

Sent Via E-mail and U.S. Mail

January 24, 2018

RECEIVED

JAN 24 2018

**DIVISION OF RECLAMATION
MINING AND SAFETY**

Ms. Virginia Brannon
Division Director
Division of Reclamation, Mining & Safety
1313 Sherman Street, Room 215
Denver, CO 80203

Re: Succession of Operators - Schwartzwalder Mine (M-1977-300) Jefferson County,
Colorado

Dear Ms. Brannon:

On behalf of Denver Water I am submitting comments to Colorado Legacy Land, LLC's (CLL) application requesting transfer and succession of operators of the Schwartzwalder Mine, in Jefferson County, Colorado.

Denver Water currently serves drinking water to 1.4 million customers in the City and County of Denver and surrounding suburbs. As discussed in further detail in Denver Water's December 4, 2017 letter concerning CLL's transfer request, Denver Water owns and operates Ralston Reservoir, an on-channel drinking water reservoir located a few miles downstream of Schwartzwalder Mine, and which currently feeds Denver Water's Moffat Treatment Plant. The Moffat Water Treatment Plant is a conventional potable water treatment facility. The Moffat plant, as well as a new plant under design, are able to reduce uranium concentrations from source water, but not without significant cost to Denver Water and its ratepayers. During the treatment process, uranium is concentrated into solids, which becomes more costly to dispose of as uranium concentrations increase. In addition, the plants are not able to remove sulfate or total dissolved solids (TDS). The addition of other chemicals like arsenic and sulfate from the Schwartzwalder Mine will add further capital and operating costs to Denver Water's ratepayers, and will create water quality health risks to our drinking water supply.

As the applicant for a transfer and succession of operators of Schwartzwalder Mine, CLL bears the burden under Hard Rock Rule 1.12.1(3) to demonstrate that it is "is capable of assuming all responsibility for the conditions included under the original permit. . . ." CLL estimates that water treatment operations at Schwartzwalder will cost \$139,636 annually. As part of its cost estimate, CLL makes several significant -- and incorrect -- assumptions, including that:

- the mine pool chemistry will sufficiently stabilize within five years that active treatment (reverse osmosis and ion exchange) will no longer be required;

- the New Water Treatment Plant (NWTP) at the Schwartzwalder Mine, which treats the mine pool water, will only need to be operated 6 months per year;
- in-situ treatment of the mine pool is working; and
- assuming the mine pool stabilizes, within five years CLL will be able to cease active treatment and reduce sampling and monitoring costs from \$77,000 annually to \$38,000 annually.

Denver Water retained Arcadis U.S. Inc. to evaluate CLL's cost estimate. Arcadis concluded that in making the above assumptions, CLL overestimates the performance of the in situ passive treatment and underestimates the cost of water treatment at Schwartzwalder. In developing its cost estimate, Arcadis evaluated water quality data for the Schwartzwalder mine pool, and supplemental information provided by CLL to DRMS in support of its transfer application. In the attached technical memorandum, which provides an independent cost estimate for the annual operation of water treatment at Schwartzwalder, Arcadis advises that:

- Sampling data from the mine pool chemistry show that constituents of concern within the mine pool are increasing, not decreasing, including uranium, arsenic, sulfate, and TDS.
- The cause could be attributed to the discharge of reverse osmosis (RO) concentrate into the mine pool, a practice which CLL plans to continue.
- The mine pool data shows that in situ treatment of the mine pool is not working.
- Based on current trends in the mine pool data, the mine pool is unlikely to stabilize.

As a consequence of these conclusions:

- CLL should plan on operating its treatment system on a year around basis, as opposed to 6 months per year.
- CLL should anticipate increased operational costs at the mine site as a result of operating on a year around basis.
- The annual cost to operate the water treatment system on a year around basis will be \$361,000 (as compared with CLL's estimate of \$139,636). Note that this cost estimate is limited to the treatment system, and does not include the capital costs to replace the water treatment system, nor does it include the cost to perform other reclamation activities proposed by CLL.

