Appendix B
Water Management Plan

Plan of Operations
Palmer Advanced Exploration Project
Haines, Alaska

Phase II – Underground Exploration Upland Mining
Lease No. 9100759

Prepared for:
Alaska Mental Health Trust Land Office
Alaska Department of Natural Resources
Alaska Department of Environmental Conservation

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Summary

This Water Management Plan describes how Constantine will manage water at the Palmer site during Stage II of the advanced exploration program. Constantine will manage two categories of water during the project: 1) storm water, and 2) underground seepage water.

Storm water includes all the natural runoff (from rain or snowmelt) coming from disturbed surfaces (roads, pads, stockpiles, etc.). Constantine is currently managing storm water in accordance with Alaska Construction General Permit (CGP) AKR 100000. The CGP authorizes the discharge of storm water associated with construction activity to waters of the U.S., in accordance with the conditions and requirements set forth in the permit. Permit authorization is required from the "commencement of construction activities" until "final stabilization" as defined in Appendix C of the CGP. Constantine will be transitioning over to the Multi-Sector General Permit (MSGP) for stormwater at the completion of surface construction and then operate under the MSGP for the duration of the underground exploration program.

Underground seepage water includes natural inflows to the underground exploration ramp. The seepage water will be collected and discharged to the environment, at the surface, under an approved land application disposal (LAD) system design.

Routinely, the underground seepage water will be discharged through the buried lower LAD diffuser, but initially it will be discharged through the upper diffuser during the initial development of the underground ramp. The lower diffuser is located along the access road east of Waterfall Creek. The upper diffuser is located approximately 250 meters south of the portal. The entire LAD system design is subject to review by ADEC.

Constantine has completed several hydrogeology studies in the field and computer modeling as a means of characterizing groundwater and estimating potential seepage flow rates into the proposed underground ramp. Constantine has estimated the anticipated volume of underground seepage but there remains a degree of uncertainty about the seepage rate. This is typically the case in predicting groundwater inflows prior to initiating development of any underground development. Because of this uncertainty Constantine has incorporated conservative estimates into the design of its LAD system and has an adaptive water management strategy that includes probing for zones with high inflow rates in advance of the ramp development and employing pressure grouting as a means of stemming the flow in these zones.

Constantine will also adhere to a list of explosives management BMP's with the objective of minimizing contact between water and explosives residue.

The objective of this Water Management Plan is to describe how Constantine will manage water on the site while meeting all regulatory requirements and minimizing the risk of any unauthorized discharges to the environment.

Constantine has completed a variety of environmental monitoring and characterization studies which include Acid Base Accounting, Aquatic Biology, Cultural Resources, Geology, Geotechnical, Water Quality, Groundwater Hydrology, Meteorology, Snow and Avalanche, Wetlands, Wildlife and Wildlife Habitat as a major step in characterizing the natural environment in the project area. Information derived from these studies was integrated into the project designs and into this Water Management Plan with the intent of preventing undue degradation to the environment.

1.0 WATER MANAGEMENT

Constantine will manage two categories of water during the underground advanced exploration project including: 1) stormwater, and 2) underground seepage water.

Constantine will also consume a small volume of water to meet underground drilling, grouting and blast dust mitigation needs.

Stormwater includes all the natural runoff (from rain or snowmelt) coming from disturbed surfaces (roads, pads, stockpiles, etc.). Constantine currently manages storm water under authority of the Alaska Construction General Permit (CGP) AKR 100000. The CGP authorizes the discharge of storm water associated with construction activity to waters of the U.S., in accordance with the conditions and requirements set forth in the permit. Permit authorization is required from the "commencement of construction activities" until "final stabilization" as defined in Appendix C of the CGP. Constantine will terminate their coverage under the CGP in 2019 once the access road construction is completed. At that point they will migrate to the Multi-Sector General Permit (AKR060000) for stormwater and the permit will cover storm water management on the portion of the access road on Mental health trust lands where heavy truck traffic will be ongoing during the development of the underground exploration ramp.

Underground seepage water includes natural groundwater inflows into the underground exploration ramp. This is generally in the form of relatively small seeps associated with fractures and faults in the wallrock.

The underground seepage water will eventually be discharged to the environment at the surface under authorization from ADEC through a LAD design approval.

Routinely, the seepage water will be discharged by land applying it through the buried lower LAD diffuser, but initially it will be discharged through the upper diffuser. The lower diffuser is located along the access road east of Waterfall Creek. The upper diffuser is located approximately 250 meters south of the portal (Figure 1). The entire system is referred to as the LAD system and its design is subject to review by ADEC prior to construction. Seepage water will be pumped to the portal where the water will be directed the LAD system. For the purpose of the approval process Constantine is considering the buried diffusers, settling ponds and piping to comprise the LAD system. The settling ponds are integral to the lower diffuser because they will allow fine suspended particulates to settle and minimizing the clogging of the system with fines and prolonging the useful life of the buried LAD diffuser. The settling for the discharge to the upper diffuser will occur in the underground water sumps.

