CLEAR CREEK ASSOCIATES

Memorandum

To: Lisbon Valley Mining Company

Utah Department of Environmental Quality, Division of Water Quality

Date: August 20, 2021

From: Alison H. Jones

Doug Bartlett

Subject: Independent Financial Assurance Bonding Estimate

1. Introduction

Lisbon Valley Mining Company LLC (LVMC) is the applicant for an underground injection control (UIC) permit for an in situ mining project in La Sal, Utah. A draft permit (UTU-37-AP-5D5F693) has been issued by the Utah Department of Environmental Quality, Division of Water Quality (UDWQ), which included an estimate for three years of financial assurance (FA) bonding for closure of the project. UDWQ requested an independent third-party estimate of the FA amount for the first three years of operation. LVMC retained Clear Creek Associates, LLC (Clear Creek) to conduct the review and formulate an independent estimate for the FA.

The objective of this review is to arrive at an independent FA bonding estimate that is sufficient to meet the conditions required by Part III, Section L.1 of the draft permit. The estimate is based on Clear Creek's understanding of this project and our experience with in situ copper recovery. In situ mining for copper is not a widespread practice at this time. Industry-wide experience related to in situ mining for copper is limited, and to our knowledge, there have been no closures of in situ copper mines in the United States.

1.1 Background

LVMC owns and operates an open-pit copper mine and heap leach operation in lower Lisbon Valley approximately 17 miles southeast of the unincorporated town of La Sal, Utah. LVMC has identified a copper resource immediately south and east of their current operation that they have found to be suitable for in situ mining. Three deposits have been identified: the GTO, Lone Wolf,

and Flying Diamond deposits, which are estimated to contain greater than 800 million pounds of copper suitable for in situ (ISR) recovery. This closure estimate was prepared for 3 years of mining at the GTO deposit. GTO is deeper and more expensive to mine than Lone Wolf and Flying Diamond. Closure costs for the initial three years of mining Lone Wolf and Flying Diamond deposits will be lower than costs for GTO closure.

Disseminated copper is primarily hosted in the Burro Canyon (BC) aquifer and to a lesser extent the deeper Navajo (N) aquifer. The UIC application allows for in situ mining in the BC aquifer only. The BC aquifer water quality is poor, and according to the LVMC application, there are no registered residential, municipal, or other commercial water wells in the BC aquifer within the Project area other than those owned by LVMC.

1.2 Scope of Work

The following tasks were conducted for this review:

- Review of UIC application and draft permit to understand the scope of the project and the steps involved in the closure.
- Discussions with LVMC regarding assumptions made in the initial bond amount.
- Discussion with Peter Brinton at Utah Division of Oil, Gas and Mining (UDOGM) regarding indirect costs and escalation.
- Review/revise and update as necessary for completeness, unit costs, and quantities.
- Preparation of this document summarizing the review with conclusions.

2. Project Description

2.1 Wellfield Operations

ISR is a method of mining where a metal, in this case copper, is dissolved from rock while it is still in the ground (i.e. in situ). There are no open pits, waste rock, or tailings produced in this type of mining. Low pH water, called "raffinate", is injected into wells that are screened in the mineralized zone. As the raffinate travels through the mineralized rock from the injection well to the recovery well, it dissolves the disseminated copper. The raffinate containing dissolved copper flows toward pumping (or recovery) wells, where it is pumped to the surface.

The recovered raffinate (which is now called pregnant leachate solution or "PLS") is processed in a solution extraction and electrowinning plant. In this process, the metal precipitates out as copper cathode plates. After the copper is removed, the low pH raffinate is then re-circulated into the wellfield.

Injection and recovery wells are generally installed in a grid of "5-spots" where each injection well is surrounded by 4 recovery wells and each recovery well is surrounded by 4 injection wells. The grid may be modified to take advantage of fractures or other features that are identified by geologists as the wellfield expands. Injection wells can be converted to recovery wells (and vice versa), if needed. The injection and recovery wells will be screened in the BC aquifer. Due to low conductivity strata above and below the BC aquifer, solutions will be confined to this aquifer.

