecting approximately 2 kg of sample from each weekly rock pile, selectively collecting the finer material from multiple parts of the pile. A monthly composite sample is then created from the four individual samples, crushed and split in two. One 4 kg split is used for testing, and the other is retained. |
| 3 | Topic 3: Shake-Flask Extractions | **Comment** Section 3 notes that "Material characterized by an NPR value of between 1 and 2 is classified as Uncertain (moderate risk) and requires additional information to determine acid rock drainage (ARD) potential, including shake flask extraction (SFE) analysis. Although CZN confirmed during a call with CZN confirmed during a call with | **Apr 29:** Yes, we would conduct SFE analysis on 'high risk' material as well (NPR<1). | Board staff propose a Board Directive requiring CZN to update Section 3 of the GVP to clarify that SFE analysis will be conducted on “high risk” material (NPR<1). |

Noted. Board staff recommend a Board Directive requiring CZN to update section 3 with clarification as to the weight of waste rock samples to be collected and submitted as a composite for analysis, as discussed in response to the review comment.
ENR on April 6, that this analysis would be conducted on high risk, or PAG/ML material as well, it should be clarified in the text. ENR notes that a shake flask extraction is a useful test for determining mineral solubility and element mobility; however, it isn't clear how CZN intends to use results from such testing to "determine ARD potential". The chemistry of the leachate from a SFE test is a combination of sample moisture, dissolution of original minerals, and dissolution of weathering products (e.g. oxidation). SFEs are performed with a liquid : solid ratio that is higher than natural conditions, over a short time frame (typically 24 hours). Caution must be used when interpreting results of SFEs, and assuming that resulting leachate concentrations reflect natural conditions.

**Recommendation** 1) ENR recommends that CZN revise the text to clarify whether or not high risk material will also be submitted for SFE analysis, or if this material will be immediately returned to the underground for storage in a blind heading.

**Comment** None

**Recommendation** 2) ENR recommends that CZN clarify the goals of the SFE analysis, and how the results will be used to manage waste rock with uncertain ARD potential.

**Apr 29:** The goal of SFE analysis is to assist with assessment of leachability compared to water quality guidelines and effects assessment.

Board staff note that CZN's response indicates the major goal of the SFE analysis, as is indicated in the GVP. However, the GVP is still not clear how the results will be used to manage waste rock with uncertain ARD potential. Board staff note that more detail is provided in response to
| 5 | **Topic 4: Decline Water Quality** | **Comment** Section 5 of the Geochemical Verification Program describes the sampling and analysis of decline water. CZN states that samples will be submitted for ICP dissolved metals, and that total metals concentrations will be skewed by suspended sediment. ENR acknowledges that decline water is expected to have very high suspended sediment load and this will result in a large difference between total metals and dissolved metals concentrations. ENR notes however, the site EQC are for total and not dissolved concentrations. Additionally, the purpose of sampling the decline water is to understand the overall quality. In order to fully characterize the decline water, both total and dissolved metals analysis are required. By analyzing for both total and dissolved metals in the decline water, any trends observed in discharge from the Polishing Pond (SNP Station 3-4) can be more easily sourced and lead to the development of possible mitigations to address those trends. This could also allow for water treatment to be adjusted for expected water quality. | **Apr 29:** Section 5 of the GVP explains that decline water will blend with water from the old workings, and that the combined stream is then treated. The combined stream is also the subject of SNP Station 3-7 which requires total metals analysis. Perhaps this wasn’t clear to ENR. CZN will periodically also take a dissolved metals sample of the combined stream to determine the dissolved load, since the total metals analysis is not useful as it is skewed by the high TSS content. In this respect, we will have both total and dissolved metals data to to assess trends in Polishing Pond discharge. The decline water sample we refer to is in addition to the 3-7 samples, and is intended to determine the dissolved load in decline water only. We do not propose to collect a total metals sample because the result will not be meaningful because of the high TSS. | Board staff note that based on this comment and response, and the information presented in the GVP, it is not clear how the different points of discharge from the 880 Level could have implications for sampling total vs. dissolved metals. In the GVP it indicates “the sampling location will depend on the location of drainage discharge. If the water is discharged into the 880 level adit, samples will be collected at the point of discharge prior to intermingling with drainage from the old workings. If the Decline water is carried by pipeline to the 870 portal, it will be sampled there”. Consequently, it is unclear to Board staff if ENR’s comment was focused on water from the 880 level adit, the 870 portal, or both. CZN’s response appears to be based on the assumption that ENR was referring to the water carried by the pipeline to the 870 portal (the combined stream). Board staff propose a Board Directive requiring CZN to update the GVP to further clarify the two
Recommendation 1) ENR recommends that CZN submit decline water samples for both total and dissolved metals analysis in order to fully characterize the water quality from the decline.