For these reasons, Denver Water requests that DRMS:

1. Require that CLL demonstrate that it has the financial capability to operate the treatment system on a year around basis under Arcadis's conclusions, or deny the application if CLL is unable or unwilling to do so;
2. Pursuant to Rule 1.12.1(1) of the Hard Rock/Metal Mining Rules, require a financial warranty of at least \$17.6 million, sufficient to cover annual treatment costs of \$361,000, as well as reclamation costs, mine pool dewatering costs, and future capital

costs for the replacement of the treatment and dewatering system at Schwartzwalder;
and

3. Due to the adverse trends in uranium, arsenic, sulfate, and TDS, order Cotter Corporation to discontinue its practice of discharging RO concentrate into the mine pool, and initiate more appropriate and effective treatment.

Because of the complexity of the Schwartzwalder Mine and its proximity to a significant drinking water supply, it is critical that the operator of the Schwartzwalder Mine have the financial capability to appropriately operate the mine. It is also necessary to have an adequate financial warranty to ensure that the public's water supply is adequately protected.

If you have any questions regarding the contents of this letter, please do not hesitate to contact me.

Sincerely,



James S. Lochhead
CEO/Manager
Denver Water

Attachments: (1) Technical Memorandum from Arcadis, Re: Schwartzwalder Mine Water Treatment Estimate (1/19/2018)

Cc: Cotter Corporation
Colorado Legacy Land, LLC
City of Arvada

Mr. Dan J. Arnold
Attorney
Denver Water
1600 West 12th Avenue
Denver, CO 80204

ARCADIS U.S., Inc.
630 Plaza Drive
Suite 100
Highlands Ranch
Colorado 80129
Tel 720 344 3500
Fax 720 344 3535
www.arcadis-us.com

Subject:

Schwartzwalder Mine Water Treatment Estimate

Dear Mr. Arnold:

This technical memorandum transmits the opinion of Arcadis regarding the cost of future mine dewatering, active treatment, and in situ treatment of the Schwartzwalder Mine by the New Water Treatment Plant (NWTP). Our opinion is limited to the NWTP, and does not address soil removal actions, or decontamination and disposal of site waste materials.

The opinion relies on our review of information provided by Denver Water and the Division of Mining Reclamation and Safety (DRMS), and including review of available information on the Colorado Department of Health and Environment (CDPHE) Environmental Records website (DMRs, correspondence). We have not reviewed design or operational information, nor have we contacted representative of Colorado Legacy Land (CLL). Our role was to develop an independent, conservative cost estimate, based on our experience and professional judgement, for annual operation of the NWTP, under different assumptions than those used by CLL. Unit costs are the same as those presented by CLL to not introduce other cost variables.

The salient difference between the Arcadis Operations and Maintenance (O&M) cost estimate for the Schwartzwalder Mine NWTP and the CLL cost estimate is in the underlying assumptions of each entity used. CLL's cost calculations assume that in-situ treatment is effective at decreasing dissolved concentrations of the constituents of concern, and that by creating reducing conditions in the mine pool, the constituents of concern will be immobilized. Immobilized constituents of concern would allow the passive treatment of the mine pool and the assumed cessation of active treatment after five years.

However, results from the 2017 mine pool chemistry show increasing, *not decreasing*, constituents of concern as shown in the Appendix B figures. This suggests that something is not going according to the CLL plan as demonstrated by the most recent

ENVIRONMENT

Date:

January 19, 2018

Contact:

Stephen Rogers, CWP

Phone:

720.409.1953

Email:

stephen.rogers@arcadis.com

Our ref:

CO002307.0001

mine pool data. For the O&M cost estimate analysis, Arcadis assumed a worst case where in-situ treatment does not immobilize the constituents of concern, and that active treatment will be required year-round for an indefinite period, for at least an additional 20 years. The Arcadis analysis also assumes that annual in-situ treatment chemical applications will be applied to foster reducing conditions in the mine pool.

