TECHNICAL MEMORANDUM

Date:	5/4/17	**Project No.:**	1655230-01
To:	Erika Guerra	**Company:**	Lehigh Southwest Cement Company
From:	George Wegmann, PG Bill Fowler, PG, CEG		
c:	Sean Hungerford	**Email:**	Erika.Guerra@LehighHanson.com
RE:	EMSA Storm Water Runoff Evaluation Update, Lehigh Permanente Facility		

1.0 INTRODUCTION

Golder Associates (Golder) has prepared this update to summarize activities completed since July 2016 at the East Material Storage Area (EMSA) of Lehigh Southwest Cement Company's Permanente facility located at 24001 Stevens Creek Boulevard, Santa Clara County, and to provide recommendations for additional measures that can be completed in the near-term to continue to reduce selenium in the Pond 30 discharge.

The EMSA is an approximately 54-acre overburden storage area in the northeast portion of the quarry. Storm water runoff within the EMSA is directed to a series of swales, ditches, berms and intermediate ponds before reporting to Pond 30, a detention basin located at the base of the EMSA, which ultimately discharges to Permanente Creek. Overburden storage ceased in the EMSA in approximately 2014. In 2015, Lehigh partially completed reclamation in the EMSA by installing a non-limestone layer of material over disturbed areas in the EMSA.

In March 2016, Lehigh commenced an expanded water sampling program in the EMSA to identify the causes for elevated selenium in Pond 30 water. Golder collected runoff and seepage samples from numerous locations during storm events in March/April 2016. Golder repeated the sampling process in March/April 2017, and added new sampling points. The results have led Golder to recommend the construction of various improvements, described below. Golder is also in the process of developing a water balance predictive model to further evaluate system-wide flows under various operating and climatic scenarios. The results of this work will be used to assess long-term facility improvements, including water management at the EMSA.

Golder's evaluation of the effectiveness of activities to date is that Lehigh's recent improvements, and mainly the installation of the water interceptor drain, have reduced the volume of water containing elevated selenium that has entering Pond 30 and the adjacent drainage swale. Golder recommends further increasing the withdrawal rate from the interceptor drain, and completing the pond/swale lining project (once

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sensitive species concerns have been abated). The details associated with these recommended actions are set forth below.

2.0 CONSTRUCTION IMPROVEMENTS

2.1 Interceptor Drain

Sample analysis performed by Golder in March/April 2016 (described further below) indicated that some storm water runoff was infiltrating into the EMSA non-limestone cover and overburden, and emerging as seeps characterized by elevated levels of selenium. Accordingly, in consultation with Santa Clara County, Lehigh constructed an interceptor drain along a west-east alignment between the EMSA toe and the Pond 30 drainage channel (swale) to intercept the seepage emerging along the Pond 30 bench from the toe of the slope, and to prevent this water from entering Pond 30. The drain is backfilled with coarse material and is in the form of a trench that is approximately 350 feet long, on average 3 feet wide, and 5-6 feet deep. Lehigh installed a vertical riser with a submersible pump and float valve to facilitate management of the seepage water collected in the drain.

From the drain, the water is pumped to a 5,000 gallon holding tank. Lehigh then transfers the water from the holding tank to the cement plant reclaim water system by emptying the tank with a water truck. In the current configuration, the drain submersible pump has a pumping rate of approximately 60 gallons per minute (gpm). The pump is shut down when the holding tank is full so the maximum production rate from the trench is currently undefined. The drain was placed in service in February 2017; approximately 164,000 gallons and 324,000 gallons were removed from the drain in February and March, respectively. The interceptor drain and associated pump system became operational on February 8, 2017, later than originally scheduled due to delays from the presence of California red-legged frog (CRLF) in Pond 30.

2.2 Management of Storm Water Run-on

Lehigh made improvements during the 2015/2016 wet season to divert storm water run-on from upgradient facility areas outside of the EMSA boundary from entering the EMSA drainage area. Lehigh installed a catch basin and pipeline to intercept storm water from along the main access road at the upgradient boundary of the EMSA. The intercepted water is then diverted to Pond 11 of the reclaim water system to help minimize run-on into the EMSA drainage. During the current wet season, Lehigh reviewed and inspected the diversion to ensure it is functioning as intended.