1) ENR recommends that CZN submit decline water samples for both total and dissolved metals analysis in order to fully characterize the water quality from the decline.

discharge points. Board staff believe it would be helpful for CZN to specifically clarify why the points of discharge would vary, and how this would affect the combined stream at SNP station 3-7.

Board staff note ENR’s comment regarding total metals and believe that confirmatory sampling for total metals could be helpful to fully characterize the decline water, as ENR has indicated. CZN indicated in the GVP that elevated metals concentrations in the Decline is highly unlikely. Board staff suggest CZN consider including total metals sampling along with dissolved metals as a response to a noticeable change (which would have to be defined in the GVP) to total metals at SNP station 3-7, in order to better understand the change and to further assess water quality of the second decline.

Board staff propose a Board Directive for CZN to consider the proposed option and update the GVP with the appropriate details, as necessary. If CZN maintains that total metals should not be sampled, CZN should update the GVP with further rational as to why sampling for total metals is not necessary.
### Topic 5: Attachment 2 Water Quality Tables

**Comment** In Attachment 2, it isn’t clear if the data presented in the Collection Pond Water Sample tables is total or dissolved concentrations.  
**Recommendation** 1) ENR recommends that the Collection Pond Water Sample data tables be revised to specify whether this data is total or dissolved concentrations.  
**Comment** Apr 29: OK. They are totals.  
**Board Staff Analysis** Board staff propose a Board Directive requiring CZN to update the “Collection Pond Water Sample” in Attachment 2 to indicate that the data presented is total concentrations.

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<th>ID</th>
<th>Topic</th>
<th>Reviewer Comment/Recommendation</th>
<th>Proponent Response</th>
<th>Board Staff Analysis</th>
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| 1  | Geochemical Verification Program | Inspectors from the Department of Lands reviewed the geochemical verification program document. Inspectors have no comments for the document.  
**Recommendation** Not applicable. |                     | N/A                  |

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| 1  | Attachment 1: Specialized underground equipment | On page 3, under Surface Facilities, it mentions that the existing equipment fleet at the site will be used, although one or two pieces of specialized underground equipment may be brought in. It is not clear if the specialized underground equipment was included in the Type A Land Use Permit Application (MV2019C0011).  
**Recommendation** Did CZN account for the specialized underground equipment in the Type A Application for Permit MV2019C0011? | Apr 29: Yes. Jumbo drills and scoop trams are listed in the applcation. | Noted. |

| 2  | Attachment 1: Figures 3 to 5 | Figure 3 to 5 are not labelled with the figure | Apr 29: OK | Board staff propose a Board Directive |
| 3 | Waste Rock Water Management, Decline Water Management | Comment | For Waste Rock Water Management and Decline Water Management, CZN indicated that sampling for rock pile seepage in the sump and Decline drainage, respectively, will occur at the same time as, and using the same methods (including QA/QC) as sampling for the Water Licence SNP. It is not clear which Reporting Requirements of the SNP, as outlined in Part A, CZN will follow, or if CZN intends to follow all Reporting Requirements. Further, Board staff are wondering if an SNP station should be added to the SNP of MV2019L2-0006 to include the Rock Pile seepage in the sump. | **Recommendation** | Board staff recommends CZN clarify which specific Reporting Requirements from the SNP will be followed for sampling associated with Rock Pile seepage and decline drainage. |

