**DOWNEY | BRAND**
ATTORNEYS LLP

Nicole E. Granquist
ngranquist@downeybrand.com
916/520-5369 Direct
916/520-5769 Fax

621 Capitol Mall, 18th Floor
Sacramento, CA 95814
916/444-1000 Main
916/444-2100 Fax
downeybrand.com

October 31, 2013

**VIA U.S. MAIL AND ELECTRONIC MAIL**

Ms. Dyan Whyte
Assistant Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612

Re: *Submittal of EMSA/WMSA Groundwater Investigation, Implementation, and Reporting Workplan – Additional Directive 1, June 26, 2013 Conditional Concurrence with the Workplan for Characterization of the Eastern and Western Materials Storage Areas*

Dear Ms. Whyte:

Enclosed, pursuant to the Regional Water Quality Control Board, San Francisco Bay Region's, ("Regional Water Board") June 26, 2013 Conditional Concurrence with the Workplan for Characterization of the Eastern and Western Materials Storage Areas, Lehigh Southwest Cement Company ("Lehigh") timely[1] encloses the Groundwater Investigation, Implementation, and Reporting Workplan in accordance with Additional Directive 1. If you or your staff have any questions regarding the enclosed Workplan, or would like to discuss further, please do not hesitate to contact me or Greg Knapp at Lehigh.

Very truly yours,

*Nicole Granquist*

Nicole E. Granquist

Enclosure

Cc: Lindsay Whalin, Regional Water Quality Control Board, San Francisco Bay Region
Greg Knapp, Director Environmental Region West, Lehigh
Scott Rickman, Regional Counsel, Lehigh Hanson

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[1] The deadline for submission of the enclosed workplan was extended to October 31, 2013 via the October 1, 2013 Staff Response to Submittal of Pond Characterization (Addendum) and Response to Conditions Pond (Waste) Characterization.

WORK PLAN

# WORKPLAN

## SITE GROUNDWATER CHARACTERIZATION AND DETECTION MONITORING PROGRAM

**Lehigh Southwest Cement Company**
**Permanente Plant and Quarry**
**24001 Stevens Creek Boulevard**
**Cupertino, California**

**Submitted To:** San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

**Submitted By:** Golder Associates Inc.
425 Lakeside Drive
Sunnyvale, CA 94085

**October 2013** **063-7109-915**

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Golder Associates

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425 Lakeside Drive
Sunnyvale, CA 94085

**This Workplan has been prepared by and under the direction of:**

George C. Wegmann
Senior Geologist

PROFESSIONAL GEOLOGIST
WILLIAM L. FOWLER
No. 1401
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

William L. Fowler, PG, CEG
Associate/Program Leader

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## 1.0 INTRODUCTION

Golder Associates Inc. (Golder) on behalf of Lehigh Southwest Cement Company (Lehigh) has prepared this Workplan for conducting an investigation of the hydrogeology of the Lehigh Permanente Cement Plant and Quarry (Site) located at 24001 Stevens Creek Boulevard in Santa Clara County, California (Figure 1) and to implement a detection monitoring program. The requirement for the investigation was included in a letter from the San Francisco Bay Regional Water Quality Control Board (RWQCB) to Lehigh dated June 26, 2013, providing conditional concurrence for a previous submittal, "*Workplan for Characterization of the Eastern and Western Materials Storage Area,"* and requesting additional technical work and reports. The requirement was included as Additional Investigation Technical Report Item 1:

> *"1. **Groundwater Investigation Workplan, Implementation, and Reporting:** A characterization of site hydrogeology is necessary to inform the development of a detection monitoring program in accordance with title 27. In addition, it is necessary to evaluate potential impacts to groundwater from the waste piles, and identify if surface water or groundwater that discharges to drinking water aquifers have been or could be impacted from on-site sources.*
>
> *We require that you submit and implement a workplan to install a groundwater monitoring well network to achieve both objectives. The network must be sufficient to characterize the hydrogeology of the site, including the interaction between site groundwater and adjacent surface waters including Permanente Creek and creeks to the north and west of the site. Given the reversal of groundwater flow direction caused by pumping in the quarry (indicated by the disappearance of Permanente Creek flow in the stretch adjacent to the quarry), it is expected that the hydrogeology of the site is complicated, necessitating that a qualified and experienced team of hydrogeologists perform the investigation. In order to adequately evaluate potential groundwater contamination, the COCs listed above must be monitored quarterly for a minimum of 2 years to obtain a robust dataset for evaluating impacts.*
>
> *A technical report must be submitted that presents and analyzes the results of the hydrogeologic and contaminant investigation. Graphics depicting the potentiometric surface of groundwater on site, including adjacent to Permanente Creek and creeks to the north and west of the site to demonstrate where the creeks are gaining and losing, must be included. In addition, groundwater contaminant data must be compared to the applicable water quality objectives for the protection of drinking water and aquatic habitat."*

In accordance with the above, we have prepared this Workplan for review and concurrence by the RWQCB. The primary objectives of the proposed work are:

1. Characterize the site hydrogeologic conditions in sufficient level of detail such that a groundwater detection monitoring program can be developed in accordance with CCR Title 27;

2. Utilize the detection monitoring program to characterize groundwater geochemistry to evaluate potential impacts to groundwater or surface water from the east material storage area and west material storage area; and,

The following Workplan describes the proposed technical approach for meeting the stated project objectives. The Workplan includes a narrative of the site historical background and the regional topographic and geologic setting. This is followed by the proposed scope of work and schedule for the investigation. We are proposing a phased investigation to first develop and outline the conceptual site model (CSM) for the Site, and then to install a monitoring well network adequate to meet the requirements for detection monitoring under CCR Title 27.

## 2.0 SITE OVERVIEW

The Site mainly consists of a cement manufacturing plant, limestone quarry, and material (*e.g.,* overburden) storage areas (EMSA and WMSA) located in the unincorporated foothills of western Santa Clara County, approximately two miles west of the City of Cupertino (Figure 2). Additional structures located at the Site include an inactive aluminum plant, wastewater treatment plant, aggregate rock plant, and laboratory. The Site occupies a portion of a 3,510-acre property owned by Hanson Permanente Cement, Inc., and is operated by Lehigh Southwest Cement Company (collectively, Lehigh).

The Site currently comprises approximately 570 acres of operational areas, which consist of surface mining excavations, overburden stockpiling, crushing and processing facilities, access roads, administrative offices and equipment storage. The Site also includes other predominantly undisturbed areas, either held in reserve or which buffer operations from adjacent land uses. The main operational areas of the Site are currently as follows:

- Quarry: The Quarry is where mineral extraction currently occurs and has historically taken place. The Quarry features a large mining pit with elevations that currently range from approximately 750 feet to 1,750 feet above mean sea level (amsl). Limestone and greenstone mined from the Quarry are crushed and either processed into aggregate products at Lehigh’s on-site Rock plant or are used for cement manufacture at Lehigh’s adjacent cement plant.
- East Materials Storage Area (EMSA): The EMSA is located to the east of the Quarry and is one of two main storage sites for overburden and waste rock. The EMSA partially overlies a former manufacturing area and associated historical waste repositories. Elevations at the EMSA range from 550 feet at the eastern end of the EMSA up to 1,270 feet amsl at the west end. The EMSA measures approximately 77 acres in plan area. At final completion, the EMSA will reach a maximum elevation of 910 feet amsl and a maximum thickness of approximately 150 feet.
- West Materials Storage Area (WMSA): The WMSA is the original historic overburden and waste rock storage site, located west of the Quarry. Elevations in the WMSA range from 1,500 to 1,950 feet amsl. The WMSA has reached capacity and will be re-graded as part of the approved Reclamation plan for the Site.
- Rock Plant: The Rock Plant is located in the southeast portion of the site, on the south side of Permanente Creek, and processes mined material into aggregate products. The Rock Plant occupies gentle slopes from approximately 580 feet to 770 feet amsl. .
- Cement Plant: The cement manufacturing plant lies adjacent to the Quarry on the east and is comprised of several main buildings, processes, and associated equipment. The Cement plant occupies a major north-south trending sub-canyon to Permanente Creek. The plant site includes a rail siding and coal storage area that runs from the east up Permanente Creek to the plant. Elevations in this area range from approximately 530 feet at the Creek up to about 1000 feet at the ridgetop of the drainage basin.

# 3.0 REGIONAL SETTING

## 3.1 Topography

The Site is situated in the foothills of the rugged, northwest-trending Santa Cruz Mountains segment of the California Coast Ranges. The Site and its main areas, are primarily situated on the north canyon wall of the east-flowing Permanente Creek (Figure 3). Topography in the area consists of moderately to steeply-sloped terrain with rounded ridges and drainages (Figure 3). Considerable cutting and filling has occurred over the 70 plus years of site mining, including the mining of the main pit, placement of overburden and related materials in the EMSA and WMSA areas, and also considerable grading associated with development of the cement plant area.

Relief at the Quarry ranges from about 2,000 feet along the higher ridge crests to less than 500 feet amsl along the eastern portions of Permanente Creek. Average overall slope angles are typically around 25˚. The steepest natural slopes are on the order of 40˚ over smaller slope heights (100 to 200 feet) and generally correspond to limestone outcrops.

## 3.2 Geologic Setting

The majority of the Site is underlain by complexly deformed and faulted rocks of the Franciscan Assemblage (Figure 4). The eastern portion of the Site, including portions of the Cement Plant and the EMSA, are underlain by Plio-Pleistocene rocks of the Santa Clara Formation. Overlying the bedrock are modern alluvial deposits associated with Permanente Creek (restricted to the eastern portion of the property), and relatively shallow surficial deposits comprised of soil and colluvium. The geology of the area has been mapped in various levels of detail for published maps by the following:

- Rogers and Armstrong (1973)
- Sorg and McLaughlin (1975)
- Vanderhurst (1981)
- Brabb, Graymer, and Jones (2000)

In addition, site-specific mapping at various scales, and utilizing both surface outcrop and subsurface drill core data, has also been completed by various geologists working for Lehigh. The following provides an overview of the primary geologic units at the Quarry.

### *3.2.1 Franciscan Terrane*

The following information regarding the Franciscan rocks as exposed in the Quarry has been excerpted from Foruria (2004) who performed detailed geologic mapping for the Quarry.

Cement-grade limestone and aggregate are extracted from the intricately folded and faulted limestones and metabasalts (greenstones) in the Quarry. These rocks are part of the Permanente Terrane of the

Jurassic-Cretaceous age Franciscan Assemblage. The Franciscan Assemblage represents a subduction zone assemblage of highly deformed, variably metamorphosed, marine sedimentary rocks with oceanic crust-related submarine basalt (greenstone), chert, and limestone. This limestone-metabasalt assemblage reaches a minimum total thickness of approximately 1,100 feet and dips to the southeast.

All major stratigraphic horizons within the Franciscan rocks as exposed in the main quarry are separated by low-angle faults forming a structurally imbricated thrust stack of layered and folded rock units.. The deformed thrust stack is a gently folded, northeast-trending, southeast dipping sequence in the eastern area of the pit and transitions southwestward to a series of en-echelon, northwest-trending, southeast-plunging, anticlinal and synclinal folds in the western area. High angle, brittle faults crosscut the Franciscan rocks, dissecting the rocks along prominent north-south and northwest-southeast orientations. A major through-going regional fault, the northwest strand of the Berrocal fault, crosses through the western end of the quarry.

### 3.2.2 Santa Clara Formation

The Santa Clara Formation overlies a portion of the Franciscan Assemblage rocks in the north-central portion of the property (Figure 4). The Santa Clara Formation is a continental fluvial and alluvial deposit that is composed of unconsolidated to slightly consolidated conglomerate, sandstone, siltstone, and claystone (Vanderhurst, 1981). The age of the Santa Clara Formation ranges from late Tertiary to Pleistocene. Uplift of the Coast Ranges during this time resulted in increased erosion of the mountains and deposition of the Santa Clara Formation. The contact between the Franciscan rocks and Santa Clara Formation is considered to be unconformable, with the Santa Clara Formation deposited on an eroded Franciscan terrain (Rogers and Armstrong, 1973).

### 3.2.3 Surficial Deposits

#### 3.2.3.1 Alluvium

Alluvium at the Site is limited to modern unconsolidated alluvial deposits along the active stream channel of Permanente Creek. These deposits are comprised of a poorly-sorted mixture of cobbles, gravels, sand, silt and clay. Deposits range from a few inches thick in the upper reaches of the watershed where erosion has cut the channel down into bedrock, to tens of feet thick where the channel widens and deepens as it approaches the flatter terrain of the Santa Clara Valley.

#### 3.2.3.2 Colluvium

Colluvial deposits exist throughout the Site on natural slopes including areas underlying existing older overburden fills (i.e. EMSA and WMSA). The natural slopes in general are overlain with approximately one to two feet of soil and colluvial materials, which thickens to several feet to perhaps tens of feet thick in the larger natural swales in the region.

Where colluvial materials were encountered in exploratory activities they were described as predominantly clayey sand with gravel to clayey gravel, with some gravelly clay. Gravel size was up to 3-inches. In general, at the time of the investigations, the colluvium was dry and ranged from loose to very stiff or dense. During winter rainfall months, the colluvium likely becomes saturated from ephemeral runoff and infiltration.

