Water Resources Division
Nunavut Regional Office
Iqaluit, NU
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INAC CIDMS #: 1221613

June 15, 2018

NWB File: 1BR-CUL1118

Via email to: licensing@nwb-oen.ca

Richard Dwyer
Manager of Licencing
Nunavut Water Board
Gjoa Haven, NU, X0E 1J0

Dear Mr. Dwyer:

Re: 1BR-CUL1118 – Cullaton Lake Mine Closure and Reclamation Plan Review - Cullaton Lake Gold Mine – Barrick Gold Corporation

The attached technical review memorandum is provided for the Nunavut Water Board's (NWB) consideration. The submission date of June 15, 2018 was agreed to verbally in order to keep moving the renewal process forward. Comments have been provided pursuant to the Department's mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*.

Should you have any questions or comments, please do not hesitate to contact me at (819) 953-8988 or by email at Ian.Parsons@canada.ca.

Sincerely,

Original signed by

Ian Parsons
A/Manager, Water Resources

Cc: Spencer Dewar, Director Resource Management (INAC)
Erik Allain, Director of Lands (INAC),
Christine Wilson, Water Resource Officer (INAC)

Technical Review Memorandum

Re: 1BR-CUL1118 – Cullaton Lake Mine Closure and Reclamation Plan Review - Cullaton Lake Gold Mine – Barrick Gold Corporation

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1.0 Introduction

Indigenous and Northern Affairs Canada (INAC) has reviewed the updated Cullaton Lake Closure and Reclamation Plan (CRP) dated June 30th, 2017. The updated CRP was prepared by the Palmer Environmental Consulting Group Inc. on behalf of Barrick Gold Inc. The updated plan was submitted as part of the Water License renewal process and combines information and data from studies completed since the submission of the prior Abandonment and Restoration (A&R) Plan into one comprehensive report. In addition to describing the remedial approach for the site, the document presents a proposed post-closure monitoring program.

It is significant to note that decommissioning activities at the mine began in 1990 after it was placed on care and maintenance. By 2003, when the property became wholly owned by Barrick, most aspects of the A&R Plan had already been implemented. Reclamation areas at the mine included underground mine workings, waste rock and overburden piles, a tailings containment area, buildings and equipment, mine infrastructure, landfills and other waste disposal areas, and water management systems.

Within this context, it was INAC's expectation that the updated CRP would: a) describe the previously completed remedial works; b) explicitly identify and address any site issues that have yet to be fully resolved; and c) describe any future actions that will be taken to ensure the site remains stable over the long-term.

2.0 Overall Review Findings

INAC commissioned Arcadis Canada Inc. to perform a technical review of the updated CRP. The overall findings of Arcadis are as follows:

- **Engineering Basis** - The CRP presents a technically sound, logical approach to prevent and mitigate potential environmental impacts associated with the closed mine. While there are some uncertainties regarding the long-term performance of the site, there are no critical technical flaws with the plan.
- **Plan Content** - The CRP is generally consistent with the approach described in the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (Guidelines) (INAC et al., 2013).

Taking into consideration site-specific differences, the technical approaches proposed in the CRP are similar to those used during the closure and reclamation planning of other Northern mines. Further, there is evidence that "lessons learned" from other sites have informed plans for the long-term management of the site.

- **Chemical Stability** - Post-closure monitoring that has occurred to date suggests that the site is chemically stable and is not resulting in significant adverse impacts to the receiving environment. While there are some uncertainties associated with the long-term condition of the site, the magnitude, duration and spatial extent of future chemical loadings from the site are not expected to be significant when considered within the regional context.
- **Physical Stability** - There are no apparent high-risk events associated with the engineered and natural structures included in the CRP. The only potential exception relates to the tailings dam, which is discussed separately in Section 3.2.

3.0 Potential Technical Concerns

Notwithstanding the generally positive assessment noted above, Arcadis identified a number of topics that represent potential concerns with the CRP. Those topics were discussed in a teleconference between INAC, Barrick, Arcadis and the NWB on April 27th, 2018. The topics identified by Arcadis are presented in Appendix 1 and a follow-up response from Barrick can be found in Appendix 2. Summaries of the potential technical concerns and actions recommended by INAC are provided below.