In the unlikely event that the LAD system (settling ponds, diffusers) is ever overwhelmed by the flow volumes from underground or by an exceptional precipitation event that exceeds the freeboard in the settling ponds, then water would discharge over the emergency spillway constructed in the ponds, which has been designed to protect the structural integrity of the ponds.

The physical components of Constantine's LAD system are illustrated in Figure 1 and described below. They include:

- A pair of settling ponds.
- Buried lower diffuser consisting of three parallel perforated pipes
- Piping to convey water from the portal to the settling ponds and from the ponds to the buried diffuser with pipe valves and manifolds to allow water flow in/around the ponds and the three buried perforated diffuser pipes.
- A buried upper diffuser , 250 meters south of the portal
- Piping to convey water from the portal to the upper diffuser.
- Valves at the portal to control flows to either the upper diffuser or the settling ponds.
- Totalizer(s) to record flows to the upper diffuser and settling ponds

The ponds will allow settleable solids to settle prior to conveying the water to the lower LAD diffuser pipes. Settling solids prior to discharge is expected to prolong the useful life of the lower LAD diffuser by minimizing clogging of the receiving environment (gravels) downgradient of the LAD diffuser. The ponds are designed so that the seepage water will enter the first pond and, at a flow rate of 500 gpm, water will have a settling time of 12 hours in each pond. Lower flow rates will allow more settling time and vis versa. The ponds are of like-size, each holding approximately 358,500 gallons (1.1 acre-feet). The conceptual designs for the impoundments that surround the ponds have been submitted to ADNR dam safety unit for jurisdictional review and on July 12, 2018 ADNR dam safety concluded that the dams are not under jurisdiction of the Alaska Dam Safety Program.

Constantine has completed several hydrogeology studies in the field and computer modeling as a means of characterizing groundwater and estimating potential flow rates into the future underground ramp. Constantine has also been collecting groundwater samples from wells and surface seeps as part of an effort to predict the water quality of seepage water inflows into the ramp.