2.3 Pond 30 and Swale Improvements

Lehigh planned to complete the lining of Pond 30 and the drainage swale directly upgradient of Pond 30 prior to the start of the 2016/2017 wet season to allow for the effective conveyance of storm water and further control seepage. The work was delayed due to the presence of the CRLF in Pond 30. Lehigh has requested the necessary permits from federal wildlife officials to relocate the CRLF to a newly established

habitat. Once approval is obtained and the area is clear of the CRLF, Lehigh will complete the lining project. Additionally, the presence of the CRLF prevented Lehigh from performing maintenance activities of Pond 30. Therefore, sediment and accumulated water were not removed from Pond 30 in between rain events.

3.0 EMSA SAMPLING AND EVALUATION

In March/April 2016 and March/April 2017, Golder collected samples from up to 19 different locations on the EMSA non-limestone cover and three locations along the Pond 30 swale. The 2017 rounds also included sampling from the seepage collected in the interceptor drain. Sample locations in 2017 targeted the locations sampled in 2016, as well as any new areas noted during field activities. All of the sample locations are shown on Figure 1. The final growth-medium and vegetative layer that is the next stage in the reclamation process has not been placed to date and therefore, the samples are from the non-limestone cover material.

3.1 Sampling Procedure

Under the direction of a California Professional Geologist, Golder field staff collected a total of 81 surface water samples on field dates from March 2016 to the present that coincided with significant rainfall events. Of these, 33 samples were collected in March and April 2017 (daily precipitation totals for the current wet season are listed on Table 1).

During the rain events, Golder inspected the EMSA for runoff and/or sheet flow to target these areas for sampling. Rainfall appeared to readily infiltrate the EMSA material in locations where no significant runoff or sheet flow was observed by field staff during the storm events. For the majority of the sample locations, samples were collected of water that accumulated on the cover material. Samples were also collected at several locations where water appeared to be emanating as seeps from the toe of the EMSA slopes. The type of sample is noted on Table 2.

Samples were collected in accordance with Golder's Standard Operating Procedures and transported to a certified analytical laboratory in a chilled cooler under chain of custody documentation. A dedicated plastic scoop was used to collect water samples. Golder then transferred the samples to laboratory supplied sample bottles preserved with nitric acid. The laboratory analyzed the samples for total selenium via EPA Method 200.8. Golder also measured pH and turbidity in the field.

3.2 Sampling Results

The results of the sampling events are included on Table 2 and illustrated on Figure 1. Photographs of new sampling locations are included in Attachment A. Consistently low levels of selenium below 5 µg/L were detected in samples of water that accumulated on the cover material, considered representative of direct surface runoff, consistent with the findings from last year. Two samples, EC-15 and EC-27, were collected along the toe of the upper EMSA fill slope, but above the main EMSA haul road (Figure 1). These samples

are considered more representative of seeps emanating from the toe of the slopes than direct runoff of the cover material. The EC-15 results were 2.9 µg/L and 7.9 µg/L; last year the EC-15 results ranged from 6.8 µg/L to 27 µg/L. The EC-27 results ranged from 0.88 µg/L to 2.9 µg/L for this year. While EC-27 was only sampled this year, the results are similar to sample locations from last year that were collected in the same general area. No seepage was observed by EC-13 and EC-16 during this year's sampling events; therefore, no samples were collected.

The maximum concentrations noted this year were from the interceptor drain samples (P-30 Tank). The current P-30 Swale East and West results, ranging from 5.5 µg/L to 27 µg/L, were significantly less than the results from the 2015/2016 wet season. P-30 Swale East and West locations are along the drainage swale that conveys storm water from the main drainage to Pond 30 and are directly downgradient of the interceptor drain. Consistent with the 2015/2016 wet season, the most upgradient swale sample location (P-30 Swale Entry) had the lowest detection of selenium of the three swale sample locations. This suggests that higher selenium containing water is still entering the drainage swale downgradient of the P-30 Swale Entry location, closer to the vicinity of the P-30 Swale West and East sample locations.