## 3.3 Structural Setting

The San Andreas Fault zone is located approximately two miles southwest of the Quarry. The Sargent-Berrocal Fault Zone (SBFZ), part of the Santa Cruz Mountains front-range thrust fault system, parallels the San Andreas to the east and forms the eastern-most structural boundary to the Permanente Terrain.

Near the Site, the SBFZ consists of two northwest-trending, sub-parallel faults, namely the northeastern-most Monta Vista Fault Zone and the southwestern-most Berrocal Fault Zone (Sorg and McLaughlin, 1975). The Monta Vista Fault Zone is located approximately one mile to the northeast of the North Quarry. A strand of the Berrocal Fault Zone lies beneath the adjacent cement plant area to the south of the EMSA, and extends west to other portions of the Quarry (Mathieson, 1982; Sorg and McLaughlin, 1975).

# 4.0 SITE HYDROGEOLOGIC SETTING

## 4.1 Climate

The regional climate is Mediterranean with the majority of precipitation occurring between November and April. Average annual precipitation is about 22 inches, consistent with the intermediate altitudes of the Santa Clara Valley, and more than 50 inches in the surrounding mountains (Hanson, 2004). The climate is also variable on an annual basis with dryer and wetter seasons from year to year.

## 4.2 Surface Water Flow

There are two primary drainages present within the project area which could receive surface or groundwater discharge from the developed portions of the Site. The predominate drainage for the Site is Permanente Creek which drains the vast majority of the developed portions of the Site (Figure 5). Permanente Creek is situated just south of existing Quarry and is mainly entrenched in limestone. Permanente Creek is generally dry adjacent to the Quarry during the dry season and flows typically year-round both upstream of and downstream from the Quarry.

To the north is an unnamed branch of Permanente Creek that runs parallel to Permanente Creek and joins the main channel about one mile downstream from where the main channel leaves the Site at the eastern edge of the property. The creek traverses Rancho San Antonio park and is hereafter referred to as Rancho San Antonio Creek. This drainage area receives a small input from the north-western portion of the WMSA where the waste rock fill lies to the north of the ridge dividing Permanente Creek from the northern sub-basin.

## 4.3 Seeps

Seepage in the existing Quarry has been observed in the headscarp of a large landslide on the north highwall between elevations 1,400 and 1,600 feet, which then enters the northwestern part of the existing quarry at elevation 750 feet. An additional seep at approximately elevation 850 feet along the southwest portion of the existing quarry which is now hard-piped to a sump located on the 950 elevation bench. Seeps in the WMSA and EMSA are being investigated under a separate workplan. Findings will be incorporated with the CSM.

## 4.4 Groundwater Occurrence

The occurrence of groundwater is almost exclusively within secondary openings such as joints, fractures, shear zones and faults within the Franciscan bedrock. In general, groundwater occurs under unconfined conditions; however, the structural complexity also locally creates perched and semi-confined conditions. The hydraulic properties of the Franciscan are highly variable. Most published values for hydraulic conductivity of the Franciscan are in the range of $1 \times 10^{-5}$ to $1 \times 10^{-6}$ cm/sec. Well yields are typically low, in the range of a few gallons per minute (gpm) to tens of gpm and are restricted to domestic use. Specific yields are very low on the order of less than 3% (DWR Bulletin, 1975).

Groundwater also occurs within the Santa Clara Formation that outcrops in the eastern portion of the Site. Groundwater likely occurs in both secondary openings and pore spaces within the more granular packages of the Santa Clara Formation. In general, the Santa Clara formation rocks overlie the Franciscan Formation.

## 4.5 Groundwater Flow

The regional-scale direction of groundwater flow is interpreted to be from west to east, flowing from the topographic high at Black Mountain toward the Santa Clara Valley. In the area of the main Permanente Creek drainage basin, groundwater flow through the limestone and graywacke/greenstone is likely to the south and north from the steep groundwater divides/ridges separating Permanente Creek from Monte Bello Creek to the south, and the ridge separating Permanente Creek from Rancho San Antonio Creek to the north. Groundwater also enters the main quarry pit due to the dewatering that has occurred over the years.

Based on existing data, groundwater flow is preferentially within the more permeable limestone units; however, because the limestone units are of limited extent (truncated by greenstone and graywacke), the overall groundwater flow system is controlled by the lower permeability of the greenstone/graywacke units. Recharge to the overall groundwater system is primarily by the infiltration of precipitation. The areas with flatter slopes or areas in topographic lows receive more recharge, because runoff of the rainfall is less than the runoff generated from the steeper slopes. Runoff from the steeper slopes accumulates in topographically low spots, thereby increasing infiltration.

# 5.0 SCOPE OF WORK

The following phased scope of work is proposed to: (1) compile available data and develop a conceptual site model regarding the occurrence and flow of groundwater at the Site, (2) develop a proposed detection monitoring program based on the CSM, (3) obtain concurrence for the proposed program from the RWQCB, (4) install the proposed monitoring well network, and (5) conduct two years of quarterly monitoring.

## 5.1 Phase 1 – Design Detection Monitoring Program

### *5.1.1 Phase 1 –Task 1: Data Compilation and Preliminary CSM*

Golder will compile available data regarding the occurrence and flow of groundwater at the site. There are four main groups of data available for the site that provides some indication of the depth to groundwater, groundwater flow directions, hydraulic properties, and groundwater geochemistry. These include:

- Data associated with geotechnical investigations and dewatering of the main pit. This data is primarily in the form of head measurements over time, and aquifer properties of the main limestone ore body. There is also geochemical data related to groundwater extraction and discharge from the pit.
- Data from an investigation of an area south of Permanente Creek where additional limestone resources occur. This historic data is from 2008-2010 and includes groundwater head measurements over time and geochemical data.
- Groundwater head and chemistry data from historic investigations of former waste disposal areas now overlain by waste rock associated the EMSA conducted in the late 1970's and early 1980's.
- Flow and chemistry data associated with studies of surface water flow in Permanente Creek.

The locations of the data sources described above are shown on Figure 5.

The available data will be compiled to expand upon the information provided in the background section of this Workplan and to further develop a preliminary CSM. The CSM will concentrate on the depth to groundwater in various areas of the site, estimated flow directions, and groundwater/surface water interaction. As part of this task, Golder will also review historic topographic maps and aerial photographs to understand areas of significant cutting/filling, former topographic conditions including former sidecanyon locations and secondary drainages to Permanente Creek. Existing and historical chemistry data will also be compiled to develop a preliminary model of groundwater flow direction and chemistry in various areas of the site.

### 5.1.2 Phase 1 –Task 2: Develop Proposed Detection Monitoring Program and Report

Based on the preliminary CSM and existing monitoring points, Golder will develop a groundwater contour map identifying groundwater flow directions and surface locations to aid in determining the well network for proposed detection monitoring program (DMP). A report will be prepared detailing the findings, conclusions and recommendations. The report will include appropriate tables and figures illustrating the findings of the investigation and appendices of relevant supporting data. The report will specifically provide a proposed detection monitoring program for the Site including recommended well locations, depths, and screened intervals.

### 5.1.3 Phase 1 – Task 3: Regulatory Review

The detection monitoring program will be submitted to the RWQCB for review and concurrence. Golder will be available, if requested, to meet to discuss the CSM and the recommended DMP.

## 5.2 Phase 2 - Monitoring Well Installations

Installation, development, and sampling of monitoring wells will be conducted based on the methods described in this section once the proposed DMP has been approved by the RWQCB. We anticipate that the Phase 2 work will include the following tasks:

- Task 1: Pre-field Planning, Scheduling and Coordination
- Task 2: Monitoring Well Installation, Development, and Survey
- Task 3: Well Installation Report

### 5.2.1 Phase 2 –Task 1: Pre-field Planning, Scheduling and Coordination

Prior to commencement of drilling activities, Golder will complete the following pre-field activities:

- Schedule and contract subcontractors
- Obtain drilling permits from Santa Clara Valley Water District
- Coordinate and schedule with our subcontractor, Lehigh, and the RWQCB
- Prepare a site-specific site health and safety plan (HASP) in accordance to Occupational Safety and Health Administration (OSHA) requirements set forth in 29 CFR 1910.120
- Mark drill locations and notify Underground Service Alert (USA) 48 hours in advance of field work
- Perform additional utility locating as needed using a private utility location contractor, if needed

### 5.2.2 Phase 2 – Task 2: Monitoring Well Installation and Development

We anticipate that monitoring wells will be installed primarily along the downgradient portions of the Site. Depending on the well locations and subsurface materials present, multiple drilling techniques, such as air rotary, mud rotary, and rotosonic, may be necessary.

#### 5.2.2.1 Drilling

During drilling activities, core and/or cuttings will be logged by a Golder geologist working under the direct supervision of a Professional Geologist. The logging will include a description of the formation materials with depths at which each change in materials occurs, and the penetration rate of each drill pipe section, reported in minutes per joint, drill bits used (type and size), and any notable events, such as loss of circulation, hole instability, voids, etc.

#### 5.2.2.2 Well Installation

Well casing installation will begin as soon as possible after the borehole total depth has been reached. Wells will be constructed with new, 2-inch diameter, flush-threaded Schedule 40 PVC casing and well screens; screens will be 0.010-inch factory slots. The well casing will be suspended from the top and allowed to hang freely in the borehole at all times during well construction. Screen lengths will be selected based on hydraulic conditions. Based on our CSM, well pairs may be installed to aid in characterizing vertical hydraulic gradients.

The filter pack, which will be placed from the base of the borehole to approximately 3 feet above the top of the screens, will consist of clean, graded silica sand (#1C). The filter pack sand will be installed through a tremie pipe into the annulus with clean water so that sand is released into the annular space no more than 10 feet above the level of the sand. The filter pack placement will proceed without interruption until completion. The level of the filter pack will be checked and adjusted, if necessary.

A sanitary seal consisting of bentonite chips will be installed immediately above the filter pack. The bentonite chip seal will be a minimum of 1 foot thick. The bentonite chips will be allowed to hydrate for a minimum of 15 minutes before the bentonite-grout slurry is placed. The grout slurry will be mixed to manufacturer's specification and will be pumped through a tremie pipe fitted with a 90-degree elbow at the base. The grout will be discharged into the annulus no more than 3 feet above the bentonite chip seal. Grout will be added until remaining water is displaced and the grout reaches the surface.

#### 5.2.2.3 Well Survey

The completed well top-of-casing elevation and the horizontal position will be surveyed by a licensed land surveyor. The elevation will be surveyed to the NGVD88 datum. The horizontal position will be surveyed to state plane coordinates. The survey results will be incorporated into the site's existing basemap.

#### 5.2.2.4 Well Development

The wells will be developed by a combination of surging, bailing, and pumping techniques. Surging will be performed opposite the screened sections beginning with the shallowest section. Bailing or pumping will occur near the bottom of the casing. Well development will consist of cycles of surging and bailing or pumping until the discharged water is relatively clear. As water is removed from the wells, temperature, conductivity, pH, and turbidity will be recorded at regular intervals along with an estimate of the volume of water removed and the depth to the water surface.

### 5.2.3 Phase 2 – Task 3: Reporting

Upon the completion of well completion and development activities, Golder will prepare a summary report and submit to the RWQCB. The report will document field activities and include boring logs, well construction details, and other pertinent information.

## 5.3 Phase 3 – Implement Detection Monitoring Program

Upon completion of Phase 2, Golder will begin quarterly groundwater sampling in accordance with the procedures outlined below. Per the RWQCB's directive, eight quarterly monitoring events will be implemented over a two year period.

### 5.3.1 Phase 3 – Task 1: Groundwater Monitoring Well Sampling

Groundwater samples will be collected via low-flow groundwater sampling procedure. The procedure described below for low-flow groundwater sampling is based on the Golder's procedure for groundwater sampling and the following U.S. Environmental Protection Agency (EPA) technical publications from the Office of Solid Waste and Emergency Response.

- Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (EPA-540/S-95/504, April 1996)
- Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (EPA SW-846, Base Manual [3rd edition, November 1986], through Update III [June 1997])

Low-flow groundwater sampling involves removal of water from the geologic formation immediately surrounding the screened interval of a monitoring well at discharge rates sufficiently low to minimize drawdown in the well. Minimizing drawdown minimizes mixing between the overlying stagnant casing water (or water that may be in direct contact with the atmosphere) and water near the pump intake interval, which is more likely to be representative of formation water.

Before sampling, low-flow purging shall be conducted to obtain groundwater that is representative of formation water screened by the monitoring well. Purging is anticipated to be performed using dedicated bladder pumps. Pumps shall be capable of consistent flow rates less than 0.5 liters per minute (Lpm), and pumps shall be capable of consistent operation across low-flow pumping rates (i.e., between 0.1 and 0.5 Lpm). Purge water will be discharged to the ground surface.

During purging, flow rates will be set according to the following requirements:

- Flow rates will be selected such that drawdown in the well is minimized (i.e., observed drawdown is less than 0.1 meter [0.33 feet]), if feasible.
- Initial flow rates during purging will be no more than 0.5 Lpm, and will be adjusted downward as required to minimize drawdown.

