

4.10 Hydrology and Water Quality

This section discusses the existing environmental and regulatory setting of the Project, identifies potential impacts related to implementation of the Project, and proposes mitigation measures for those impacts determined to be significant. Setting information in this section was compiled from the Reclamation Plan Amendment (RPA) (EnviroMINE, 2011), technical reports prepared in support of the RPA and peer reviews of those reports, resource agency websites and databases, and Geographic Information System (GIS) data.

4.10.1 Setting

4.10.1.1 Regional Climate and Precipitation

The Quarry is located in the southern San Francisco Bay (Bay) area, in the foothills of unincorporated western Santa Clara County, just west of the City of Cupertino. The climate of the southern Bay area is Mediterranean, characterized by mild, wet winters and warm, dry summers. Temperatures in the County tend to be fairly mild, and rarely drop far below freezing in the valley flat (SCBWMI, 2003). Mean annual precipitation at the Quarry is approximately 25 inches (County of Santa Clara, 2007). Rainfall distribution in the Project Area is strongly controlled by topography, as annual rainfall is greatest on high ridges to the west and decreases eastward toward the Santa Clara Valley. Almost all precipitation falls as rain between October and April.

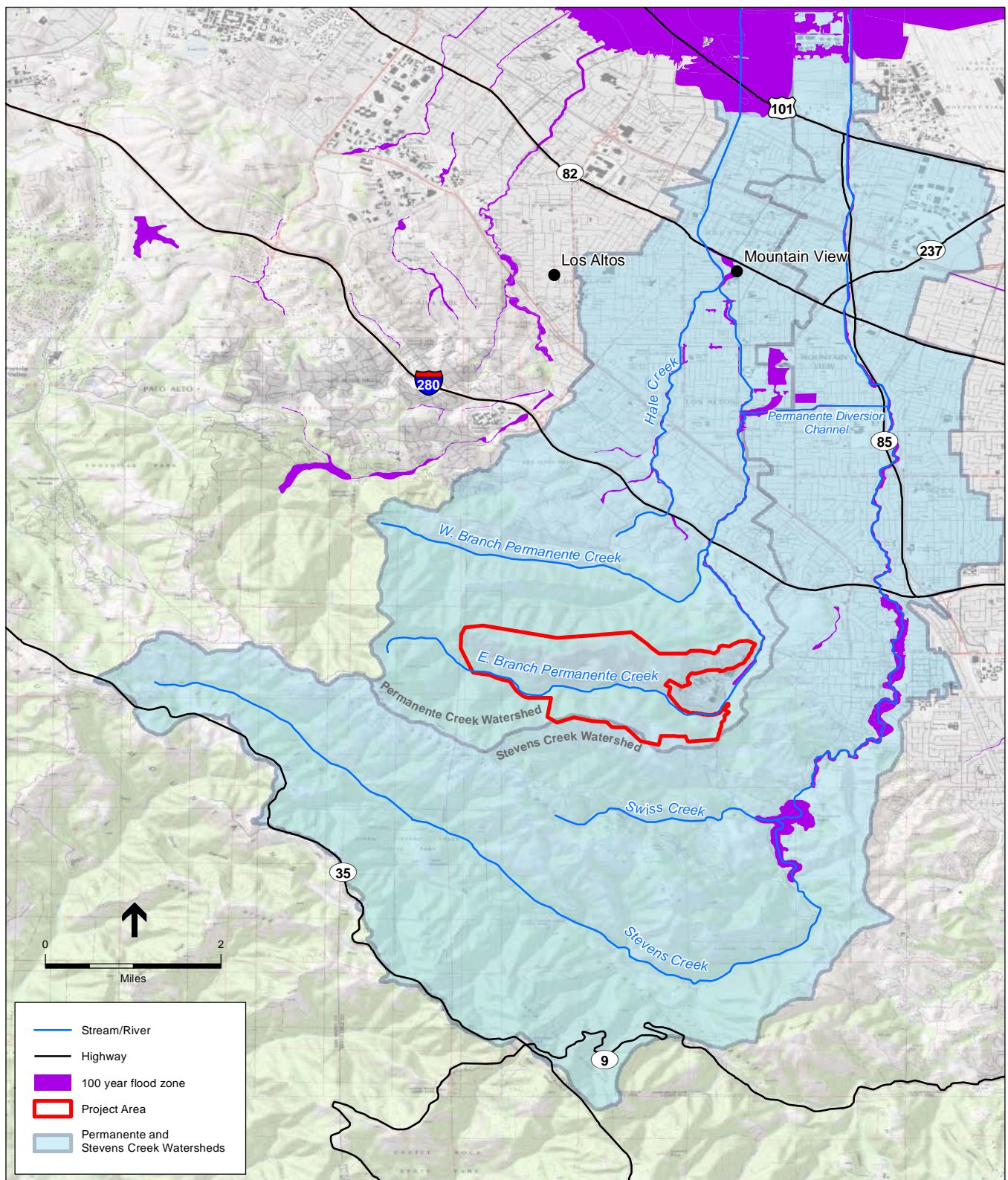
4.10.1.2 Surface Water Hydrology and Drainage

Permanente Creek Watershed

The Quarry lies within the Permanente Creek watershed (**Figure 4.10-1**). Permanente Creek discharges into southern San Francisco Bay (South Bay). The entire Permanente Creek watershed comprises approximately 17 square miles of land, and the main channel is about 13 miles in length, rising on the southeast side of Black Mountain (elevation 2,800 feet) and flowing east then north to the South Bay (SCBWMI, 2003; RWQCB, 2007a).¹ Other than the Quarry and some rural residential development, the upper watershed is relatively undeveloped.² In the lower watershed, Permanente Creek flows through the cities of Los Altos and Mountain View and discharges into the South Bay through the Mountain View Slough. Most of the lower watershed within the Santa Clara Valley is heavily urbanized and the channels have been extensively modified. In the lower watershed, peak flows of up to 1,500 cubic feet per second (cfs) are diverted to Stevens Creek (to the east) by way of the Permanente Creek Diversion, which was constructed in 1959 (SCBWMI, 2003). The diversion structure was designed to allow low flows to continue downstream in Permanente Creek while routing a substantial portion of the larger flood flows into Stevens Creek.

¹ Unless otherwise noted, all reported elevations in this chapter refer to feet above mean sea level (amsl).

² The *lower* watershed, or lower Permanente Creek, refers to the watershed area and stream reaches downstream of Interstate 280; the *upper* watershed, or upper Permanente Creek, refers to the watershed area and stream reaches upstream of Interstate 280.



SOURCE: FEMA, 2007;
Creek and Watershed Map of the Santa Clara basin, 2005

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Figure 4.10-1
Regional Hydrologic Setting

The Quarry is located in the upper watershed in the southern headwater area of the Permanente Creek watershed, which encompasses approximately 3.9 square miles of steep, upland terrain on the east side of the Santa Cruz Mountains.³ Elevations in the southern headwater area range from 400 to 2,800 feet, and the average is 1,400 feet (Nolan and Hill, 1989). Most of the southern headwater area that is undisturbed by activities related to the Quarry is undeveloped and dominated by chaparral and upland broadleaved forest and, to a lesser extent, grassland areas.

Driven by the Mediterranean climate, flow in Permanente Creek generally rises in late fall or early winter and then recedes throughout a long base flow period during the spring and summer. In most years Permanente Creek remains perennial, but during particularly dry years (e.g., Water Year 1987)⁴ the creek will cease to flow in the summer or early fall (Nolan and Hill, 1989). Like most small watersheds draining parts of the Coast Ranges, annual flow volumes and peak discharges are highly variable, both within a given year as well as from one year to the next. The steep topography of the upper watershed results in short duration, high intensity runoff during storm events.

Quarry Area

The land associated with the Quarry accounts for much of the watershed area composing the Permanente Creek southern headwater area, 6 percent of which is impervious surfaces (Nolan and Hill, 1989). While much of the site drains directly or indirectly to Permanente Creek, a portion of the Quarry area drains directly into the Quarry pit. Water that is pumped out of the pit is discharged into the creek. Although most of the runoff from the WMSA flows to the Quarry pit, some stormwater runs off the WMSA and is ultimately conveyed to the creek further downstream of the site where Wild Cat Creek approaches I-280.

Permanente Creek has been considerably modified along particular reaches on the site. The creek alignment has been altered and straightened in some areas, and portions of the creek bordering the Quarry are contained within a culvert or open concrete-lined channel. Additionally, there are at least two instream detention ponds within the reach of Permanente Creek adjacent to the Project Area.⁵ At the upstream and downstream ends of the site, Permanente Creek is typically perennial, yet over the middle section of the site (e.g., directly south of the Quarry pit) Permanente Creek tends to flow only intermittently (Golder Associates, 2011). Downstream of the intermittent reach, dewatering of the Quarry pit provides or supplements the flow in Permanente Creek, which helps to keep the flow regime largely perennial downstream of the dewatering discharge point.

³ The *southern headwater area* generally refers to the Permanente Creek watershed upstream of the confluence with West Fork (or Branch) Permanente Creek.

⁴ A Water Year begins on October 1 of the previous year and ends on September 30 of the designated Water Year. For example, Water Year 1987 comprises October 1, 1986 through September 30, 1987.

⁵ The term *instream*, in this case, is used to refer to ponds/structures that are built within the low-flow channel (i.e., not within the bank full channel margins, or within the broader floodplain area)

Surface Water Quality

In general, water quality within streams depends on the mineral composition of the soils and associated parent material (e.g., bedrock) in the watershed, the hydrologic and hydraulic characteristics of the streams, the types of contaminant sources present in the watershed, and the extent and nature of human development and disturbance.

The San Francisco Bay Regional Water Quality Control Board (RWQCB) is responsible for the protection of water quality and the development of water quality standards for the area of Santa Clara County that includes the Project Site. Through a process governed by the Federal Clean Water Act (CWA), the RWQCB (2007b) has formally identified water quality issues for water bodies within and near the Project area (e.g., Permanente Creek and Stevens Creek). Section 303(d) of the CWA requires that states develop a list of water bodies that do not meet water quality standards, establish priority rankings for waters on the list, and develop action plans, called Total Maximum Daily Loads (TMDL), to improve water quality.⁶ In 2007, the RWQCB compiled the 303(d) list for the San Francisco Bay Area (RWQCB, 2007b) based on recommendations from staff and information solicited from the public and other interested parties. Further, on February 11, 2009, the RWQCB adopted a resolution (RWQCB, 2009) approving staff recommendations for proposed additions, deletions and changes to the 303(d) list of impaired water bodies for the Bay area; this included proposals for listing Permanente Creek as impaired for selenium and water toxicity. The list of existing and proposed impaired water bodies relevant to the Project area is presented in **Table 4.10-1** (further information regarding federal, state, and local water quality policies and regulations, including water quality objectives, beneficial uses, and water quality standards, is presented below in Section 4.10.1.4, *Regulatory Setting*).

Through regionally-based monitoring programs, both the RWQCB and the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) have, to varying degrees over the last 8 years, monitored and assessed water quality conditions within the Permanente Creek watershed. Existing water quality issues have been documented within the Permanente Creek watershed, particularly in the lower reaches of the creek that traverse the more heavily urbanized areas. For example, the RWQCB (2007a) has noted that temperature and dissolved oxygen conditions throughout the watershed would make it difficult for Permanente Creek to support salmonid populations without further improvements. Nutrient and contaminant data indicate considerable inputs of metals, pesticides, and PAHs in the lower watershed. Further, toxicity tests indicate the presence of constituents at toxic levels both at the upstream and downstream ends of the most urbanized areas of the Permanente Creek watershed. (RWQCB, 2007a). The monitoring data (RWQCB, 2007a; SCVURPPP, 2007) generally suggest that the urban areas are of most concern for stream degradation and for transport of metals, PAHs, and legacy pesticides to the Bay. However, in the vicinity of the Quarry, monitoring data and previous investigations suggest that the existing concentrations of total dissolved solids (TDS), sulfate, some metals, including selenium and mercury, and suspended sediments are relatively high.

⁶ A TMDL defines how much of a specific pollutant a given water body can tolerate without exceeding water quality standards, and serves as the means to attain and maintain water quality standards such that the water body could support designated and potential beneficial uses identified in the San Francisco Bay Basin Water Quality Control Plan (RWQCB, 2007b).

**TABLE 4.10-1
EXISTING AND PROPOSED SECTION 303(D) LIST OF IMPAIRED WATER BODIES**

Water Body	Pollutant	Proposed or Approved TMDL Completion Date ^b	Potential Sources
Permanente Creek	Diazinon	2006 (approved) ^c	Urban Runoff/Storm Sewers
	Toxicity ^a	2021	Unknown
	Selenium ^a	2021	Unknown
Stevens Creek	Diazinon	2006 (approved) ^c	Urban Runoff/Storm Sewers
	Toxicity	2019	Unknown
SF Bay, South	Chlordane, DDT, Dieldrin	2008	Nonpoint Source
	Dioxin Compounds, Furan Compounds	2019	Atmospheric Deposition
	Exotic Species	2019	Ballast Water
	Mercury	2006	Atmospheric Deposition, Industrial and Municipal Point Sources, Natural Sources, Nonpoint Sources, Resource Extraction
	Polychlorinated biphenyls (PCBs)	2006	Unknown Nonpoint Source
	PCBs (dioxin-like)	2019	Unknown Nonpoint Source
	Selenium	2019	Agriculture, Domestic Use of Groundwater

NOTES:

- ^a The RWQCB has adopted a resolution (no. R2-2009-0008) (RWQCB, 2009) approving recommended changes to the existing 303(d) list, including the recommendation to list Permanente Creek as impaired by diazinon and toxicity. Staff will now transmit the changes to the 303(d) list to the State Water Resources Control Board, which will approve statewide revisions to the list. The 2008 303(d) list will take effect when the U.S. Environmental Protection Agency considers and approves a final list.
- ^b The date of planned TMDL completion is provided in the 303(d) lists from the State Water Resources Control Board. Although the planned date of completion has been passed for many of the TMDL projects, approved TMDLs have not been completed as of September 2010.
- ^c A Basin Plan amendment incorporating a TMDL and water quality attainment strategy for diazinon and pesticide-related toxicity in the Bay Area's urban creeks has been incorporated into the Basin Plan. The amendment was adopted by the RWQCB on November 16, 2005, and approved by the State Water Resources Control Board on November 15, 2006. It has been approved by the State Water Board, the Office of Administrative Law, and the U.S. Environmental Protection Agency. The final plan, incorporating all amendments, was published January 18, 2007. (RWQCB, 2007c)

SOURCE: RWQCB, 2007b; RWQCB, 2009

The effect of these conditions on aquatic life in Permanente Creek has been studied (WRA, 2011). The creek was found to support several amphibian, fish, and benthic invertebrate species in both upstream and downstream locations, including a resident population of rainbow trout in upstream areas where year-round flows exist. Waste screen bio-analyses were conducted on water collected from a location below the Quarry pit discharge point in February and April 2009 using fathead minnows (*Pimephales Promelas*), with a 100 percent survival rate over a 96-hour period (WRA, 2011). As such, laboratory analysis shows that existing water quality in Permanente Creek is not acutely toxic to some fish species. However, studies have not been performed to determine whether selenium concentrations in fish located in portions of Permanente Creek downstream from the Quarry differ from than those in fish located upstream from the Quarry.