At the end of Year 3, the GTO wellfield will contain 71 wells (26 5-spots made up of 26 injection wells, 45 extraction wells) in an approximate 150 foot by 150 foot grid). In addition there will be 7 monitoring wells outside of the wellfield.

2.2 Hydraulic Control

An important element of operating a wellfield is hydraulic control. This is the mechanism by which raffinate/PLS in the aquifer is prevented from escaping the wellfield. Maintaining hydraulic control is important from an economic perspective (PLS is a valuable commodity) and an environmental perspective. A slight inward gradient is maintained so that groundwater flows toward the wellfield from all directions. This inward gradient is achieved by pumping out slightly more water than is pumped into the wellfield, resulting in a cone of depression centered on the wellfield. Maintaining inward gradients is a key principle used for all ISR projects. For this reason, it is important to maintain the proper balance of injection and extraction flow rates.

2.3 Wellfield Closure

After copper grades in the PLS decline, the mine block will undergo closure to neutralize the low pH water in the wellfield and abandon the wells. LVMC has proposed a multi-year closure process that will consist of:

- Rinsing
- Closure Monitoring

- Well Plugging and Abandonment
- Post-Closure monitoring

Each of these steps is summarized in the following sections.

2.3.1 Rinsing

A two-year rinsing process will include the following steps:

- **Step 1**--Wellfield resting: Injection will cease and solution will rest in place for 7 months. During this rest period, solutions will neutralize and hydraulic control will be maintained by pumping a subset of the extraction wells that are spatially distanced throughout the wellfield. Solutions will be pumped to the ISR dedicated collection ponds for evaporation.
- **Step 2**--Wellfield recirculation: over the course of 9 months, approximately five pore volumes of solution will be circulated through the wellfield. Solution removed from the wellfield will pumped to collection ponds for evaporation as described above. During this time, a lesser amount (approximately 300 gpm) of fresh makeup water will be injected into the wellfield. This strategy will continue to maintain hydraulic control.
- **Step 3**--One pore volume will be pumped from the wellfield and evaporated. As it is removed it will be replaced with a pore volume of fresh water from LVMC's nearby wells.

2.3.2 Closure monitoring

During the two-year rinsing process, eight rounds of quarterly groundwater monitoring, will be conducted to evaluate the rinsing process. Six monitoring wells and four extraction wells will be monitored eight times during the rinse, as described in the permit application. Monitoring results will be reported to the regulators as required in the draft permit.

2.3.3 Well Abandonment

After rinsing and closure monitoring, pumping will be discontinued and the wellfield injection/recovery wells will be plugged and abandoned. The monitoring wells will be filled with a cement to a few feet below the land surface. The annulus above the screened interval will be cemented during initial installation to prevent vertical movement of groundwater and leaching solutions outside the casing.

At the land surface, approximately 2-5 feet of the casing will be removed and the surface will be regraded.

Monitoring wells will remain in service for the 5-year post-closure monitoring period. They will be plugged and abandoned using the same methodology as the injection/extraction wells.

2.3.4 Post-Closure Monitoring

Annual post-closure monitoring will be conducted as described in the permit application. Monitoring results will be reported to the regulators as required in the draft permit.

3. Closure Costs

3.1 Assumptions

This bond review was conducted for the wellfield only. Closure costs for the ISR surface disturbance, which includes surface collection ponds and associated infrastructure will be included in the Company's existing open pit reclamation surety which is active and overseen by UDOGM. Also, all LVMC copper production facilities associated with ISR are covered in the existing reclamation surety with UDOGM. All evaporation activities associated with ISR will be conducted using collection ponds dedicated to the ISR project only and will not have any association with the open pit operation. After completion of ISR evaporation activities, the ISR collection ponds and related surface facilities will be reclaimed per standard UDOGM bonding requirements. Clear Creek reviewed the LVMC UIC permit application, including the closure cost estimate. Assumptions included in this bond estimate are:

- The bond estimate is for closure for the first 3 years of the ISR operations. Year 1 (2022) is primarily construction costs. No in situ leaching will occur in Year 1. Leaching will occur during years 2 (2023) and year 3 (2024). The bond calculation was conducted for the year of greatest reclamation cost liability, which is at the end of Year 3 when the maximum number of injection and recovery wells will exist. All of the activities for Years 1-3 are at the GTO deposit.
- RSMeans (Gordion Group, 2021) labor rates include overhead and profit.
- Costs for labor, monitoring, well abandonment, and maintenance were escalated to the year in which they are anticipated to be incurred. A 2.69%/year escalation rate, compounded annually, was used based on the past 5 years of RSMeans historical cost indices (Gordian, 2021), as recommended by DOGM.

- The wellfield is staffed in 2025-2026 for rinsing operations. Employees remaining in 2027 will be employed for 3 months to close the wellfield.
- Electrical costs for wellfield rinsing were based on the current rate of $0.06/kw-hr. Electrical costs were not escalated.
- Well abandonment costs were based on the UDOGM guidance (UDOGM, 2021), using $5.50 per linear foot for the plugging cost, $210 for wellhead removal, and $12,000 for mobilization. These costs were escalated from 2021 to the year they will be incurred. The wellfield wells will be abandoned in 2027 and the monitoring wells will be abandoned in 2031 after 5 years of post-closure monitoring.
- Closure and post-closure monitoring labor costs and expenses are based on Clear Creek's experience in monitoring groundwater at mining sites. Costs for sample shipping, generator rental, mileage (from Salt Lake City) and laboratory analyses are included.
- Laboratory costs for closure and post-closure monitoring were based on a laboratory quote from a commercial laboratory, and escalated to the year the cost will be incurred. Subcontracted laboratory costs were marked up 15%, as is customary.
- Water treatment is not expected to be necessary, based on LVMC's understanding of the acid neutralizing capacity of the rock. However, the cost for sodium bicarbonate addition, including mixing equipment, is included in the bond estimate because, as the permit notes this treatment may be implemented. The mixing will be done in an existing impoundment that is included in the surface mine bond.
- Indirect costs of 21.8% were applied. This includes 5% for insurance, permits and bonds, 5% contingency, 2.5% for engineering redesign, 6.8% for main office expense, and 2.5% for project management (UDOGM Tech 007, 2017).
- The UDOGM Tech 007 (2017) guidance recommends a 10% indirect cost for mobilization (which also includes insurance, permits and bonds). Instead, we used 5% for insurance, permits and bonds (see bullet point immediately above). Mobilization costs are included in the labor and subcontractors' costs. It is worth noting that this project will require very little equipment for reclamation, since all surface reclamation will be covered by the UDOGM open pit reclamation surety, and thus mobilization costs are small. The only mobilizations are for the drill rigs (for abandonment) and monitoring staff (who we have assumed will come from Salt Lake City).

3.2 Closure Costs

Clear Creek estimates the closure costs, using the assumptions provided in Section 3.1, will be $6,184,000. A spreadsheet summarizing the costs is attached.

4. Conclusions

Clear Creek Associates prepared this independent third-party estimate of closure costs for the first three (3) years of in situ mining at the Lisbon Valley Mining Company GTO deposit. In general, our analysis confirms the accuracy of the Company's operational closure cost estimate but differs from LVMC's estimate in the following ways:

- This estimate escalates costs from 2021 to the year in which they are expected to be incurred.
- This estimate used DOGM's guidelines for indirect costs, with the exception of mobilization costs.
- This estimate includes costs for water treatment during the second year of rinsing. LVMC's experience with leaching in the surface mine indicates this will not likely be necessary. However, because it is referenced in the UIC application as a possibility, we recommend that it be included.

5. References

Gordian Group, Inc., 2020. Heavy Construction Costs with RSMeans data, 2021. Derrick Hale, PE, editor.

State of Utah Department of Natural Resources Division of Oil, Gas and Mining (UDOGM), 2017. Calculation guidelines for determining coal mining reclamation bond amounts, Directive number Tech-007.