**Recommendation** Board staff recommend CZN update the Plan to include figure numbers for Figures 3 to 5. | **Apr 29:** The requirements referred to were related to sampling, not reporting. For reporting, since monitoring of decline activities will involve both solids testing (ABA) and water sampling, we propose to report separately from the SNP reports, as we did for the first decline. Reporting frequency will depend on results and activity. For example, once mining and waste rock sampling has been completed, very few results would be generated, especially in winter with no rock pile seepage. Decline water would still be monitored as part of the SNP. | **Recommendation** | Board staff note that it is still not clear from CZN’s response which items from Part A of the SNP will be incorporated into the GVP for sampling (e.g. is it item 3 – 8? Or just the QA/QC requirements?). Board staff recommend a Board Directive requiring CZN to update the GVP with the list of relevant items from Part A of the SNP (related to sampling) that will be incorporated into the GVP. | Board staff recommend that CZN’s reporting approach for the GVP be clarified in the GVP, and that CZN submit reports to the Board according to the (potential future) approved GVP thereafter. For instance, please clarify the timing for the submission of results (e.g. monthly update with results if applicable or indicating not applicable; within 90 days following a sampling event, etc.). Reviewers should have the opportunity to comment on specific reporting requirements. | Board staff note that a proposed administrative update will be brought to the
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<th>Waste Rock Water Management, Decline Water Management</th>
<th><strong>Comment</strong> See comment above</th>
<th><strong>Recommendation</strong> Board staff recommend CZN indicate if they believe adding an SNP station for the Rock Pile seepage in the sump would be appropriate.</th>
<th><strong>Apr 29:</strong> As indicated in the GVP, the initial rock pile sampling frequency would be weekly, reducing to monthly if and when results indicate concentrations less than EQC. Sampling may cease once decline activities have been completed. Results would be reported separately from the SNP reports. Therefore, we don't believe there is a compelling argument for the addition of an SNP station. We note one was not added for the first decline.</th>
<th>Noted.</th>
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<tr>
<td>5</td>
<td>Waste Rock Water Management, Decline Water Management, QA/QC</td>
<td><strong>Comment</strong> For Waste Rock Water Management and Decline Water Management, CZN indicated that sampling for rock pile seepage in the sump and Decline drainage, respectively, will occur at the same time as, and using the same methods (including QA/QC) as sampling for the Water Licence SNP. Board staff note that CZN has not yet submitted a letter from a (Minister approved) Analyst that indicates CZN's QA/QC Plan is approved, as required through Annex A, Part A, condition 6. <strong>Recommendation</strong> Board staff recommend CZN provide an update on Analyst approval of the QA/QC Plan for the SNP under MV2019L2-0006.</td>
<td><strong>Apr 29:</strong> CZN is communicating with Taiga re QA/QC Plan approval.</td>
<td>Noted.</td>
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<td>ID</td>
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<td>Reviewer Comment/Recommendation</td>
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<td>6</td>
<td>General Comment</td>
<td><strong>Comment</strong> Board staff note that it would be helpful to include appropriate cross references to the Effluent Treatment Plan and Mine Water Contingency Plan because seepage from the waste rock pile that does not meet defined EQC will be managed through the treatment plant and the Polishing Pond. <strong>Recommendation</strong> CZN to include cross references to other relevant management plans in the next version of this Plan.</td>
<td>Apr 29: OK</td>
<td>Board staff propose Board Directive requiring CZN to update the GVP to include reference to the Effluent Treatment Plan and Minewater Treatment Contingency Plan, where appropriate.</td>
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**Racher Consulting: Kathy Racher**