3.1 A&R Planned -vs- Actual Actions

The original 1991 A&R Plan was revised and accepted in 1996. Closure activities were conducted up until 2002 and no significant changes have been made to the site since that time. As part of its review, Arcadis assessed the extent to which the original A&R plan had been implemented and determined whether there were any potentially significant discrepancies between the planned and actual conditions. Notable findings of the review are as follows:

1.Residual Shear Lake Waste Rock – The A&R Plan required that waste rock in the vicinity of Shear Lake be consolidated in an Encapsulated Waste Rock (EWR) Facility to mitigate potential acid rock drainage and/or metal leaching potential (ARD/ML). The consolidation and encapsulation work that was completed removed enough of the loading from the Shear Lake site that it subsequently became possible to identify a separate residual waste rock deposit that was and continues to generate acidic drainage. Based on assessments conducted by Lorax, the seepage chemistry measured in the field and laboratory extractions appears to represent both the current and future conditions. The lack of remaining acid generating sulphide in the waste rock indicates that the measured seepage chemistry is not likely to deteriorate further. Monitoring in Shear Creek shows only slight exceedances of Canadian Council of Ministers of the Environment (CCME) Water Quality guidelines within a short reach of Shear Creek.

2. Tailings Cover Thickness – The A&R Plan closure concept for the tailings facility involved placement of a 1.4 m thick granular cover on the dry portion of the tailings. The intent was to ensure that the active layer of the permafrost would remain within the cover, thereby maintaining the underlying tailings in a permanently frozen state. In practice, this cover thickness was not achieved and, based on test pitting, the actual thickness is approximately 1 m (there are no as-built design drawings). The test pitting also confirmed that the active layer currently penetrates into the tailings and that the thawed tailings are consistently water-saturated. On this basis, the original design intent of the A&R Plan was not achieved. However, similar to the residual waste rock in the vicinity of Shear Lake, there is limited evidence to suggest that the tailings are resulting in significant adverse impacts and no impacts have been measured in the Kognak River which is the primary receiver downstream of the site.

In a follow-up response to INAC, Barrick reviewed and assessed the rationale for the above discrepancies in the context of further remediation (see Appendix 2). Based on site reconnaissance, Barrick confirmed that the additional fill material necessary to fully address the A&R Plan discrepancies noted above is not available in the immediate area. Specifically, there are reportedly limited viable borrow sources within a 5 km radius and there is insufficient waste rock available at the site to construct new access roads. Taking into consideration the current water quality in the vicinity of the site, Barrick concluded that the disturbance that would be caused by constructing additional access roads to find and open distant borrow pits is not warranted.

INAC Conclusion and Recommendation: Based on the water chemistry observed to date, INAC supports Barrick's conclusions that the A&R discrepancies noted above do not justify incurring the negative impacts that would likely be triggered by efforts to acquire additional borrow material. This support is contingent on the following conditions: 1) that Barrick conduct the long-term water quality monitoring and site inspection regime (as proposed); 2) that scheduled reviews of monitoring/inspection data be performed to determine whether any changes to this approach are warranted in the future; and 3) that the A&R discrepancies and rationale for the selected approach be clearly documented in the final CRP.

3.2 Long-Term Performance of the Tailings Dam

A portion of the tailings facility is maintained below a water cover to limit the potential for tailings mobilization and ARD/ML. Water quality monitoring conducted to date suggests that the water cover is generally serving its intended purpose. However, the water cover requires that Dam 1 be maintained indefinitely as a water/tailings retention structure. Based on this requirement and an earlier review conducted by BGC (2011), INAC recommended that the dam be subjected to a comprehensive Dam Safety Review (DSR) in accordance with current Canadian Dam Association (CDA) Dam Safety Guidelines.

In response to INAC's recommendation, Barrick commissioned Thurber Engineering Ltd. to conduct the DSR which was finalized in 2016. Thurber classified Dam 1as a low

category dam with low consequence of failure for any credible failure mode. With the exception of potential modifications to conform with CDA wind setup and wave runup requirements, no improvements to the dam safety management were deemed necessary in the short-term. However, in the long-term, Thurber recommended that consideration be given to decommissioning Dam 1 (i.e., eliminating its ability to store water).