General Minerals and Metals

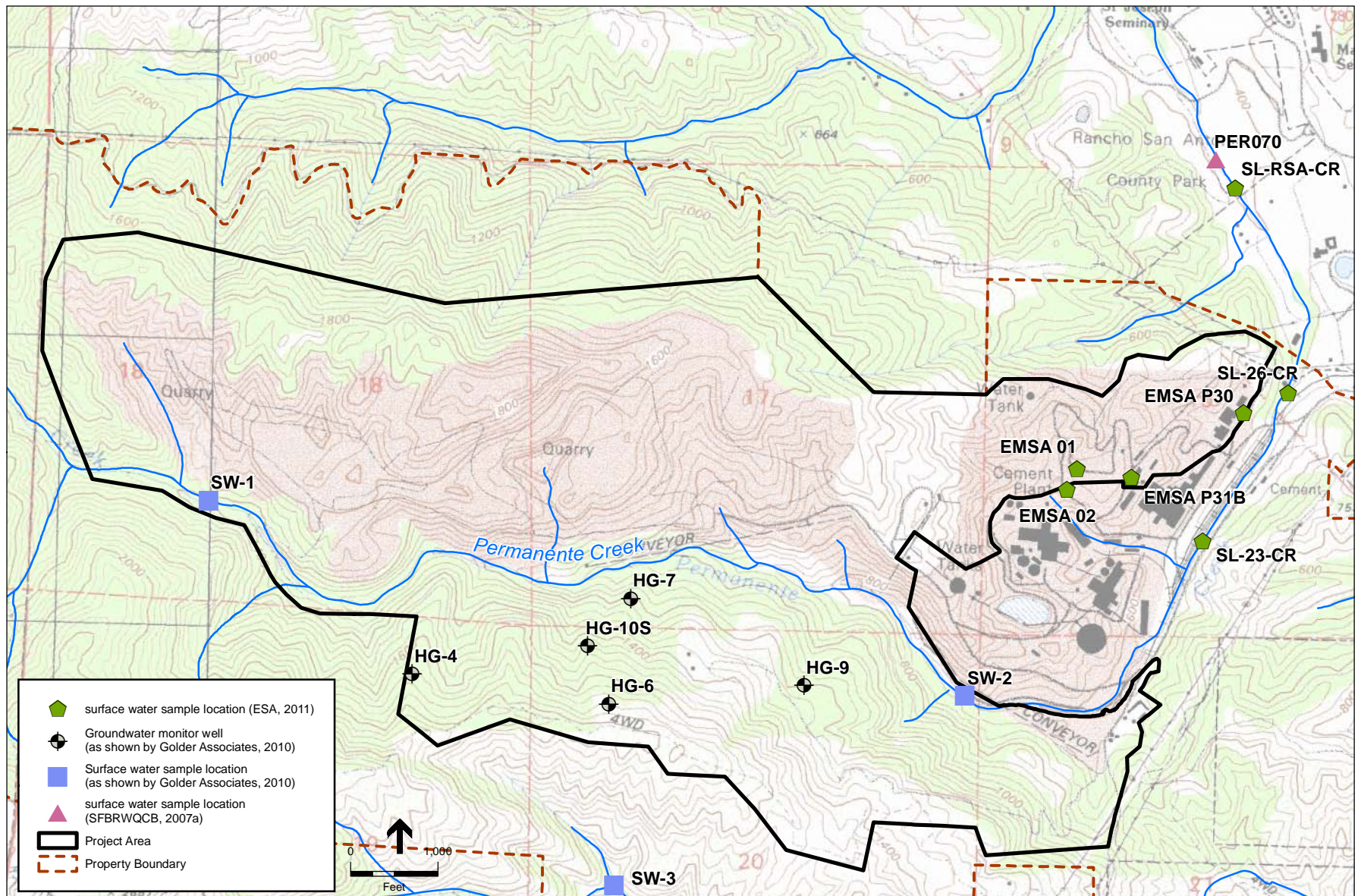
Compared to nearby areas, the Permanente Creek watershed likely has more naturally occurring mineralized rock outcrops and these could be contributing to the relatively high concentrations of some constituents in background water (SES, 2011). Based on surface water samples from locations on Permanente Creek adjacent to and just downstream of the Quarry site (see **Figure 4.10-2**), surface water quality parameters generally meet relevant objectives within the *San Francisco Bay Basin (Region 2) Water Quality Control Plan* (Basin Plan) (RWQCB, 2007c), with the exception of TDS, sulfate, nickel, mercury, and selenium (**Table 4.10-2**).⁷ Further, water quality monitoring conducted by the RWQCB (2007a) and the SCVURPPP (2007) has also shown that selenium concentrations in Permanente Creek, in the reaches adjacent to and near the Quarry, are generally greater than the water quality objective presented in the Basin Plan. The RWQCB (2007a) reported that, at their upstream Permanente Creek monitoring site (PER070; see Figure 4.10-2), which is just downstream of the Quarry, the selenium concentration in water was greater than the Basin Plan water quality objective for aquatic life during all three seasons sampled (i.e., dry, wet, and spring). In general, measured dissolved selenium concentrations in Permanente Creek have ranged from 1.7 to 81 micrograms per liter (µg/l) in the vicinity of the Quarry (Table 4.10-2); the (4-day average) Basin Plan objective for selenium is 5 µg/l (RWQCB, 2007c).

Various water quality parameters have been measured within runoff from the EMSA, the Quarry pit, and the WMSA. The WMSA contains the same type of overburden and waste rock that is and would be placed within the EMSA as well as within wall-washing samples (Table 4.10-2).⁸ Sampling of surface runoff from the EMSA area, which included flowing, concentrated runoff (e.g., within a ditch/gully and from detention pond inlet pipes) as well as still water from detention ponds, found levels of selenium and mercury that were almost always in excess of the Basin Plan objectives. The vast majority of the selenium detected in each sample was in the dissolved form, rather than being associated with suspended sediment and measured only as the total recoverable selenium. Similar to the general surface water characteristics, a sample of runoff from the WMSA met the relevant water quality objectives within the Basin Plan, with the exception of TDS, sulfate, molybdenum, and selenium. Also, wall-washing samples from the Quarry pit further indicate that selenium is likely readily dissolved and transported from the exposed limestone rock surfaces by surface runoff.

Waterborne selenium concentrations in the Project Area can be compared with background conditions (described above) and also with standards for surface water as established by the RWQCB in the current Basin Plan (RWQCB, 2007c) or with other promulgated values such as

⁷ The objective for nickel is based on hardness, and the objective value assumes a hardness of 100 mg/l calcium carbonate (CaCO₃) (RWQCB, 2007c). For example, higher hardness values would result in higher concentration values for the water quality objective according to the equations presented by the RWQCB (2007c). The referenced surface water samples (i.e., at SW-1 and SW-2) also reported relatively high hardness values (i.e., between 600 and 800 mg/l, on average). Therefore, the reported nickel concentrations, though high in some instances, would likely not exceed the Basin Plan water quality objectives.

⁸ Wall-washing refers to tests that were performed on exposed rock faces within the Main Pit. The tests involved washing an approximately one square meter area of rock face with a known volume of water. The resultant water was analyzed for dissolved and total metal concentrations and general minerals. The amount of wash water used in the tests was approximately equivalent to a 0.25-inch rain event (SES, 2011).



SOURCE: Golder Associates, 2010; SFBRWQCB, 2007a; Sowers et al., 2005; ESA, 2011

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Figure 4.10-2
Project Area Monitoring and Sampling Locations

Maximum Contaminant Levels (MCLs) from the U.S. Environmental Protection Agency (USEPA) (collectively, Benchmarks) to characterize existing conditions. Selenium concentrations at SW-1 (7.18 µg/l; upstream Permanente Creek) were more than an order of magnitude higher than background as reflected by SW-3 (0.366 µg/l) in the adjacent Monte Bello Creek watershed. The effect of the ongoing Quarry pit dewatering discharges (which enter the creek between SW-1 and SW-2) on existing Permanente Creek water quality is indicated by the samples collected at SW-2 (the downstream location in Permanente Creek), where dissolved selenium concentrations ranged from 13 to 81 µg/l.⁹ A Quarry pit water sample in January 2010 had a dissolved selenium concentration of 82 µg/l (Golder, 2011), indicating that dewatering is a significant factor with respect to selenium concentrations in the creek. Mercury, which occurs naturally in the various rock types and in groundwater, meets the Benchmarks at both SW-1 and SW-2 apart from one isolated exception at 0.07 µg/l, which is not significantly above the 0.025 µg/l 4-day average goal and is below the 2.4 µg/l 1-hour goal (CH2MHill, 2011). Elevated concentrations of mercury were found at several locations within the property (up to 8.9 µg/l in an atypical sample with a large amount of suspended sediment in it from a roadway).

Selenium is released from limestone materials through biogeochemical processes when the rock surface is exposed to water and oxygen. Selenium is chemically similar to sulfur; dissolved selenium typically occurs in an oxidized form (oxygen-rich forms of selenate or selenite, which are analogous to sulfate and sulfite). If the oxidized forms are in a chemically reducing (i.e., with little or no oxygen, referred to as anoxic or anaerobic) environment, they will be transformed to the reduced forms (selenide or elemental selenium). Elemental selenium is a solid, and selenide forms insoluble compounds with iron, calcium, and other common mineral cations (SES, 2011). Selenide can also form volatile compounds that de-gas to the atmosphere.

Leaching of Constituents from Quarry Rock

An important characteristic of the Project Area with respect to water quality is the leachability of various constituents, particularly selenium, from rocks at the site. Studies were conducted to characterize the principal rock types in the site vicinity, their chemical characteristics, and the leachability of constituents from them (SES, 2011). The predominant rock type that is extracted and processed onsite is limestone, which grades from a dark bituminous limestone to a gray to white, high-chert-content limestone. The Quarry primarily produces limestone for cement production and for construction aggregate uses. “Limestone” in this section refers to cement-grade limestone, and “aggregate” means other limestone grades and greenstone suitable for use in construction aggregate products. The term “overburden” refers to rock materials that are not suitable for use as limestone or aggregate. They include rocks such as greenstones, metabasalts, and greywacke in addition to minor amounts of low-grade limestone not suitable for use as aggregate.

To characterize rock materials present in the Quarry and overburden material such as that in the EMSA and WMSA, several different types of tests were conducted (SES, 2011). The tests included determining the total metals and selenium content of the rocks and the leachability of

⁹ Permanente Creek is at least partially dewatered upstream of sample location SW-2. Water that is captured by the pit is pumped back into the creek via a pond adjacent to the creek.

TABLE 4.10-2
MONITORED POLLUTANT CONCENTRATIONS IN PROJECT AREA

	Metals (dissolved fraction unless otherwise indicated)															
	TDS (mg/l)		sulfate (SO ₄) (mg/l)		iron (µg/l)		manganese (µg/l)		mercury (µg/l)		molybdenum (µg/l)		nickel (µg/l)		selenium (µg/l)	
	range	average	range	average	range	average	range	average	range	average	range	average	range	average	range	average
Surface Water																
Permanente Creek																
SW-1 ^b	350 - 1,800	1,110	450 - 1,110	578	**(<7.2) - 9.7	6.6	0.3 - 1.9	0.9	0.0008 – 0.055	0.015	1.8 - 5.7	3.8	2.2 - 4.7	3.1	1.7 - 11.0	7.2
SW-2 ^b	1,000 - 1,100	1,067	550 - 600	570	(<9.3) - 18.0	8.0	2.1 - 3.9	2.8	0.0013 – 0.07	0.0187	83 - 750	440.8	27 - 110	62.8	13 - 81	62
SL-23-CR ⁱ	--	--	--	--	--	--	--	--	--	0.056 ^j	--	120 ^j	--	29 ^j	--	24
SL-26-CR ⁱ	--	--	--	--	--	--	--	--	--	0.052 ^j	--	110 ^j	--	27 ^j	--	22
SL-RSA-CR ⁱ	--	--	--	--	--	--	--	--	--	(<0.025) ^j	--	120 ^j	--	24 ^j	--	23
PER070 ^a	720 - 850	765	326 - 379	347	--	--	--	--	--	--	--	--	1.6 - 30.9	13.5	5.1 - 18.8	9.9
ZOMB-1 ^l	310	--	--	--	--	--	--	--	0.00026	--	ND<5	--	ND<5	--	ND<10	--
SL-4A3-PD ^m	930	--	--	--	--	--	--	--	0.00678	--	340	--	110	--	48	--
PERMUS ⁿ	720	--	--	--	--	--	--	--	0.00731	--	140	--	33	--	19	--
Monte Bello Creek																
SW-3 ^b	340 - 360	353	18 - 28	22.8	ND (<9.3)	ND(<7.2)	0.11 –1.4	0.6375	<0.0002—0.00089	0.0006	0.91 - 24	9.63	0.87 – 1.4	1.14	ND (<0.38) - 0.71	0.366
Upland Runoff																
EMSA 01 (road) ^{i,k}	--	--	--	--	--	--	--	--	--	8.9 ^j	--	31 ^j	--	3400 ^j	--	33
EMSA 02 (ditch/gully) ⁱ	--	--	--	--	--	--	--	--	--	0.062 ^j	--	96 ^j	--	14 ^j	--	38
EMSA P31B-IN (pond inlet) ⁱ	--	--	--	--	--	--	--	--	0.091 -- 0.11	0.105 ^j	12 --160	86 ^j	49 --180	115 ^j	8.3 -- 36	22
EMSA P31B (pond) ⁱ	--	--	--	--	--	--	--	--	0.037 -- 0.099	0.068 ^j	19 -- 74	47 ^j	19 --110	65 ^j	12 --18-	15
EMSA P30-IN (pond inlet) ⁱ	--	--	--	--	--	--	--	--	<0.025 -- 0.36	0.031 ^j	6.3 -- 70	38.1 ^j	18 -- 150	84 ^j	7.1 -- 22	15
EMSA P30 (pond) ⁱ	--	--	--	--	--	--	--	--	-0.073 -- 0.039	0.056 ^j	20 -- 47	34 ^j	20 -- 49	35 ^j	13 –19	16
WMSA ^g	--	900	--	550	--	(<9.3)	--	14	--	--	--	120	--	3.4	--	29
Groundwater																
HG-4 ^b	880 - 1,500	1,220	380 - 770	605	(<7.2) – 33	16.4	19 – 120	85	0.011 – 0.023	0.015	31 – 45	38	1.3 – 24	9	0.27 – 3.9	1.4
HG-6 ^b	460 – 490	470	8.6 – 16	13	(<7.2) – 46	26	33 – 58	45	0.001 – 0.006	0.002	1.3 – 3.6	2.5	0.47 – 2.1	1	(<0.4)	(<0.4)
HG-7 ^b	530 - 580	547.5	29 - 31	30.3	290 - 330	310	320 - 330	325	0.014 – 0.068	0.032	0.54 – 0.81	0.68	1.7 – 3.1	2.28	--	(<0.38)
HG-9 ^b	450 - 490	470	26 - 48	35.8	--	(<9.3)	0.19 - 17	6.6	0.001 – 0.024	0.008	0.93 – 3.7	2.5	1.6 – 2.9	2.33	(<0.38) – 0.9	0.5
HG-10S ^b	340 - 400	370	29 - 30	29.5	(<9.3)	(<9.3)	0.16 - 85	42.6	0.063	0.063	5 - 16	10.5	1.7 - 10	5.9	(<0.38) – 2.8	1.5
Wall Washing																
*Limestone (MHG) ^f	--	65	--	61	--	11	--	2.6	--	--	--	6.7	--	0.91	--	14
*Limestone (MLHG) ^f	--	91	--	15	--	160	--	1.2	--	--	--	14	--	4.9	--	0.7
Greywacke ^f	--	61	--	4.9	--	720	--	8.6	--	--	--	2.6	--	1.7	--	(<0.38)
Chert ^f	--	67	--	2.6	--	1,400	--	7.9	--	--	--	1.4	--	5.9	--	(<0.38)
Greenstone ^f	--	100	--	3.3	--	970	--	11	--	--	--	0.37	--	3.5	--	(<0.38)
Basin Plan Objective	--	500 ^c	--	250 ^c	--	300 ^c	--	50 ^c	--	0.025 ^d	--	50 ^e	--	52 ^{d,h}	--	5.0 ^d