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<tbody>
<tr>
<td>1</td>
<td>Joint submission of LÍÍDLII KU’E’ FIRST NATION (LKFN) and NAHA DEHÉ DENE BAND (NDBB)</td>
<td><strong>Comment</strong> Note the KRacher Consulting is submitting these comments on behalf of the LKFN and the NDBB. <strong>Recommendation</strong> None</td>
<td></td>
<td>Noted.</td>
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<td>2</td>
<td>Metal leaching potential of waste rock.</td>
<td><strong>Comment</strong> The text at the top of page 3 in Attachment 1 states “Geochemical data from the previous program confirmed that the rock formations distant from the Vein are essentially benign and note significant source of leachable metals. The data in Table 1 confirms this.” <strong>Recommendation</strong> As we have not engaged a geochemistry expert to review this information, are you able to explain what kind of geochemistry results would indicate a “significant source of leachable metals” for comparison? Our goal is to better understand the predictions of metal leaching of the waste rock on surface.</td>
<td>Apr 29: Perhaps a better indication of leachability is the collection pond results provided at the end of Attachment 2. These can be directly compared to EQC. We will change Attachment 1 to refer to these results.</td>
<td>Noted. Board staff propose a Board Directive requiring CZN to update the Geology and Development Rock section in Attachment 1 to reference the collection pond results provided at the end of Attachment 2 for increased clarify.</td>
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<tr>
<td>Section</td>
<td>Sampling strategy for waste rock</td>
<td><strong>Comment</strong></td>
<td>Section 3 of the plan states that &quot;CZN received guidance from MESH Environmental on sampling strategy. CZN will sample rock from each weekly pile based on visual inspection to ensure representivity.&quot; <strong>Recommendation</strong></td>
<td>Does the CZN staff member that takes samples need specific qualifications to conduct the &quot;visual inspection to ensure representivity”? Did MESH Environmental make any recommendations to CZN in this regard?</td>
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<td>Section 4</td>
<td>Evaluation of metal leaching characteristics in waste rock</td>
<td><strong>Comment</strong></td>
<td>According to the last three paragraphs of section 3, Shake Flask Extraction (SFE) analysis, and hence metal leaching characteristics, will only be performed on rock samples that have a measured NPR value between 1 and 2. <strong>Recommendation</strong> Is this correct? Is there no need to evaluate metal leaching characteristics of other representative waste rock samples even if they are determined to be non-potentially acid generating?</td>
<td><strong>Apr 29:</strong> CZN indicated to Ms Racher that samples with a NPR&lt;1 would also be subject to SFE analysis. However, CZN is trying to limit unnecessary testing of essentially benign country rock, and therefore does not intend to conduct SFE analysis on samples with a NPR&gt;2 as such material is considered to be non-PAG (MEND 2009).</td>
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<td>Section 5</td>
<td>Comparison of SFE analysis results to water quality guidelines</td>
<td><strong>Comment</strong></td>
<td>In the last paragraph of section 3 it states that &quot;Elemental concentrations which exceed the water quality guidelines by less than one order of magnitude are interpreted not to pose a specific risk to the receiving environment&quot;.</td>
<td><strong>Apr 29:</strong> The author of this advice is Tetra Tech, 2019 (Phase 1 PWR GVP). We believe the basis for it is that SFE results are widely assumed to over-estimate seepage concentrations due to the 3:1 liquid to solid ratio in the tests.</td>
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<td>Contingency if ARD rock is encountered</td>
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<td><strong>Recommendation</strong></td>
<td>Is this comparison based on best practices or some kind of guidance like MEND? We would like to better understand the basis for the criteria presented for metal leaching.</td>
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<td><strong>Comment</strong></td>
<td>In section 3 of the plan, it states that in the unlikely event that potentially acid generating rock is encountered, that one contingency would be to &quot;take the rock back underground for storage in a blind heading.&quot; <strong>Recommendation</strong> Could you please describe this in more detail? For example, is a &quot;blind heading&quot; an area where conditions would be less likely to lead to ARD? Is this a common practice at other mine sites? Also, did CZN have to employ this contingency during Apr 29: This was discussed with Ms Racher. CZN noted that vein mineralization is exposed in the blind headings, and that as such, the placed of PAG material would not make conditions underground any worse. We also discussed the use of the completed decline for waste disposal, as reflected in our response to ENR 1. CZN did not need to employ contingencies for the first decline.</td>
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<td><strong>Apr 29:</strong></td>
<td>Noted. See Board Staff Analysis to ENR-1.</td>
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before approval, so referencing that Program does not resolve this comment. Board staff are of the opinion that CZN should provide further justification for the rational that elemental concentrations which exceed the water quality guidelines by less than one order of magnitude are not interpreted to pose a specific risk to the receiving environment. For instance – is there evidence that shows SFE results over-estimate seepage concentrations due to the 3:1 liquid to solid ratio in tests? That should be provided in the GVP. Reviewers should have the opportunity to respond to CZN’s justification. Board staff propose a Board Directive accordingly.
<table>
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<th>Further investigation for rock samples with potential for metal leaching</th>
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<td>7</td>
<td><strong>Comment</strong> At the end of section 3, it states: &quot;Elemental concentrations which exceed the water quality guideline by greater than one order of magnitude, are interpreted to have some potential for risk and should be considered for further investigation&quot;. <strong>Recommendation</strong> What kind of further investigations would be undertaken? How would these investigations influence how the waste rock is managed?</td>
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<td><strong>Apr 29:</strong> This also originates from Tetra Tech. We believe the further investigation might include confirmation, potentially re-sampling to determine if results were skewed by the presence of a small amount of sulphide material, and ultimately a better understanding of material properties allowing for the selection of an appropriate remedy. Again, we must stress that the chances of encountering such material are considered to be very low.</td>
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<td>See Board staff response to ENR-4.</td>
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<td></td>
<td>Reporting monitoring results</td>
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<td>8</td>
<td><strong>Comment</strong> In the Plan, CZN proposes to test waste rock for ARD/ML potential as well as to monitor water quality of the waste rock pile seepage and decline drainage. However, it isn't clear how/when CZN will report the monitoring results or the decisions that are made in response to monitoring (e.g., the decision to send seepage directly to the Catchment Pond if it is shown to meet EQC for a month). <strong>Recommendation</strong> Could CZN please clarify how and when they will share that monitoring information with the Board and with the LKFN and NDDB?</td>
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<td><strong>Apr 29:</strong> Reporting was discussed with Ms. Racher and she generally concurred with the proposal described in our response to MVLWB 3.</td>
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<td>See response to MVLWB-3.</td>
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</table>
April 20, 2020