NWTP active treatment currently consists of two parallel RO systems, one in service and one in standby mode. Ion exchange (IX) polishes the RO permeate (note that Cotter¹ describes the IX process as “necessary to polish the RO effluent to allow Cotter to meet the uranium discharge standard” while CLL² describes the IX process as “redundant” using their assumption of successful in situ treatment). RO concentrate reports to the mine pool, after receiving a barium addition to remove radium. According to the reviewed documents, the RO concentrate is supposed to sink to the bottom of the mine pool without mixing. Arcadis interpreted the 2017 mine pool chemistry (characterized by increased total dissolved solids (TDS) and sulfate) as a consequence of RO concentrate mixing with the mine pool. The recently-measured low radium concentrations in the mine pool could be an indication that barium-treated concentrate is mixing with the mine pool water, instead of settling to the bottom of the pool undisturbed as intended. An alternative interpretation for the recent changes in mine pool chemistry may be the effect of exposing previously wetted surfaces as the mine pool elevation was decreased to below the Steve Adit. The increased sulfate indicates an oxidizing environment in contrast to the presumed reducing conditions resulting from treatment of the mine pool with organic substrates.

Arcadis' assumption is that active treatment will need to take place year-round to maintain a steady state mine pool elevation to avoid the wet/dry cycling that occurs with seasonal operation as proposed, and to prevent intrusion of mine pool water into the shallow alluvial groundwater system that feeds Ralston Creek. The wet/dry cycling can expose and submerge mine rock, resulting in the continual generation of constituents of concern. Given year-round operation, Arcadis assumes complete membrane replacement twice every year for one RO unit, based on the CLL cost table. The replacement costs are budgeted for all forty-eight (48) membranes replaced, every year, for year-round operation.

Arcadis' worst-case scenario also presumes disposal of contaminated process materials (e.g., RO membrane modules, cartridge filters) in a permitted RCRA landfill (Clean Harbor Deer Trail) as contrasted with the CLL experience of recycling spent IX media by Energy Fuels. The RO and filter cartridges would be disposed annually, and

¹ Cotter letter to DRMS, April 25, 2017

² CLL letter to DRMS, November 16, 2017

the (presumably non-regenerable) IX media would be disposed at the end of 20 years (i.e., a one-time cost). Arcadis assumptions are summarized below:

- One (1) RO unit and the IX treatment system will operate continuously for the entire year and one (1) RO unit will remain offline serving as a standby unit. Because the annual average inflow rate is approximately 60 gpm, 6-month operation would require RO operation at twice the average flow, or 120 gpm. The RO design flow of 100 gpm would be insufficient to treat the entire year's inflow volume in half of a year.
- The mine pool water quality will degrade over time as the concentrate is returned to the mine pool. This will require the continuous operation of the RO and ion exchange treatment systems. Data received from Cotter for 2016 – 2017 are provided in Appendix B. These data show increasing constituent concentrations (other than radium) beginning in the spring of 2017. As constituent concentrations increase, so does the driving pressure to drive the RO process. Increased pressure results in increased power demand, and perhaps equipment replacement to achieve increasing feed pressures.
- The replacement of RO membranes will occur twice per year for the operating unit. Alternatively, the standby RO unit could be placed in service every six months, with membrane replacement while an RO is in standby. This is the same assumption as CLL's cost estimate, only applied to a full year of operation, compared to 6 months of operation.
- The IX treatment system will operate continuously, with offsite disposal at the end of treatment to a landfill approved to accept radioactive waste. CLL's response to DRMS notes that the IX system is operated passively, fed by the RO permeate pressure; essentially a zero-operational cost unit process.
- The treatment will continue for a period of twenty (20) years. This includes complete site monitoring costs, as contrasted with the CLL cost estimate that assumes mine pool-only sampling.
- The in-situ treatment of the mine pool is currently ineffective (as demonstrated by 2017 mine pool data) and may remain so over the treatment period. Therefore, we have assumed continued annual organic carbon in-situ injections over the twenty-year period.