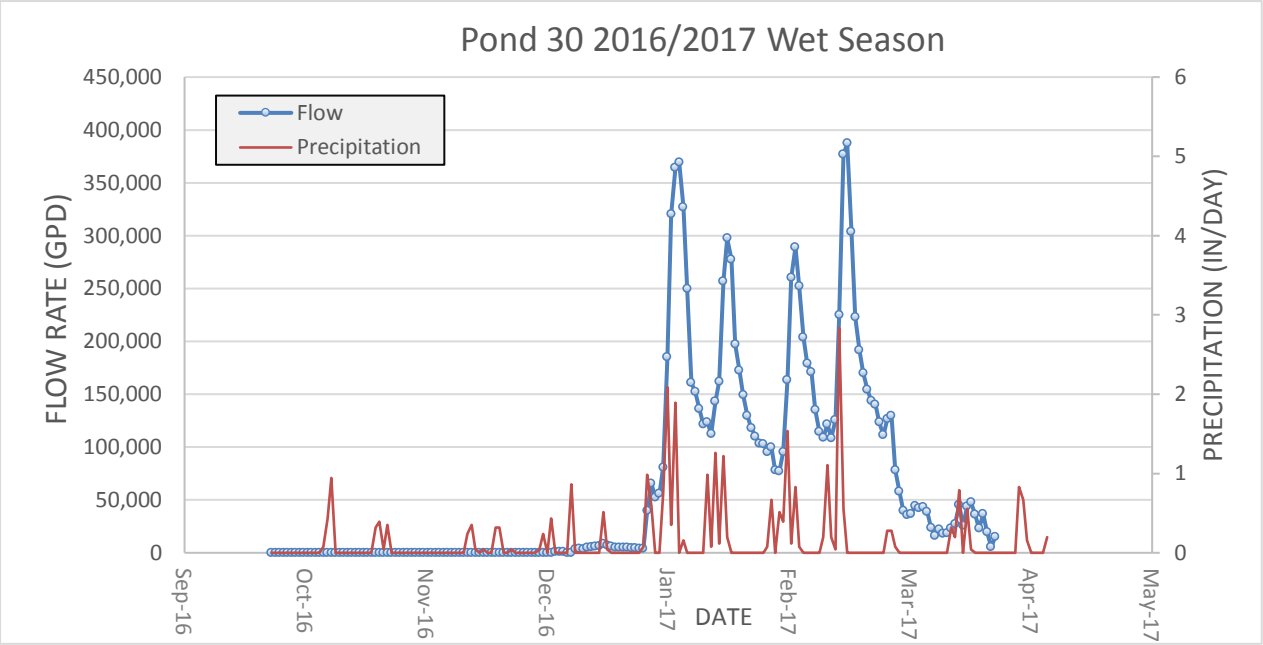
Below are the selenium results for the interceptor drain and from the Pond 30 discharge for samples collected within the same timeframe:

- Interceptor Drain (P-30 Tank): 74 µg/L (3/2/17), 46 µg/L (3/15/17), 43 µg/L (3/21/17), 41 µg/L (3/24/17), 30 µg/L (4/7/17)
- Pond 30 Discharge: 27.7 µg/L (3/6/17), 28.3 µg/L (3/29/17)

The selenium concentrations detected in the drain seepage water are consistently greater than the Pond 30 discharge water results. The data indicates that Pond 30 discharge water is a combination of storm water runoff that enters the drainage swale and any additional water that is not being captured by the Interceptor drain and seeps into the drainage swale.

3.3 Flow Rates

The total flow from Pond 30 for the 2016/2017 wet season up to March 30, 2017 was 11.6 million gallons with a maximum daily total of 390,000 gallons per day (gpd) and a maximum 7-day average of 280,000 gpd. Based on precipitation data at the Santa Clara Valley Water District (SCVWD) monitoring station located in the vicinity of the site (Maryknoll Fields), a total of 28.4 inches of rain has been recorded for the current wet season up to March 30, 2017. The following graph summarizes the flow and precipitation data.



The previous year, the total flow from Pond 30 was 6.9 MG with a maximum daily total of 550,000 gallons per day (gpd) and a maximum 7-day average of 430,000 gpd. A total of 18.3 inches of precipitation was recorded at the Maryknoll Fields station for 2015/2016 wet season.

