APPENDIX K-2: Water Management During Construction and Operations

March 7, 2016

File No.:VA101-00460/03-A.01
Cont. No.:VA16-00266

FS 64925
EMS 550121
OHS 550122

Mr. Bob Jacko
Vice President Operations
Tintina Resources Inc.
1110 - 1111 West Georgia Street
Vancouver, British Columbia
Canada, V6E 4M3

Dear Bob,

Re: Black Butte Copper Project – Water Management During Construction and Operations

1 – INTRODUCTION

Knight Piésold Ltd. (KP) completed the feasibility level design of the waste and water management systems for the Black Butte Copper Project (the Project). Key components of the design include a Cemented Tailings Facility (CTF) and Process Water Pond (PWP), which are designed to hold tailings, potentially acid generating waste rock and process water. Both of these structures will be constructed using cut-fill methods to provide the required storage capacity and construction materials.

The excavation of the CTF and PWP basins may intercept the groundwater table and water flowing into the basin areas will have to be managed during construction and operations. This letter presents a summary of common water management methods used during construction, and highlights the aspects of the Project that were designed to manage groundwater flow around the facilities.

2 – CONSTRUCTION WATER MANAGEMENT METHODS

It is not uncommon to encounter groundwater in construction projects. Broadly speaking, there are two common methods for managing groundwater during construction. The most common method is to use established surface water control practices to handle groundwater seepage. The other method involves using groundwater wells and pumping systems to draw down the water table below the excavation area.

SURFACE WATER MANAGEMENT

The most common method of dealing with groundwater in an excavation is to manage the water on surface after it seeps from the excavation face. This allows for a combined water management approach to manage precipitation and run-off concurrently with surface and groundwater flows.

The primary goals of surface water management are to direct water out of active construction areas, and to minimize erosion of exposed surfaces. Common surface water controls typically include:

- **Collection Ditches:** A collection ditch intercepts contact water runoff from disturbed areas and diverts it to a stabilized area where it can be effectively managed. Coarse non-acid generating rock and equipment to build ditches and dams are easily obtained on site, and require little further maintenance, making them effective improvements.
- **Diversion Ditches:** Diversion ditches are constructed up-gradient of disturbed areas to intercept clean surface water runoff and discharge it through a stabilized outlet designed to handle the expected runoff velocities and flows from the ditch without scouring.
- **Culverts:** Culverts are used in tandem with collection or diversion ditches to pass water flow beneath disturbed areas, typically roadways, to prevent the erosion of these constructed structures.

- **Waterbars:** Waterbars serve to reduce sheet flow and surface erosion of areas of exposed soil and/or roads by diverting runoff towards a stable vegetated area or collection ditch. Waterbars may require regular maintenance when subjected to frequent traffic crossings.
- **Temporary Sediment Traps and Sediment Basins:** A sediment trap/basin is a temporary structure used to detain runoff from small drainage areas (generally < 2 hectares) to allow sediment to settle out. A sediment trap/basin can be created by excavating a basin, utilizing an existing depression, or constructing a small dam on a slight slope downward from the work area.
- **Sumps:** Sumps are excavations placed at topographically low areas that will collect runoff. Ditch lines and berms are commonly utilized to direct water to sumps. Submersible pumps are placed into the sumps so that water can be pumped out of the construction site on an as needed basis. If necessary the collected run-off can be pumped to a sediment basin to allow fines sediment to settle out of the water.

These measures can be integrated with overall erosion control measures to ensure that the impacts of construction are limited to the disturbed areas. A detailed list of erosion control Best Management Practices (BMP) is included in KP report "Waste and Water Management Design for MOP Application" (Ref. No. VA101-460/3-2, December 3, 2015).

Surface water management is implemented using an observation based approach where groundwater seepages are identified during the excavation process and the most appropriate combination of controls is applied. This approach is extremely flexible and can be implemented with construction equipment and materials readily available on site (excepting submersible pumps, which are procured for sumps as needed). The number of control structures and capacity can be scaled up as the excavation progresses and higher volumes of groundwater seepage are dealt with.

Surface water management controls and erosion BMPs are used as needed on any construction project where precipitation, run-off, and groundwater seepage will interact with areas of disturbance.