State of Utah Department of Natural Resources Division of Oil, Gas and Mining (UDOGM), 2021. 2021 Reclamation Surety Amounts for Exploration and Small Mining Operations Including

Small Mine Three- and Five-Year Escalation, memo to Utah Board of Oil Gas and Mining from Wayne Western, Peter Brinton, and Kim Coburn dated March 24, 2021.

Independent Third-Party Financial Assurance Bonding Estimate
Lisbon Valley Mine, La Sal, Utah

August 20, 2021

			Rinsing Y1	Rinsing Y2	FIVE YEAR POST-CLOSURE PERIOD					
Closure Summary			**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	
	Mining Area (tons)		7,521,429	7,521,429						
	Pumping Volume		359,640,000	272,975,409						
	Pore Volume Circulated (including final rinse		3.5	2.7						
	Cume Rinsing Volume		359,640,000	632,615,409						
	Duration of Rinsing (days)		165	365						
	Wellfield Wells to Abandon				71					
	Monitor Wells to Abandon								7	
	Well Footage to Abandon				47,390					
	Monitoring Well Footage to Abandon								6,600	
	Wells Rinsing		23	23						
	$Kwh		$ 0.06	$ 0.06						
Labor										
	Project Manager		250,093	256,821	65,932	-	-	-	-	
	Wellfield Supervisor		232,746	239,007	-	-	-	-	-	
	Wellfield Operations		209,616	215,254	-	-	-	-	-	
	Wellfield Ops		160,464	164,781	-	-	-	-	-	
	Wellfield Electrician		262,711	269,778	69,259	-	-	-	-	
	Laborer		153,236	157,358	40,398	-	-	-	-	
	Site Security		204,816	210,326	53,996	-	-	-	-	
	Overhead, vehicles & expenses		27,801	28,548	14,658	-	-	-	-	
	Total		1,501,483	1,541,873	244,243	-	-	-	-	
Rinsing, Capital & Power										
	Rinse Recovery Pumping Power		75,091	59,246	-	-	-	-	-	
	Evaporation Pumping Power		227,902	311,604	-	-	-	-	-	
	Water Supply Power		54,872	54,872	-	-	-	-	-	
	Total		357,865	425,722						
Water Treatment			-	178,969	-	-	-	-	-	for 50% neutralization
Qtrly Monitoring, Rinse Verification Sampling, and Reporting			47,986	49,277						
Well Rehabilitation and Maintenance			56,491	58,010						
Well Abandonment										
	Wellfield		-	-	337,202	-	-	-	-	includes $12000 mobe, escalated
	Monitoring Wells		-	-	-	-	-	-	64,901	includes $12000 mobe, escalated
	Total		-	-	337,202	-	-	-	64,901	
Post Closure Monitoring			-	-	65,875	67,647	69,467	71,336	73,254	
Total Closure Cost by Year of Operation			**1,963,825**	**2,253,851**	**647,320**	**67,647**	**69,467**	**71,336**	**138,155**	**5,211,600**
Indirect Costs										
Insurance, permits, bonds		5.0%	23,117	35,599	20,154	3,382	3,473	3,567	6,908	96,200
Contingency		5.0%	98,191	112,693	32,366	3,382	3,473	3,567	6,908	260,580
Engineering Redesign		2.5%	49,096	56,346	16,183	1,691	1,737	1,783	3,454	130,290
RS Means Main Office Expense		6.8%	133,540	153,262	44,018	4,600	4,724	4,851	9,395	354,389
Project Management Fee		2.5%	49,096	56,346	16,183	1,691	1,737	1,783	3,454	130,290
Subtotal Indirect Costs		21.8%	353,040	414,246	128,904	14,747	15,144	15,551	30,118	971,749
										TOTAL FA Estimate
PROJECT TOTAL BY YEAR			**2,316,864**	**2,668,096**	**776,223**	**82,394**	**84,611**	**86,887**	**168,273**	**6,183,349**