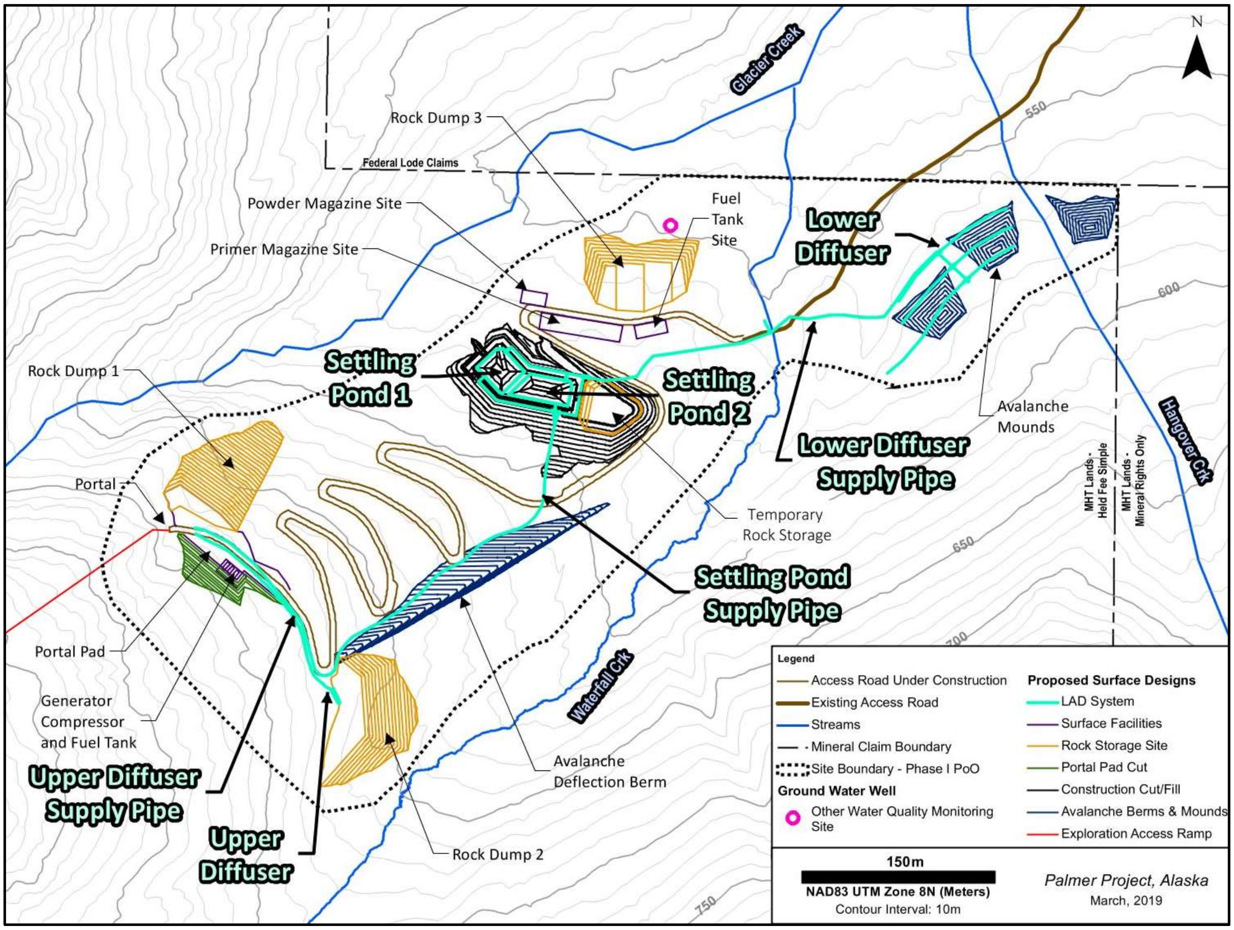


Figure 1. Major Components of Land Application Disposal System (LAD) for Underground Seepage Water

Constantine has estimated the anticipated volume of underground seepage but there remains a degree of uncertainty about the total volume of seepage which is always the case in predicting groundwater flows prior initiating development of any underground development. As a result of this uncertainty Constantine has incorporated conservative estimates into the design of its LAD, and has an adaptive water management strategy that includes probing for zones with high inflow rates in advance of the ramp development and employing pressure grouting as a means of stemming the flow in these zones prior to passing through them with the ramp. These are all described in more detail below.

1.1 Storm Water

Storm water on the project site is regulated by ADEC under the APDES Program, delegated to the State by the EPA. Storm water management for the project is currently managed under the terms of the Construction General Permit (CGP, Permit No. AKR100000) for storm water discharges associated with Industrial Activity. The CGP authorizes, and sets conditions on, the discharge of pollutants from certain industrial activities to waters of the United States. To ensure protection of water quality and human health, the permit establishes control measures and best management practices (BMP's) that must be used to control the types and amounts of pollutants that can be discharged. This general permit is intended to regulate storm water (rain and snowmelt) runoff which encounters industrial activities and materials which have the potential to cause contamination.

To obtain authorization to operate under the CGP the permittee must develop a Storm Water Pollution Prevention Plan (SWPPP) according to the requirements of permit Part 5 and submit the SWPPP to ADEC. Further, the permittee must select, design, install and maintain control measures (BMP's) to meet effluent limits. In order to begin coverage under the CGP, the permittee must submit a complete and accurate Notice of Intent (NOI) to operate under the CGP to ADEC and pay the general permit authorization fee in accordance with 18 AAC 72.

Constantine has been operating under the CGP since 2014 has maintained a SWPPP and installed BMP's to meet the pollution minimization requirements of the CGP along the segments of the Glacier Creek access road as they were constructed, including the last segment ending at the portal pad. As outlined in the SWPPP, storm water is collected along ditches along the portal access road and other disturbed areas and conveyed to discharge points in uplands or to tributaries of Glacier Creek. BMP's, including energy dissipaters, stilling ponds, relief culverts, and sediment basins are being constructed, where required, to encourage settling of suspended solids from storm water and reduce the resulting discharge of pollutants.

Constantine is doing requisite storm water monitoring (inspections) currently under the CGP. The inspection location and scope are defined in Section 6.4 of the CGP. Inspections are performed on a weekly schedule (excluding winter shut-down periods) as required by section 6.1 of the CGP that applies to sites where the mean annual precipitation exceeds 40 inches. An inspection report is completed for each inspection in accordance with CGP section 6.7. Upon completion of all surface construction activities (settling ponds, LAD, diffuser, portal pad, access road) Constantine will be transitioning over to the Multi-Sector General Permit (AKR060000) for stormwater as soon as road and surface facility construction activities are completed, likely in mid-2019. The MSGP will authorize storm water management for continued heavy traffic on the road on Mental Health Trust Lands for the duration of the underground ramp development while development rock is hauled to the surface and repurposed for a variety of construction purposes or disposed of.

