6.4.7 Exhibit G - Water Information

(1) The operation will affect groundwater systems, however through execution of the temporary substitute water supply plan, there will not be a net change to tributary groundwater flow to Boulder Creek.

(2) (a) Surface water structures are shown in Exhibit C Pre-Mining Plan Map

(b) The sand and gravel deposit to be mined is an alluvial aquifer tributary to Boulder Creek.

(c) Water from dewatering operations is routed to sediment pond to allow for settling of suspended sediment. A stormwater management plan has been prepared for the site which identifies BMP's to prevent pollution to surface waters due to stormwater runoff.

(3) Under full operation, the project will consume approximately 20 acre-ft / year due to evaporative loss of exposed groundwater in dewatering trenches, water lost within the mined product and water consumed for dust control.

(4) The replacement source for all depletions to Boulder Creek is fully consumable water rights owned by the City of Lafayette.

(5) The applicant has applied for and received a NPDES Stormwater Discharge Permit. The permit number is COG501535

The groundwater Monitoring and Mitigation plan has been revised as follows;

Step 1 - Establish Monitoring Well Grid and Baseline Ground Water Elevations

CTL Thompson, Inc. had supervised the installation of 7 piezometers (4 up gradient and 3 down gradient from the proposed mining operations) within the City of Lafayette property surrounding the proposed mining operations. Piezometers 1 through 3 have been in service for several years and piezometers 4 through 7 were installed on July 1,9 and 16, 2009. The piezometers are at the locations shown on Exhibit C Pre-Mine Plan Map and the drill logs are given in Exhibit G Attachment A. Water level measurements were made at the time of drilling and several days after drilling. Since that time the City of Lafayette has continued monitoring of the piezometers. The measurements are attached as an appendix. From these measurements, we have established the following seasonal baseline ground water elevations;

	Winter Baseline December 31	Spring Baseline March 31	Summer Baseline June 30	Fall Baseline September 31
Piezometer	Water Elevation	Water Elevation	Water Elevation	Water Elevation
1	5037.9	5036.4	5039.3	5038.8
2	5036.2	5035.9	5036.7	5036.3
3	5030.4	5030.3	5033.7	5031.7
4	5062.6	5062.6	5064.8	5064.1
5	5060.7	5060.7	5061.9	5061.3
6	5044.2	5043.3	5045.9	5045.8
7	5039.1	5039.0	5041.5	5041.4

Ground water elevations will continue to be measured at the established piezometers quarterly starting at the time of permit approval from the DRMS. This will further confirm seasonal water surface elevations for the site prior to mining. In addition, just prior to beginning Compacted Clay and drain installation, an additional measurement at each well will be completed. Measurements will be provided to the RMS as part of an annual report.

Step 1A - Establish Monitoring Well Grid and Baseline Ground Water Elevations

Cell 2A

Due to excavation and dewatering of Cell 2A prior to measuring baseline groundwater elevations along the southwest and western boundaries, a groundwater model was developed (Goose Haven Reservoir Expansion Groundwater Modeling Report December 2023 (GWM)). Piezometers P-11, P-12 and P-13 were installed in June of 2023 and will provide post reclamation water level measurements for comparison with the GWM predicted Pre-Mining water levels. The GWM predicted pre-mining water levels at those piezometer locations are P-11 = 5078ft, P-12 = 5066ft and P-13 = 5049ft.

Step 2 - Monitoring

Following compacted Clay Liner and drain installation and through mining, piezometers (P1-P7 and P11-P13) will continue to be measured quarterly with measurements provided to the DRMS as part of the annual report.

Step 3 - Mitigation Triggers

A ground water modeling study was prepared by CTL Thompson in Sept 2010 for the proposed operation to include estimated effects as a result of Groundwater Barrier and drain installation. The anticipated effects modeled at the locations of the proposed piezometers are as follow:

Piezometer	Predicted Change in Water Elevation (Feet)
1	0
2	-0.5
3	0
4	0
5	0
6	3.0
7	0

As can be seen the highest anticipated change occurs in piezometer 6 in the south east corner of the proposed mining operation and most near the Swartz residence. Despite this change, the ground water surface is anticipated to stay well below (approximately 11 feet) the basement floor elevation of the home following drain and Compacted Clay Liner construction.

If a change in groundwater elevation greater than two feet beyond the seasonal baseline plus the anticipated (modeled) change in ground water elevations occurs, then an intermediate second measurement will be taken 45 days after the initial reading. If the reading is still outside the mitigation trigger and an impact is imminent (i.e. a flooded basement or field), mitigation will be performed.