Water levels will be measured at 3 to 5 minute intervals. Monitoring of field water-quality parameters using flow-through cell will be performed. Stabilization of field water-quality parameters is indicative of the presence of formation water. Field measurements for pH, specific conductance, dissolved oxygen (DO), temperature, and turbidity are to be recorded during purging on field data sheets. In general, the order of stabilization is pH, temperature, and specific conductance, followed by DO and turbidity. Stabilization should be considered complete when readings for all parameters have stabilized after three successive readings. The three successive readings should be within the following limits:

- Specific Conductivity: ± 3%
- pH: ± 0.2 standard unit
- Turbidity: ± 10% for values greater than 5 NTUs, or three readings below 5 NTUs
- DO: ± 10% for values greater than 0.5 mg/L, or three readings below 0.5 mg/L
- Temperature: ± 3%
- ORP: ± 10 millivolts

After field measurements stabilize, groundwater water samples will be collected in as outlined in Section 6.2. If there is no water in the well at the beginning of the sampling event, the well will be considered dry, a notation on the water sample field data sheet will be made, and no sample will be collected. If the well dries because of extremely low recharge rates before stabilization occurs, the well will be allowed to recharge up to 24-hours and samples will be collected when sufficient volume is available.

### 5.3.2 Phase 3 – Task 2: Groundwater Elevation Survey

The water level in each well will be measured with an electric sounder that has cable markings stamped at 0.01-foot increments. The water level is measured by lowering the sensor into the monitoring well. A low current circuit is completed when the sensor contacts the water, which serves as an electrolyte. The current in the completed circuit is amplified and the amplified current activates an indicator light and audible buzzer, thus signaling when water has been contacted. The sensor is not to be lowered below the water surface more than is necessary to obtain a reading; water-level measurements should minimize disturbance and mixing of casing water.

Depth to water is recorded to the nearest 0.01 foot on a water sample field data sheet. The groundwater elevation at the monitoring well is calculated by subtracting the measured depth to water from the datum mark at the top of the well casing.

Additionally, pore pressure readings will be collected from other data points, such as vibrating wire transducers that are installed at various locations through the Site. The location of these data points will be noted in the CSM.

### *5.3.3 Phase 3 – Task 3: Reporting*

Upon the completion of the eight quarters of monitoring, a technical report will be submitted that presents the results of the hydrogeologic investigation. The report will include potentiometric surface of groundwater on site, including adjacent to Permanente Creek and creeks to the north and west of the site to demonstrate where the creeks may be gaining and losing. Groundwater data will be evaluated and compared to the applicable water quality objectives..

## 5.4 Equipment Decontamination

Equipment that is in contact with potentially contaminated soil or water will be decontaminated prior to and after use. Decontamination consists of steam cleaning (high pressure, hot water rinse) or phosphate-free detergent wash and deionized (DI) or tap water rinse as appropriate. Rinse water will be disposed of to the ground designated areas at the Site.

## 5.5 Constituents of Concern

All groundwater samples will be submitted to a California-certified analytical laboratory for analysis of the parameters listed in Table 1. Table 1 also details the analytical method, sample collection requirements relating to container type, preservatives (if any), and holding times.

The constituents of concern (COC) to be analyzed will consist of the priority pollutants listed in Appendix 4 of the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* as requested in the RWCQB's June 26, 2013 letter. The list includes the following parameters:

- Inorganics, including hexavalent chromium
- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs)
- Polychlorinated biphenyl compounds (PCBs)

Total petroleum hydrocarbons (TPH) as gasoline, diesel, and motor oil will be analyzed. Analytical methods will be used capable of quantifying results at concentrations no higher than the minimum levels set in the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California.* For TPH, 100 micrograms per Liter (µg/L) will be used as the minimum quantifying limit.

**Table 1: Laboratory Analytical Summary**

| Parameter | Analytical Method | Preservative | Sample Bottle | Holding Time |
|---|---|---|---|---|
| VOCs | EPA 624 | None | 4-40 milliliter VOAs | 3 days |
| SVOCs | EPA 625/625SIM | None | 2-1 Liter Amber | 7 days |
| PCBs | EPA 608 | None | 2-1 Liter Amber | 7 days |
| TPH as diesel, and motor oil | EPA 8015 | None | 1-1 Liter Amber | 14 days |
| TPH as gasoline | EPA 8015 | HCL | 2-40 millimeter VOAs | 14 days |
| PP13 As, Cd, Cr, Pb, Se, Ag, Sb, Be, Cu, Zn, Ni, Tl (total and dissolved) | EPA 200.8 | $HNO_3$ | 2-500 milliliter plastic | 180 days |
| Mercury | EPA 1631 | None | 1-8 oz glass double bag | 28 days |
| Hexavalent Chromium | SM3500 | Ammonium Sulfate | 1-250 milliliter poly | 180 days |

## 6.0 DATA MANAGEMENT AND QUALITY CONTROL

Representative samples will be obtained through the use of generally accepted sampling procedures. Data comparability will be obtained through the use of standard operating procedures and through standard analytical methods used by the laboratory. Additionally, adherence to the procedures and Quality Control (QC) approach contained in this Workplan will provide for comparable data throughout the duration of this project.

### 6.1 Field Equipment Calibration and Maintenance

Field calibration requirements shall be in compliance with the technical procedure describing the instruments use and/or with the manufacturer's instructions issued with the equipment. Lease equipment shall require certifications or other documentation demonstrating acceptable calibration status for the entire period of use for this project. Daily records of calibration activities will be kept by field personnel.

### 6.2 Sample Handling

Sample containers will be provided by the laboratory and will be certified pre-cleaned. For chemical analyses that require preserving acids, the bottles will also be pre-acidified so that the samples are immediately preserved. Sampling for mercury will be conducted under EPA sampling procedure 1669 to the extent practicable. VOC sample bottles will be filled so there was no head space

Water samples collected for dissolved metals analyses will be filtered prior to sample collection by filtering the samples through a disposable 0.45-micron acrylic copolymer filter before being placed into the pre-acidified, pre-cleaned containers. Each filter will be used once and discarded. While not anticipated to be necessary, as an alternative, the sample for dissolved metals may be collected in a non-preserved plastic bottle for the lab to filter, as long as the sample is submitted to the lab and filtered by the lab as soon as possible.

The sample containers for all parameters will be filled and labeled immediately following sample collection. Field data sheets documenting sampling collection date, time, location, personnel, weather conditions, sample identification, and measured field parameters will be completed for each sample. Water samples will be kept cool with ice to four degrees centigrade in insulated coolers or refrigerators until delivery to the laboratory. Each sample will be logged on a chain-of-custody record, which will accompany the samples through collection and delivery to the analytical laboratory.

### 6.3 Duplicates and Blanks

To assess the precision of field sampling procedures and the variability of the sample source, duplicates will be collected at a frequency of 1 in 20 samples. Each duplicate is to be collected after performing the decontamination and purging routines used for normal sample collection. When both sample results exceed the RDL (reporting detection limit) the RPD (relative percent difference) should be less than 25% or the current lab acceptance limit, whichever is lower.

Equipment blanks will be collected should non-dedicated equipment be used during sampling. Laboratory-supplied deionized water will be run through the decontaminated sampling equipment and into appropriate sample containers. Equipment blanks will be collected at a frequency of 1 per 20 samples per piece of non-dedicated field equipment and analyzed for the same parameters as the environmental sample collected immediately preceding the equipment blank. Trip blanks will not be submitted for this work based on the COCs.

## 6.4 Laboratory QA/QC

Standard laboratory QC procedures will be used by the analytical laboratory to document possible biases related to the analytical process. These QC procedures include the use of surrogate spikes, method blanks, matrix spikes, and matrix spike duplicates. Surrogate spiking compounds are added to every gas chromatography-mass spectrometry (GC/MS) surrogate spike sample. Method blanks are analyzed to assess possible effects of the laboratory environment on samples. Matrix spikes and matrix spike duplicates are analyzed by the laboratory to provide a quantitative measure of accuracy and precision, and to document effects that the sample matrix has on the analysis. As part of the data validation, the laboratory will provide a narrative summarizing the QC data on surrogate spikes, method blanks, and matrix spikes and if samples were analyzed within recommended holding times.

## 6.5 Field Reports

Accurate documentation of field activities is necessary for efficient completion of this investigation. Personnel will record daily activities on a daily field form and appropriate field data sheets. Documentation will include the following:

- weather conditions
- work activities and field observations
- description, date, and time of sample collection
- photographs of field activities and sample locations
- visitors to the Site
- calibration records
- deviations from the Workplan
- health and safety related issues or situations

## 6.6 Chain-of-Custody Procedures

The chain-of-custody procedures to be used during the investigation will be conducted as described below:

- The field sampler will have custody of the samples from the time they are collected until they are transferred to the laboratory courier.
- All bottles will be labeled with sample number and location by the sampler.
- The sample number, date, and collection time will be listed on the chain-of-custody form.
- When transferring possession of the samples, the individuals relinquishing and receiving will sign, date, and note the time on the COC form.
- Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory.

## 6.7 Laboratory Reports

Data reduction, review, and reporting will be performed under the contract laboratory's standard operating procedures. Data will be provided to data recipients within three weeks of receipt of the last sample for a sampling event and will be reported in the standard laboratory reporting format. This includes an analytical result, MDL (method detection limit), and reporting limit (RL). All analytical data packages submitted by the analytical laboratory shall include the following:

- Sample receipt, chain-of-custody and shipping documentation, including identification of field sampling personnel, shipping personnel (or organization)
- Analytical results for each sample containing the reduced results for all analytes/constituents requested in the chain of custody, request for analysis or purchase order

Sample results will be available through LIMS or in an electronic version (Excel) of the hardcopy report.

## 7.0 SCHEDULE

The schedule below summarizes the time frame for implementation of the proposed scope of work assuming that approval of this Workplan is received from the RWQCB by November 28, 2013.

**Table 2: Schedule**

| Task | Target Completion Date |
|---|---|
| Phase 1 - Task 1: Data Compilation & CSM | December 31, 2013 |
| Phase 1 - Task 2: Detection Monitoring Program Report | January 15, 2014 |
| Phase 1 - Task 3: Regulatory Review & Approval | February 15, 2014 |
| Phase 2 – Tasks 1–3: Monitoring Well Installation and Report | June 15, 2014 |
| Phase 3 – Tasks 1 & 2: Quarterly Monitoring Program | July 2014 – July 2016 |
| Phase 3 – Task 3: Report Results of Investigation | October 31, 2016 |

## 8.0 REFERENCES

Brabb, E.E., Graymer, R.W. and Jones D.L.. 2000. Geologic Map and Map Database of the Palo Alto 30' x 60' Quadrangle, California. U.S. Geological Survey Miscellaneous Field Studies Map MF-2332 ,U.S. Department of the Interior, U.S. Geological Survey.

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Rogers, T.H. and Armstrong, C.F., 1973. Environmental Geologic Analysis of the Monte Bello Ridge Mountain Study Area, Santa Clara County, California, California Division of Mines and Geology Preliminary Report 17.

Sorg, D.H., and McLaughlin, R.J., 1975. Geologic Map of the Sargent-Berrocal Fault Zone between Los Gatos and Los Altos Hills, Santa Clara County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-643, scale 1:24,000.

Vanderhurst, W., 1981. The Santa Clara Formation and Orogenesis of Monte Bello Ridge, 114 p.

## FIGURES




## REFERENCES

Spatial Reference:
NAD 1983 StatePlane California III FIPS 0403 feet

Base Maps
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

PROJECT
WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE
**REGIONAL LOCATION MAP**

Golder Associates

| | | | |
|---|---|---|---|
| PROJECT No. | 063-7109-913 | | FILE No. SiteLocMap |
| DESIGN | DLM | 1/28/2010 | SCALE: AS SHOWN REV. 0 |
| GIS | DLM/MM | 10/29/2013 | |
| CHECK | GW | 10/29/2013 | |
| REVIEW | BF | 10/29/2013 | **FIGURE 1** |


## LEGEND

- Stream
- Property Boundary

## NOTES

1) Locations based on conversion from local coordinates or Google Earth placement.