Constantine will continue to manage stormwater as described in the MSGP SWPPP until the site is deemed to meet the "final stabilization" definition under the MSGP.

1.2 Underground Seepage Water

Natural groundwater is anticipated to seep into the underground ramp as the ramp advances. Inflows are modeled to increase as the ramp gets longer; the highest flows are anticipated in the

Kudo fault area. Constantine will need to manage this water, including discharging it to the environment to develop the ramp and maintain exploration activities in the ramp into the future.

Tundra Consulting (2018) estimates seepage inflows for the first 1,250 m (4,100 ft) of ramp to peak at approximately 200 gpm (highest during spring freshet) and then stabilize at a sustained rate of approximately160 gpm. Tundra suggests that a higher flow rate should be anticipated for the remainder of the ramp, although an estimate of those flows was not developed.

Water quality sample data and constituent loading studies completed by pHase (2018) indicate the seepage inflows will be generally good quality. The water will also pick up some nitrate compounds as a result of interaction with the ramp system and blasting residues therein. In addition, the seepage water will pick up suspended solids as it is conveyed underground and to the portal.

Constantine has used these base-case parameters to design this water management plan and the components parts of the water conveyance and discharge system but has also incorporated a significant degree of conservatism and adaptive management to reduce the risks associated with water management in general.

Constantine has designed a seepage water conveyance and discharge system, collectively referred to as a LAD, consisting of two settling ponds, buried upper and lower diffusers and the piping required to convey water from the portal through the system with several operational options for controlling flows.

As described in more detail below, Constantine will collect all underground seepage in a series of sumps, pump it to the portal, convey it through pipe to two settling ponds before being piped further to the lower diffuser or pipe the water to the upper diffuser located some 250 meter on-contour with the portal.

The entire water conveyance and discharge system, collectively referred to as the LAD, will be authorized by ADEC through a design review and approval process leading to an "Approval to Construct" from ADEC prior to construction. The LAD design and descriptive narrative will be submitted separately to ADEC for review and approval. That document contains a more in-depth description of the LAD and the design basis.

Owing to the uncertainty in the volume of underground seepage inflows, at least in the farthest portions of the proposed ramp, Constantine will use an adaptive management strategy to managing seepage water in effort to identify zones of high flow rates and pressure grout them to cut off flows. The adaptive management strategy is discussed further in section 2.3 of this Water Management Plan.

1.2.1 Underground Seepage Water Quantity

Between 2014 and 2017, Constantine completed field studies including packer testing, shut-in/flow measurements, water level monitoring (in drillholes), and computer modeling to estimate seepage rate for underground inflows. That work was managed by Tundra Consulting (2016, 2017). The work performed in 2017 was more focused on the underground ramp design proposed in the Phase II Plan of Operations compared to work in previous years.

The proposed underground ramp design includes an inclined, 1,612 m ramp and a 400 m drilling drift. The first 1,250 m of the ramp is projected to pass through Jasper Mountain Basalt, a competent unit with few faults and low anticipated seepage rates. The ramp then progresses through a transitional unit consisting of a mix of basalt and argillite, the Kudo Fault, a major sub-vertical fault zone, and finally terminating in the Hanging Wall Basalt, which consists of variably faulted basalt and lesser metasediment, generally with higher anticipated flow rates. The drilling drift will be completely within the Hanging Wall Basalt.

Hydraulic conductivity is dominantly controlled by faults and fracture zones where the K is high while the competent rock is characterized by low K. The proposed ramp would intersect three hydrogeological domains: the low K Jasper Mountain domain, the high K Kudo Fault Zone, and the intermediate K South Wall domain which includes the Hanging Wall Basalt.

Tundra (2018) applied a transient analytical flow model to estimate flow into the proposed ramp. The method incrementally estimates flow as the ramp is advanced. The analysis is most sensitive to K and pressure head above the ramp (i.e., saturated thickness above the ramp) and is less sensitive to the storage capacity of the rocks and the ramp radius. Enough data are available to estimate flows for the first 1250 m of the ramp (Jasper Mountain Basalt) which would take almost a year to develop through. The estimated flow for this portion of the ramp would peak at approximately 200 gpm (13 L/s) and settle at a sustained rate of approximately 160 gpm (10 L/s) during the first year of ramp development. It should be noted that short-term higher flow rates will likely come from faults and fracture zones. Insufficient data are available to perform a flow estimation for the remainder of the ramp. However, based on the hydrogeological model and the available data for the Hanging Wall Basalt, Tundra (2018) concluded that a higher flow rate is expected in the remainder of ramp.