4.0 SUMMARY AND RECOMMENDATIONS

Low levels of selenium below 5 µg/L were detected in the majority of the samples collected from ponding or limited runoff on or directly from the cover, which is consistent with the 2015/2016 wet season data. Results from the EMSA monitoring program suggest that elevated selenium concentrations are confined to specific areas along the bases of certain slopes that emerge as seepage. It appears the newly constructed interceptor drain has been effective in decreasing selenium concentrations in the drainage swale and Pond 30, as shown in downward-trending selenium levels at samples taken from the swale combined with elevated levels found in water intercepted in the interceptor drain. Recommendations for additional actions to consider to further reduce selenium concentrations in the Pond 30 discharge, with an emphasis on measures that can be accomplished during the next year, are presented below.

4.1 Line Pond 30 and Pond 30 Drainage Swale

As noted previously, Golder recommends lining Pond 30 and the drainage swale directly upgradient of Pond 30 to allow for the effective conveyance of storm water and further reduce the amount of seepage into the swale and pond. The work was delayed because of the discovery of the CRLF in Pond 30. Lehigh is in the process of obtaining necessary permits to relocate the CRLF to a newly established off-site habitat.

Once the permits have been procured, Lehigh will complete the lining project. The liner will consist of a geomembrane or concrete liner to: (1) reduce the seepage in and out of the pond and the drainage swale, and (2) to facilitate the maintenance and removal of sediments that accumulate within the pond throughout the wet season. Routine sediment removal will help reduce the residence time that water stored within Pond 30 is in contact with potentially selenium-containing sediments. The specific type of liner will be evaluated further by Lehigh prior to implementation. One potential option consists of a geomembrane-lined swale and pond combined with a concrete access ramp and sump in the pond to facilitate sediment removal.

4.2 Management of Pond 30 Water

Golder recommends that Lehigh remove sediment and water that accumulates in Pond 30 between rain events, when feasible based on weather conditions and breaks between anticipated storm systems. This will reduce the residence time that water remains in contact with potentially selenium-containing sediment. The method of removal would depend on the quality of water present in Pond 30. Where representative sampling demonstrates that water is acceptable for discharge to Permanente Creek, water in the pond could be pumped out via the discharge pipe through outfall 006. Where sampling reveals water quality that is not acceptable for discharge to Permanente Creek, water will be transferred to the cement plant reclaim water system.

4.3 Interceptor Drain Operation and Performance Enhancement

The current interceptor drain appears to be functioning as designed and is capturing seepage between the toe of the slope and the Pond 30 swale area. Golder suggests making the following additional improvements to increase the efficiency of the interceptor drain and the amount of water that is captured:

- Extend the interceptor drain further to the north of Pond 30 by approximately 100 feet. This will allow for the collection of seepage that may be emerging from this area and contributing to elevated selenium levels in Pond 30.
- Enhance the withdrawal rate of the interceptor drain by installing a second pump in the drain capable of a 60 gpm pumping rate, a pipeline from the holding tank to the cement plant reclaim water system, and a transfer pump to directly convey the water in the holding tank to the cement plant reclaim water system. We recommend the new conveyance system has a minimum transfer rate of 120 gpm, which is equivalent to the anticipated maximum withdrawal rate from the enhanced drain. The increased capacity will allow for the optimization of the drain operation and provide additional data to evaluate its effectiveness during the 2017/2018 wet season.