## REFERENCES

1)Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
2) Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

1,250 0 1,250 Feet

PROJECT
WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE

# SITE PLAN

Golder Associates

| PROJECT No. | | 063-7109 | FILE No. SitePlan.mxd |
|---|---|---|---|
| DESIGN | DZF | 10/31/2013 | SCALE: AS SHOWN REV. 0 |
| GIS | DZF | 10/31/2013 | FIGURE 2 |
| CHECK | GW | 10/31/2013 | |
| REVIEW | GW | 10/31/2013 | |

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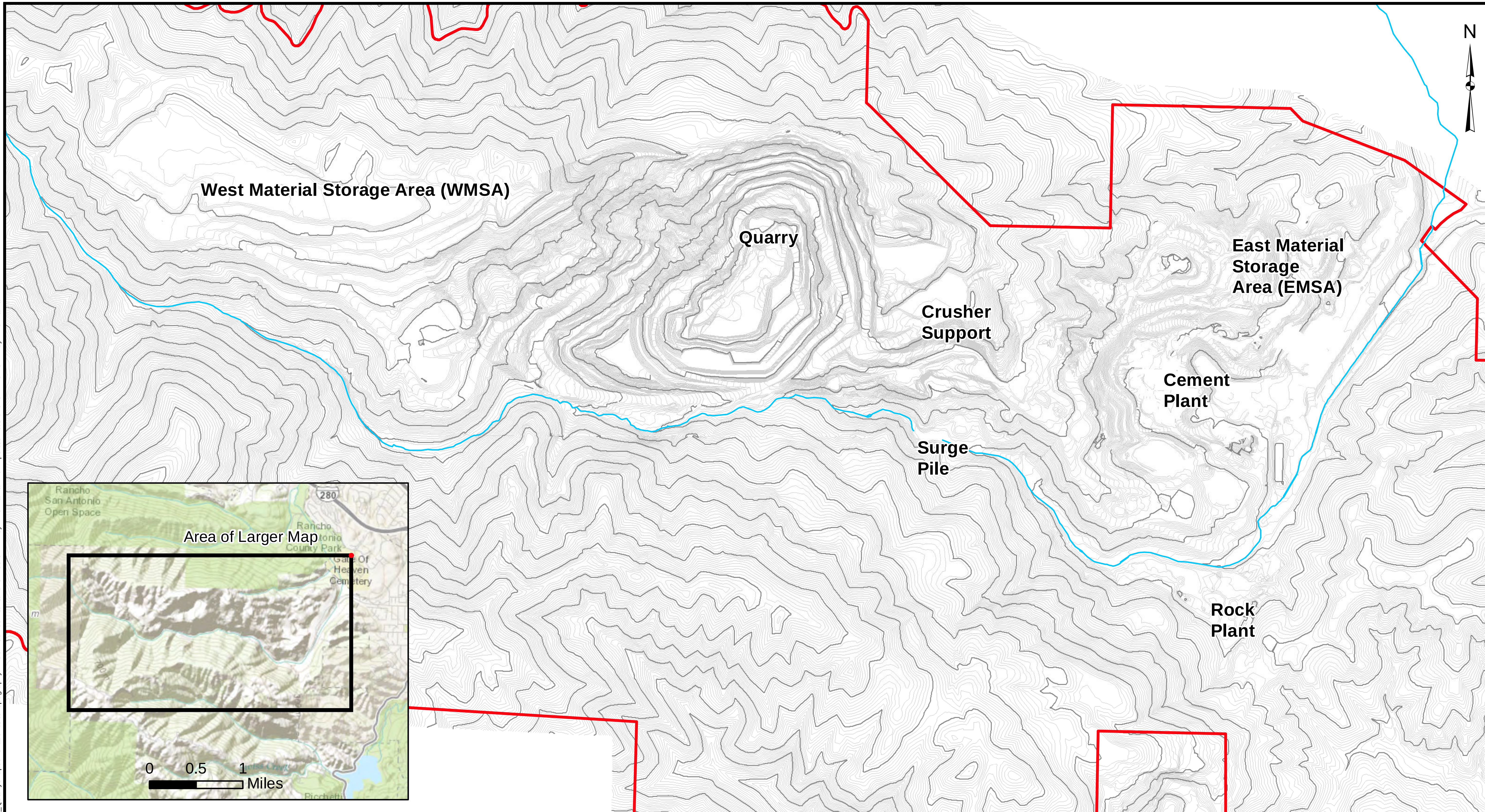


## LEGEND

- Permanente Creek
- Property Boundary

**April 2013 Topography**

- 100 ft contour
- 10 ft contour

## REFERENCES

1) Topography recieved from Cliff Maddox April 2013.
2) Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

1,000 0 1,000 Feet

PROJECT
WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE
**SITE TOPOGRAPHY**

Golder Associates

| PROJECT No. | | 063-7109-913 | FILE No. | SiteTopography.mxd |
|---|---|---|---|---|
| DESIGN | MM | 6/28/2013 | SCALE: AS SHOWN | REV. 0 |
| GIS | MM | 10/29/2013 | | |
| CHECK | GW | 10/29/2013 | **FIGURE 3** | |
| REVIEW | WLF | 10/29/2013 | | |

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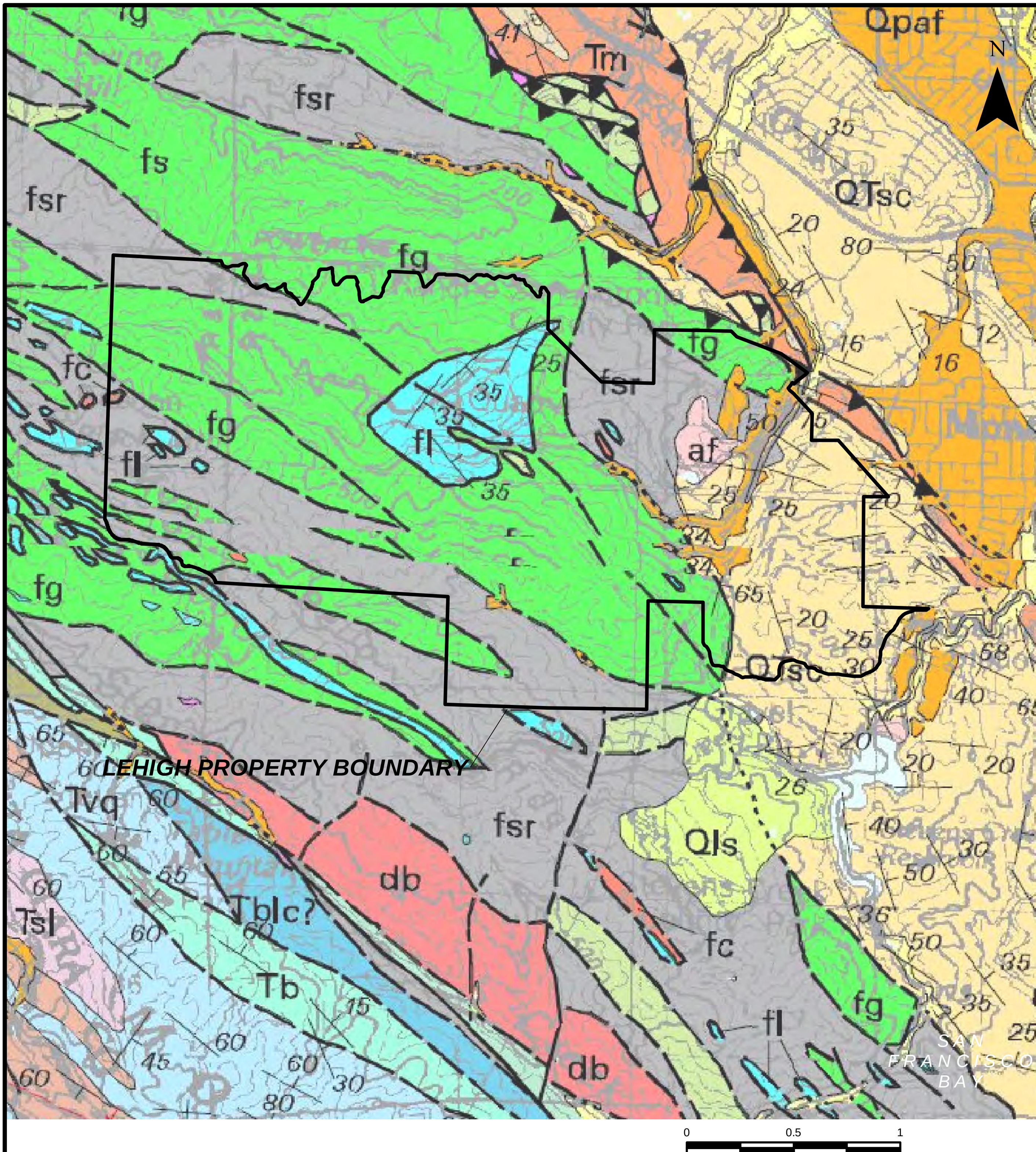


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## REFERENCES


US Geological Survey, Geologic Map and Map Database of the Palo Alto 30' x 60' Quadrangle, California; Brabb, E.E., R.W.Graymer, and D.L., Jones, 2000. MF Studies Map MF-2332.
(http://pubs.usgs.gov/mf/2000/mf-2332/mf2332m.pdf)


PROJECT

WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE

REGIONAL GEOLOGIC MAP

Golder Associates

| PROJECT No. | | 063-7109 | FILE No. | |
|---|---|---|---|---|
| DESIGN | DLM | 1/28/2010 | SCALE: AS SHOWN | REV. 0 |
| GIS | DLM | 1/28/2010 | | |
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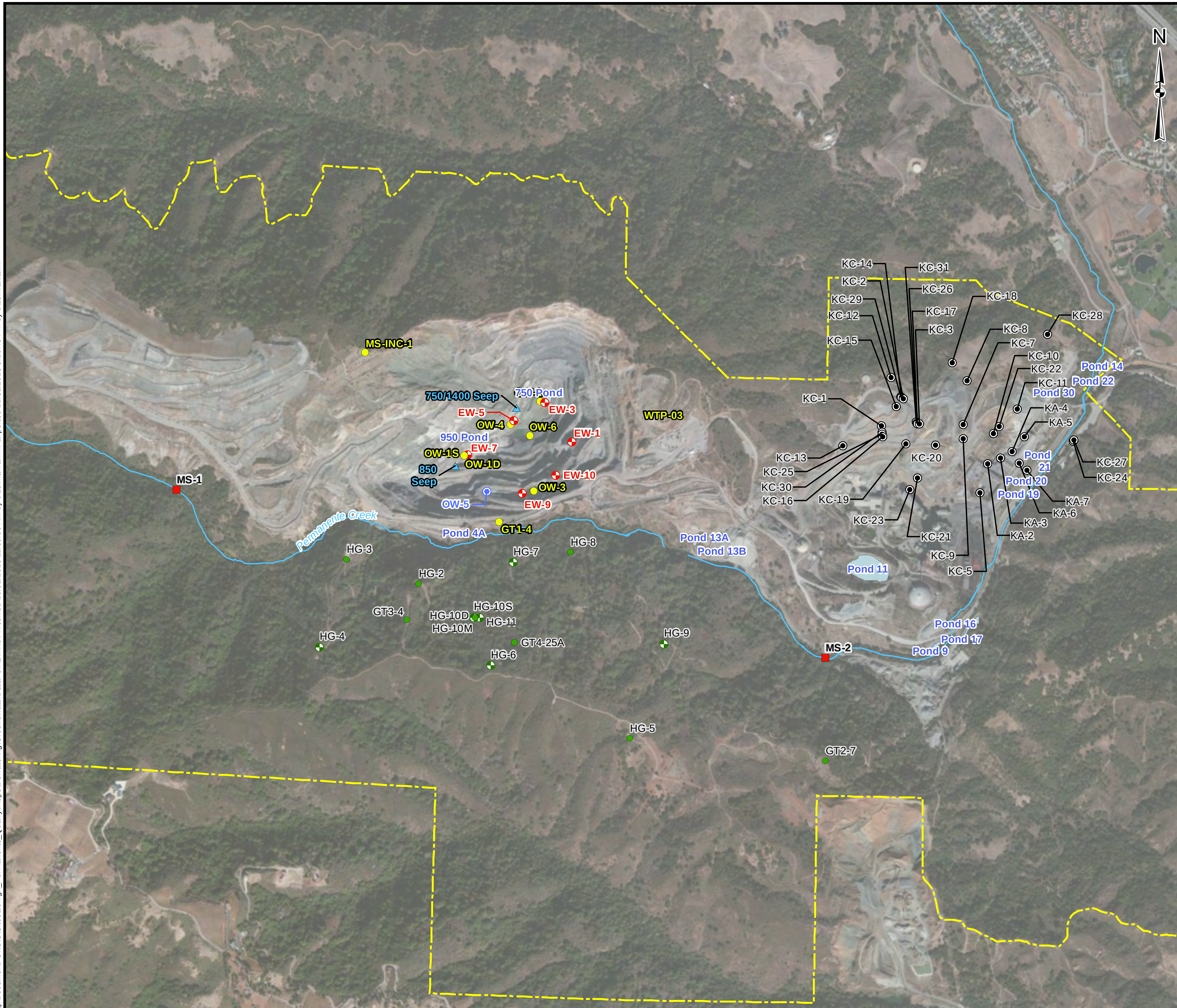


Map Document: G:\GIS\Sites\Lehigh_Permanente_Quarry\Maps\Dewatering\GroundwaterDataPoints.mxd / Modified 10/31/2013 11:56:06 AM by DZelmanfahm / Exported 10/31/2013 3:16:48 PM by DZelmanfahm

## LEGEND

- Historical EMSA Monitoring Well
- Southern Permanente Piezometer (VWT)
- Southern Permanente Well
- Piezometer (observation well)
- Extraction Well
- Piezometer (VWT)
- Seep
- Surface Water Station
- Stream
- Facility Boundary
- Pond

## NOTES

1) Locations based on conversion from local coordinates or Google Earth placement.