1.2.2 Underground Seepage Water Quality

Constantine's prediction of the seepage water quality is based on an analysis by consultant pHase Geochemistry completed in 2018. Their report is included in Appendix C of Constantine's waste management permit application. Phase started with background groundwater geochemistry from site P29 (groundwater monitoring site) and scaled those concentrations for each constituent using the leachate results from the humidity cell and field barrel samples. The resultant predicted concentrations for a list of constituents, including explosive residues, is included in Table 1. With a comparison to Alaska acute and chronic water quality standards (AWQS)and the background water quality for the monitoring wells up- and downgradient from the lower LAD diffuser.

The table illustrates that the predicted water chemistry from the underground ramp may not meet AWQS for Al, Mn and V. But will likely only exceed background water chemistry for Mn and V compared to MW-01 and MW-02 located upgradient and downgradient of the proposed lower diffuser. This would suggest that the LAD will be an effective means of disposing of the underground seepage water while being protective of the environment.

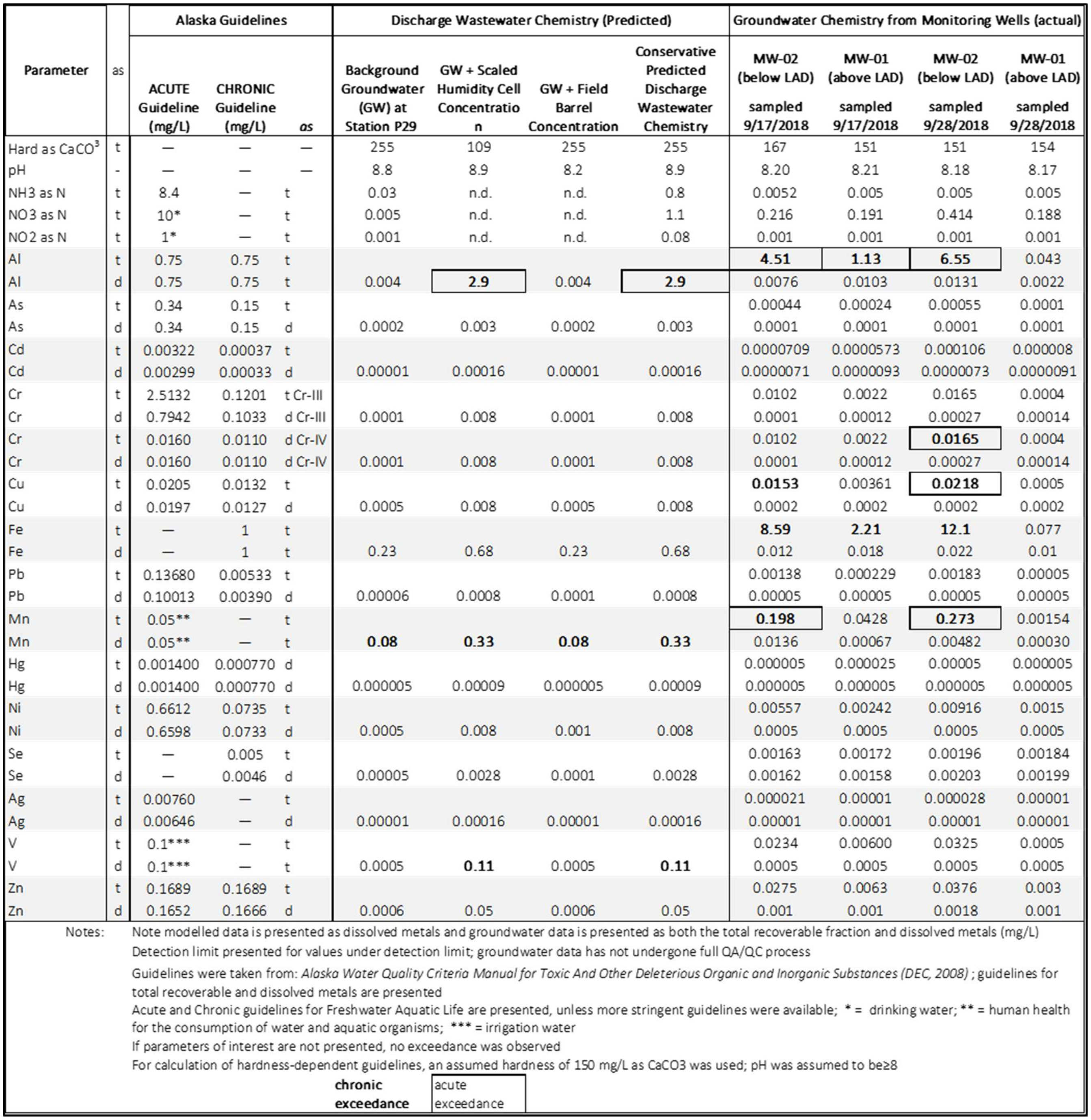
1.2.3 Underground Seepage Water Management and Disposal