^a As reported in RWQCB (2007a); samples collected in Jun 02, Apr 02, and Jan 03.
^b As reported in Golder Associates (2011) and SES (2011); samples collected in Feb 09, Apr 09, Sep/Oct 09, and Jan 10 (HG-10S only sampled in Sep/Oct 09 and Jan 10).
^c Water quality objective for municipal supply, secondary Maximum Contaminant Level (MCL) (RWQCB, 2007c).
^d Water quality objective for freshwater water quality, 4-day average (RWQCB, 2007c).
^e Water quality objective for agricultural supply (RWQCB, 2007c).
^f As reported in SES, (2011); sampled on November 24, 2009.
^g As reported in SES, (2011); sampled on January 13, 2010.
^h The objective for nickel is based on hardness. The objective value assumes a hardness of 100 mg/l calcium carbonate (CaCO₃).
ⁱ As reported in ESA (2011); samples collected on February 16, 2011 and March 24, 2011.
^j Value represents the TOTAL metal concentration for the sample.
^k Sample represents shallow, concentrated sheet flow from a Quarry road; the sample is not representative of non-road areas within the EMSA and, for this location, there are additional probable sources of metals and other inorganic constituents besides the waste rock (e.g., fluids/residues from heavy machinery and trucks).
^l Violet creek Tributary, south of WMSA. Sampling conducted by Lehigh, April 7, 2010 (Lehigh, 2010)
^m Pond 4 retention pond, adjacent to Quarry pit. Sampling conducted by Lehigh, April 7, 2010 (Lehigh, 2010)
ⁿ County Access Road Bridge. Sampling conducted by Lehigh, April 7, 2010 (Lehigh, 2010)

mg/l = milligrams per liter
µg/l = micrograms per liter
ND= not detected

* MHG = Medium to High grade limestone; MLHG = High and Medium/low grade limestone
** Values in () are non-detect with indicated detection limits.

SOURCE: ESA, 2011; SES, 2011; Golder Associates, 2011; RWQCB, 2007c

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general minerals and other constituents from these materials. Leachability was determined using the Modified California Assessment Manual Waste Extraction Test (CAM WET) and wall washing tests. Quarry water runoff from the west wall of the Quarry pit also was analyzed for those constituents. Results of these tests are presented in **Tables 4.10-3 and 4.10-4**.

Total concentrations of selenium and various metals in rock from boring samples collected in the Quarry pit and the area of a formerly proposed South Quarry¹⁰ varied by rock type (see Table 4.10-3). Selenium concentrations in composite boring samples of greywacke (10 milligrams per kilogram (mg/kg)), limestone (8.5 mg/kg), fault breccia (15 mg/kg), greenstone (15 mg/kg), and metabasalt (13 mg/kg) were notably higher than in chert (2.4 mg/kg) from the previously proposed South Quarry location. Individual samples of limestone from the Quarry pit indicate that limestone is heterogeneous with respect to selenium content; selenium concentration ranged from not detected (<0.76 mg/kg) to 6.6 mg/kg. This is thought to be due to different grades of limestone. The composite sample data are considered better indicators of average bulk conditions because of those variations among the types of limestone and because the composite samples are more representative of the overall bulk rock composition.

De-ionized water was used in conducting the CAM WET tests on the composite samples from the formerly proposed South Quarry (see Table 4.10-4). Results of these tests indicated that the limestone contains relatively low concentrations of leachable selenium (6 µg/l from the rock containing 8.5 mg/kg) in comparison to other rock types. However, selenium leachability from the overburden materials (such as greywacke, fault breccia, greenstone, metabasalt and chert) was very limited; all concentrations in water were less than 0.6 µg/l from those rocks, even though selenium concentrations in the rocks were typically higher than in limestone. This phenomenon will be further confirmed by sampling and testing during the backfilling and reclamation period as described in Mitigation measure 4.10-1.

Wall washing tests performed on exposed faces within the Quarry pit by Golder (2011) involved washing an approximately one-meter-square area of rock face with an amount of water that was about equivalent to a 0.25-inch rainstorm event. The resultant wash water was analyzed for dissolved and total selenium concentrations to provide an indication of the amount of total recoverable and dissolved constituents that could be leached out during a rainstorm for the various rock types (Table 4.10-2). The total receivable concentrations include the selenium contained in solid particles washed off the walls as well as in the wash water and are therefore higher than the dissolved values, which reflect only the amount of selenium in the wash water.

Similar to the CAM WET results (Table 4.10-4), the dissolved constituent concentrations from the wall wash tests for greywacke, chert, and greenstone (<0.38 µg/l) were very low (Table 4.10-2) compared to the bulk rock concentrations. However, dissolved selenium concentrations in wash water from limestone (0.7, 14, and 49 µg/l in individual samples; SES, 2011) varied greatly and

¹⁰ The South Quarry location was sampled because it was being considered as an expansion of the Quarry facilities in a prior reclamation plan amendment proposal, since the limestone formation being mined in the Quarry pit extends into this area. However, the South Quarry is not part of the RPA.

were generally much higher than from other rocks. Similarly, total selenium concentrations in the wash water from limestone (60 to 230 µg/l) were far higher than from the other rock types (all <11 µg/l), probably because there was a substantial amount of suspended sediments in the wash water.

Suspended Sediment

The upper Permanente Creek watershed previously has been documented as having a generally high sediment yield and notable accumulations of fine sediment (Nolan and Hill, 1989; SCVURPPP, 2007). The naturally high sediment yield is attributable, in part, to the underlying geology (i.e., the Franciscan Complex) and steep topography. The Franciscan Complex is generally recognized as producing relatively high sediment yields within Coast Range watersheds. However, activities associated with the Quarry (e.g., overburden stockpiles) previously have been identified as contributing to and increasing the ambient sediment load within the Permanente Creek watershed (Nolan and Hill, 1989; RWQCB, 1999). Nolan and Hill (1989) concluded that the sediment yield (i.e., tons per square mile) in the southern headwater area of Permanente Creek was approximately 3.5 times higher than that which would be expected under natural conditions. This difference was attributed to an increase in the availability of sediment, as opposed to increases or changes in runoff. Within and near the Project Area, Nolan and Hill (1989) noted that landforms susceptible to erosion include several types of active and inactive landslides, gullies, rills, unstable stream banks, bare ground and slopes, spoils and storage piles, and roads. Data presented by Nolan and Hill (1989) suggest that the increase in sediment availability could be attributed, in part, to land disturbances (e.g., bare ground, spoils piles) that were in close proximity to or interfaced with stream channels and related to activities at the Quarry. The RWQCB has previously cited the Quarry, on a number of occasions, for violating water quality standards. The most recent cleanup and abatement order was issued to the Quarry in 1999 (RWQCB, 1999), and a notice of violation was issued to the Quarry as recently as March of 2010; these orders and violations relate primarily to the discharge of sediment-laden stormwater to Permanente Creek. Among other regulatory mechanisms (described below), water quality related to the operation of the Quarry (including the Project site) continues to be regulated by the RWQCB under Cleanup and Abatement Order No. 99-018 (RWQCB, 1999). The Cleanup and Abatement Order relates primarily to the discharge of sediment-laden storm water to Permanente Creek. The principal sources of existing erosion and sediment loading to surface drainages (including Permanente Creek) are Quarry access roads, material piles, and areas which, due to the natural slope and topography, drain directly to Permanente Creek with little attenuation (or storage) of runoff. During storm events, overflow of existing retention ponds is also a notable mechanism of erosion and sediment entrainment (URS, 2010). The Quarry has implemented interim measures as required by the RWQCB to help control erosion and subsequent sediment delivery to Permanente Creek.

Flooding

In the Permanente Creek watershed, floods typically occur during the wet season from November through April. Normally, in the upper watershed, floods are flashy in nature as the time of concentration for tributaries is usually short and stream flows thus respond rapidly to rainfall. The

TABLE 4.10-3
MINED MATERIAL AND OVERBURDEN CONSTITUENT CONCENTRATIONS

Constituent	Units	C-1	C-2	C-3	C-4	C-5	GT1-2-08-213	Average of Detections for SQ	B1-1	B1-2	B1-3	B1-4	B2-1	Average of Detections for NQ	B2-2	
		SQ Boring Composite	SQ Boring Composite	SQ Boring Composite	SQ Boring Composite	SQ Boring Composite	SQ Boring Composite		NQ Single Sample	NQ Single Sample	NQ Single Sample	NQ Single Sample	NQ Composite		mg/kg	EMSA OB Composite
		Graywacke	Limestone	Flt. Breccia	Greenstone	Metabasalt	Chert		Limestone	Limestone	Metavolcan	Graywacke				
		(7/1/09)	(7/1/09)	(7/1/09)	(7/1/09)	(7/1/09)	(7/1/09)		(1/22/10)	(1/22/10)	(1/22/10)	(1/22/10)				
Antimony	mg/kg	ND (<1.7)	6.5	4.2	ND (<1.7)	ND (<1.7)	5.3	3.09	ND (<1.7)	ND (<1.7)	ND (<1.7)	ND (<1.7)	ND (<1.7)	ND (<1.7)	ND (<1.7)	
Arsenic	mg/kg	5.1	8.4	2.4	ND (<0.71)	4.8	5.7	4.46	ND (<0.71)	2.7	ND (<0.71)	7.5	2.7	2.7	2.6	
Asbestos	mg/kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Barium	mg/kg	60	800	180	46	110	560	292.7	940	290	590	49	ND (<0.13)	373.8	750	
Beryllium	mg/kg	0.17	0.3	ND (<0.026)	ND (<0.026)	0.032	0.11	0.106	ND (<0.026)	ND (<0.026)	ND (<0.026)	ND (<0.026)	ND (<0.026)	ND (<0.026)	ND (<0.026)	
Cadmium	mg/kg	0.071	0.068	ND (<0.033)	ND (<0.033)	ND (<0.033)	0.15	0.056	ND (<0.033)	6.5	ND (<0.033)	ND (<0.033)	ND (<0.033)	1.3	ND (<0.033)	
Chromium IV	mg/kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Chromium Compounds	mg/kg	95	29	260	400	110	6.6	150.1	ND (<0.045)	30	200	35	130	79.0	110	
Cobalt	mg/kg	20	21	34	93	26	8.4	33.7	ND (<0.18)	ND (<0.18)	37	10	27	14.8	23	
Copper	mg/kg	50	56	56	45	62	27	49.3	ND (<0.13)	48	47	37	44	35	44	
Fluoride Salts	mg/kg	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Lead	mg/kg	9.7	6.8	8.3	ND (<0.59)	11	2	6.3	ND (<0.59)	ND (<0.59)	ND (<0.59)	ND (<0.59)	ND (<0.59)	ND (<0.59)	ND (<0.59)	
Mercury	mg/kg	0.033	0.15	0.053	ND (<0.014)	ND (<0.014)	ND (<0.014)	0.043	ND (<0.014)	0.77	0.16	ND (<0.014)	0.12	0.21	0.11	
Molybdenum	mg/kg	0.22	2.3	ND (<0.18)	ND (<0.18)	1	0.74	0.74	ND (<0.18)	20	ND (<0.18)	ND (<0.18)	ND (<0.18)	4	ND (<0.18)	
Nickel	mg/kg	120	120	250	1,200	100	220	335	ND (<0.12)	59	230	71	180	108	150	
Selenium	mg/kg	10	8.5	15	15	13	2.4	10.7	ND (<0.76)	6.6	ND (<0.76)	ND (<0.76)	ND (<0.76)	1.6	ND (<0.76)	
Silver	mg/kg	ND (<0.086)	0.63	0.13	ND (<0.086)	0.16	ND (<0.086)	0.17	ND (<0.086)	ND (<0.086)	ND (<0.086)	0.86	ND (<0.086)	0.21	ND (<0.086)	
Thallium	mg/kg	ND (<0.94)	ND (<0.94)	0.97	ND (<0.94)	ND (<0.94)	ND (<0.94)	0.55	ND (<0.94)	1.2	ND (<0.94)	ND (<0.94)	ND (<0.94)	0.6	ND (<0.94)	
Vanadium	mg/kg	64	15	75	53	70	5.9	47.2	ND (<0.062)	560	80	27	67	146.8	56	
Zinc	mg/kg	250	67	75	64	71	150	112.8	14	180	73	51	72	78	75	

NOTES:
ND = Not detected at the specified detection limit.
When an ND was included in the calculation of an average value, it was assumed to be one half the detection limit.
If all samples were ND, then the lowest detection limit was retained.
SQ = South Quarry

SOURCE: SES, 2011

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**TABLE 4.10-4
OVERBURDEN LEACHABILITY BY MODIFIED CAM WET**

Constituent (Dissolved)	Units	C-1	C-2	C-3	C-4	C-5	GT1-2-08- 213	Average of Detections for SQ (µg/l)
		SQ Boring Composite	SQ Boring Composite	SQ Boring Composite	SQ Boring Composite	SQ Boring Composite	SQ Boring Composite	
		Graywacke	Limestone	Flt. Breccia	Greenstone	Metabasalt	Chert	
		(7/1/09)	(7/1/09)	(7/1/09)	(7/1/09)	(7/1/09)	(7/1/09)	
Antimony	µg/l	7.2	1.5	5.8	0.98	8.5	3.2	4.53
Arsenic	µg/l	3	1.3	6.2	2.7	7.3	1.2	3.6
Asbestos	µg/l	–	–	–	–	–	–	–
Barium	µg/l	59	220	120	37	120	170	121
Beryllium	µg/l	ND (<0.18)	ND (<0.18)	ND (<0.18)	ND (<0.18)	ND (<0.18)	ND (<0.18)	ND (<0.18)
Cadmium	µg/l	ND (<0.13)	ND (<0.13)	ND (<0.13)	ND (<0.13)	ND (<0.13)	ND (<0.13)	ND (<0.13)
Chromium (total)	µg/l	ND (<0.55)	ND (<0.55)	ND (<0.55)	1.9	ND (<0.55)	ND (<0.55)	0.55
Cobalt	µg/l	0.29	0.15	0.13	0.34	0.1	0.25	0.21
Copper	µg/l	1.3	ND (<0.68)	ND (<0.68)	ND (<0.68)	ND (<0.68)	1.2	0.64
Fluoride Salts	µg/l	–	–	–	–	–	–	–
Lead	µg/l	1.2	0.11	ND (<0.054)	ND (<0.054)	0.09	0.12	0.262
Mercury	µg/l	ND (<0.016)	0.21	ND (<0.016)	ND (<0.016)	ND (<0.016)	ND (<0.016)	0.042
Molybdenum	µg/l	11	27	7.3	2.3	28	12	14.6
Nickel	µg/l	1.7	1.7	2	8.1	0.89	3.2	2.93
Selenium	µg/l	ND (<0.38)	6	ND (<0.38)	ND (<0.38)	0.58	ND (<0.38)	1.22
Silver	µg/l	ND (<0.065)	ND (<0.065)	ND (<0.065)	ND (<0.065)	ND (<0.065)	ND (<0.065)	ND (<0.065)
Thallium	µg/l	ND (<0.11)	ND (<0.11)	ND (<0.11)	ND (<0.11)	ND (<0.11)	ND (<0.11)	ND (<0.11)
Vanadium	µg/l	1.5	ND (<1.2)	12	18	4.9	ND (<1.2)	6.27
Zinc	µg/l	22	8.1	11	11	10	37	16.5
Manganese	µg/l	5.2	2.5	7.5	3	3.1	1.2	3.8
Calcium	mg/l	18	16	13	17	11	14	14.8
Magnesium	mg/l	4.3	4.2	6.8	8.3	5.4	14	7.2
Sodium	mg/l	8.8	4.0	7.9	5.9	6.6	2.7	6.0
Potassium	mg/l	3.7	2.8	3.9	0.96	4.1	2.0	2.9
Total Alkalinity	mg/l	37	42	56	76	46	49	51
Chloride	mg/l	1.6	1.1	1.3	2.0	1.3	1.4	1.45
Sulfate	mg/l	22	12	16	3	8.8	29	15.1
pH	number	8.11	8.16	8.24	8.29	8.36	8.27	8.2
EC	µmhos/cm	160	130	160	160	130	190	155

NOTES:

ND = Not detected at the specified detection limit.