## REFERENCES

1)Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
2) Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

1,250 0 1,250 Feet

PROJECT
WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE
**GROUNDWATER DATA POINTS**

Golder Associates

| PROJECT No. | | 063-7109 | FILE No. | GroundwaterDataPoints.mxd |
|---|---|---|---|---|
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| GIS | MM | 10/31/2013 | | |
| CHECK | GW | 10/31/2013 | FIGURE 5 | |
| REVIEW | GW | 10/31/2013 | | |

# WORKPLAN

## SITE GROUNDWATER CHARACTERIZATION AND DETECTION MONITORING PROGRAM

**Lehigh Southwest Cement Company**
**Permanente Plant and Quarry**
**24001 Stevens Creek Boulevard**
**Cupertino, California**

WORK PLAN

**Submitted To:** San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

**Submitted By:** Golder Associates Inc.
425 Lakeside Drive
Sunnyvale, CA  94085

**October 2013** **063-7109-915**

A world of capabilities delivered locally

Golder Associates

# WORKPLAN

## SITE GROUNDWATER CHARACTERIZATION AND DETECTION MONITORING PROGRAM

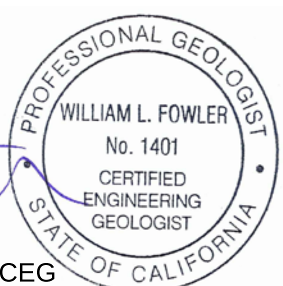
### Lehigh Southwest Cement Company
### Permanente Plant and Quarry
### 24001 Stevens Creek Boulevard
### Cupertino, California

**Submitted To:** San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

**Submitted By:** Golder Associates Inc.
425 Lakeside Drive
Sunnyvale, CA 94085

**This Workplan has been prepared by and under the direction of:**

George C. Wegmann
Senior Geologist




William L. Fowler, PG, CEG
Associate/Program Leader

## Table of Contents

## Tables



## Figures

## 1.0 INTRODUCTION

Golder Associates Inc. (Golder) on behalf of Lehigh Southwest Cement Company (Lehigh) has prepared this Workplan for conducting an investigation of the hydrogeology of the Lehigh Permanente Cement Plant and Quarry (Site) located at 24001 Stevens Creek Boulevard in Santa Clara County, California (Figure 1) and to implement a detection monitoring program. The requirement for the investigation was included in a letter from the San Francisco Bay Regional Water Quality Control Board (RWQCB) to Lehigh dated June 26, 2013, providing conditional concurrence for a previous submittal, "*Workplan for Characterization of the Eastern and Western Materials Storage Area,"* and requesting additional technical work and reports. The requirement was included as Additional Investigation Technical Report Item 1:

> *"1. **Groundwater Investigation Workplan, Implementation, and Reporting:** A characterization of site hydrogeology is necessary to inform the development of a detection monitoring program in accordance with title 27. In addition, it is necessary to evaluate potential impacts to groundwater from the waste piles, and identify if surface water or groundwater that discharges to drinking water aquifers have been or could be impacted from on-site sources.*
>
> *We require that you submit and implement a workplan to install a groundwater monitoring well network to achieve both objectives. The network must be sufficient to characterize the hydrogeology of the site, including the interaction between site groundwater and adjacent surface waters including Permanente Creek and creeks to the north and west of the site. Given the reversal of groundwater flow direction caused by pumping in the quarry (indicated by the disappearance of Permanente Creek flow in the stretch adjacent to the quarry), it is expected that the hydrogeology of the site is complicated, necessitating that a qualified and experienced team of hydrogeologists perform the investigation. In order to adequately evaluate potential groundwater contamination, the COCs listed above must be monitored quarterly for a minimum of 2 years to obtain a robust dataset for evaluating impacts.*
>
> *A technical report must be submitted that presents and analyzes the results of the hydrogeologic and contaminant investigation. Graphics depicting the potentiometric surface of groundwater on site, including adjacent to Permanente Creek and creeks to the north and west of the site to demonstrate where the creeks are gaining and losing, must be included. In addition, groundwater contaminant data must be compared to the applicable water quality objectives for the protection of drinking water and aquatic habitat."*

In accordance with the above, we have prepared this Workplan for review and concurrence by the RWQCB. The primary objectives of the proposed work are:

1. Characterize the site hydrogeologic conditions in sufficient level of detail such that a groundwater detection monitoring program can be developed in accordance with CCR Title 27;

2. Utilize the detection monitoring program to characterize groundwater geochemistry to evaluate potential impacts to groundwater or surface water from the east material storage area and west material storage area; and,

The following Workplan describes the proposed technical approach for meeting the stated project objectives. The Workplan includes a narrative of the site historical background and the regional topographic and geologic setting. This is followed by the proposed scope of work and schedule for the investigation. We are proposing a phased investigation to first develop and outline the conceptual site model (CSM) for the Site, and then to install a monitoring well network adequate to meet the requirements for detection monitoring under CCR Title 27.

## 2.0 SITE OVERVIEW

The Site mainly consists of a cement manufacturing plant, limestone quarry, and material (*e.g.,* overburden) storage areas (EMSA and WMSA) located in the unincorporated foothills of western Santa Clara County, approximately two miles west of the City of Cupertino (Figure 2). Additional structures located at the Site include an inactive aluminum plant, wastewater treatment plant, aggregate rock plant, and laboratory. The Site occupies a portion of a 3,510-acre property owned by Hanson Permanente Cement, Inc., and is operated by Lehigh Southwest Cement Company (collectively, Lehigh).

The Site currently comprises approximately 570 acres of operational areas, which consist of surface mining excavations, overburden stockpiling, crushing and processing facilities, access roads, administrative offices and equipment storage. The Site also includes other predominantly undisturbed areas, either held in reserve or which buffer operations from adjacent land uses. The main operational areas of the Site are currently as follows:

- Quarry: The Quarry is where mineral extraction currently occurs and has historically taken place. The Quarry features a large mining pit with elevations that currently range from approximately 750 feet to 1,750 feet above mean sea level (amsl). Limestone and greenstone mined from the Quarry are crushed and either processed into aggregate products at Lehigh's on-site Rock plant or are used for cement manufacture at Lehigh's adjacent cement plant.
- East Materials Storage Area (EMSA): The EMSA is located to the east of the Quarry and is one of two main storage sites for overburden and waste rock. The EMSA partially overlies a former manufacturing area and associated historical waste repositories. Elevations at the EMSA range from 550 feet at the eastern end of the EMSA up to 1,270 feet amsl at the west end. The EMSA measures approximately 77 acres in plan area. At final completion, the EMSA will reach a maximum elevation of 910 feet amsl and a maximum thickness of approximately 150 feet.
- West Materials Storage Area (WMSA): The WMSA is the original historic overburden and waste rock storage site, located west of the Quarry. Elevations in the WMSA range from 1,500 to 1,950 feet amsl. The WMSA has reached capacity and will be re-graded as part of the approved Reclamation plan for the Site.
- Rock Plant: The Rock Plant is located in the southeast portion of the site, on the south side of Permanente Creek, and processes mined material into aggregate products. The Rock Plant occupies gentle slopes from approximately 580 feet to 770 feet amsl. .
- Cement Plant: The cement manufacturing plant lies adjacent to the Quarry on the east and is comprised of several main buildings, processes, and associated equipment. The Cement plant occupies a major north-south trending sub-canyon to Permanente Creek. The plant site includes a rail siding and coal storage area that runs from the east up Permanente Creek to the plant. Elevations in this area range from approximately 530 feet at the Creek up to about 1000 feet at the ridgetop of the drainage basin.

# 3.0 REGIONAL SETTING

## 3.1 Topography

The Site is situated in the foothills of the rugged, northwest-trending Santa Cruz Mountains segment of the California Coast Ranges. The Site and its main areas, are primarily situated on the north canyon wall of the east-flowing Permanente Creek (Figure 3). Topography in the area consists of moderately to steeply-sloped terrain with rounded ridges and drainages (Figure 3). Considerable cutting and filling has occurred over the 70 plus years of site mining, including the mining of the main pit, placement of overburden and related materials in the EMSA and WMSA areas, and also considerable grading associated with development of the cement plant area.

Relief at the Quarry ranges from about 2,000 feet along the higher ridge crests to less than 500 feet amsl along the eastern portions of Permanente Creek. Average overall slope angles are typically around 25˚. The steepest natural slopes are on the order of 40˚ over smaller slope heights (100 to 200 feet) and generally correspond to limestone outcrops.

## 3.2 Geologic Setting

The majority of the Site is underlain by complexly deformed and faulted rocks of the Franciscan Assemblage (Figure 4). The eastern portion of the Site, including portions of the Cement Plant and the EMSA, are underlain by Plio-Pleistocene rocks of the Santa Clara Formation. Overlying the bedrock are modern alluvial deposits associated with Permanente Creek (restricted to the eastern portion of the property), and relatively shallow surficial deposits comprised of soil and colluvium. The geology of the area has been mapped in various levels of detail for published maps by the following:

- Rogers and Armstrong (1973)
- Sorg and McLaughlin (1975)
- Vanderhurst (1981)
- Brabb, Graymer, and Jones (2000)

In addition, site-specific mapping at various scales, and utilizing both surface outcrop and subsurface drill core data, has also been completed by various geologists working for Lehigh. The following provides an overview of the primary geologic units at the Quarry.

### *3.2.1 Franciscan Terrane*

The following information regarding the Franciscan rocks as exposed in the Quarry has been excerpted from Foruria (2004) who performed detailed geologic mapping for the Quarry.

Cement-grade limestone and aggregate are extracted from the intricately folded and faulted limestones and metabasalts (greenstones) in the Quarry. These rocks are part of the Permanente Terrane of the

Jurassic-Cretaceous age Franciscan Assemblage. The Franciscan Assemblage represents a subduction zone assemblage of highly deformed, variably metamorphosed, marine sedimentary rocks with oceanic crust-related submarine basalt (greenstone), chert, and limestone. This limestone-metabasalt assemblage reaches a minimum total thickness of approximately 1,100 feet and dips to the southeast.

All major stratigraphic horizons within the Franciscan rocks as exposed in the main quarry are separated by low-angle faults forming a structurally imbricated thrust stack of layered and folded rock units.. The deformed thrust stack is a gently folded, northeast-trending, southeast dipping sequence in the eastern area of the pit and transitions southwestward to a series of en-echelon, northwest-trending, southeast-plunging, anticlinal and synclinal folds in the western area. High angle, brittle faults crosscut the Franciscan rocks, dissecting the rocks along prominent north-south and northwest-southeast orientations. A major through-going regional fault, the northwest strand of the Berrocal fault, crosses through the western end of the quarry.

### 3.2.2 Santa Clara Formation

The Santa Clara Formation overlies a portion of the Franciscan Assemblage rocks in the north-central portion of the property (Figure 4). The Santa Clara Formation is a continental fluvial and alluvial deposit that is composed of unconsolidated to slightly consolidated conglomerate, sandstone, siltstone, and claystone (Vanderhurst, 1981). The age of the Santa Clara Formation ranges from late Tertiary to Pleistocene. Uplift of the Coast Ranges during this time resulted in increased erosion of the mountains and deposition of the Santa Clara Formation. The contact between the Franciscan rocks and Santa Clara Formation is considered to be unconformable, with the Santa Clara Formation deposited on an eroded Franciscan terrain (Rogers and Armstrong, 1973).

### 3.2.3 Surficial Deposits

#### 3.2.3.1 Alluvium

Alluvium at the Site is limited to modern unconsolidated alluvial deposits along the active stream channel of Permanente Creek. These deposits are comprised of a poorly-sorted mixture of cobbles, gravels, sand, silt and clay. Deposits range from a few inches thick in the upper reaches of the watershed where erosion has cut the channel down into bedrock, to tens of feet thick where the channel widens and deepens as it approaches the flatter terrain of the Santa Clara Valley.

#### 3.2.3.2 Colluvium

Colluvial deposits exist throughout the Site on natural slopes including areas underlying existing older overburden fills (i.e. EMSA and WMSA). The natural slopes in general are overlain with approximately one to two feet of soil and colluvial materials, which thickens to several feet to perhaps tens of feet thick in the larger natural swales in the region.

Where colluvial materials were encountered in exploratory activities they were described as predominantly clayey sand with gravel to clayey gravel, with some gravelly clay. Gravel size was up to 3-inches. In general, at the time of the investigations, the colluvium was dry and ranged from loose to very stiff or dense. During winter rainfall months, the colluvium likely becomes saturated from ephemeral runoff and infiltration.

## 3.3 Structural Setting

The San Andreas Fault zone is located approximately two miles southwest of the Quarry. The Sargent-Berrocal Fault Zone (SBFZ), part of the Santa Cruz Mountains front-range thrust fault system, parallels the San Andreas to the east and forms the eastern-most structural boundary to the Permanente Terrain.

Near the Site, the SBFZ consists of two northwest-trending, sub-parallel faults, namely the northeastern-most Monta Vista Fault Zone and the southwestern-most Berrocal Fault Zone (Sorg and McLaughlin, 1975). The Monta Vista Fault Zone is located approximately one mile to the northeast of the North Quarry. A strand of the Berrocal Fault Zone lies beneath the adjacent cement plant area to the south of the EMSA, and extends west to other portions of the Quarry (Mathieson, 1982; Sorg and McLaughlin, 1975).