The Arcadis O&M cost estimate is presented below in Attachment A. Arcadis used the same unit costs and line items as the CLL cost estimate as presented in the November 11, 2017, correspondence between CLL and DRMS. The difference between the two cost estimates is that CLL assumes active treatment for five years,

¹ Cotter letter to DRMS, April 25, 2017

² CLL letter to DRMS, November 16, 2017

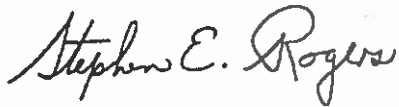
January 19, 2018

after which the RO units will be placed in reserve, followed by 5 years of in situ treatment. The Arcadis estimate assumes complete active treatment for the entire 20-year period, including a full-time operator and complete site sampling requirements.

The Arcadis estimate for the O&M cost of the NWTP is \$361,000 per year.

Sincerely,

Arcadis U.S., Inc.

A handwritten signature in black ink that reads "Stephen E. Rogers". The signature is written in a cursive style with a large, stylized 'S' and 'R'.

Stephen Rogers, CWP

Copies:

Tom Mountfort, Denver Water
David Gomes, Arcadis
Jake Schill, Arcadis
Shannon Ulrich, Arcadis
Phil DeDycker, Arcadis

¹ Cotter letter to DRMS, April 25, 2017

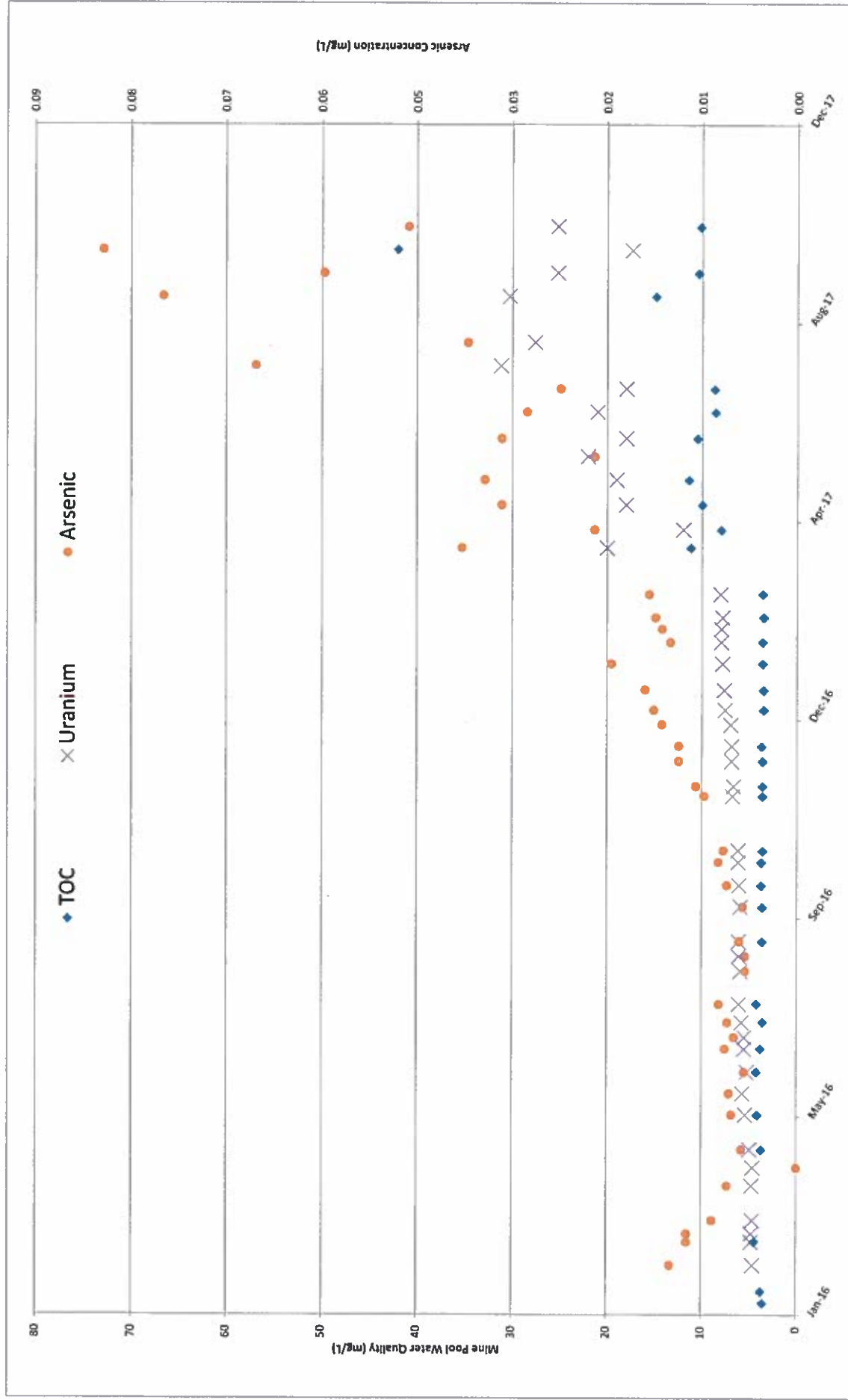
² CLL letter to DRMS, November 16, 2017

Appendix A

Operational Costing Utilities	Quantity	Unit Price (\$)	Total Cost (\$)	Explanation Note	Reference
Electrical, kWh	504,922	\$ 0.12	\$ 60,590.64	Assume year round operation of (1) RO unit	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Propane	1,000	\$ 4.00	\$ 4,000.00	NWTP heating	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Chemical					
Organic Carbon	1,972	\$ 1.50	\$ 2,958.00	Quarterly per DRMS	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Sodium Hydroxide	6	\$ 750.00	\$ 4,500.00	CIP only, does not include influent water treatment	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Hydrochloric Acid	6	\$ 750.00	\$ 4,500.00	CIP only, does not include influent water treatment	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Citric