When an ND was included in the calculation of an average value, it was assumed to be one half the detection limit.

If all samples were ND, then the lowest detection limit was retained.

SQ = South Quarry

SOURCE: SES, 2011

Federal Emergency Management Agency (FEMA) is responsible for mapping areas subject to flooding during a 100-year flood event (i.e., a flood event that has a 1 percent chance of occurring in a given year). According to FEMA (2007), the 100-year flood hazard zone for Permanente Creek extends upstream to a point within the Quarry site approximately adjacent to the aluminum plant (Figure 4.10-1). Within and near the Quarry site, the 100-year flood hazard zone for Permanente Creek is relatively narrow, extending only a few hundred feet across (i.e., 200 to 300 feet). Just downstream of Permanente Road, the magnitude of the 100-year flood peak in Permanente Creek is approximated to be 1,480 cfs (FEMA, 2009).

4.10.1.3 Groundwater Hydrology

Within the Project Area, groundwater flows through two general formations (or mediums): bedrock, and a small portion of the Santa Clara valley aquifer that intersects the Quarry site. The Project area is underlain by bedrock of the Franciscan Complex, which is a chaotic mix of highly deformed, ancient marine sediments and crustal rocks. The occurrence of groundwater throughout the Franciscan Complex is almost exclusively within secondary openings such as joints, fractures, shear zones and faults within the bedrock (Golder Associates, 2011). In general, the bedrock has a relatively low permeability, yet the specific value (or rate) varies locally across the different bedrock units (i.e., within the limestone, greenstone, etc.). Over the eastern portion of the EMSA, the Santa Clara Formation, a more permeable deposit of unconsolidated to slightly consolidated conglomerate, sandstone, siltstone, and claystone, lies above the bedrock of the Franciscan Complex. This portion of the EMSA (i.e., the part comprising part of the Santa Clara Formation) overlies the western margin of the Santa Clara Subbasin, which is part of the larger Santa Clara Valley Groundwater Basin (DWR, 2004). The Santa Clara Formation is exposed only on the west and east sides of the Santa Clara valley.

Regionally, the 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 (Golder Associates, 2011). Locally, groundwater discharges to Permanente Creek, Monte Bello Creek (to the south, a tributary to Swiss Creek and then Stevens Creek), and an unnamed creek in the eastern half of the Quarry (a tributary to Permanente Creek) (Golder Associates, 2011). Groundwater also discharges to the Quarry pit. Adjacent to the Project Area, the typically perennial reaches of Permanente Creek (i.e., upstream and downstream of the Quarry Pit) are maintained primarily by groundwater discharging directly to the stream channel during the dry season, as well as by dewatering discharges from the Quarry pit.

A number of geotechnical borings were excavated across the EMSA, generally to a depth of 45 feet below ground surface (bgs). Groundwater was not encountered in any of the boreholes (Golder Associates, 2009). The portion of the EMSA closest to Permanente Creek (i.e., the eastern edge) is approximately 100 feet above the channel bed. Subsequent investigations further upstream on Permanente Creek (near the Main Pit) have shown fall (October 2009) groundwater elevations near the creek to be 50 to 90 feet above the bed elevation of the creek (Golder Associates, 2011).

Groundwater Quality

For the Santa Clara Sub-basin, the groundwater in the major producing aquifers within the basin is generally of a bicarbonate type, with sodium and calcium the principal cations (DWR, 1975, *as cited by* DWR, 2004). Although hard (i.e., having high hardness or carbonate values), it is of good to excellent mineral composition and suitable for most uses. Drinking water standards are met at public supply wells without the use of treatment methods (SCVWD, 2001, *as cited by* DWR, 2004).

The different bedrock units underlying the Project Area (i.e., the limestone, greenstone, and greywacke) are known to produce measureable concentrations of trace metals, particularly if the metals occur within sulfide deposits, which tend to weather rapidly when in contact with oxygenated water. Groundwater quality information was collected in the area to the south of the Quarry pit and on the south side of Permanente Creek. This information is reflective of the quality and chemical characteristics of the groundwater that comes into contact with the various, principal bedrock units underlying the entire Project Area. Based upon groundwater samples taken at five monitoring wells (HG-4, HG-6, HG-7, HG-9, and HG-10; see Figure 4.10-2), groundwater quality generally meets the relevant objectives within the Basin Plan, with the exception of TDS, sulfate, iron, manganese, and molybdenum (Table 4.10-2). Average mercury concentrations in the groundwater from all wells that were sampled more than once also meet the objectives for 1-hour maximum (2.4 µg/l) for protection of aquatic organisms and drinking water (2 µg/l); the single sample from well HG-10 (0.063 µg/l) exceeded the objective for protection of aquatic organisms (0.025 µg/l). However, these constituents are likely naturally elevated in groundwater due to the mineralized nature of the bedrock (SES, 2010).

4.10.1.4 Regulatory Setting

The following section provides a brief summary of the federal, state, and local water quality- and hydrology-related regulations, goals and policies relevant to the Project.

Federal Regulations

Federal Emergency Management Agency

Under Executive Order 11988, FEMA is responsible for the management and mapping of areas subject to flooding during a 100-year flood event (i.e., an event with a one percent chance of occurring in a given year). FEMA requires that local governments covered by federal flood insurance pass and enforce a floodplain management ordinance that specifies minimum requirements for any construction within the 100-year floodplain. The proposed Project area does not fall within the 100-year floodplain delineated by FEMA (2007).

Federal and State Water Quality Policies

The statutes that govern Project activities and operations that may affect water quality are the CWA (33 U.S.C. §1251) and the Porter-Cologne Water Quality Control Act (Porter-Cologne) (Water Code §13000 et seq.). These acts provide the basis for water quality regulation in the Project Area.

The California legislature has assigned the primary responsibility to administer and enforce statutes for the protection and enhancement of water quality to the State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCBs). The SWRCB provides state-level coordination of the water quality control program by establishing statewide policies, and plans for the implementation of state and federal regulations. The nine RWQCBs throughout California adopt and implement water quality control plans that recognize the unique characteristics of each region with regard to natural water quality, actual and potential beneficial uses, and water quality problems. The RWQCB adopts and implements a Water Quality Control Plan that designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan (Water Code §§13240-13247).

The National Toxics Rule and the California Toxics Rule

Federal water quality criteria for priority toxic pollutants have been established for non-ocean surface waters (including enclosed bays and estuaries) of California by the USEPA (state water quality objectives for priority pollutants have also been established by some RWQCBs in their respective water quality control plans [Basin Plans]; Basin Plans are discussed in further detail below). Federal priority toxic pollutant criteria have been promulgated for California by the USEPA in the 1992 (amended in 1995) National Toxics Rule (NTR; 40 CFR 131.36) and in the 2000 California Toxics Rule (CTR; 40 CFR 131.38). For California, the criteria in the CTR supplement the criteria in the NTR (i.e., the CTR does not change or supersede any criteria previously promulgated for California in the NTR) (SWRCB, 2000). The USEPA disseminated the CTR in order to fill a gap in California water quality standards created in 1994 with a court ruling that overturned the State's water quality control plans. Except as specified in the CTR, the federal criteria apply to all waters assigned any aquatic life or human health beneficial uses as designated in the Basin Plans. The CTR establishes ambient aquatic life criteria for 23 priority toxics, ambient human health criteria for 57 priority toxics, and a compliance schedule provision which authorizes the State to issue schedules of compliance for new or revised National Pollutant Discharge Elimination System (NPDES) permit limits based on the federal criteria when certain conditions are met (USEPA, 2010). California must use these criteria, together with existing water quality standards when controlling pollution in inland surface waters, enclosed bays, and estuaries.

Beneficial Use and Water Quality Objectives (CWA §303)

The RWQCB is responsible for the protection of the beneficial uses of waters within the San Francisco Bay region, including the Project Area. The RWQCB uses its planning, permitting, and enforcement authority to meet this responsibility and has adopted the Basin Plan (RWQCB, 2007c) to implement plans, policies, and provisions for water quality management.

In accordance with state policy for water quality control, the RWQCB employs a range of beneficial use definitions for surface waters, groundwater basins, marshes, and mudflats that serve as the basis for establishing water quality objectives and discharge conditions and prohibitions. The Basin Plan has identified existing and potential beneficial uses supported by the key surface water drainages throughout its jurisdiction (RWQCB, 2007c). The beneficial uses of any specifically identified

water body generally apply to all its tributaries (RWQCB, 2007c). Beneficial uses identified for water bodies within and near the Project Area are summarized in **Table 4.10-5**. Existing and potential beneficial uses in both the Permanente Creek and Stevens Creek watersheds include cold water and wildlife habitat, fish spawning, and contact and non-contact water recreation. The Stevens Creek watershed also includes warm water habitat, fish migration, and freshwater replenishment as designated beneficial uses. The beneficial uses of groundwater in the Project Area include drinking water, industrial process and service water supply, and agricultural use.

**TABLE 4.10-5
DESIGNATED BENEFICIAL USES OF WATER BODIES IN THE PROJECT AREA**

Water Body	Designated Beneficial Uses
Surface Waters	
Permanente Creek	COLD, SPWN, WILD, REC-1, REC-2
Stevens Creek	COLD, MIGR, SPWN, WARM, WILD, REC-1, REC-2
Groundwater Basins	
Santa Clara Valley, Santa Clara Subbasin	MUN, PROC, IND, AGR

NOTES:

Beneficial Uses Key:

MUN (Municipal and Domestic Water Supply); PROC (Industrial Process Water Supply); IND (Industrial Service Water Supply); AGR (Agricultural Water Supply); COLD (Cold Freshwater Habitat); MIGR (Fish Migration); SPWN (Fish Spawning); WARM (Warm Freshwater Habitat); WILD (Wildlife Habitat); REC-1 (Body Contact Recreation); REC-2 (Noncontact Recreation).

SOURCE: RWQCB, 2007c

The Basin Plan also includes water quality objectives that are intended to be protective of the identified beneficial uses (RWQCB, 2007c); the beneficial use designation and the accompanying water quality objectives collectively define the water quality standards for a given water body or region. Under CWA §303(d), the State of California is required to develop a list of impaired water bodies that do not meet water quality standards and objectives. As described above (see Table 4.10-1), existing and proposed impairments for Permanente Creek include diazinon, toxicity, and selenium. Existing impairments for Stevens Creek included diazinon and toxicity. Throughout the Bay Area, diazinon pollution of surface water is currently being addressed by a TMDL (RWQCB, 2005). For toxicity, the Basin Plan (RWQCB, 2007c) states that all waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species (RWQCB, 2007c). For selenium, the Basin Plan water quality objective is 5 µg/l (4-day average) (RWQCB, 2007c), which is the criteria promulgated in the NTR. A TMDL has not yet been established by the RWQCB for selenium.

Water Quality Certification (CWA §401)

Section 401 of the CWA requires that an Applicant for any federal permit (e.g., a CWA §404 permit) obtain certification from the state that the permitted action (e.g., discharge of fill) will

comply with the other provisions of the CWA and with state water quality standards. For example, before the U.S. Army Corps of Engineers (USACE) can issue a §404 permit, it must certify, under §401, that the permitted action meets state water quality standards. For the Project Area, the RWQCB must provide the water quality certification required under CWA §401. Water quality certification under CWA §401, and the associated requirements and terms, is necessary in order to minimize or eliminate the potential water quality impacts associated with the action(s) requiring a federal permit. The Applicant would contact the relevant federal agency(s) in order to determine whether a federal permit would be required. If a federal permit is required, then the Applicant would be required to obtain water quality certification from the RWQCB. CWA §401 and §404 also are discussed in Section 4.4, *Biological Resources*.

National Pollutant Discharge Elimination System Program (CWA §402)

The CWA was amended in 1972 to provide that the discharge of pollutants to waters of the United States from any point source is unlawful unless the discharge is in compliance with a NPDES permit. In 1987, amendments to the CWA added Section 402(p), which establishes a framework for regulating municipal and industrial stormwater discharges under the NPDES program. In November of 1990, the USEPA published final regulations that also establish NPDES permit application requirements for discharges of stormwater from construction projects that encompass 5 acres or more of soil disturbance. Regulations (the Phase II Rule) that became final on December 8, 1999, expanded the existing NPDES program to address stormwater discharges from construction sites that disturb land equal to or greater than 1 acre and less than 5 acres (small construction activity).

Santa Clara Valley Urban Runoff Pollution Prevention Program

The SCVURPPP is an association of 13 cities and towns in Santa Clara valley, the County, and the Santa Clara Valley Water District (SCVWD) which shares a common NPDES permit to discharge stormwater to South San Francisco Bay (SCVURPPP, 2010). In addition to the County, member agencies (co-permittees) include Campbell, Cupertino, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale, and the SCVWD. The program is organized, coordinated, and implemented in accordance with a Memorandum of Agreement (MOA) signed by each co-permittee (SCVURPPP, 2010). The SCVURPPP has conducted monitoring in local creeks within its program area since 2002 in order to comply with requirements specified in its NPDES permit, which was issued in 2001 by the RWQCB.