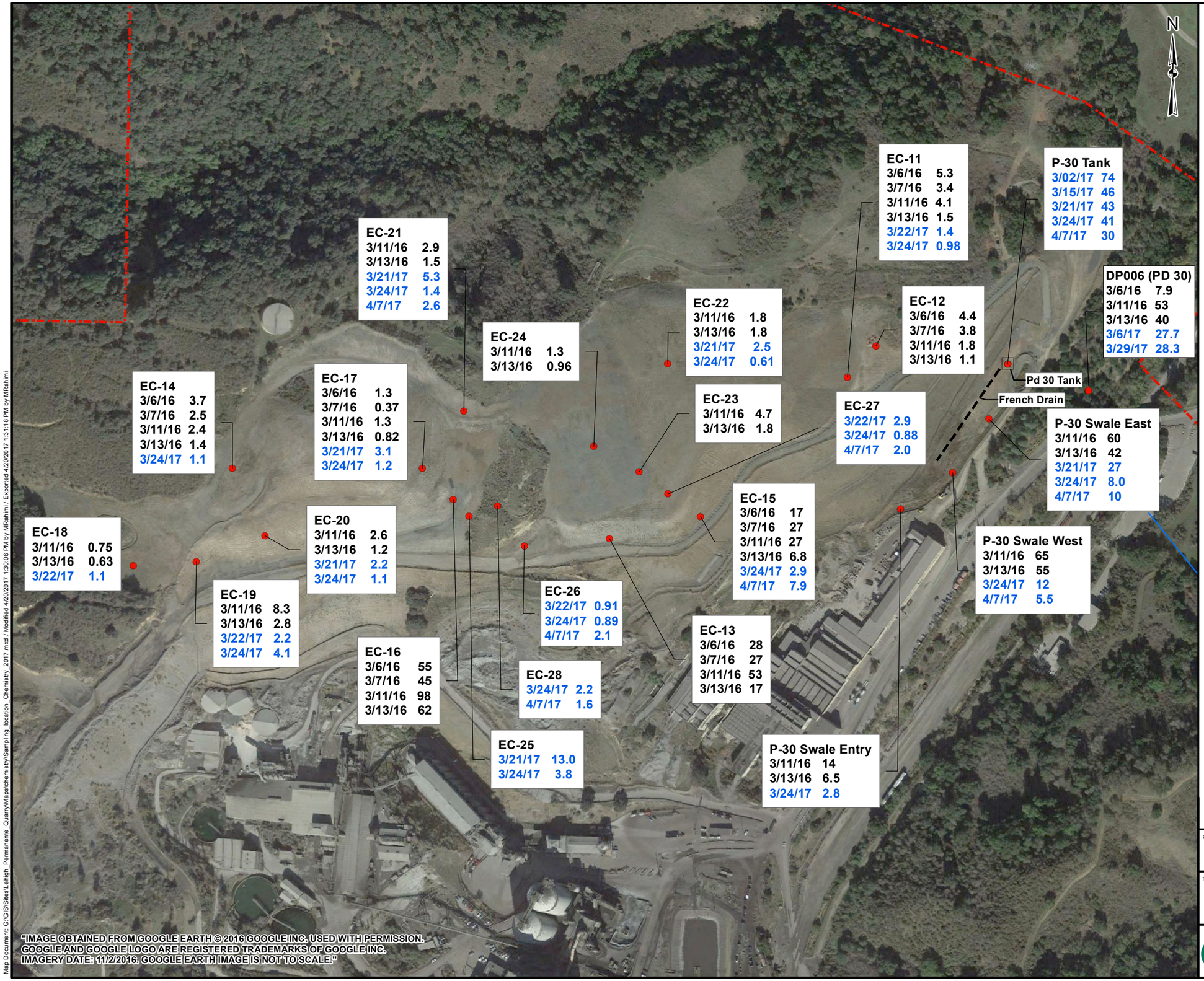
4.4 Monitoring

Golder recommends performing monitoring during the 2017/2018 wet season to demonstrate the effectiveness of the additional improvements outlined above. The monitoring program should focus on water quality of seeps and storm water runoff along the main drainage conveyance system and to further determine the current interceptor drain collection capacity and effectiveness.

Attachments:

Figure 1 – EMSA Selenium Concentrations
Table 1 – Precipitation Data
Table 2 – EMSA Selenium Results
Attachment A – EMSA Sampling Location Field Photos

FIGURES



LEGEND

- Sampling Locations
- Date Selenium(ug/L)
- Property Boundary

REFERENCES

1) USGS 1/9th Arc NED DEM based off of 2006 LIDAR Survey
2) Service Layer Credits:
3) Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet
4) Former Ridgecrest created from 1952 Cupertino and 1955 Mindego Hills Quadrangle USGS Topographic Maps.