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

VIA MVLWB Online Review System

Re:  [CanZinc Corporation – Mineral Exploration, Prairie Creek Mine – Geochemical Verification Program (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 March 24, 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.”

1 Re: Paulette’s Application, [1973] 6 W.W.R. 97 (N.W.T.) [Re: Paulette’s Application].
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 CanZinc’s existing Prairie Creek Mine water license requires the submission of a Geochemical Verification Program. ADKFN has been invited to submit comments and recommendations regarding CanZinc’s proposed Geochemical Verification Program.

Any potential leachate from waste rock is very concerning to ADKFN, as it has the potential to impact the health and contaminant body burdens of 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.

---

2 Sambaa K’e Dene First Nation v. Duncan, 2012 FC 204.
To ensure that ADKFN is aware of impacts of leachate from waste rock on our ability to exercise our rights within our Traditional Territory as outlined above, ADKFN reiterates the importance of routine and timely water quality reporting from CanZinc to our Lands and Resources Office. We also request information about CanZinc’s waste rock management plans as they are developed or adapted, based on results from the geochemical verification program.

We recommend that CanZinc provide water quality reports to ADKFN on a quarterly basis, and any changes to waste rock management arising from geochemical verification on annual basis. Finally, we also ask that CanZinc verify that no potentially acid generating (PAG) waste rock will be used in construction of the future all-season road within ADKFN traditional territory and/or within watershed which drain directly into ADKFN’s territory.