General Industrial Permit (SWRCB Order No. 97-03-DWQ)

For stormwater discharges associated with industrial activities, the SWRCB has adopted the Industrial Storm Water General Permit, SWRCB Order 97-03-DWQ (General Industrial Permit). This permit regulates discharges associated with 10 broad categories of industrial activities, including hard rock and aggregate mining. Existing operations at the Quarry, as well as those activities proposed as part of the Project, are and would be regulated under the General Industrial Permit (or an equivalent or more specific individual NPDES permit, as determined by the RWQCB). Discharges of stormwater associated with industrial activities are authorized by the

General Industrial Permit, which is issued under both State (i.e., Waste Discharge Requirements, or WDRs) and federal (i.e., NPDES) water quality regulations. The General Industrial Permit serves to cover the operational life of an industrial activity, and it requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) in order to reduce or eliminate stormwater pollutants associated with industrial activity. The General Industrial Permit also requires the development of a stormwater pollution prevention plan (SWPPP) and a monitoring program. Within the SWPPP, sources of pollutants are to be identified and the means to manage these sources to reduce stormwater pollution are to be described (e.g., best management practices [BMPs]). The General Industrial Permit also requires that an annual report be submitted by July 1 of each year. However, the RWQCB issued a letter February 18, 2011, regarding the NOV issued March 2011 and determining that the facility cannot operate under their current Industrial Storm Water Permit.

The most recent SWPPP for the Quarry, which includes a Storm Water Monitoring Program (SWMP), was submitted to the RWQCB in March of 2010 (URS, 2010). Controlling erosion and subsequent delivery of sediment to Permanente Creek is the primary focus of the SWPPP (URS, 2010). Currently, stormwater runoff is sampled at multiple locations throughout the Quarry and the results are submitted to the RWQCB on an annual basis; the sampling locations include drainage basins and channels within the Quarry (e.g., sediment basins/ponds) as well as locations within the Permanente Creek channel, including at points downstream of the EMSA.

Hazardous Materials and Spill Prevention Control and Countermeasure Plan

The Aboveground Petroleum Storage Act of 1990 requires facilities storing petroleum products in a single tank greater than 1,320 gallons, or facilities storing petroleum in aboveground tanks or containers with a cumulative storage capacity of greater than 1,320 gallons, to file a storage statement with the SWRCB and prepare a spill prevention, control, and countermeasure plan. The plan must identify appropriate spill containment measures or equipment for diverting spills from sensitive areas, as well as discuss facility-specific requirements for the storage system, inspections, recordkeeping, security, and personnel training. Other hazardous materials which are used or stored at the Quarry include motor oil (new and used), diesel fuel, and lubrication oil. All of these materials, with the exception of the Quarry diesel fuel tank, which is stored in a double walled tank in secondary containment, and the warehouse standby generator diesel fuel tank, are stored with a cover and therefore have a low-to-very low likelihood of stormwater contact (URS, 2010).

Surface Mining and Reclamation Act of 1975

Under the State of California's Surface Mining and Reclamation Act of 1975 (SMARA), all operators of surface mines in California must prepare and submit for approval by the lead agency a reclamation plan, along with financial assurances that sufficient funds will be available to accomplish reclamation (Pub. Res. Code §2770). This plan must be prepared by a mining Applicant prior to initiation of mining activities. SMARA is administered by lead agencies (most often counties or cities) and the California Department of Conservation. The County is the SMARA Lead Agency for this Project. SMARA contains a number of provisions addressing

geotechnical and slope stability issues (see Section 4.7, *Geology, Soils, and Seismicity*, for further detail) as well as drainage diversion structures, waterways (14 California Code of Regulations (CCR) §3706) and stream protection including surface and groundwater (14 CCR §3710). SMARA also dictates that erosion control methods shall be designed for the 20-year storm, and shall control erosion and sedimentation. This is applicable to operations in the EMSA as well as after reclamation is complete in the EMSA (Chang Consultants, 2009a). The SMARA regulations also require reclamation plans to include performance standards for drainage and erosion to protect water quality, including streams, surface and groundwater. These performance standards must ensure compliance with the CWA and Porter-Cologne and other legal requirements (14 CCR §§3706, 3710).

SWRCB Mining Waste Management

The SWRCB has promulgated Mining Waste Management Regulations (27 CCR §22470 et seq.) that apply to all owners or operators of a waste management unit for the treatment, storage, or disposal of mining waste (Mining Unit); mining waste includes overburden and waste rock.¹¹ As such, Mining Units include waste piles (27 CCR §22470 (a)) and the EMSA would be considered a Mining Unit as defined in the Mining Waste Management Regulation (27 CCR §22470 et seq.). These regulations are administered by the RWQCB through the issuance of WDRs unless these requirements are waived by the RWQCB. Due to the presence of non-hazardous, soluble pollutants (e.g., selenium) (see Table 4.10-2), the overburden materials in the Project Area, which contain limestone material, would likely be categorized as Group B mining wastes as defined within these regulations.¹² Accordingly, the Applicant would be required to implement certain siting and construction standards, including peak stream flow protection, precipitation and drainage controls, and a leachate collection and removal system (LCRS). A LCRS has specific requirements that are outlined within the Mining Waste Management Regulations (27 CCR §20340 (b) through (e)).

Porter-Cologne Water Quality Control Act

Porter-Cologne (Water Code §13000 et seq.) is the basic water quality control law for California. California's water quality laws are administered by the SWRCB and locally by the nine RWQCBs, within a framework of statewide coordination and policy. The SWRCB establishes statewide policy for water quality control and provides oversight of the RWQCBs' operations. Porter-Cologne and the CWA overlap in many respects, as the entities established by Porter-Cologne are in many cases enforcing and implementing federal laws and policies. The RWQCBs implement both the Federal Clean Water Act and the State's Porter-Cologne Water Quality Act through permitting processes and the enforcement of water quality laws. In addition to other

¹¹ Mining waste is waste from the mining and processing of ores and mineral commodities. Mining waste includes: (1) overburden; (2) natural geologic materials which have been removed or relocated but have not been processed (waste rock); and (3) the solid residues, sludges, and liquids from the processing of ores and mineral commodities (27 CCR §22480 (a)).

¹² Group B mining wastes include: mining wastes that consist of or contain non-hazardous soluble pollutants of concentrations which exceed water quality objectives for, or could cause, degradation of waters of the state (27 CCR §22480 (b)). The Applicant expects the cap materials for the overburden areas to be categorized as Group C mining wastes.

regulatory responsibilities, the RWQCBs have the authority to conduct, order, and oversee investigation and cleanup where discharges or threatened discharges of waste to waters of the State could cause pollution or nuisance, including impacts to public health and the environment. The responsibilities of RWQCB includes jurisdiction over discharges from mining operations.

Specific to the Permanente Quarry, the RWQCB, San Francisco Region, maintains jurisdiction over the quality of discharges from that facility. In June 2011, the RWQCB issued a Water Code §13267 Order to Lehigh that presented a comprehensive plan to address discharges from the Permanente facility so as to ensure compliance with the Porter-Cologne Water Quality Control Act, the Federal Clean Water Act and applicable water quality standards. Deadlines in this Order were slightly amended via July 2011 correspondence. In accordance with this plan, process-related discharges from the Quarry were authorized in October and November 2011 by the RWQCB pursuant to the General NPDES Permit for Aggregate Mining, Sand Washing, and Sand Offloading operations, Order No. R2-2008-0011 ("Sand & Gravel Permit"). A Report of Waste Discharge was subsequently submitted to the RWQCB by Lehigh on November 30, 2011, for purposes of obtaining an individual NPDES Permit for the facility that will specifically regulate pollutants of concern, namely, selenium. The Regional Water Board is in the process of preparing and issuing that NPDES permit, and a comprehensive monitoring plan was submitted to the RWQCB by Lehigh on October 20, 2011 to support its issuance. Via this process, the discharge will be in compliance with the Porter-Cologne Water Quality Control Act, the Federal Clean Water Act, and applicable water quality standards.

Under current RWQCB requirements, the Applicant must:

- Continue to maintain and pursue all appropriate permits and authorizations through the RWQCB, including the issuance of a NPDES Permit that will reduce or remove selenium to levels consistent with all applicable Basin Plan or other water quality standards.
- Comply with requirements set forth by the RWQCB in the Water Code §13267 Order, the Sand & Gravel Permit authorizations, and in the upcoming issued individual NPDES Permit.
- Follow any directions or proposed measures imposed by the RWQCB that will improve its performance sufficiently to meet the performance criteria if annual surface water monitoring indicates that discharges from the Quarry exceed applicable effluent or receiving water limitations specified in the upcoming individual NPDES Permit.
- Maintain procedures to ensure prompt identification and repair of damage to BMPs or structural control facilities, especially after large storm events.
- Conduct routine inspection and maintenance of BMPs, structural control facilities, and outfalls. If inspections reveal that BMPs, structural control facilities, and/or outfalls are damaged, corrective actions must be implemented immediately.

Waste Discharge Requirements

Actions that involve, or are expected to involve, discharge of waste are subject to water quality certification under CWA §401 (e.g., if a federal permit is being sought or granted) and/or WDRs under Porter-Cologne. Chapter 4, Article 4 of Porter-Cologne (Water Code §§13260-13274) states

that persons discharging or proposing to discharge waste that could affect the quality of waters of the state (other than into a community sewer system) shall file a Report of Waste Discharge (ROWD) with the applicable RWQCB. For discharges directly to surface water (waters of the United States) an NPDES permit is required, which is issued under both state and federal law. For other types of discharges, such as waste discharges to land (e.g., spoils disposal and storage), erosion from soil disturbance, or discharges to waters of the State (such as isolated wetlands), WDRs are required and are issued exclusively under state law. WDRs typically require many of the same BMPs and pollution control technologies as those that are required by NPDES-derived permits. Further, the WDRs application process is generally the same as for CWA §401 water quality certification, though in this case it does not matter whether the particular project is subject to federal regulation.

As previously described, existing operations at the Quarry, as well as those activities proposed as part of the Project, are and would be regulated under the General Industrial Permit. Discharges of stormwater associated with industrial activities are authorized by the General Industrial Permit, which is issued under both State (i.e., WDRs) and federal (i.e., NPDES) water quality regulations. As such, the Project would be subject to WDRs and regulated under the existing provisions of the Industrial General Permit (or an equivalent or more specific individual NPDES permit or WDRs, as determined by the RWQCB), and any wastewater discharges as a result of the Project would be required to be consistent with the water quality objectives defined in the Basin Plan (RWQCB, 2007c).

County of Santa Clara Plans, Policies, and Ordinances

General Grading and Erosion Control Standards

The County's policies and standards pertaining to grading and erosion control are contained in Title C, Division C12, Chapter III of the County of Santa Clara Ordinance Code. The consulting geologist shall provide verification to the County Geologist that all of the recommendations presented in the geologic investigation reports have been incorporated into the plans prior to approval of final improvement plans. The required grading would be carried out in accordance with the requirements set forth by the County Land Development Engineering Office and the County Grading Ordinance. At the time of construction, all graded areas shall be reseeded in conformance with the County Grading Ordinance to ensure that the Project would minimize the potential for erosion on the site. All other land use and engineering aspects of this Project would be conditioned by the recommendations set forth by the County Land Development Engineering Office.

As defined in the County Grading Ordinance, grading associated with surface mining and reclamation activities and covered by an approved reclamation plan is exempt for grading permit requirements.

Surface Mining Ordinance and Surface Mining and Land Reclamation Standards

The County of Santa Clara Zoning Ordinance, §4.10.370, regulates uses classified as *Surface Mining*. In addition, the County Board of Supervisors approved the Surface Mining and Land Reclamation Standards (March 30, 1993) to comply with and implement the provisions of SMARA,

by adopting procedures for reviewing, approving, and/or permitting surface mining operations, reclamation plans, and financial assurances in the unincorporated areas of Santa Clara County. The ordinance contains requirements for the content of a reclamation plan, outlines the review procedure, and defines mining standards. The following are applicable standards concerning water quality protection and erosion contained in the ordinance that would apply to the proposed Project:

Protection of Streams and Water-Bearing Aquifers

- Commercial excavations shall be conducted in a manner so as to keep adjacent streams, percolation ponds, or water-bearing strata free from undesirable obstruction, silting, contamination, or pollution of any kind. The objective is to prevent discharges which would result in higher concentrations of silt than existed in offsite water prior to mining operations;
- The removal of vegetation and overburden in advance of surface mining shall be kept to a minimum;
- Stockpiles of overburden and minerals shall be managed to minimize water and wind erosion;
- Erosion control facilities such as detention basins, settling ponds, (de-silting and energy dissipaters) ditches, stream bank stabilization and diking, shall be constructed and maintained as necessary to control erosion;
- The County of Santa Clara Planning Commission (Planning Commission) may restrict excavation in the natural or artificially enlarged channel of any river, creek, stream or natural or artificial drainage channel when such excavation may result in the deposit of silt therein;
- Excavations which may penetrate near or into usable water-bearing strata will not reduce the transmissivity or area through which water may flow unless approved equivalent transmissivity or area has been provided elsewhere, nor subject such groundwater basin or sub-basin to pollution or contamination;
- Maximum depth of excavation shall not be below existing streambed or groundwater table except in such cases where the reclamation plan indicates that a lake or lakes will be part of the final use of the land or where such plan indicates that adequate fill to be used to refill such excavation to conform to the approved reclamation plan. Such plan to be subject to review and approval of the RWQCB and local flood control and water district agencies prior to initiation of excavation.

Erosion and Drainage

Grading and revegetation shall be designed to both prevent excessive erosion and to convey surface runoff to natural drainage courses or interior basins designed for water storage. Lakes, ponds, streams, or other bodies of water may be created within an excavation only when created in accordance with the reclamation plan approved by the County of Santa Clara Planning Commission (Planning Commission) and after considering the recommendations of the County Environmental Health Department, SCVWD, and other affected public agencies. Final surfaces shall be treated to prevent erosion unless otherwise specifically permitted by the Planning Commission.

County of Santa Clara Drainage Manual (2007)

The *Santa Clara County California Drainage Manual 2007* (County of Santa Clara, 2007) (Drainage Manual) sets forth County administrative policy for stormwater drainage design. The Office of Development Services prepared the Drainage Manual to provide a framework for the various hydraulic and hydrologic analyses necessary to plan and design stormwater drainage and flood control facilities within the County. Consistent design and evaluation criteria for stormwater drainage systems help the Office of Development Services and other agencies review stormwater drainage and flood protection designs and impact statements for projects throughout the County, both within and outside of incorporated areas (County of Santa Clara, 2007). The Drainage Manual identifies multiple design standards, methods of analyses, and engineering tools required for the planning and design of stormwater drainage systems and flood control facilities within the County. With respect to conveyance capacities, the Drainage Manual indicates that new stormwater drainage systems and channels shall be designed to convey the 10-year storm without surcharge, and a safe release shall be provided for the 100-year flow (Chang Consultants, 2009a).

County of Santa Clara General Plan (1994)

The Santa Clara County General Plan (County of Santa Clara, 1994) identifies the following policy relevant to the proposed Project and pertaining to water quality and hydrology:

Policy C-RC 20: Adequate safeguards for water resources and habitats should be developed and enforced to avoid or minimize water pollution of various kinds, including: a. erosion and sedimentation; b. organic matter and wastes; c. pesticides and herbicides; d. effluent from inadequately functioning septic systems; e. effluent from municipal wastewater treatment plants; f. chemicals used in industrial and commercial activities and processes; g. industrial wastewater discharges; h. hazardous wastes; and i. non-point source pollution.

4.10.2 Baseline

The baseline established for purposes of analyzing potential impacts to hydrology and water quality reflect the conditions as they existed in June 2007, the year the first NOP of an EIR to analyze impacts of a proposed amendment of the Applicant's existing, approved reclamation plan was published. The regulatory framework described above, the physical characteristics of the site drainage, and site operations have not changed significantly since 2007 but many of the surface water and groundwater samples used the analysis of this project were obtained after 2007. However, given that overall conditions have not changed significantly since 2007, the water quality data provided by the post-2007 water samples are considered representative of 2007 site conditions and thus appropriate for this analysis.