Acid	18	\$ 50.00	\$ 900.00	CIP only, does not include influent water treatment	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Barium Chloride	60	\$ 89.00	\$ 5,340.00	Concentrate treatment	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Anti-Scaleant	3	\$ 7,700.00	\$ 23,100.00	RO feed	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Purchase and Disposal					
RO Membranes	48	\$ 495.00	\$ 23,760.00	Purchase and installation	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Cartridge Filters	144	\$ 12.00	\$ 1,728.00	Purchase and installation	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Radioactive Waste Disposal	1	\$ 2,400.00	\$ 2,400.00	Radioactive wastes disposal in permitted landfill annually	Quote received from Deer Trail Landfill Facility Response 5 from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) differs from Arcadis assumption
Sampling					
Compliance Sampling	1	\$ 77,064.00	\$ 77,064.00	Assumes year round operation	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Response 6
Maintenance & Labor					
Operator	1	\$ 81,000.00	\$ 81,000.00	Assumes full time operator and year round operation of the water treatment plant	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Plant Maintenance	1	\$ 17,182.00	\$ 17,182.00	Assume year round operation of (1) RO unit. Includes RO maintenance, electrical, and mechanical maintenance.	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
3rd Party Support	1	\$ 22,080.00	\$ 22,080.00	RO, software, electrical, and mechanical	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
RO System Standby	12	\$ 2,500.00	\$ 30,000.00	Assume (1) RO unit in standby year round	Amount taken from CLL Response to DRMS Request for Additional Information (SO01) Schwartzwalder Mine (M-1977-300) 11-07-17, Cost estimate included as attachment
Total Annual Operational Cost (\$)			\$		361,102.64

Assumptions:
-Cost Estimate was developed in 2017 US dollars.

Appendix B-1



Appendix B-2