Step 3A - Mitigation Triggers Cell 2A

The post-mining GWM water level simulation, when compared to the pre-mining scenario predicts the following deltas southwest and west of Cell 2A; P-11 = -0.5ft, P-12 = 0.27ft and P-13= -1.78ft. Post-mining water level measurements which will trigger additional groundwater mitigation are therefore defined as a delta for no more than +2ft as compared to the pre-mining GWM simulated water levels. Specifically, P-11 post-reclamation water levels shall not exceed 5080ft, P-12 post-reclamation water levels shall not exceed 5068ft and P-13 post-reclamation water levels shall not exceed 5061ft.

Step 4 - Mitigation Alternatives

Mitigations to a raised or lowered water table will be completed by the City under the following conditions.

1. Monitoring data demonstrates that a change in ground water surface elevation has occurred beyond that anticipated through Compacted Clay Liner and drain installation and as a result of seasonal variation.
2. The change in ground water elevation has caused an impact to adjacent water supply, an impact is imminent, or has caused an impact to basement or field as a result of high groundwater elevation.

Lowering of water table

If mitigation from a lowered water table is required, one of the two following actions will be completed by the City.

1. Alternative 1 - The City will provide the well owner with water, until the water level returns to normal.
2. Alternative 2 - The City will drill the affected party's well deeper to restore well production to pre project conditions.

Raising of Water Table

If mitigation to lower the water table is required, one of the two following actions will be completed by the City.

1. Alternative 1 - A well and pump will be installed and operated to locally reduce the water elevations in the aquifer.
2. Alternative 2 - An additional subsurface drain may be installed to reduce the water surface elevations in the vicinity of the impacted structure or field.

Step 4A - Mitigation Cell 2A

Should the post-reclamation water levels exceed those values given in Step 3A above, then a Technical Revision will be filed with the DRMS to include the design and engineering of additional perimeter underdrain to be installed along the western boundary of Cell 2A.

Commitment

Operator shall commit to the mitigation measures above regardless of whether the mitigation triggers are the result of installing a clay liner on Reservoir #2 or Reservoir #4

Cell 2A South Underdrain Design

As specified in Exhibits E and F, Cell 2A will construct a compacted clay embankment around the perimeter of the reservoir. For the purpose of mitigating potential groundwater mounding up-gradient of the reservoir. The Cell 2A underdrain was designed as follows:

Since the only historical onsite water table data in the vicinity of Cell 2A includes elevation data form piezometers P4 and P5, regional water table elevation contours published by the USGS Front Range Infrastructure Resources Project (FRIRP) Fact Sheet 113-98, were used to determine baseline upgradient and westerly water table information. This was done by developing a 3 dimensional surface of the USGS data, then lowering it by a uniform value to correspond with the Goose Haven site datum. The 3d surface water table surface from onsite data was then merged with the USGS data to yield an approximate overall water table contour map which is shown in Exhibit G Sheet 1. An analytical solution to groundwater flow based on Darcy's law was then used to determine the volumetric flow requirement of the drain. Given a conservative assumption that that groundwater mounding could saturate the full vertical extent of the soil profile above the historical water table, the calculation is as follows;

Darcy's Law ; Q=(K*dh/dl)*A

where;

Q= volumetric flow

K= saturated hydraulic conductivity = 28 ft/day (from NRCS web soil survey)

dh/dl = hydraulic gradient = .02 (from Exhibit G – Sheet-1)

A= Cross sectional area = 2300 ft x 4ft= 9,200 ft^2

Therefore Q= 28 ft/day x .02 x 9,200 ft^2 = 5,152 ft^3 /day = **0.06 c.f.s.**

The underdrain alignment extends for 30+95.34 ft of which 2,300 ft are perforated pipe and

Exhibit G, Attachment A gives the modeled flow capacity for 2300 ft of perforated section and 795.34 ft of solid pipe. Both sections are calculated to exceed the design flow of 0.06 c.f.s.

The end of the underdrain alignment ties into an existing 8" pipe which daylights into the lower Boulder Ditch. This existing pipeline to Lower Boulder Ditch was historically used to drain the agricultural fields occupied now by Cell 2A.

Underdrain Construction

The underdrain was constructed by excavating a trench to the elevations shown in **Exhibit G Cell 2A Underdrain Plan & Profile Sheets 2-7**. For the first 2,300 ft, 6” SDR-22 PVC pipe was perforated with 2 tows of 3/8” holes spaced 1 ft apart. The pipe was backfilled with 6” of d50 = 1” rock surrounded with mirifi geotextile fabric surrounded by 6” of sand to create a filter pack. The remaining trench solid 795.34 ft section was bedded with 6” of sand. The entire trench was then backfilled with native silty sand (ML).