4.10.3 Significance Criteria

Consistent with the County's Environmental Checklist and Appendix G of the CEQA Guidelines, the Project would have a significant impact if it would:

- a) Violate any water quality standards or waste discharge requirements;

- b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- c) Substantially alter the existing drainage pattern of a site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or sedimentation on- or offsite;
- d) Substantially alter the existing drainage pattern of a site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;
- e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- f) Otherwise substantially degrade water quality;
- g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows;
- i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam; or inundation by seiche, tsunami, or mudflow.
- j) Be located in an area of special water quality concern (e.g., the Los Gatos or Guadalupe Watershed);
- k) Be located in an area known to have high levels of nitrates in well water;
- l) Result in a septic field being constructed on soil where a high water table extends close to the natural land surface;
- m) Result in a septic field being located within 50 feet of a drainage swale, 100 feet of any well, water course or water body, or 200 feet of a reservoir at capacity;
- n) Conflict with Water Collaborative Guidelines and Standards for Land Uses Near Streams

4.10.4 Discussion of Criteria with No Hydrology and Water Quality Impacts

As discussed below, implementation of the Project would cause no effect on criteria b), g), i), k), l), m), or n). Because the Project could cause impacts related to the remaining criteria, they are analyzed in Section 4.10.5.

b) The Project would not substantially deplete groundwater supplies, interfere substantially with groundwater recharge, or adversely affect groundwater quality.

Groundwater at the Quarry has been altered from the pre-mining condition by the excavation of the Quarry pit. Groundwater that once discharged to Permanente Creek is now at least partially captured and flows into the Quarry pit. This condition has caused changes to the pre-mining, perennial flow condition of the creek, resulting in intermittent flow in some areas adjacent to the Quarry pit. Water that is captured by the Quarry pit is now collected and pumped back into the creek. The proposed RPA involves the backfilling of the Quarry pit to an elevation of 990 amsl. Groundwater modeling has indicated that this reclaimed condition would cause groundwater to discharge to Permanente Creek and this recharge is expected to reverse the existing intermittent flow conditions. Groundwater flow and quality are discussed further in this EIR. There are no active groundwater supply wells within the RPA area. However, groundwater modeling (Golder, 2011) indicated that the proposed Quarry operation and reclamation would not have a significant effect to groundwater levels in supply wells located along Monte Bello Ridge, approximately 1.25 miles from the center of the Quarry pit. The EIR preparers reviewed the modeling results and concur with the conclusion that operation of these wells, or any other nearby wells, would not be adversely affected by the Project.

Elevated concentrations of TDS and sulfate have also been measured in local groundwater wells, in areas just upstream of the EMSA, though overall the groundwater concentrations for these constituents generally meet or are lower than those for surface water (Table 4.10-2). The hydraulic connection between surface water and groundwater concentrations (i.e., how surface water concentrations affect groundwater concentrations, and vice versa), or an accurate estimate of background (or natural) concentrations for these constituents, cannot be established with the existing data. However, given the large size of the Santa Clara Subbasin (i.e., 240 square miles), and the subsequently broad distribution of groundwater recharge areas, constituent concentrations in surface runoff from the relatively small upper Permanente Creek watershed are likely to be readily diluted and have little influence on the overall concentrations throughout the aquifer. Further, as stated above, groundwater recharge is not recognized as a beneficial use for Permanente Creek. For these reasons, it is not expected that the Project would affect groundwater quality downstream of the Quarry.

g) Place Housing or Structures within a 100-Year Flood Hazard Area.

FEMA (2007) has defined a relatively narrow 100-year flood hazard area for Permanente Creek in the vicinity of the site. The flood hazard area extends upstream to a point adjacent to the Quarry. However, the Project would not place housing or structures within this flood hazard area. There is therefore no potential for an impact of this kind and this issue is not discussed further.

i) The Project would not expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam; or inundation by seiche, tsunami, or mudflow.

In general, the Project site would not be subject to any significant flood risks. There are no dams located upstream of the Project site. Further, the Project site is beyond the potential influence of

seiche or tsunami events. Consequently, these issues are not discussed further. In the context of the proposed Project, a minor mudflow (or mudflow-like event, debris flow, etc.) would only result from a landslide or other type of slope failure. The potential for slope instability and failure is addressed in Section 4.7, *Geology, Soils, and Seismicity*, and is therefore not discussed further in this section.

k) The Project would not be located in an area known to have high levels of nitrates in well water.

The Project does not propose construction of groundwater wells; all other issues concerning groundwater quality are considered and fully addressed herein in the context of water quality standards and Appendix G of the CEQA Guidelines. Therefore, this issue is not discussed further.

l) and m) The Project would not result in a septic field being constructed on soil where a high water table extends close to the natural land surface, or in a septic field being located within 50 feet of a drainage swale, 100 feet of any well, water course or water body, or 200 feet of a reservoir at capacity.

The Project does not propose to construct or relocate a septic field. Therefore, this issue is not discussed further.

n) The Project would not conflict with Water Collaborative Guidelines and Standards for Land Uses Near Streams.

Other than the issues addressed below in the context of Appendix G of the CEQA Guidelines, no other aspects of the Project would conflict with the Water Collaborative Guidelines and Standards for Land Uses Near Streams. Therefore, this issue is not discussed further.

4.10.5 Impacts and Mitigation Measures

Impact 4.10-1: Post-reclamation conditions in the EMSA, WMSA, and Quarry pit would increase selenium concentrations in Permanente Creek to levels exceeding baseline conditions and RWQCB Basin Plan objectives. (*Less than Significant Impact with Mitigation Incorporated*)

As described above, the existing concentrations of a few water quality parameters, as measured within Permanente Creek, local groundwater, and wall washing samples, are relatively high within the Quarry area, and generally exceed the water quality objectives presented in the Basin Plan. Based on the existing information available, it is not clear what fraction of the elevated concentrations of some parameters could be directly attributable to existing Quarry operations, as opposed to naturally high background concentrations resulting from the mobilization of these constituents from the various bedrock units (limestone, greenstone, chert, etc.). Regardless of whether these constituents are naturally elevated, or elevated due in some part to the existing Quarry operations, activities associated with the Project could exacerbate concentrations of these constituents within surface water and, in particular, within Permanente Creek. Mining activities can result in release of metals, both because previously impermeable rocks are broken up and exposed to water, and because sulfide-containing rocks are exposed to oxygen, resulting in rapid

alteration and dissolution. The samples taken from EMSA and WMSA runoff, as well as the wall washing samples, serve as surrogates for estimating the potential quality of runoff water that would be generated from the Project, particularly during the interim periods before reclamation is complete and shortly after reclamation (i.e., before establishment of the planned vegetation). The following discussion and analysis is based in large part on the site-specific water quality data summarized in Table 4.10-2.

Measured surface runoff from the WMSA and EMSA contained concentrations of iron, manganese, and nickel that are likely not above background (or natural) concentrations, or that were consistently below the water quality objectives presented in the Basin Plan. Dissolved concentrations of iron and manganese in the surface water, wall washing, and WMSA runoff samples were generally much lower than the dissolved concentrations measured in the groundwater, indicating that the surface water samples were likely lower than the background (or natural) concentrations. Further, the dissolved fractions of the total recoverable amount of nickel, iron, and manganese were very low (less than one percent) in the wall washing and WMSA runoff samples. Thus, it is unlikely that these constituents could be mobilized by surface runoff and, if so, it is likely that they would be readily sequestered in areas that tend to store and accumulate hill slope or fluvial sediments. Total nickel concentrations measured in runoff from the EMSA were similar to those measured within Permanente Creek during the same runoff event, indicating that nickel can be mobilized by surface runoff and potentially delivered to receiving waters. In all but one sample (the exception being the road runoff sample within the EMSA [EMSA 01 Road], see Table 4.10-2)¹³, however, the measured nickel concentrations were below the Basin Plan objective.

Concentrations of TDS, sulfate, molybdenum, and selenium in samples from surface runoff and/or Permanente Creek are generally above the water quality objectives outlined in the Basin Plan. No surface water objectives are presented in the Basin Plan for TDS, sulfate, and molybdenum that relate to aquatic life (RWQCB, 2007c). The objectives for TDS and sulfate are based on the municipal or domestic supply, but that is not a designated beneficial use of Permanente Creek. Furthermore, both TDS and sulfate concentrations were higher at SW-1 (upstream location) than at SW-2 (downstream from the pit dewatering discharge), indicating that Quarry pit discharge water does not contribute to exceedance of the benchmarks. The only applicable objective for molybdenum is associated with agricultural supply, which also is not a designated beneficial use for Permanente Creek. Neither agricultural supply, municipal supply, nor groundwater recharge are designated as surface water beneficial uses for Permanente Creek or Stevens Creek (RWQCB, 2007c).

Measured concentrations of mercury in EMSA runoff and sometimes within Permanente Creek indicate that mercury is being mobilized and transported in surface runoff at levels that sometimes exceed the (4-day average) Basin Plan objective. Yet, unlike the case for selenium, the range of mercury concentrations in surface water samples from the creek were generally similar

¹³ Surface water sample obtained from shallow, concentrated sheet flow from a Quarry road; the sample is not representative of non-road areas within the EMSA and, for this location, there are additional probable sources of metals and other inorganic constituents besides the waste rock (e.g., fluids/residues from heavy machinery and trucks).

to those measured in groundwater (except for the road runoff sample EMSA 01, see Footnote 13). Further, atmospheric deposition is a notable source of mercury in the environment and cannot be discounted as a potential source at the EMSA, Quarry pit or WMSA. As such, the concentrations of mercury measured in runoff from the EMSA and within Permanente Creek cannot be reliably distinguished from background (or natural) concentrations based on the best available information.

Mercury, which occurs naturally in the various rock types and in groundwater, meets the RWQCB Basin Plan Benchmarks for surface water in Permanente Creek apart from one isolated concentration measured at 0.07 µg/l (SES, 2011) and samples SL-23-CR and SL-26-CR, which contained mercury at 0.056 µg/l and 0.52 µg/l, respectively (see Table 4.10-2). These three concentrations only slightly exceed the 0.025 µg/l 4-day average goal and are well below the 2.4 µg/l 1-hour goal. Sampling and analysis of the overburden (non-limestone) material, which would ultimately be used as part of the reclamation cover for limestone rock, has very low total mercury concentrations, ranging from not detected to 0.16 mg/kg. In the mined limestone, the values range from 0.15 to 0.77 mg/kg, which are similar to wetlands standards (0.35 to 1.3 mg/kg; Link, 1995). Surface water concentrations at the downstream surface water monitoring station (SW-2) below the Quarry are generally below the Basin Plan benchmark of 0.025 µg/l (concentrations range from 0.00133 to 0.07 µg/l, see Table 4.10-2) (SES, 2011). Considering the generally low background concentrations of mercury in the overburden, limestone material, and in surface water, and additionally, given that the low source concentrations would be further reduced through reclamation source control and dilution through the future drainage systems, mercury in the sediments migrating offsite is likely to be low.

Surface-water data indicate that levels of selenium are currently elevated in Permanente Creek adjacent to and downstream of the Quarry. The concentrations of selenium were measured within Permanente Creek, in local groundwater, from shallow concentrated surface runoff from the EMSA and WMSA, and in samples obtained from wall washing tests. The detected concentrations are relatively high within the Quarry area, and generally exceed the water quality objectives presented in the Basin Plan. The elevated levels appear to be due to selenium-containing runoff from quarry operations but could also be attributable, in part, to naturally occurring selenium from the geologic formations underlying and adjacent to the creek. It is neither possible nor necessary to know precisely what fraction of the elevated selenium concentrations could be directly attributable to existing Quarry operations, and what fraction to high background concentrations mobilized from the selenium-containing bedrock units (i.e., limestone). The samples taken from EMSA and WMSA runoff, as well as the wall washing samples, serve as reasonable surrogates for estimating the potential quality of runoff water that would be generated from the proposed Project, particularly during ongoing reclamation and shortly after reclamation before establishment of the proposed vegetation.

As discussed in Section 4.10.1, *Setting*, selenium concentrations measured at SW-1 (7.18 µg/l; the upstream Permanente Creek station) were more than an order of magnitude higher than the background sample collected from Monte Bello Creek at SW-3 (0.366 µg/l). Complete water quality results are presented in Table 4.10-2. The effect of the ongoing Quarry pit dewatering

discharges on existing Permanente Creek water quality is indicated by the samples collected at SW-2 (the downstream Permanente Creek station), where selenium concentrations ranged from 13 to 81 µg/l. A Quarry pit water sample in January 2010 had a dissolved selenium concentration of 82 µg/l (Golder, 2011), indicating that dewatering is a significant contributing factor with respect to selenium concentrations in Permanente Creek.

East Material Storage Area

Stormwater runoff from the EMSA currently is collected in a series of swales and conveyed to desilting basins before being released to Permanente Creek. The average selenium concentration in water samples collected from EMSA runoff ranged between 7.2 µg/l and 43 µg/l, all exceeding the Basin Plan objective of 5 µg/l. It should be noted that in some cases, these sample results were obtained from drainage channels that were lined with selenium-containing limestone material or contained check dams constructed out of limestone material. Therefore, these sample results may not represent actual concentrations of selenium in stormwater runoff flowing solely from overburden material placed in the EMSA. Nevertheless, it is a reasonable assumption that selenium-bearing limestone materials are present within the waste materials deposited in the EMSA. Of special concern is the fine-grained (clay loam texture and contains a substantially greater amount of silt and clay) discard material from the processing activities at the Rock Plant wash plant. Limestone material is washed before processing and the byproduct of that process is a fine-grained material that is deposited by truck on the EMSA. This material may contain high grade limestone and is considered a potential source of selenium if exposed to stormwater and remobilized by runoff.

EMSA Reclamation

Reclamation at the EMSA would begin upon approval of the Project and the three subphases of its reclamation would require about 9 years for completion. As discussed in Chapter 2, *Project Description*, proposed reclamation of the EMSA would achieve final contours and establish native grass and oak woodland habitats consistent with the surrounding area and topography. Final elevations would range from about 500 feet to 900 feet amsl, and overall slope angles would not exceed 2.6H:1V. These slopes would be composed of 2H:1V slopes, interrupted by 25-foot-wide benches spaced at 40-foot vertical intervals.

In accordance with the RPA, following rough grading, the surfaces of the EMSA would be covered with a foot of run-of-mine, non-limestone material consisting of greenstone, greywacke and chert obtained from the Quarry pit area. These rock types do not contain significant amounts of leachable selenium and would therefore act as a cap to separate any reactive limestone materials from surface exposure and oxidation—the process that generates selenium in the runoff. The run-of-mine, non-limestone rock would be characterized and hauled to the EMSA reclamation sites during the remainder of mining in the Quarry pit. Overlying the one foot of non-limestone material would be six inches of topsoil blended material to serve as a growth-enhancing media installed to support vegetation.

After reclamation, the runoff in the EMSA would be routed in ditches across the slope benches to perimeter ditches and then through swales and down-drains to seven desilting basins located around the EMSA. The system of cross ditches, perimeter ditches, swales and down-drains would route flows to a final basin located at the toe of the EMSA. From this basin, flows would be released to Permanente Creek.