# 4.0 SITE HYDROGEOLOGIC SETTING

## 4.1 Climate

The regional climate is Mediterranean with the majority of precipitation occurring between November and April. Average annual precipitation is about 22 inches, consistent with the intermediate altitudes of the Santa Clara Valley, and more than 50 inches in the surrounding mountains (Hanson, 2004). The climate is also variable on an annual basis with dryer and wetter seasons from year to year.

## 4.2 Surface Water Flow

There are two primary drainages present within the project area which could receive surface or groundwater discharge from the developed portions of the Site. The predominate drainage for the Site is Permanente Creek which drains the vast majority of the developed portions of the Site (Figure 5). Permanente Creek is situated just south of existing Quarry and is mainly entrenched in limestone. Permanente Creek is generally dry adjacent to the Quarry during the dry season and flows typically year-round both upstream of and downstream from the Quarry.

To the north is an unnamed branch of Permanente Creek that runs parallel to Permanente Creek and joins the main channel about one mile downstream from where the main channel leaves the Site at the eastern edge of the property. The creek traverses Rancho San Antonio park and is hereafter referred to as Rancho San Antonio Creek. This drainage area receives a small input from the north-western portion of the WMSA where the waste rock fill lies to the north of the ridge dividing Permanente Creek from the northern sub-basin.

## 4.3 Seeps

Seepage in the existing Quarry has been observed in the headscarp of a large landslide on the north highwall between elevations 1,400 and 1,600 feet, which then enters the northwestern part of the existing quarry at elevation 750 feet. An additional seep at approximately elevation 850 feet along the southwest portion of the existing quarry which is now hard-piped to a sump located on the 950 elevation bench. Seeps in the WMSA and EMSA are being investigated under a separate workplan. Findings will be incorporated with the CSM.

## 4.4 Groundwater Occurrence

The occurrence of groundwater is almost exclusively within secondary openings such as joints, fractures, shear zones and faults within the Franciscan bedrock. In general, groundwater occurs under unconfined conditions; however, the structural complexity also locally creates perched and semi-confined conditions. The hydraulic properties of the Franciscan are highly variable. Most published values for hydraulic conductivity of the Franciscan are in the range of $1 \times 10^{-5}$ to $1 \times 10^{-6}$ cm/sec. Well yields are typically low, in the range of a few gallons per minute (gpm) to tens of gpm and are restricted to domestic use. Specific yields are very low on the order of less than 3% (DWR Bulletin, 1975).

Groundwater also occurs within the Santa Clara Formation that outcrops in the eastern portion of the Site. Groundwater likely occurs in both secondary openings and pore spaces within the more granular packages of the Santa Clara Formation. In general, the Santa Clara formation rocks overlie the Franciscan Formation.

## 4.5 Groundwater Flow

The regional-scale direction of groundwater flow is interpreted to be from west to east, flowing from the topographic high at Black Mountain toward the Santa Clara Valley. In the area of the main Permanente Creek drainage basin, groundwater flow through the limestone and graywacke/greenstone is likely to the south and north from the steep groundwater divides/ridges separating Permanente Creek from Monte Bello Creek to the south, and the ridge separating Permanente Creek from Rancho San Antonio Creek to the north. Groundwater also enters the main quarry pit due to the dewatering that has occurred over the years.

Based on existing data, groundwater flow is preferentially within the more permeable limestone units; however, because the limestone units are of limited extent (truncated by greenstone and graywacke), the overall groundwater flow system is controlled by the lower permeability of the greenstone/graywacke units. Recharge to the overall groundwater system is primarily by the infiltration of precipitation. The areas with flatter slopes or areas in topographic lows receive more recharge, because runoff of the rainfall is less than the runoff generated from the steeper slopes. Runoff from the steeper slopes accumulates in topographically low spots, thereby increasing infiltration.

# 5.0 SCOPE OF WORK

The following phased scope of work is proposed to: (1) compile available data and develop a conceptual site model regarding the occurrence and flow of groundwater at the Site, (2) develop a proposed detection monitoring program based on the CSM, (3) obtain concurrence for the proposed program from the RWQCB, (4) install the proposed monitoring well network, and (5) conduct two years of quarterly monitoring.

## 5.1 Phase 1 – Design Detection Monitoring Program

### *5.1.1 Phase 1 –Task 1: Data Compilation and Preliminary CSM*

Golder will compile available data regarding the occurrence and flow of groundwater at the site. There are four main groups of data available for the site that provides some indication of the depth to groundwater, groundwater flow directions, hydraulic properties, and groundwater geochemistry. These include:

- Data associated with geotechnical investigations and dewatering of the main pit. This data is primarily in the form of head measurements over time, and aquifer properties of the main limestone ore body. There is also geochemical data related to groundwater extraction and discharge from the pit.
- Data from an investigation of an area south of Permanente Creek where additional limestone resources occur. This historic data is from 2008-2010 and includes groundwater head measurements over time and geochemical data.
- Groundwater head and chemistry data from historic investigations of former waste disposal areas now overlain by waste rock associated the EMSA conducted in the late 1970’s and early 1980’s.
- Flow and chemistry data associated with studies of surface water flow in Permanente Creek.

The locations of the data sources described above are shown on Figure 5.

The available data will be compiled to expand upon the information provided in the background section of this Workplan and to further develop a preliminary CSM. The CSM will concentrate on the depth to groundwater in various areas of the site, estimated flow directions, and groundwater/surface water interaction. As part of this task, Golder will also review historic topographic maps and aerial photographs to understand areas of significant cutting/filling, former topographic conditions including former sidecanyon locations and secondary drainages to Permanente Creek. Existing and historical chemistry data will also be compiled to develop a preliminary model of groundwater flow direction and chemistry in various areas of the site.

### *5.1.2 Phase 1 –Task 2: Develop Proposed Detection Monitoring Program and Report*

Based on the preliminary CSM and existing monitoring points, Golder will develop a groundwater contour map identifying groundwater flow directions and surface locations to aid in determining the well network for proposed detection monitoring program (DMP). A report will be prepared detailing the findings, conclusions and recommendations. The report will include appropriate tables and figures illustrating the findings of the investigation and appendices of relevant supporting data. The report will specifically provide a proposed detection monitoring program for the Site including recommended well locations, depths, and screened intervals.

### *5.1.3 Phase 1 – Task 3: Regulatory Review*

The detection monitoring program will be submitted to the RWQCB for review and concurrence. Golder will be available, if requested, to meet to discuss the CSM and the recommended DMP.

## 5.2 Phase 2 - Monitoring Well Installations

Installation, development, and sampling of monitoring wells will be conducted based on the methods described in this section once the proposed DMP has been approved by the RWQCB. We anticipate that the Phase 2 work will include the following tasks:

- Task 1: Pre-field Planning, Scheduling and Coordination
- Task 2: Monitoring Well Installation, Development, and Survey
- Task 3: Well Installation Report

### *5.2.1 Phase 2 –Task 1: Pre-field Planning, Scheduling and Coordination*

Prior to commencement of drilling activities, Golder will complete the following pre-field activities:

- Schedule and contract subcontractors
- Obtain drilling permits from Santa Clara Valley Water District
- Coordinate and schedule with our subcontractor, Lehigh, and the RWQCB
- Prepare a site-specific site health and safety plan (HASP) in accordance to Occupational Safety and Health Administration (OSHA) requirements set forth in 29 CFR 1910.120
- Mark drill locations and notify Underground Service Alert (USA) 48 hours in advance of field work
- Perform additional utility locating as needed using a private utility location contractor, if needed

### *5.2.2 Phase 2 – Task 2: Monitoring Well Installation and Development*

We anticipate that monitoring wells will be installed primarily along the downgradient portions of the Site. Depending on the well locations and subsurface materials present, multiple drilling techniques, such as air rotary, mud rotary, and rotosonic, may be necessary.

#### 5.2.2.1 Drilling

During drilling activities, core and/or cuttings will be logged by a Golder geologist working under the direct supervision of a Professional Geologist. The logging will include a description of the formation materials with depths at which each change in materials occurs, and the penetration rate of each drill pipe section, reported in minutes per joint, drill bits used (type and size), and any notable events, such as loss of circulation, hole instability, voids, etc.

#### 5.2.2.2 Well Installation

Well casing installation will begin as soon as possible after the borehole total depth has been reached. Wells will be constructed with new, 2-inch diameter, flush-threaded Schedule 40 PVC casing and well screens; screens will be 0.010-inch factory slots. The well casing will be suspended from the top and allowed to hang freely in the borehole at all times during well construction. Screen lengths will be selected based on hydraulic conditions. Based on our CSM, well pairs may be installed to aid in characterizing vertical hydraulic gradients.

The filter pack, which will be placed from the base of the borehole to approximately 3 feet above the top of the screens, will consist of clean, graded silica sand (#1C). The filter pack sand will be installed through a tremie pipe into the annulus with clean water so that sand is released into the annular space no more than 10 feet above the level of the sand. The filter pack placement will proceed without interruption until completion. The level of the filter pack will be checked and adjusted, if necessary.

A sanitary seal consisting of bentonite chips will be installed immediately above the filter pack. The bentonite chip seal will be a minimum of 1 foot thick. The bentonite chips will be allowed to hydrate for a minimum of 15 minutes before the bentonite-grout slurry is placed. The grout slurry will be mixed to manufacturer’s specification and will be pumped through a tremie pipe fitted with a 90-degree elbow at the base. The grout will be discharged into the annulus no more than 3 feet above the bentonite chip seal. Grout will be added until remaining water is displaced and the grout reaches the surface.

#### 5.2.2.3 Well Survey

The completed well top-of-casing elevation and the horizontal position will be surveyed by a licensed land surveyor. The elevation will be surveyed to the NGVD88 datum. The horizontal position will be surveyed to state plane coordinates. The survey results will be incorporated into the site’s existing basemap.

#### 5.2.2.4 Well Development

The wells will be developed by a combination of surging, bailing, and pumping techniques. Surging will be performed opposite the screened sections beginning with the shallowest section. Bailing or pumping will occur near the bottom of the casing. Well development will consist of cycles of surging and bailing or pumping until the discharged water is relatively clear. As water is removed from the wells, temperature, conductivity, pH, and turbidity will be recorded at regular intervals along with an estimate of the volume of water removed and the depth to the water surface.

### 5.2.3 Phase 2 – Task 3: Reporting

Upon the completion of well completion and development activities, Golder will prepare a summary report and submit to the RWQCB. The report will document field activities and include boring logs, well construction details, and other pertinent information.

## 5.3 Phase 3 – Implement Detection Monitoring Program

Upon completion of Phase 2, Golder will begin quarterly groundwater sampling in accordance with the procedures outlined below. Per the RWQCB's directive, eight quarterly monitoring events will be implemented over a two year period.

### 5.3.1 Phase 3 – Task 1: Groundwater Monitoring Well Sampling

Groundwater samples will be collected via low-flow groundwater sampling procedure. The procedure described below for low-flow groundwater sampling is based on the Golder's procedure for groundwater sampling and the following U.S. Environmental Protection Agency (EPA) technical publications from the Office of Solid Waste and Emergency Response.

- Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (EPA-540/S-95/504, April 1996)
- Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (EPA SW-846, Base Manual [3rd edition, November 1986], through Update III [June 1997])

Low-flow groundwater sampling involves removal of water from the geologic formation immediately surrounding the screened interval of a monitoring well at discharge rates sufficiently low to minimize drawdown in the well. Minimizing drawdown minimizes mixing between the overlying stagnant casing water (or water that may be in direct contact with the atmosphere) and water near the pump intake interval, which is more likely to be representative of formation water.

Before sampling, low-flow purging shall be conducted to obtain groundwater that is representative of formation water screened by the monitoring well. Purging is anticipated to be performed using dedicated bladder pumps. Pumps shall be capable of consistent flow rates less than 0.5 liters per minute (Lpm), and pumps shall be capable of consistent operation across low-flow pumping rates (i.e., between 0.1 and 0.5 Lpm). Purge water will be discharged to the ground surface.

During purging, flow rates will be set according to the following requirements:

- Flow rates will be selected such that drawdown in the well is minimized (i.e., observed drawdown is less than 0.1 meter [0.33 feet]), if feasible.
- Initial flow rates during purging will be no more than 0.5 Lpm, and will be adjusted downward as required to minimize drawdown.

Water levels will be measured at 3 to 5 minute intervals. Monitoring of field water-quality parameters using flow-through cell will be performed. Stabilization of field water-quality parameters is indicative of the presence of formation water. Field measurements for pH, specific conductance, dissolved oxygen (DO), temperature, and turbidity are to be recorded during purging on field data sheets. In general, the order of stabilization is pH, temperature, and specific conductance, followed by DO and turbidity. Stabilization should be considered complete when readings for all parameters have stabilized after three successive readings. The three successive readings should be within the following limits:

- Specific Conductivity: ± 3%
- pH: ± 0.2 standard unit
- Turbidity: ± 10% for values greater than 5 NTUs, or three readings below 5 NTUs
- DO: ± 10% for values greater than 0.5 mg/L, or three readings below 0.5 mg/L
- Temperature: ± 3%
- ORP: ± 10 millivolts

After field measurements stabilize, groundwater water samples will be collected in as outlined in Section 6.2. If there is no water in the well at the beginning of the sampling event, the well will be considered dry, a notation on the water sample field data sheet will be made, and no sample will be collected. If the well dries because of extremely low recharge rates before stabilization occurs, the well will be allowed to recharge up to 24-hours and samples will be collected when sufficient volume is available.