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 DENE 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
April 21, 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  
Geochemical Verification Program  
Request for Comment

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories has reviewed the program 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: Waste Rock Contingency**

**Comment(s):**

Section 3 of the Geochemical Verification Program describes that a contingency option for potentially acid generating/metal leaching (PAG/ML) waste rock “could include taking this rock back underground for storage in a blind heading.” ENR notes that the use of the word “could” suggests that this management action may or may not occur, or that there may be other options as well. During a phone call between ENR and Canadian Zinc (CZN) on April 6, 2020, CZN stated that other potential options depend on factors such as the amount of material.
Recommendation(s):

1) ENR recommends that CZN clarify in the text if this is the single contingency planned for PAG/ML waste rock, and if not, describe any other options being considered.

Topic 2: Waste Rock Sample Weight

Comment(s):

Section 3 describes the sampling methodology for waste rock from the 2nd decline development program; however, it does not describe the weight of sample that will be collected from each pile, or the final weight of the composite sample submitted for analysis. CZN agreed to include these weights in the plan during a call on April 6.

Recommendation(s):

1) ENR recommends that CZN revise Section 3 to clarify the weight of waste rock samples to be collected, and submitted as a composite for analysis.

Topic 3: Shake-Flask Extractions

Comment(s):

Section 3 notes that “Material characterized by an NPR value of between 1 and 2 is classified as Uncertain (moderate risk) and requires additional information to determine acid rock drainage (ARD) potential, including shake flask extraction (SFE) analysis. Although CZN confirmed during a call with ENR on April 6, that this analysis would be conducted on high risk, or PAG/ML material as well, it should be clarified in the text.

ENR notes that a shake flask extraction is a useful test for determining mineral solubility and element mobility; however, it isn’t clear how CZN intends to use results from such testing to “determine ARD potential”.

The chemistry of the leachate from a SFE test is a combination of sample moisture, dissolution of original minerals, and dissolution of weathering products (e.g. oxidation). SFEs are performed with a liquid : solid ratio that is higher than natural conditions, over a short time frame (typically 24 hours). Caution must be used when interpreting results of SFEs, and assuming that resulting leachate concentrations reflect natural conditions.
**Recommendation(s):**

1) ENR recommends that CZN revise the text to clarify whether or not high risk material will also be submitted for SFE analysis, or if this material will be immediately returned to the underground for storage in a blind heading.

2) ENR recommends that CZN clarify the goals of the SFE analysis, and how the results will be used to manage waste rock with uncertain ARD potential.

**Topic 4: Decline Water Quality**

**Comment(s):**

Section 5 of the Geochemical Verification Program describes the sampling and analysis of decline water. CZN states that samples will be submitted for ICP dissolved metals, and that total metals concentrations will be skewed by suspended sediment.

ENR acknowledges that decline water is expected to have very high suspended sediment load and this will result in a large difference between total metals and dissolved metals concentrations. ENR notes however, the site EQC are for total and not dissolved concentrations. Additionally, the purpose of sampling the decline water is to understand the overall quality. In order to fully characterize the decline water, both total and dissolved metals analysis are required.

By analyzing for both total and dissolved metals in the decline water, any trends observed in discharge from the Polishing Pond (SNP Station 3-4) can be more easily sourced and lead to the development of possible mitigations to address those trends. This could also allow for water treatment to be adjusted for expected water quality.

**Recommendation(s):**

1) ENR recommends that CZN submit decline water samples for both total and dissolved metals analysis in order to fully characterize the water quality from the decline.

**Topic 5: Attachment 2 Water Quality Tables**

**Comment(s):**

In Attachment 2, it isn't clear if the data presented in the Collection Pond Water Sample tables is total or dissolved concentrations.
Recommendation(s):

1) ENR recommends that the Collection Pond Water Sample data tables be revised to specify whether this data is total or dissolved concentrations.

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,

[Signature]

Patrick Clancy
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