Once limestone materials in the EMSA are covered with run-of-mine, non-limestone rock and vegetated, and the surface water drainage and management controls in place, the concentrations of selenium entering Permanente Creek from EMSA runoff would be expected to meet Basin Plan Benchmark values because the exposed limestone surfaces would be covered and runoff would occur over a non-limestone, vegetated surface. This is a reasonable prediction if the cover materials achieve the stated goal of preventing stormwater from coming into contact with reactive limestone material that could release soluble selenium. However, the performance of the non-limestone cover would be effective in reducing stormwater contact with limestone only if it is properly applied and monitored for effectiveness. Recognizing this, the potential that selenium would be released from the EMSA to Permanente Creek resulting in exceedance of Basin Plan Benchmark values is still considered to be a potentially significant impact; however, compliance with **Mitigation Measures 4.10-1a, 4.10-1b and 4.10-1c**, presented below, would reduce this impact to a less-than-significant level.

West Materials Storage Area

The WMSA contains overburden material generated from the mining of the Quarry pit. While most of the material consists of greenstone (meta-volcanic), greywacke, chert and low-grade limestone, drill logs have indicated that there are buried lenses of high-grade limestone material that have the potential to release selenium if exposed and left to react with stormwater runoff. The RPA proposes to harvest this material during reclamation of the WMSA under Phase 2 of the Project. Under baseline conditions, over half of the stormwater runoff from the WMSA flows to the Quarry pit through a series of roadside drainages, which utilize check dams to control flow. The remaining stormwater runoff either infiltrates into the overburden material or runs off the WMSA to be collected in drainage channels. Some smaller areas drain north of the site from the West Material Storage Area; flows from these areas do not enter Permanente Creek directly, but they are ultimately conveyed to the creek further downstream of the site where Wild Cat creek approaches Interstate 280. A roadside berm constructed on the outside edge of the access road and the inward slope of the road prevents stormwater from the WMSA from directly reaching Permanente Creek. However, there are areas along Permanente Creek (discussed in Impact 4.10-3) where pre- and post-SMARA mining related activities adjacent to the WMSA have resulted in debris flows and the discharge of boulders that allow stormwater to contact limestone and be discharged to the Permanente Creek. Water sample data are limited for the WMSA but a sample collected in July 2010 from a channel draining the WMSA had a selenium concentration of 29 µg/l. This sample was collected from a drainage channel that may have been underlain by selenium-containing limestone materials or the water had flowed through check dams constructed using the reactive limestone material. In other words, the sample may not be representative of the selenium concentration in stormwater flowing from only from overburden materials within the WMSA.

WMSA Reclamation

Ultimately, reclamation would remove the overburden material from the WMSA and the material would be placed in the Quarry pit as backfill. In most locations, the WMSA area would be graded down to reflect pre-mining contours that would expose the native bedrock (mostly greenstone). As discussed above, greenstone is not considered a source of selenium release to surface water. However, there are areas, such as smaller drainages, underlying the WMSA that have limestone material outcropping at the surface and these materials would be exposed following removal of the WMSA overburden. In areas where limestone is exposed at the surface, the RPA requires coverage with non-limestone-bearing overburden material (approximately one foot as is required at the EMSA) overlain by vegetation growth media. Removing the potential selenium source (high-grade limestone) by backfilling the Quarry pit and reclaiming the native exposures of limestone by coverage with non-limestone material would reduce the potential for elevated selenium concentrations in the stormwater runoff from the WMSA. However, as with the reclamation of the EMSA, the performance of the vegetative layers and non-limestone cover would be effective in reducing stormwater contact with limestone only if it is properly applied and monitored for effectiveness. Recognizing this, the potential that selenium would be released in stormwater from the former location of the WMSA to Permanente Creek is considered significant; however, **Mitigation Measures 4.10-1a** and **4.10-1b**, presented below, would reduce this impact to less than significant.

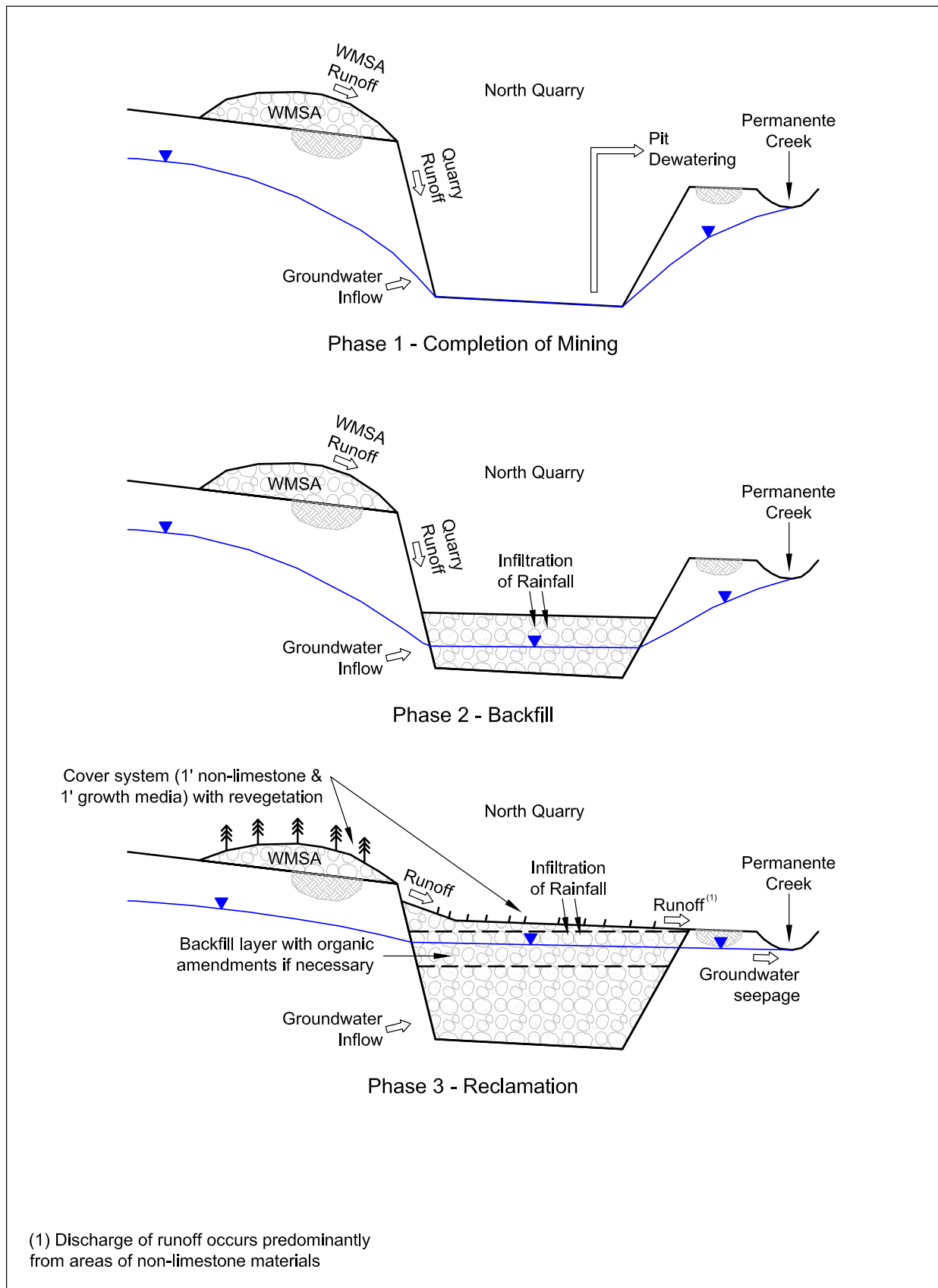
Quarry Pit

The effect of the Quarry dewatering on existing Permanente Creek water quality is indicated by the samples collected at station SW-2 and in comparison to background sampling results. A Quarry pit water sample in January 2010 had a dissolved selenium concentration of 82 µg/l (Golder, 2011), indicating that dewatering is a significant factor with respect to selenium concentrations in the creek. At SW-2, dissolved selenium concentrations ranged from 13 to 81 µg/l.

Quarry Pit Reclamation

During a period of about five years after mining operations are completed in the Quarry pit, material from the WMSA would be placed as backfill into the pit to an elevation of approximately 990 amsl. Surface water runoff and infiltrating groundwater would fill the backfilled areas. The backfill plan has been designed to ensure that the surface of the backfill will remain at or above the maximum elevation of the groundwater, thereby avoiding surface impoundments (SES, 2011). The completed surface of the Quarry pit would be sloped to facilitate drainage to Permanente Creek (**Figure 4.10-3**). Steeper slopes exposing limestone on the north side of the Quarry pit would not be covered because cover material could not be maintained on the steep slopes. These areas were considered in water quality predictive modeling as areas that could potentially contribute selenium to runoff from the Quarry pit area.

During the remaining years of mining, surface water and groundwater entering the Quarry pit would be pumped out as it has been under baseline conditions. When mining ceases, water entering the Quarry pit from surface runoff or groundwater would not be pumped, but would be left in the pit to gradually fill the voids within the backfilled material. During the interim years of



backfilling, some accumulated water may have to be pumped out to maintain dry working surfaces for backfill. For purposes of the water balance and quality evaluations completed for the analysis, it was assumed that quarry dewatering ceases after about six months of backfilling (SES, 2011).

Quarry Pit Water Quality

The water quality evaluation completed by SES for the Quarry pit used data collected from the site by Golder Associates and these data were used to assess water quality during existing and future mining and restoration phases as proposed in the RPA. Future water-quality conditions were estimated for the Quarry pit with a mass-balance water-quality spreadsheet model for each phase of the RPA spanning a 50-year period starting with Phase 1. SES (2011) performed water balance calculations for the Quarry pit for the periods of reclamation and post-reclamation conditions, typically for periods over 20 years. This time frame includes the period before Quarry pit backfilling begins and over 10 years after. Separate water balance and water quality models were established using Excel-based spreadsheets for both groundwater in the Quarry pit and for runoff from the backfilled Quarry surface. The conceptual model used for the Quarry pit backfill and runoff projections is shown in Figure 4.10-3.

The predictive water quality model assumes that the release of constituents from rock would be similar to that observed during the leachability testing described above, and there are no geochemical interactions of waterborne constituents with the adjacent rock materials (SES, 2011). For selenium, these are considered reasonable assumptions for projecting future conditions. The projections for the Quarry pit account for conditions resulting from excavation and the availability of selenium in rock surfaces. The key water mass balance components and the water quality described for each component are provided in **Table 4.10-6**. With respect to subsurface flow discharging from the pit after reclamation, the only Basin Plan Benchmarks that were exceeded in the projections are TDS and selenium. The TDS Basin Plan Benchmark is based on municipal use, which is not an existing beneficial use of Permanente Creek. Modeling projected that TDS in surface water after reclamation would be below Basin Plan Benchmark values (SES, 2011). Therefore, this analysis focuses on selenium concentrations in the surface and groundwater.

Sensitivity Analysis

Projections from predictive models can have varying outputs depending on the input data. For this reason, SES performed a sensitivity analysis with the water quality model to determine the influence of the various water quality input parameters and climatic changes. The sensitivity analyses were performed on selenium, which is considered the key constituent of concern. The sensitivity analysis included the following:

- Increasing input concentrations from each source of surface water and groundwater inflow individually by 15%, 25%, 50%, 75%, and 100%
- Using the maximum groundwater concentration as the final long-term groundwater inflow concentration (rather than the average used in the base case)
- Reducing the monthly rainfall by 30% for a period of 8 years to simulate the influence of an extended drought.

**TABLE 4.10-6
QUARRY PIT WATER QUALITY PARAMETERS**

Water Balance Component	Rock Type	Water Quality									Rationale
		Antimony (µg/l)	Arsenic (µg/l)	Cadmium (µg/l)	Copper (µg/l)	Manganese (µg/l)	Nickel (µg/l)	Selenium (µg/l)	TDS (µg/l)	SO ₄ (µg/l)	
Wall Runoff	Various	0.86	1.3	0.06	1.2	14	3.4	29	900	550	Dissolved wall runoff quality as characterized by WMSA runoff sampled in January 2010
Quarry Walls	Greenstone and greywacke	4.53	3.6	0.06	0.64	3.8	2.9	1.2	108	15	CAM WET test ^c (average for all tests)
Quarry Walls	Limestone	8.2	4.5	0.53	1.5	21	160	82	790	550	Quarry Pit Water
Infiltration through quarry backfill	Greenstone and greywacke	4.53	3.6	0.06	.64	3.8	2.9	1.2	108	15	CAM WET test (average for all tests)
Groundwater Inflow	Various, mainly limestone during Phase 1 before backfilling	8.2	4.5	0.53	1.5	21	160	82	790	550	Quarry Pit Water
	Gradual improvement during backfilling	Linear interpolation									N/A
	At the end of the backfill to the 990 level during Phase 3	0.23	2.34	0.06	1.66	21 ^a	4.1	0.7	616	143	Average groundwater quality

^a Manganese value based on Quarry pit water.

^b Dissolved fraction is used because, under backfilling conditions, wall runoff will be filtered as it migrates through the backfill into the groundwater contained in the Quarry backfill.

^c South Quarry results reflect data for the same geology and rock formations in the Quarry pit. The data were collected during mine exploration in areas south of Permanente Creek.

Source: SES, 2011

The sensitivity analysis indicated that runoff from the limestone walls would have the most profound influence on the water quality projections but the difference between the original input values and sensitivity assumptions were insignificant. Increasing the limestone quarry wall selenium concentration by 100 percent changed the range of output concentrations from 9 to 12 µg/l to 10 to 14 µg/l compared to the initial range of 10 to 15 µg/l (Table 4.10-7). Similarly, use of the maximum ground water concentration as the long term groundwater inflow concentration does not change the results (SES, 2011).

The sensitivity analysis indicates that lower monthly rainfall amounts increase the amount of time required for the pit to fill to its equilibrium level and increases the amount of time required to reach the long term concentration. Reducing the rainfall by 30 percent over 8 years lengthens the time required for the pit to fill with groundwater by one year but does not impact the final concentration of selenium.

Selenium has the greatest range of variation among the different sources of inflow, as shown in Table 4.10-6, and therefore, the sensitivity analyses for selenium are worst case among the parameters analyzed. The preparers of the EIR technically peer reviewed the sensitivity analysis and concurred with its methodology and conclusions.

Projected Selenium Concentrations

Groundwater and Groundwater Discharge from the Quarry Pit. Infiltrating surface water and groundwater would fill the backfilled Quarry pit and eventually reach a level where it discharges into Permanente Creek. However, the groundwater level is not expected to reach a level of discharge for an estimated 14 years after backfilling begins; during that time, groundwater and infiltrated surface water would remain contained in the backfill. Within that 14-year period, it is reasonable to expect that groundwater chemistry would equilibrate and resemble existing groundwater water quality because of the long residence time of the water under submerged conditions in the pit.

When groundwater begins to flow out of the Quarry pit backfill and into Permanente Creek, the water quality modeling projects that selenium concentrations would range between 10 and 15 µg/l. That range exceeds the Basin Plan Benchmark of 5 µg/l as a 4-day average, but is below the 1-hour maximum of 20 µg/l and the MCL (50 µg/l) (Table 4.10-7). However, the overall level of selenium discharged in surface water runoff to Permanente Creek may be lower during certain times of the year due to blending with creek water.