### 5.3.2 Phase 3 – Task 2: Groundwater Elevation Survey

The water level in each well will be measured with an electric sounder that has cable markings stamped at 0.01-foot increments. The water level is measured by lowering the sensor into the monitoring well. A low current circuit is completed when the sensor contacts the water, which serves as an electrolyte. The current in the completed circuit is amplified and the amplified current activates an indicator light and audible buzzer, thus signaling when water has been contacted. The sensor is not to be lowered below the water surface more than is necessary to obtain a reading; water-level measurements should minimize disturbance and mixing of casing water.

Depth to water is recorded to the nearest 0.01 foot on a water sample field data sheet. The groundwater elevation at the monitoring well is calculated by subtracting the measured depth to water from the datum mark at the top of the well casing.

Additionally, pore pressure readings will be collected from other data points, such as vibrating wire transducers that are installed at various locations through the Site. The location of these data points will be noted in the CSM.

### *5.3.3 Phase 3 – Task 3: Reporting*

Upon the completion of the eight quarters of monitoring, a technical report will be submitted that presents the results of the hydrogeologic investigation. The report will include potentiometric surface of groundwater on site, including adjacent to Permanente Creek and creeks to the north and west of the site to demonstrate where the creeks may be gaining and losing. Groundwater data will be evaluated and compared to the applicable water quality objectives..

## 5.4 Equipment Decontamination

Equipment that is in contact with potentially contaminated soil or water will be decontaminated prior to and after use. Decontamination consists of steam cleaning (high pressure, hot water rinse) or phosphate-free detergent wash and deionized (DI) or tap water rinse as appropriate. Rinse water will be disposed of to the ground designated areas at the Site.

## 5.5 Constituents of Concern

All groundwater samples will be submitted to a California-certified analytical laboratory for analysis of the parameters listed in Table 1. Table 1 also details the analytical method, sample collection requirements relating to container type, preservatives (if any), and holding times.

The constituents of concern (COC) to be analyzed will consist of the priority pollutants listed in Appendix 4 of the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* as requested in the RWCQB's June 26, 2013 letter. The list includes the following parameters:

- Inorganics, including hexavalent chromium
- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs)
- Polychlorinated biphenyl compounds (PCBs)

Total petroleum hydrocarbons (TPH) as gasoline, diesel, and motor oil will be analyzed. Analytical methods will be used capable of quantifying results at concentrations no higher than the minimum levels set in the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California.* For TPH, 100 micrograms per Liter (µg/L) will be used as the minimum quantifying limit.

**Table 1: Laboratory Analytical Summary**

| Parameter | Analytical Method | Preservative | Sample Bottle | Holding Time |
|---|---|---|---|---|
| VOCs | EPA 624 | None | 4-40 milliliter VOAs | 3 days |
| SVOCs | EPA 625/625SIM | None | 2-1 Liter Amber | 7 days |
| PCBs | EPA 608 | None | 2-1 Liter Amber | 7 days |
| TPH as diesel, and motor oil | EPA 8015 | None | 1-1 Liter Amber | 14 days |
| TPH as gasoline | EPA 8015 | HCL | 2-40 millimeter VOAs | 14 days |
| PP13 As, Cd, Cr, Pb, Se, Ag, Sb, Be, Cu, Zn, Ni, Tl (total and dissolved) | EPA 200.8 | $HNO_3$ | 2-500 milliliter plastic | 180 days |
| Mercury | EPA 1631 | None | 1-8 oz glass double bag | 28 days |
| Hexavalent Chromium | SM3500 | Ammonium Sulfate | 1-250 milliliter poly | 180 days |

## 6.0 DATA MANAGEMENT AND QUALITY CONTROL

Representative samples will be obtained through the use of generally accepted sampling procedures. Data comparability will be obtained through the use of standard operating procedures and through standard analytical methods used by the laboratory. Additionally, adherence to the procedures and Quality Control (QC) approach contained in this Workplan will provide for comparable data throughout the duration of this project.

### 6.1 Field Equipment Calibration and Maintenance

Field calibration requirements shall be in compliance with the technical procedure describing the instruments use and/or with the manufacturer's instructions issued with the equipment. Lease equipment shall require certifications or other documentation demonstrating acceptable calibration status for the entire period of use for this project. Daily records of calibration activities will be kept by field personnel.

### 6.2 Sample Handling

Sample containers will be provided by the laboratory and will be certified pre-cleaned. For chemical analyses that require preserving acids, the bottles will also be pre-acidified so that the samples are immediately preserved. Sampling for mercury will be conducted under EPA sampling procedure 1669 to the extent practicable. VOC sample bottles will be filled so there was no head space

Water samples collected for dissolved metals analyses will be filtered prior to sample collection by filtering the samples through a disposable 0.45-micron acrylic copolymer filter before being placed into the pre-acidified, pre-cleaned containers. Each filter will be used once and discarded. While not anticipated to be necessary, as an alternative, the sample for dissolved metals may be collected in a non-preserved plastic bottle for the lab to filter, as long as the sample is submitted to the lab and filtered by the lab as soon as possible.

The sample containers for all parameters will be filled and labeled immediately following sample collection. Field data sheets documenting sampling collection date, time, location, personnel, weather conditions, sample identification, and measured field parameters will be completed for each sample. Water samples will be kept cool with ice to four degrees centigrade in insulated coolers or refrigerators until delivery to the laboratory. Each sample will be logged on a chain-of-custody record, which will accompany the samples through collection and delivery to the analytical laboratory.

### 6.3 Duplicates and Blanks

To assess the precision of field sampling procedures and the variability of the sample source, duplicates will be collected at a frequency of 1 in 20 samples. Each duplicate is to be collected after performing the decontamination and purging routines used for normal sample collection. When both sample results exceed the RDL (reporting detection limit) the RPD (relative percent difference) should be less than 25% or the current lab acceptance limit, whichever is lower.

Equipment blanks will be collected should non-dedicated equipment be used during sampling. Laboratory-supplied deionized water will be run through the decontaminated sampling equipment and into appropriate sample containers. Equipment blanks will be collected at a frequency of 1 per 20 samples per piece of non-dedicated field equipment and analyzed for the same parameters as the environmental sample collected immediately preceding the equipment blank. Trip blanks will not be submitted for this work based on the COCs.

## 6.4 Laboratory QA/QC

Standard laboratory QC procedures will be used by the analytical laboratory to document possible biases related to the analytical process. These QC procedures include the use of surrogate spikes, method blanks, matrix spikes, and matrix spike duplicates. Surrogate spiking compounds are added to every gas chromatography-mass spectrometry (GC/MS) surrogate spike sample. Method blanks are analyzed to assess possible effects of the laboratory environment on samples. Matrix spikes and matrix spike duplicates are analyzed by the laboratory to provide a quantitative measure of accuracy and precision, and to document effects that the sample matrix has on the analysis. As part of the data validation, the laboratory will provide a narrative summarizing the QC data on surrogate spikes, method blanks, and matrix spikes and if samples were analyzed within recommended holding times.

## 6.5 Field Reports

Accurate documentation of field activities is necessary for efficient completion of this investigation. Personnel will record daily activities on a daily field form and appropriate field data sheets. Documentation will include the following:

- weather conditions
- work activities and field observations
- description, date, and time of sample collection
- photographs of field activities and sample locations
- visitors to the Site
- calibration records
- deviations from the Workplan
- health and safety related issues or situations

## 6.6 Chain-of-Custody Procedures

The chain-of-custody procedures to be used during the investigation will be conducted as described below:

- The field sampler will have custody of the samples from the time they are collected until they are transferred to the laboratory courier.
- All bottles will be labeled with sample number and location by the sampler.
- The sample number, date, and collection time will be listed on the chain-of-custody form.
- When transferring possession of the samples, the individuals relinquishing and receiving will sign, date, and note the time on the COC form.
- Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory.

## 6.7 Laboratory Reports

Data reduction, review, and reporting will be performed under the contract laboratory's standard operating procedures. Data will be provided to data recipients within three weeks of receipt of the last sample for a sampling event and will be reported in the standard laboratory reporting format. This includes an analytical result, MDL (method detection limit), and reporting limit (RL). All analytical data packages submitted by the analytical laboratory shall include the following:

- Sample receipt, chain-of-custody and shipping documentation, including identification of field sampling personnel, shipping personnel (or organization)
- Analytical results for each sample containing the reduced results for all analytes/constituents requested in the chain of custody, request for analysis or purchase order

Sample results will be available through LIMS or in an electronic version (Excel) of the hardcopy report.

## 7.0 SCHEDULE

The schedule below summarizes the time frame for implementation of the proposed scope of work assuming that approval of this Workplan is received from the RWQCB by November 28, 2013.

**Table 2: Schedule**

| **Task** | **Target Completion Date** |
|---|---|
| Phase 1 - Task 1: Data Compilation & CSM | December 31, 2013 |
| Phase 1 - Task 2: Detection Monitoring Program Report | January 15, 2014 |
| Phase 1 - Task 3: Regulatory Review & Approval | February 15, 2014 |
| Phase 2 – Tasks 1–3: Monitoring Well Installation and Report | June 15, 2014 |
| Phase 3 – Tasks 1 & 2: Quarterly Monitoring Program | July 2014 – July 2016 |
| Phase 3 – Task 3: Report Results of Investigation | October 31, 2016 |

## 8.0 REFERENCES

Brabb, E.E., Graymer, R.W. and Jones D.L.. 2000. Geologic Map and Map Database of the Palo Alto 30' x 60' Quadrangle, California. U.S. Geological Survey Miscellaneous Field Studies Map MF-2332 ,U.S. Department of the Interior, U.S. Geological Survey.

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Vanderhurst, W., 1981. The Santa Clara Formation and Orogenesis of Monte Bello Ridge, 114 p.

# FIGURES


Map: G:\GIS\Sites\Lehigh_Permanente_Quarry\Maps\General\SiteLocMap.mxd | Modified: 10/29/2013 12:54:10 PM | Plotted: 10/31/2013 11:26:23 AM by DZelmanfahm

## REFERENCES

Spatial Reference:
NAD 1983 StatePlane California III FIPS 0403 feet

Base Maps
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

PROJECT
WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE
**REGIONAL LOCATION MAP**

Golder Associates

| | | | |
|---|---|---|---|
| PROJECT No. | | 063-7109-913 | FILE No. SiteLocMap |
| DESIGN | DLM | 1/28/2010 | SCALE: AS SHOWN REV. 0 |
| GIS | DLM/MM | 10/29/2013 | |
| CHECK | GW | 10/29/2013 | |
| REVIEW | BF | 10/29/2013 | |

**FIGURE 1**


## LEGEND

- Stream
- Property Boundary

## NOTES

1) Locations based on conversion from local coordinates or Google Earth placement.

## REFERENCES

1)Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
2) Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