GROUNDWATER DEPRESSURIZATION

Groundwater seepage into excavated areas can be mitigated by drawing down the phreatic surface of the immediate area below the excavation depth. Drawdown is achieved by installing one or more groundwater wells with pump systems near the excavation. Continuous pumping over time will eventually draw down the phreatic surface, leaving the target area within a cone of depression.

Groundwater depressurization is commonly used in open pit mining operations (or other large scale excavations), where reducing pore water pressure in slopes is required to stabilize the walls of an excavation. Depressurization measures can be implemented in cases where the flow rate of groundwater to surface exceeds the capacity of surface water controls to handle alone. A recent example is the Mt. Milligan Mine (located in British Columbia, Canada) where a cut off trench was being excavated in alluvial material with a near-surface groundwater table. Drawdown wells were utilized in conjunction with sumps and pumps stations to dewater the tailings facility cut off trench during construction.

Properly implemented, groundwater depressurization is an effective method to dewater excavations; however, there are drawbacks to using this method. A comprehensive understanding of the hydrogeological conditions is required in order to effectively plan out the depressurization program, especially if perched water tables or aquifers are present. Drawing down the water table may have adverse effects on the surrounding area, especially if well water is used by the surrounding land owners. Lastly, installing and maintaining groundwater wells is expensive, especially when alternatives methods for water management are available.

It is recommended to use surface water management methods (as described in the previous section) due to the cost and complexity required to install and maintain groundwater wells.

3 – GROUNDWATER MANAGEMENT FOR THE BLACK BUTTE PROJECT

Overall site water management during the initial construction of CTF and PWP will be completed using surface water management methods and erosion control BMPs. The available hydrogeological data indicates that while the CTF and PWP excavation may intersect the groundwater table, the amount of seepage expected can be easily handled during construction using these conventional methods.

The CTF and PWP designs incorporate foundation drain systems that will be installed beneath the liners. These drains will handle ground water flows during construction and operations. These drain systems consist of an interconnected series of perforated pipes places in gravel filled trenches that will collect groundwater flows and pass them beneath the impoundments to collection ponds. The foundation drain systems have a design capacity to handle average anticipated groundwater flows plus additional capacity to handle surges of water infiltrating the groundwater system from storm events.

Figure 1 and Figure 2 show the plan view of the CTF and PWP foundation drain systems.