Owing to the inclination of the underground ramp, all seepage inflows will flow, by gravity, toward the portal. Initially seepage will report to the water ditch along the driving surface in the ramp and flow toward the next sump down-ramp, where it will collect. As sumps fill and then overflow, the water will flow down-ramp, in the ditch, to the next sump. Eventually flows will report to sumps 1 & 2, closest to the portal. Sumps 1 & 2 are configured such that water will be allowed to settle in sump 2 and overflow to sump 1, where it will be conveyed to the portal and then either piped to the upper diffuser, or down to the settling ponds and discharged through the lower diffuser.

Constantine will dispose of water temporarily to the upper diffuser and then to the lower diffuser. Infiltration tests, completed in 2017, indicate that the talus can accept considerable water. Constantine will make daily observations at the base of the talus below the upper diffuser and downslope of the lower diffuser for the appearance of new seeps.

Constantine will monitor flow volumes from the portal using a totalizer(s) regardless of what discharge point of the LAD system they are directed to. This is the best gauge of seepage water inflows. Constantine will also monitor water quality at monitoring wells MW-01, MW-02 and a new monitoring well to be constructed in 2019 below the proposed upper diffuser as a means of tracking any changes to background water quality after the LAD system is in operation. Monitoring is also discussed Attachment 1 of Constantine's waste management permit application.

Table 1. Predicted Ramp Water Quality.



Parameter	as	Alaska Guidelines			Discharge Wastewater Chemistry (Predicted)				Groundwater Chemistry from Monitoring Wells (actual)			
		ACUTE Guideline (mg/L)	CHRONIC Guideline (mg/L)	as	Background Groundwater (GW) at Station P29	GW + Scaled Humidity Cell Concentration	GW + Field Barrel Concentration	Conservative Predicted Discharge Wastewater Chemistry	MW-02 (below LAD) sampled 9/17/2018	MW-01 (above LAD) sampled 9/17/2018	MW-02 (below LAD) sampled 9/28/2018	MW-01 (above LAD) sampled 9/28/2018
Hard as $CaCO^3$	t	—	—	—	255	109	255	255	167	151	151	154
pH	-	—	—	—	8.8	8.9	8.2	8.9	8.20	8.21	8.18	8.17
NH3 as N	t	8.4	—	t	0.03	n.d.	n.d.	0.8	0.0052	0.005	0.005	0.005
NO3 as N	t	10*	—	t	0.005	n.d.	n.d.	1.1	0.216	0.191	0.414	0.188
NO2 as N	t	1*	—	t	0.001	n.d.	n.d.	0.08	0.001	0.001	0.001	0.001
Al	t	0.75	0.75	t					**4.51**	**1.13**	**6.55**	0.043
Al	d	0.75	0.75	t	0.004	**2.9**	0.004	**2.9**	0.0076	0.0103	0.0131	0.0022
As	t	0.34	0.15	t					0.00044	0.00024	0.00055	0.0001
As	d	0.34	0.15	d	0.0002	0.003	0.0002	0.003	0.0001	0.0001	0.0001	0.0001
Cd	t	0.00322	0.00037	t					0.0000709	0.0000573	0.000106	0.000008
Cd	d	0.00299	0.00033	d	0.00001	0.00016	0.00001	0.00016	0.0000071	0.0000093	0.0000073	0.0000091
Cr	t	2.5132	0.1201	t Cr-III					0.0102	0.0022	0.0165	0.0004
Cr	d	0.7942	0.1033	d Cr-III	0.0001	0.008	0.0001	0.008	0.0001	0.00012	0.00027	0.00014
Cr	t	0.0160	0.0110	d Cr-IV					0.0102	0.0022	**0.0165**	0.0004
Cr	d	0.0160	0.0110	d Cr-IV	0.0001	0.008	0.0001	0.008	0.0001	0.00012	0.00027	0.00014
Cu	t	0.0205	0.0132	t					**0.0153**	0.00361	**0.0218**	0.0005
Cu	d	0.0197	0.0127	d	0.0005	0.008	0.0005	0.008	0.0002	0.0002	0.0002	0.0002
Fe	t	—	1	t					**8.59**	**2.21**	**12.1**	0.077
Fe	d	—	1	t	0.23	0.68	0.23	0.68	0.012	0.018	0.022	0.01
Pb	t	0.13680	0.00533	t					0.00138	0.000229	0.00183	0.00005
Pb	d	0.10013	0.00390	d	0.00006	0.0008	0.0001	0.0008	0.00005	0.00005	0.00005	0.00005
Mn	t	0.05**	—	t					**0.198**	0.0428	**0.273**	0.00154
Mn	d	0.05**	—	t	**0.08**	**0.33**	**0.08**	**0.33**	0.0136	0.00067	0.00482	0.00030
Hg	t	0.001400	0.000770	d					0.000005	0.000025	0.00005	0.000005
Hg	d	0.001400	0.000770	d	0.000005	0.00009	0.000005	0.00009	0.000005	0.000005	0.000005	0.000005
Ni	t	0.6612	0.0735	t					0.00557	0.00242	0.00916	0.0015
Ni	d	0.6598	0.0733	d	0.0005	0.008	0.001	0.008	0.0005	0.0005	0.0005	0.0005
Se	t	—	0.005	t					0.00163	0.00172	0.00196	0.00184
Se	d	—	0.0046	d	0.00005	0.0028	0.0001	0.0028	0.00162	0.00158	0.00203	0.00199
Ag	t	0.00760	—	t					0.000021	0.00001	0.000028	0.00001
Ag	d	0.00646	—	d	0.00001	0.00016	0.00001	0.00016	0.00001	0.00001	0.00001	0.00001
V	t	0.1***	—	t					0.0234	0.00600	0.0325	0.0005
V	d	0.1***	—	t	0.0005	**0.11**	0.0005	**0.11**	0.0005	0.0005	0.0005	0.0005
Zn	t	0.1689	0.1689	t					0.0275	0.0063	0.0376	0.003
Zn	d	0.1652	0.1666	d	0.0006	0.05	0.0006	0.05	0.001	0.001	0.0018	0.001