1,250 0 1,250 Feet

PROJECT

WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE

**SITE PLAN**

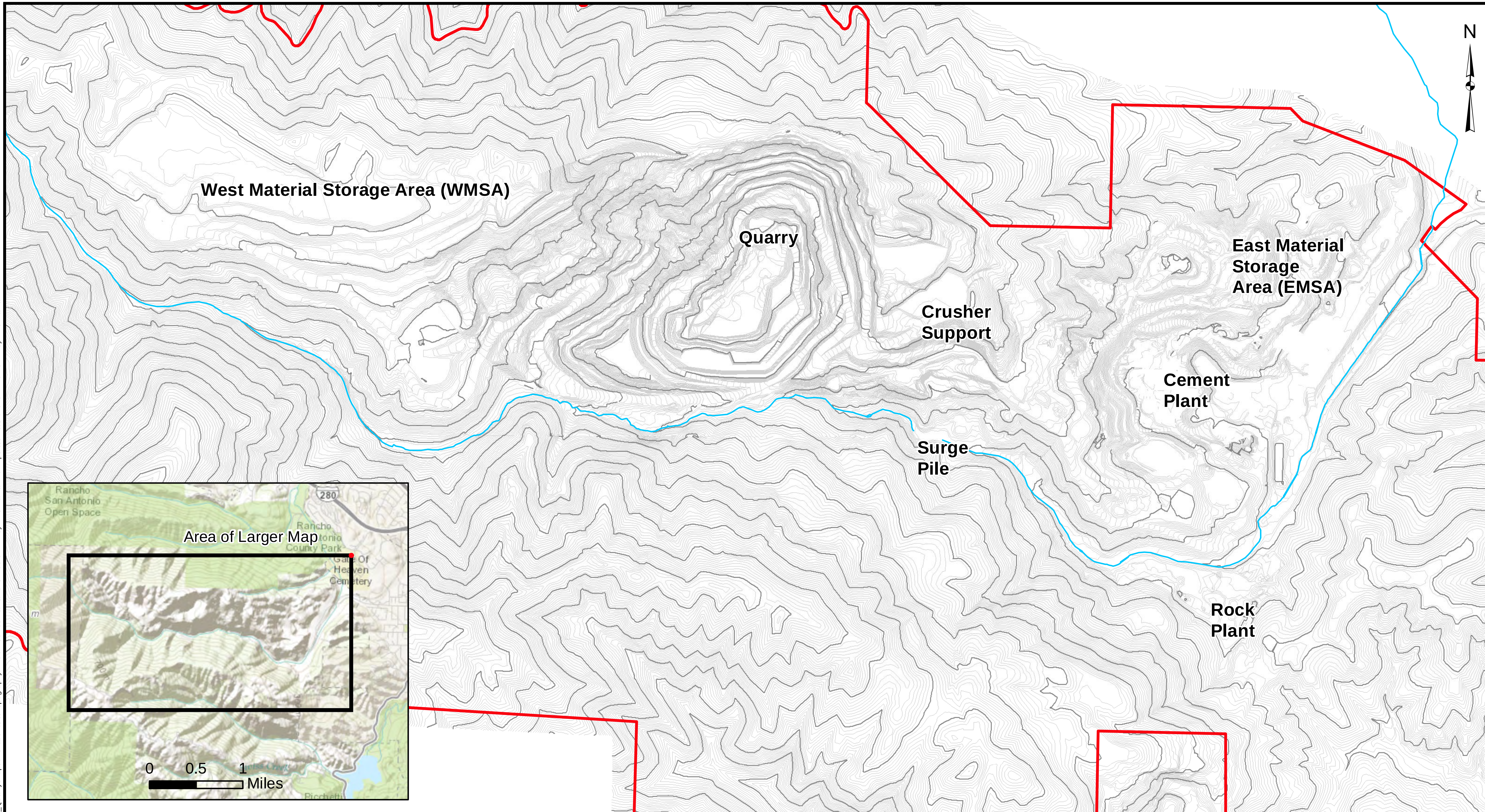
Golder Associates

| PROJECT No. | | 063-7109 |
|---|---|---|
| DESIGN | DZF | 10/31/2013 |
| GIS | DZF | 10/31/2013 |
| CHECK | GW | 10/31/2013 |
| REVIEW | GW | 10/31/2013 |

FILE No. SitePlan.mxd
SCALE: AS SHOWN REV. 0

**FIGURE 2**

Map Document: G:\GIS\Sites\Lehigh_Permanente_Quarry\Maps\General\SitePlan.mxd / Modified 10/31/2013 12:16:11 PM by DZelmanfahm / Exported 10/31/2013 12:25:31 PM by DZelmanfahm




## LEGEND

- Permanente Creek
- Property Boundary

**April 2013 Topography**

- 100 ft contour
- 10 ft contour

## REFERENCES

1) Topography recieved from Cliff Maddox April 2013.
2) Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

1,000 0 1,000 Feet

PROJECT
WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE
**SITE TOPOGRAPHY**

Golder Associates

| | | |
|---|---|---|
| PROJECT No. | | 063-7109-913 |
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| GIS | MM | 10/29/2013 |
| CHECK | GW | 10/29/2013 |
| REVIEW | WLF | 10/29/2013 |

FILE No. SiteTopography.mxd
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**FIGURE 3**

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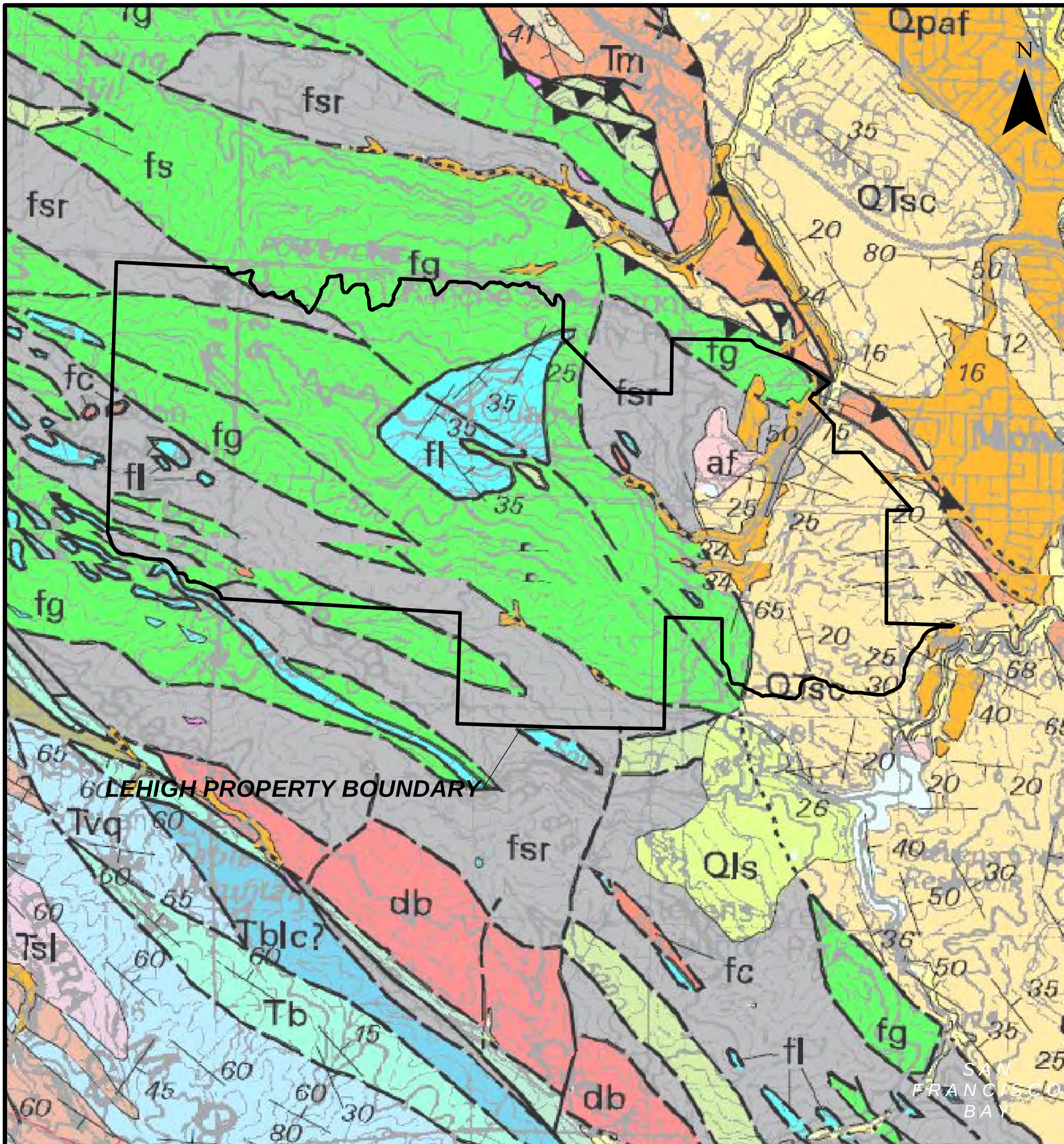


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## REFERENCES


US Geological Survey, Geologic Map and Map Database of the Palo Alto 30' x 60' Quadrangle, California; Brabb, E.E., R.W.Graymer, and D.L., Jones, 2000. MF Studies Map MF-2332.
(http://pubs.usgs.gov/mf/2000/mf-2332/mf2332m.pdf)


PROJECT

WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE

REGIONAL GEOLOGIC MAP

Golder Associates

| | | |
|---|---|---|
| PROJECT No. | | 063-7109 |
| DESIGN | DLM | 1/28/2010 |
| GIS | DLM | 1/28/2010 |
| CHECK | GW | 1/28/2010 |
| REVIEW | WLF | 1/28/2010 |

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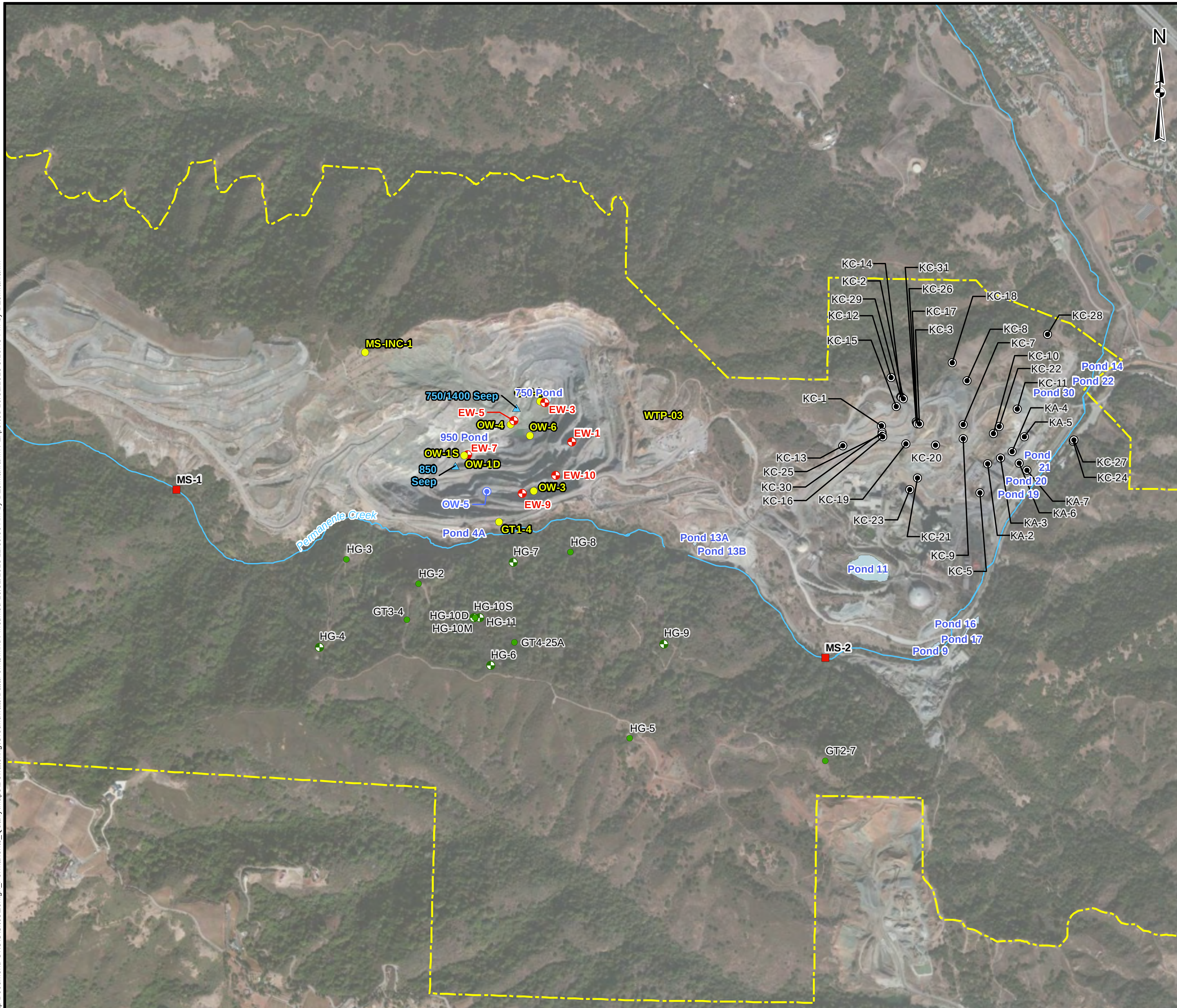
**FIGURE 4**

Map Document: G:\GIS\Sites\Lehigh_Permanente_Quarry\Archivelz_mxd\H_RegionalGeologicMap.mxd / Modified 10/29/2013 12:35:49 PM by DZelmanfahm / Exported 10/31/2013 11:41:40 AM by DZelmanfahm




## LEGEND

- Historical EMSA Monitoring Well
- Southern Permanente Piezometer (VWT)
- Southern Permanente Well
- Piezometer (observation well)
- Extraction Well
- Piezometer (VWT)
- Seep
- Surface Water Station
- Stream
- Facility Boundary
- Pond

## NOTES

1) Locations based on conversion from local coordinates or Google Earth placement.

## REFERENCES

1)Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
2) Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet

1,250 0 1,250
Feet

PROJECT
WORKPLAN: SITE GROUNDWATER CHARACTERIZATION
PERMANENTE QUARRY
SANTA CLARA COUNTY, CALIFORNIA

TITLE
# GROUNDWATER DATA POINTS

Golder Associates

| | | |
|---|---|---|
| PROJECT No. | | 063-7109 |
| DESIGN | MM | 6/5/2013 |
| GIS | MM | 10/31/2013 |
| CHECK | GW | 10/31/2013 |
| REVIEW | GW | 10/31/2013 |

FILE No. GroundwaterDataPoints.mxd
SCALE: AS SHOWN REV. 0

**FIGURE 5**

Map Document: G:\GIS\Sites\Lehigh_Permanente_Quarry\Maps\Dewatering\GroundwaterDataPoints.mxd / Modified 10/31/2013 11:56:06 AM by DZelmanfahm / Exported 10/31/2013 3:16:48 PM by DZelmanfahm