300 0 300 Feet

1 in = 300 feet

PROJECT

LEHIGH PERMANENTE FACILITY
SANTA CLARA COUNTY, CA

TITLE

EMSA SELENIUM CONCENTRATIONS

Golder Associates

PROJECT No.	063-7109-914	FILE No.	mpling_location_Chemistry_2017.mxd
DESIGN	MM 4/2/2013	SCALE: 1:3,700	REV. 0
GIS	MR 4/20/2017		
CHECK	GW 4/20/2017		
REVIEW	GW 4/20/2017		

FIGURE 1

Map Document: G:\GIS\Sites\Lehigh_Permanente_Quarry\Maps\chemistry\Sampling_location_Chemistry_2017.mxd / Modified 4/20/2017 1:30:06 PM by MRahimi / Exported 4/20/2017 1:31:18 PM by MRahimi

TABLES

Table 1 Precipitation Record
Lehigh Permanente Facility
May 2017

Date	Prec (in)	Date	Prec (in)	Date	Prec (in)	Date	Prec (in)
12/1/2016	0.0	1/1/2017	0.0	2/1/2017	0.0	3/1/2017	0.0
12/2/2016	0.0	1/2/2017	0.1	2/2/2017	0.1	3/2/2017	0.0
12/3/2016	0.0	1/3/2017	1.0	2/3/2017	0.7	3/3/2017	0.0
12/4/2016	0.0	1/4/2017	0.6	2/4/2017	0.0	3/4/2017	0.3
12/5/2016	0.0	1/5/2017	0.0	2/5/2017	0.5	3/5/2017	0.3
12/6/2016	0.0	1/6/2017	0.0	2/6/2017	0.4	3/6/2017	0.1
12/7/2016	0.0	1/7/2017	0.7	2/7/2017	1.5	3/7/2017	0.0
12/8/2016	0.2	1/8/2017	2.1	2/8/2017	0.1	3/8/2017	0.0
12/9/2016	0.0	1/9/2017	0.4	2/9/2017	0.8	3/9/2017	0.0
12/10/2016	0.4	1/10/2017	1.9	2/10/2017	0.1	3/10/2017	0.0
12/11/2016	0.0	1/11/2017	0.0	2/11/2017	0.0	3/11/2017	0.0
12/12/2016	0.0	1/12/2017	0.2	2/12/2017	0.0	3/12/2017	0.0
12/13/2016	0.0	1/13/2017	0.0	2/13/2017	0.0	3/13/2017	0.0
12/14/2016	0.0	1/14/2017	0.0	2/14/2017	0.0	3/14/2017	0.0
12/15/2016	0.9	1/15/2017	0.0	2/15/2017	0.0	3/15/2017	0.0
12/16/2016	0.0	1/16/2017	0.0	2/16/2017	0.2	3/16/2017	0.0
12/17/2016	0.0	1/17/2017	0.0	2/17/2017	1.1	3/17/2017	0.0
12/18/2016	0.0	1/18/2017	1.0	2/18/2017	0.2	3/18/2017	0.0
12/19/2016	0.0	1/19/2017	0.1	2/19/2017	0.0	3/19/2017	0.0
12/20/2016	0.0	1/20/2017	1.3	2/20/2017	2.8	3/20/2017	0.3
12/21/2016	0.0	1/21/2017	0.1	2/21/2017	0.6	3/21/2017	0.2
12/22/2016	0.0	1/22/2017	1.2	2/22/2017	0.0	3/22/2017	0.8
12/23/2016	0.5	1/23/2017	0.2	2/23/2017	0.0	3/23/2017	0.0
12/24/2016	0.0	1/24/2017	0.0	2/24/2017	0.0	3/24/2017	0.6
12/25/2016	0.0	1/25/2017	0.0	2/25/2017	0.0	3/25/2017	0.0
12/26/2016	0.0	1/26/2017	0.0	2/26/2017	0.0	3/26/2017	0.0
12/27/2016	0.0	1/27/2017	0.0	2/27/2017	0.0	3/27/2017	0.0
12/28/2016	0.0	1/28/2017	0.0	2/28/2017	0.0	3/28/2017	0.0
12/29/2016	0.0	1/29/2017	0.0			3/29/2017	0.0
12/30/2016	0.0	1/30/2017	0.0			3/30/2017	0.0
12/31/2016	0.0	1/31/2017	0.0			3/31/2017	0.0