Notes: Note modelled data is presented as dissolved metals and groundwater data is presented as both the total recoverable fraction and dissolved metals (mg/L)

Detection limit presented for values under detection limit; groundwater data has not undergone full QA/QC process

Guidelines were taken from: *Alaska Water Quality Criteria Manual for Toxic And Other Deleterious Organic and Inorganic Substances (DEC, 2008)* ; guidelines for total recoverable and dissolved metals are presented

Acute and Chronic guidelines for Freshwater Aquatic Life are presented, unless more stringent guidelines were available; * = drinking water; ** = human health for the consumption of water and aquatic organisms; *** = irrigation water

If parameters of interest are not presented, no exceedance was observed

For calculation of hardness-dependent guidelines, an assumed hardness of 150 mg/L as CaCO3 was used; pH was assumed to be≥8

chronic exceedance | acute exceedance

1.2.4 Explosive Management Source Control Best Management Practices.

This section describes the best management practices, protocols and procedures that will be implemented to ensure the optimal use and minimal loss of explosive products. Strategies that lead to optimal or even reductions in the amount of explosives needed to accomplish mining objectives will directly correlate to the risk of nitrogen-related impacts to the receiving environment, including water, and the types of management strategies necessary to meet environmental protection goals. All the following factors in some manner can play a role in optimal explosive use and minimizing the quantity of nitrogen released to the environment.

Strategies are provided for each of the following as described below:

- **Explosive product selection**
    - Constantine has chosen to use packaged emulsion as the primary blasting agent for the program.
- **Powder factor optimization**
    - With drifting rounds, once the contractor finds a drill/blast pattern that works well in the rock they are drifting in, they will use it routinely. In the interest of drilling efficiency, they will keep the number of holes to a minimum, which means the powder usage will also be efficient.
- **Practices for explosive storage (preventing contact with water/moisture)**
    - Packaged emulsion will be stored in weatherproof magazines separate from blasting caps to prevent contact with water and for safety. The magazines will be provided by the explosives vendor, thus the magazine size is not currently known. After the development contract has been awarded, the contractor will inform Constantine of the number of magazines and the magazine storage capacity. At that time safety berms will be designed to comply with Bureau of Alcohol, Tobacco, and Firearms (BATF) regulations and to provide avalanche protection.
- **Practices to prevent water contacting explosive in blast holes (i.e., blast hole liners, bench dewatering)**
    - Grades in the underground ramp access at the Palmer Project vary from +2.5% to +12%. Ground water and drill water will drain away from the face, thus there will be no ponding at the face. Holes will be blown clean of debris and water before loading.
- **Drill pattern optimization**
    - Drill pattern density and drillhole depth will be optimized to attain the desired break using the minimum amount of explosive.
- **Explosive loading**
    - The blasts at Palmer will be small (5m x 5m x ~3m), so the explosives loading process will be fast. Excess explosives brought to the face, but not used, will be returned to the magazines.
- **Spill response/reporting**

  - This would apply to bulk loaded explosives, which will not be used at Palmer. Any sticks of emulsion that are dropped will be picked up and used or returned to storage.

