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MEMORANDUM

April 18, 2017

To: Debbie Haldeman, CEMEX

Cc: Pat Mitchell, Mitchell Chadwick
            Yasha Saber, Compass Land Group
            Karen Spinardi, Spinardi Associates

From: Andy Kopania

Subject: Runoff from East Rim Access and Upper Quarry Haul Roads
            CEMEX Clayton Quarry

At your direction, I have prepared an evaluation of the potential runoff from the East Rim Access Road that will exist along the crest of the east rim of the excavation after mining is completed at the Clayton Quarry and the upper part of the Quarry Haul Road where it is located on the Knoxville Formation.   The location of the East Rim Access Road and the Quarry Haul Road is shown Sheet Number 4 of the Reclamation Plan Amendment application.   Roadway details are shown on Sheet Number 11.   The general parameters for both road segments are comparable.   Therefore, an analysis of the East Rim Access Road was conducted and the findings were then applied to the upper part of the Quarry Haul Road over the Knoxville Formation.

The general parameters for the East Rim Access Road include:

- Roadway width (including crest of safety berms) = 66 ft[1]
- Roadway length south of haul road = 2,250 ft
- Maximum elevation = 950 feet above mean sea level (ft msl)
- Minimum elevation = 750 ft msl
- Area = 3.41 acres

The peak runoff for the East Rim Access Road was calculated based on the standards and other information developed by Contra Costa County Flood Control and Water Conservation   District   (CCCFCD) (http://ca-contracostacounty2.civicplus.com/2455/Hydrology-Standards   and

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1 While the total roadway width will be 75 feet, the outer four to five feet of each safety berm will be sloped to drain away from the roadway.   Thus, the width of the roadway that drains internally will be 66 feet, per Sheet Number 8.

http://www.cccounty.us/530/Documents-and-Standards).   The standards and methods used for this evaluation are consistent with those described in the *Hydrology Analysis Report, April 2017, CEMEX Clayton Quarry, Clayton, Contra Costa County, California*, prepared by EMKO Environmental, Inc.   Runoff from the East Rim Access Road will not be retained onsite, but will be conveyed to the reclaimed quarry pit.   Therefore, CCCFCD recommendations for detention basin sizing are not applicable and the design storm is the 20-yr, 1-hr event in accordance with SMARA Section 3706(d).

Peak runoff at the time of concentration for the 20-yr, 1-hr storm event was calculated based on an average annual rainfall of 19.00 inches, identified from CCCFCD Drawing B-166.   Rainfall intensities were obtained from CCCFCD Precipitation-Frequency-Duration-Depth curves for recurrence intervals of 10 years, 25 years, and 100 years (Drawings B-159, B-160, and B-162, respectively) and interpolated to identify the appropriate conditions for the 20-yr, 1-hr storm event at the quarry site.   CCCFCD documents, as cited above, were used to select the runoff coefficient (C), to determine the adjusting factor (f), to calculate the time of concentration (Tc), and to estimate rainfall intensity at the time of concentration (i).   The parameters used are shown in Table 1.

TABLE 1					
Peak Storm Runoff from East Rim Access Road Above 750 ft msl					
CCCFCD Rational Method Parameters					
East Rim AccessRoad			Tc =	7.4	min
Runoff Calc		Q(cfs) = C x f x i(in/hr) x A(acres)			
	C	f	i	A	Q
10-yr	0.8	1	2.27	3.41	6
20-yr	0.8	1.07	2.54	3.41	7
25-yr	0.8	1.1	2.68	3.41	8
100-yr	0.8	1.25	3.32	3.41	11

As indicated in Table 1, the peak runoff from a 20-yr, 1-hr storm event from the entire length of the East Rim Access Road would be approximately seven cubic feet per second (cfs).   While the average slope of the roadway is 10 percent, the slope varies from four percent to 14 percent locally.   As indicated on Sheet Number 11, the roadway surface would have a one-percent cross slope toward the west (quarry pit side) with a drainage ditch located along the west side of the roadway, adjacent to the safety berm.

A one-foot deep, rock-lined v-ditch with 2:1 side slopes, with an average slope of 10 percent, will convey up to 11 cfs at a flow velocity of 5.5 feet per second, which is more than adequate to convey the runoff from the roadway without the potential for erosion within the ditch.   Due to the variation in slope along the East Rim Access Road, it is recommended that culverts or side channels be located every ±500 feet along the roadway to divert the flow into the quarry pit.   The culverts or channels should extend

downward across the exposed Knoxville Formation in the east wall of the quarry and discharge onto the diabase, at an elevation of approximately 625 ft msl or lower, to prevent erosion of the Knoxville Formation below the roadway.

The upper part of the Quarry Haul Road has a slope of 10 percent and a width that is comparable to the East Rim Access Road, as indicated on Sheet Number 4. Therefore, the drainage structures, dimensions, and spacing discussed above are also appropriate for the upper part of the Quarry Haul Road, where Knoxville Formation is present. Where the Quarry Haul Road is located on diabase, the potential for erosion is effectively non-existent, so specific drainage features are not needed.

Actual runoff conveyance facilities will be designed and constructed to the physical extents and dimensions of the East Rim Access Road at the time of their construction, and therefore may vary from the concept outlined in this memorandum. However, the information provided in this memorandum is sufficient to support the environmental review of the Reclamation Plan Amendment, and to demonstrate that the roadway features, as shown on Sheet Numbers 4 and 8, meet the requirements of SMARA Section 3706(d).