Data is from SCVWD Maryknoll Fields Station (6144), http://alert.valleywater.org
No precipitation from 10/1/16 through 11/30/16

Table 2
EMSA Selenium Results
Lehigh Permanente Facility
May 2017

Sample Location	Date	Sample Type	Selenium ug/L	pH	Turbidity NTU	Notes
EC-11	3/22/2017	Cover	1.4 J	7.73	6.78	
EC-11	3/24/2017	Cover	0.98 J	7.33	2.42	
EC-14	3/24/2017	Cover	1.1 J	8.41	15.9	
EC-15	3/24/2017	Seep	2.9	7.76	106.8	limited flow
EC-15	4/7/2017	Seep	7.9	NM	NM	less than 1 gpm
EC-17	3/21/2017	Cover	3.1	9.26	2.56	
EC-17	3/24/2017	Cover	1.2 J	8.38	6.79	
EC-18	3/22/2017	Cover	1.1	7.94	2.55	limited flow
EC-19	3/22/2017	Cover	2.2	7.97	3.27	
EC-19	3/24/2017	Cover	4.1	8.56	12.2	
EC-20	3/21/2017	Cover	2.2	8.04	5.95	
EC-20	3/24/2017	Cover	1.1 J	8.37	1.93	
EC-21	3/21/2017	Cover	5.3	8.92	2.1	
EC-21	3/24/2017	Cover	1.4	8.02	1.06	
EC-21	4/7/2017	Cover	2.6	8.20	3.19	
EC-22	3/21/2017	Cover	2.5	8.29	15.4	
EC-22	3/24/2017	Cover	0.61 J	7.82	1.54	
EC-25	3/21/2017	Cover	13	8.56	204	
EC-25	3/24/2017	Cover	3.8	8.13	33.0	
EC-26	3/22/2017	Cover	0.91 J	8.14	53.4	runoff from above
EC-26	3/24/2017	Cover	0.89	7.73	93.3	runoff from above
EC-26	4/7/2017	Cover	2.1	8.24	8.09	runoff from above
EC-27	3/22/2017	Cover	2.9	8.00	16.7	
EC-27	3/24/2017	Seep	0.88 J	7.76	6.40	less than 1 gpm
EC-27	4/7/2017	Seep	2.0	7.94	4.06	less than 1 gpm
EC-28	3/24/2017	Cover	2.2	8.13	5.81	
EC-28	4/7/2017	Cover	1.6	8.22	11.6	
P-30 Swale East	3/21/2017	Seep/Runoff	27	7.18	8.92	limited flow
P-30 Swale East	3/24/2017	Seep/Runoff	8.0	7.54	12.6	limited flow
P-30 Swale East	4/7/2017	Seep/Runoff	10	7.52	1.41	standing water
P-30 Swale West	3/24/2017	Seep/Runoff	12	7.80	6.31	low flow
P-30 Swale West	4/7/2017	Seep/Runoff	5.5	7.49	0.89	standing water
P-30 Swale Entry	3/24/2017	Seep/Runoff	2.8	8.04	3.84	low flow
P-30 Tank	3/2/2017	Seep	74	--	--	from tank
P-30 Tank	3/15/2017	Seep	46	--	--	from tank
P-30 Tank	3/21/2017	Seep	43	7.18	8.90	from tank
P-30 Tank	3/24/2017	Seep	41	7.30	1.22	from tank
P-30 Tank	4/7/2017	Seep	30	7.53	2.58	from tank
DP006 (P-30)	3/6/2016	Discharge	7.9	--	--	
DP006 (P-30)	3/11/2016	Discharge	53	--	--	
DP006 (P-30)	3/13/2016	Discharge	40	--	--	
DP006 (P-30)	3/6/2017	Discharge	27.7	7.86	37.90	
DP006 (P-30)	3/29/2017	Discharge	28.3	7.87	2.30	

Notes:
J = estimated value below laboratory reporting limit

ATTACHMENT A

PHOTO A1: EC-25

PHOTO A2: EC-26

PHOTO A3: EC-27

PHOTO A4: EC-28