- **Incident management/investigation**
  - Incidents will be investigated by the Contractor (who will hold the BATF license) and Constantine. Reports will be made to the proper authorities (BATF and/or MSHA).
- **Training and inspection**
  - Only trained personnel will be allowed to handle, load, and detonate explosives. All shipments of explosives will be inspected and inventoried upon arrival.
- **Dealing with misfires**
  - After blasting and after mucking, the face will be inspected for misfires. Misfires will be detonated by inserting a new cap and firing after the face has been safely cleared of personnel.
- **Handling and disposal waste explosive products**
  - Defective or excess explosive products will be returned to the vendor.

1.3 Adaptive Strategies

There is typically a degree of uncertainty, or a lack of precision, in the prediction of seepage rates of groundwater into any underground excavation, including the ramp system proposed by Constantine. With a robust data set supported by field investigations and computer modeling, the estimate can still have a range that is as large as an order of magnitude (i.e. 50 to 500 gpm, or 10 to 100 gpm).

To address this uncertainty Constantine has thoroughly considered a range of options for managing water, including options for managing the unlikelihood of very high unanticipated seepage rates.

Constantine will use an adaptive management strategy for managing seepage inflows. It will be prepared to implement several different operating procedures in response to changing conditions. It is important to note that Constantine will be advancing the ramp at a rate of approximately 12 ft/day and will be probing in front of that to detect any new significant water inflows. Constantine has the flexibility to stop the ramp at any time before it intersects unanticipated large volumes of water.

Constantine may implement one or more of the following adaptive strategies in response to conditions underground.

- Discharge seepage water through the buried upper and /or the lower LAD diffusers.
- From time to time, drill probe holes in front of the advancing ramp to identify fracture zones, perform hydrogeology testing, and define seepage rates in advance of intersecting them with the ramp.

- Use pressure grouting techniques to create a grout curtain around the ramp to minimize the seepage inflows prior to intersecting them with the ramp.
- Plug and cement all exploration drill holes unless required to be left open for hydrogeology or other surveys.
- Install pressure transducers in underground artesian drillholes or perform other hydrogeologic tests underground to contribute to the understanding and characterization of the groundwater in the area.
- Modify or add additional underground sumps to encourage settling of solids before water is pumped to settling ponds.
- Use approved settling additives (flocculants) in underground sumps or sediment ponds to encourage settling of suspended solids prior to discharging through the diffusers.

1.4 Water Consumption

Water will be used for excavating the development ramp and for underground exploratory core drilling.

This water will consist of seepage water sourced from one of the underground sumps or from one or more artesian underground drill holes. Constantine will apply for TWUA's as soon as practical after identifying a suitable water source underground.

For surface uses (dust control, portal pad/collar and initial ramp development) water will be sourced from sites already approved under one of a three TWUA's. Constantine currently has authorization for 15 designated water source locations under three TWUA's - TWUA F2014-101, TWUA F2014-102 and F2015-080. TWUA F2014-101 expires on October 31, TWUA F2014-102 expires on Dec 31, 2018, 2018; F2015-080 expires on July 13, 2020. The TWUA's contain conditions that must be complied with, including conditions designed to protect water quality and aquatic resources. For example, in fish-bearing waters, intake screens must be designed to avoid fish entrapment, entrainment or injury (note that none of the currently authorized sources are known to be fish-bearing) and pumping operations must be conducted in a way to prevent petroleum products or hazardous substances entering the surface or groundwater. Authorizations F2014-101 and TWUA2014-102 each allow for the combined withdraw of up 86,400 gallons of water per day between May 1st and October 31st at an intake rate of up to 20 gallons per minute per pump, subject to a maximum of three pumps per source. Primarily the existing TWUA's will be used to support any surface exploration drilling activities which are authorized under Constantine's multi-year APMA # J145690 permit and are not discussed further in this Plan.

There are no current plans to use any site water for domestic uses during the activities proposed in this Plan of Operations.

1.5 REFERENCES

2018, Hydrology Report, Palmer Exploration Project, Haines, Alaska, Tundra Consulting company report, 47 p.

2018, Geochemical Source Term Predictions, Palmer Project, pHase Geochemistry company report, 21 p.

2018, Geochemical Characterization in Support of a Proposed Exploration Drift, Palmer Project. pHase Geochemistry company report, 29 p.

2017, Hydrology Report, Palmer VMS Project, Haines Alaska, Tundra Consulting company report, 30 p.