Thurber's recommendation to decommission the dam is supported by a number of compelling arguments, including a general preference for closure options that have no long-term care and maintenance requirements. Despite this recommendation, the current version of the CRP indicates that the dam and water cover will remain in place indefinitely. The rationale for adopting this approach instead of dam decommissioning is not presented in the CRP.

During the April 27th conference call, INAC requested clarification and justification on Barrick's plans for the dam. The requested information was provided in Barrick's response (dated May 21st - see Appendix 2) and during a follow-up conference call held on May 25th. Specifically, Barrick clarified that:

a. Their preferred option for Dam 1 is to keep it in place indefinitely (i.e., a wet cover will be maintained for the foreseeable future). Periodic inspections and monitoring will be incorporated into long-term management plans for the site to confirm that the dam continues to serve its intended purpose. Financial assurances will also be provided to address credible maintenance scenarios.
b. At key milestones (e.g., licensing renewals) Barrick will evaluate whether any modifications to the management strategy for Dam 1 are warranted. Among other options, this evaluation will determine whether the decommissioning of the dam is an appropriate future action.

In their responses, Barrick indicated that progressive decommissioning of the dam over multiple years may be considered in the future. This would be achieved by manually excavating the crest of the spillway, thereby lowering the upstream water levels. While this approach would have the benefit of eliminating the water retention structure, it would also expose tailings that are currently submerged beneath the water cover. The exposed tailings would then be subject to chemical weathering, direct exposure to terrestrial biota, wind dispersion and erosion. As a consequence, INAC anticipates that some form of granular cover would be necessary if the dam is decommissioned. However, as stated previously, there is limited cover available within the vicinity of the site and sourcing such material would likely result in significant environmental impacts.

INAC Conclusion and Recommendation: While INAC would prefer to permanently eliminate future liabilities associated with Dam 1 by decommissioning the structure, doing so would likely require the placement of a granular cover over the exposed tailings. Taking into consideration the current environmental status of the site and the impacts associated with obtaining new borrow material to cover the tailings, INAC accepts Barrick's proposal to maintain the dam in its current state, subject to the following conditions: 1) the performance of ongoing inspections, environmental monitoring and periodic dam safety reviews; 2) the selected approach and all applicable alternatives (including dam decommissioning) are explicitly evaluated in the final CRP;

3) scheduled reviews of the monitoring/inspection data are conducted to determine whether any changes to this approach are warranted in the future; and 4) financial assurances are provided to address credible maintenance scenarios that could arise within the next 100 years.

3.3 Additional Topics

While the subjects addressed in Sections 3.1 and 3.2 above are particularly important to the finalization of the CRP, Arcadis requested further information on a series of additional topics, as presented on pages 12 to 17 of Appendix 1. Based on the responses provided by Barrick (as documented in Appendix 2), INAC has no significant concerns associated with the additional topics. Nonetheless, in an effort to effectively document all project decisions, the additional topics should be addressed in the final CRP.

INAC Conclusion and Recommendation: The supplemental information provided by Barrick in response to the additional topics should be incorporated into the final CRP.

4.0 Financial Security

The topics addressed in this document are relevant to the financial security that will be required for the long-term monitoring, care and maintenance of the former Cullaton Lake Mine. INAC and Barrick are progressing in ongoing discussions to determine this security amount. INAC and Barrick are working within the 180 day short-term renewal window that has been issued by the board. INAC anticipates submitting further documentation on recommended financial security, well before the 180 day deadline, when the parties have reached agreement on a global amount for the site.

5.0 Closure

In summary, INAC has concluded that the Cullaton Lake Mine CRP presents a technically sound, logical approach to prevent and mitigate long-term impacts associated with the site. On this basis, INAC supports the implementation of the plan, contingent on the implementation of the recommendations and conditions presented herein.

Appendix 1:

Arcadis Review of Cullaton Lake Mine CRP and Associated Documentation

Appendix 2:

Barrick Response to Arcadis Review