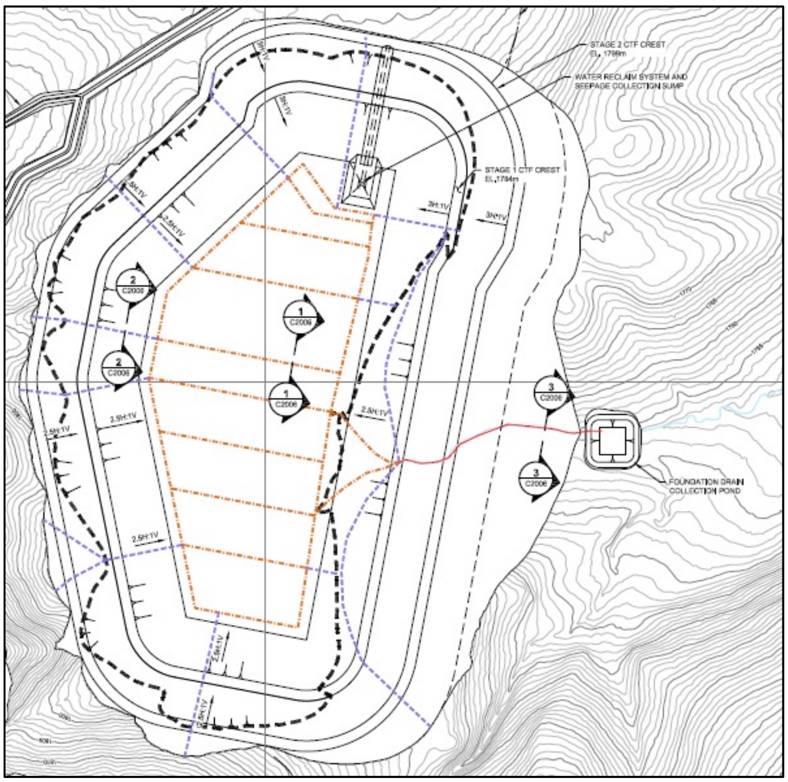

Figure 1 CTF Foundation Drain System

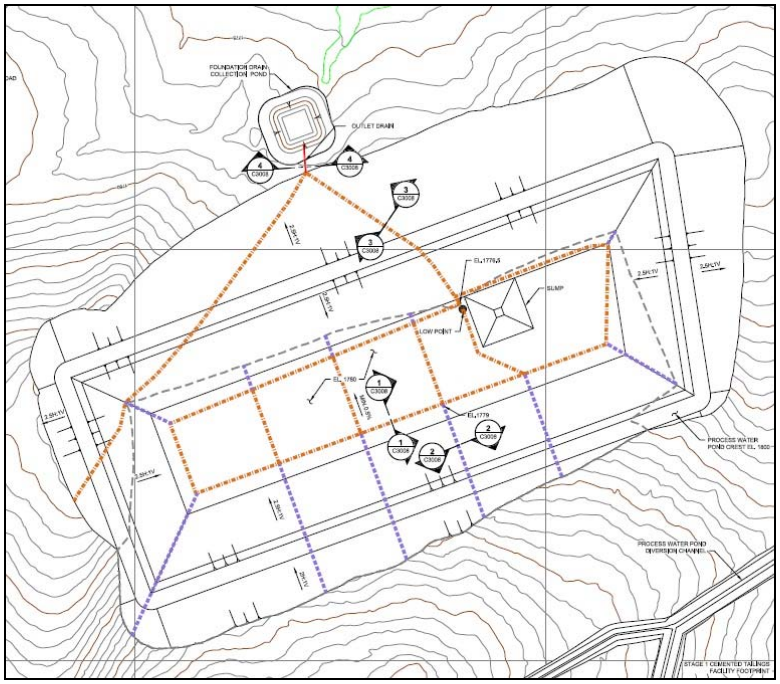

Figure 2 PWP Foundation Drain System

The foundation drain systems will be field fit during construction to ensure that the pipe networks are placed to maximize groundwater seepage interception. Field fitting the foundation drain systems requires that groundwater be able to seep into the construction areas so that seepage zones can be identified. The use of perimeter wells to depressurize the construction sites as an initial measure is not a recommended as it will prevent any optimization of the drain systems.

The foundation drain systems, once installed, will manage groundwater seepage and runoff during the remainder of construction, operations, and closure.

POST-CLOSURE WATER MANAGEMENT

Groundwater management at the PWP location will not be required post-closure as the PWP will be deconstructed and the area reclaimed. At closure, the PWP will be dewatered and the liner system and foundation drain system will be removed. The PWP excavation will be filled in using available embankment fill material. The surface will be contoured and revegetated to return the area to a pre-mining state.

The CTF will be capped at closure with an impermeable HDPE liner system and a protective fill covering. The surface of the CTF impoundment and embankments will be contoured and revegetated. These closure measures will ensure that surface water (from precipitation and run-off) will not affect the long-term stability of the CTF. The foundation drain system beneath the CTF will remain operational as part of the post-closure maintenance and monitoring program.

Stability analyses of the CTF for post-closure conditions indicate that the anticipated pore pressures within the CTF will have a negligible effect on stability as such groundwater flow beneath the impoundment only requires monitoring and management with regards to water quality.

Post-closure stability and groundwater quality monitoring will continue indefinitely and monitoring data will be provided to the DEQ. The foundation drain system will remain functional as part of this monitoring program, and will not be decommissioned until the DEQ rules that post-closure water quality monitoring is no longer required.

Knight Piésold
CONSULTING

Please contact the undersigned with any questions or comments.

Yours truly,
Knight Piésold Ltd.

PROVINCE OF BRITISH COLUMBIA
G. I. D. MAGOON
36097
ENGINEER
Mar. 7 2016

Prepared: Greg Magoon, P.Eng.
Project Engineer

Reviewed: For Ken Embree, P.Eng.
Managing Principal

Approval that this document adheres to Knight Piésold Quality Systems: BB