Based on the projected selenium concentrations determined by the predictive water quality model, the Applicant proposes to further reduce potential selenium levels in the Quarry pit water with in situ (in place) conditioning of the backfill with organic material. Decomposition of the organic matter enhances the necessary chemical reducing conditions needed to minimize the mobility of selenium in groundwater. As discussed in Section 4.10.1, *Setting*, dissolved selenium at the Quarry is in the oxidized form of selenate. If these oxidized forms are introduced to a sufficiently oxygen-reduced (also referred to as anaerobic) environment they will be transformed to selenide or elemental selenium. Elemental selenium is a solid, and selenide forms insoluble compounds

TABLE 4.10.7
WATER QUALITY PROJECTIONS FOR SUBSURFACE FLOW OUT OF THE QUARRY PIT

Constituent	Quarry Pit Water (after reclamation)	Basin Plan Benchmarks (Table 1)	Drinking Water Benchmarks (for comparison)
Antimony	2 – 3	–	6
Arsenic	2.0 – 3.0	150 (4d), 340 (1h)	10
Cadmium	0.15 – 0.20	1.1 (4d), 3.9 (1h)	5
Copper	1.5 – 1.6	9 (4d), 13 (1h)	1,300
Manganese ^a	15 – 20	–	50
Nickel	30 – 40	52 (4d), 470 (1h)	100
Selenium	10 – 15 ^b	5 (4d), 20 (1h)	50
TDS	600 – 650	450	500
Sulfate	120 – 140	–	250

^a Concentration projections for manganese are higher than what will be observed because manganese will not behave conservatively as assumed in the projection models.

^b Prescribed mitigation measures are anticipated to decrease this conservative projection by a factor of 3 (i.e., to a range of 3 to 5 µg/l).

Source: SES, 2011

with iron, calcium, and other common minerals. Selenide can also form harmless volatile compounds that de-gas to the atmosphere (SES, 2011). Case histories at other mines in the United States and Canada indicate that backfilling a mine pit and saturating the material causes chemically reducing (i.e., anoxic or anaerobic) conditions that result in very low mobility of selenium (e.g., BLM, USFS, and IDEQ, 2007; Park, 2008; SAPSM, 2020; ITRC, 2011; Kirk, 2011).

Case studies have shown that chemical-reducing or anaerobic conditions can be promoted in the Quarry pit backfill by amending the upper 25 to 50 feet with organic matter. The organic matter would be combined with the backfill material during placement in the Quarry pit. Mulched green waste would likely be the preferred material due to its availability from local composting centers. The Applicant estimates that approximately 63,000 tons (about 170,000 cubic yards) of green waste would be required. The organic matter would be placed in the Quarry pit with the backfill material and heavy equipment would mix the mulch into the fill material. The addition of the organic material would take about three years.

Post-Reclamation Surface Water Runoff from the Quarry Pit. Once the Quarry pit is backfilled, surface water from much of the WMSA and Quarry pit area would infiltrate the backfill or run off surrounding surfaces and into Permanente Creek. During Phase 2, the concurrent reclamation of the WMSA would gradually incorporate reclamation stormwater best management practices (BMPs), which could reduce runoff into the Quarry pit area.

Projections of future water quality in the runoff from the reclaimed Quarry pit area are that waterborne selenium concentrations will be in the range of 2 to 4 µg/l, which is below the chronic Basin Plan Benchmark level for a 4-day average concentration. (**Table 4.10-8**). After reclamation, the quality of the Quarry pit water is expected to meet or come close to meeting the applicable

**TABLE 4.10-8
PROJECTIONS OF FUTURE WATER QUALITY IN RUNOFF
FROM RECLAIMED QUARRY AREA (µg/l)**

Constituent	Runoff (after reclamation)	Basin Plan Benchmarks	Drinking Water Benchmarks (for comparison)
Antimony	4 – 5	–	6
Arsenic	3 – 4	150 (4d), 340 (1h)	10
Cadmium	0.05 – 0.10	1.1 (4d), 3.9 (1h)	5
Copper	0.60 – 0.80	9 (4d), 13 (1h)	1,300
Manganese ^a	4 – 5	–	50
Nickel	2 – 3	52 (4d), 470 (1h)	100
Selenium	2 – 4	5 (4d), 20 (1h)	50
TDS	140 – 180	450	500
Sulfate	30 – 60	–	250

^a Concentration projections for manganese are higher than what will be observed because manganese will not behave conservatively as assumed in the projection models.

Source: SES, 2011

Basin Plan Benchmarks for selenium, and runoff water quality is expected to meet applicable Benchmarks. The Drinking Water Benchmarks, although not applicable to Permanente Creek surface water, are included in the table to demonstrate that the water quality will not pose a risk to human health if it were to be used for consumption (SES, 2011).

It is reasonable to assume that, if properly implemented, the use of organic material as a supplement to produce an anaerobic condition in the backfill would reduce selenium concentrations in water that would discharge from the Quarry pit after reclamation. However, in recognition of the uncertainties with predictive models, especially those that project water quality concentrations 20 years in the future, and the potential for selenium concentrations in water discharged from the site to exceed Basin Plan Benchmark values during or following reclamation, this impact is considered significant. **Mitigation Measure 4.1-1b** prescribed below would further reduce the long-term uncertainty of the predictive modeling by providing ongoing water quality monitoring and verification to ensure selenium concentrations remain below Basin Plan Benchmark values.

Mitigation Measures Identified in this Report

This report identifies additional water management, monitoring, and verification mitigation measures beyond those proposed in the RPA to ensure that post-reclamation selenium concentrations remain below Basin Plan Benchmark levels. It is anticipated that water monitoring described would be conducted as part of any additional monitoring required by the RWQCB.

The following mitigation strategy is intended reduce selenium concentrations in the surface runoff from the EMSA, the Quarry pit, and the WMSA. These measures involve 1) verification that non-limestone materials are used as the final reclamation cover, and 2) water monitoring to

ensure stormwater and non-stormwater discharges do not contain selenium concentrations exceeding Basin Plan Benchmark values.

Mitigation Measure 4.10-1a: Professional Geologist Verification of Non-Limestone-Containing Material Use. A California-certified Professional Geologist shall be onsite during reclamation to verify that non-limestone run-of-mine rock is used as cover on the EMSA and WMSA. In addition, the Geologist shall observe and document activities associated with placing the final overburden on the Quarry pit (i.e., ensuring that organic material is mixed to specifications). Using visual and field testing methods, with occasional bulk sampling and laboratory analysis, the geologist shall observe and document the type of rock placed over the limestone-containing material during reclamation activities. The geologist shall inspect and document whether limestone is present at the source area (Quarry pit and WMSA), whether limestone rock is transported from the source area to segregation stockpiles, and whether limestone is present within the lifts of the proposed 1-foot layer of run-of-mine cover rock (in the EMSA, WMSA, and Quarry pit). Inspection involves observing the excavation, hauling, stockpiling, and placement of the non-limestone cover material, performing a visual assessment of the rock, and conducting random spot sampling and field testing of suspect rock fragments. If observation, field testing, or laboratory analysis indicates that significant amounts of limestone are intermixed with the supposed non-limestone cover material, the geologist shall document its presence, temporarily halt fill operations, and notify the County Planning Office and field superintendent. Once notified, the Applicant shall remove the limestone-containing materials and then perform verification field sampling in addition to laboratory verification.

Mitigation Measure 4.10-1b: Verification and Water Quality Monitoring. The Applicant shall implement the following water monitoring and verification program within 90 days of Project approval and continue the program throughout the backfilling and reclamation phases and for 3 years following completion of reclamation. As part of this program, the Applicant shall:

- Collect quarterly Quarry pit water samples and analyze for general water chemistry and dissolved and total metals, including selenium.
- Perform quarterly electrical conductivity and pH measurements of the Quarry water.
- Measure and record daily volumes of any water that is pumped from the pit area.
- Conduct annual seep surveys in March or April of each year within the Quarry pit. Any seeps identified shall be sampled for general water chemistry and minerals and dissolved metals, and the seep flow rate shall be estimated.
- Perform routine testing of each of the various rock types that comprise the overburden to further characterize bulk and leachable concentrations of key metal constituents (selenium in particular). Such testing shall be performed until the average concentrations and the variability within a rock type is no longer changing significantly as new data are gathered.
- Sample and test runoff from the EMSA and WMSA throughout and following reclamation to confirm the concepts and closure plans (i.e., that cover with non-limestone material and revegetation results in runoff water quality that meets Basin Plan Benchmarks and all other applicable water quality standards). Stormwater runoff monitoring and sampling shall be conducted following the placement and final

grading of the 1-foot run-of-mine non-limestone cover material to ensure that surface water discharging from this cover does not contain selenium at concentrations exceeding Basin Plan Benchmark values. Three rounds of representative surface water samples shall be collected and analyzed to verify rock cover performance prior to the placement of the vegetative growth layer.

- The data obtained through this mitigation measure shall be used to reevaluate the water balance components such as runoff and groundwater inflow and the water quality associated with these within the last five years of active mining. Based on the results of any refined water balance and water quality projections, the Applicant shall also review and refine the water management procedures.
- Reclamation of the Quarry Pit, EMSA, and WMSA areas shall not be considered complete until 5 years of water quality testing as described above demonstrate, to the satisfaction of the Director of Planning and Development, that selenium in surface water runoff and any point source discharges has been reduced below all applicable water quality standards, including Basin Plan Benchmarks.

Significance after Mitigation: As discussed in detail in the Regulatory Framework section, above, under the current requirements from the RWQCB, the Applicant must continue to maintain and pursue all appropriate permits and authorizations through the RWQCB including the NPDES Permit to reduce selenium. In addition, the Applicant must comply with requirements set forth by the RWQCB in the §13267 Order, the Sand & Gravel Permit authorizations, and in the upcoming issued individual NPDES Permit. The Applicant must sample as directed by the Sand & Gravel Permit authorizations and in the upcoming issued individual NPDES Permit. Finally, the Applicant must maintain procedures to ensure prompt identification and repair of damage to BMPs or structural control facilities, especially after large storm events.

In addition to these established regulatory requirements to protect surface water quality, implementation of Mitigation Measures 4.10-1a and 1b would: 1) ensure that the non-limestone material placed as cover over the EMSA and WMSA consists of documented non-limestone material, 2) verify the effectiveness of the stormwater quality controls throughout and after reclamation to ensure that proposed cover systems are adequately shielding limestone materials from surface exposure and preventing the discharge of selenium in concentrations exceeding applicable water quality standards, and 3) provide data to refine and re-evaluate water quality projections before reclamation is complete. The required regulatory measures and the prescribed mitigation measures would reduce the uncertainty in the water quality projections and provide a metric to manage stormwater quality and reduce potential discharges of selenium to Permanente Creek. These mitigation measures would reduce the impact to less than significant.

Impact 4.10-2: Interim reclamation activities within the Project Area would contribute concentrations of selenium, Total Dissolved Solids (TDS), and sediment in Permanente Creek. (Significant and Unavoidable Impact)

After approval of the RPA, reclamation would begin at the EMSA and would continue for an estimated 20 years until the final reclamation is complete at the WMSA and Quarry pit.

Reclamation activities would be most pronounced in the EMSA, WMSA, and Quarry pit but would also occur to a lesser degree at the Crusher/Quarry Office Area, Surge Pile, and Rock Plant. In addition, reclamation activities at the Permanente Creek Reclamation Area (PCRA) would be implemented during Phase 1 and Phase 2 of reclamation. During the estimated 20 years of reclamation activities, the RPA area has the potential to deliver selenium-bearing stormwater and sediment to Permanente Creek. Reclamation phasing and proposed activity in each of the RPA areas are discussed below.

EMSA

The primary reclamation activity at the EMSA would consist of grading and recontouring. Placing the final cover with non-limestone run-of-mine materials would require stockpiling and hauling. During the interim period while reclamation is under way, limestone-bearing rock, fine grained, wash material deposited from the rock plant, and other fine to coarse-grained material within the EMSA would be disturbed and exposed to stormwater and wind erosion.

Quarry Pit

Reclamation by backfilling would commence in Phase 2. The Quarry pit would continue to act as a catch basin for the surface water flowing off the WMSA and surrounding areas. Considering that reclamation of the Quarry pit primarily involves backfilling a closed basin, the potential for selenium-bearing stormwater and sediment to be released to the Permanente Creek is less than the other areas. However, selenium-bearing water would likely be released when the pit requires occasional dewatering during backfilling operations.

WMSA

The WMSA would continue to receive waste material from the Quarry pit and elsewhere on the Quarry property until reclamation of the WMSA begins in Phase 2. During the interim period before reclamation begins at the WMSA, which could be at least 10 years, the WMSA would essentially remain as it is under baseline conditions. Under these conditions, stormwater runoff is collected in drainages that are conveyed to the Quarry pit. In certain areas, especially on the north end of the WMSA, stormwater runs off the WMSA and is ultimately conveyed to the creek further downstream of the site where Wild Cat Creek approaches I-280. After reclamation commences at the WMSA, material would be used to backfill the Quarry pit.

Crusher/Quarry Office Area

Stormwater and sediment from the Crusher/Quarry Office area would continue to occur as it has under baseline conditions until Phase 3 when the area undergoes reclamation. During reclamation, finish grading would disturb soil, resulting in temporary stockpiles requiring Best Management Practices (BMPs) to manage runoff and control erosion. Stormwater runoff and erosion control measures would be required until a growth medium erosion control measures are installed and reseeding and planting activities are complete.

Surge Pile

Reclamation of this area would occur in Phase 3 and would require the excavation and removal of the Surge Pile. Excavation and final grading in this area could result in exposed disturbed areas that have the potential to discharge sediment offsite to Permanente Creek. Temporary BMPs, as presented in the RPA, would be installed during activities to control including silt fences, and hydroseeding.

Rock Plant

Reclamation of the Rock Plant in Phase 3 would require finish grading, application of growth medium, installation of erosion control measures, and reseeding and planting activities. Limited ground disturbance is anticipated in this area and temporary BMPs would be implemented as necessary.

Impact Discussion

The RPA would span a period of about 20 years and during that time, many areas within the RPA would undergo active ground disturbance by excavation, grading, stockpiling, hauling and conveyor operation. Areas not undergoing active reclamation work would be temporarily idle (i.e. stockpiles, temporary working slopes, unused conveyors). Through the duration of reclamation, both active and inactive areas have the potential to produce runoff, be subject to erosion, and discharge sediment to Permanente Creek and, as in the case of the WMSA, to Wild Cat Creek from the tributary at the north end of the WMSA. Depending on the location, some of the stormwater runoff generated from these areas could contain selenium. While the RPA indicates that temporary sediment control BMPs would be implemented as needed in accordance with the drainage plan and current SWPPP, the need for more rigorous control would be necessary. Therefore, because interim reclamation conditions could introduce sediment, waterborne selenium, and TDS into the drainage channels, desiltation basins, and potentially, Permanente Creek, this impact is considered significant.

Mitigation of this impact requires aggressive use of interim BMPs to protect areas that are disturbed, temporarily inactive, and partially reclaimed from stormwater runoff and erosion. The performance of these measures would be evaluated by regular surface water quality monitoring. If surface water monitoring indicates that there is selenium, elevated TDS, or excessive sediment in the runoff, the source of these pollutants would be evaluated and appropriate BMPs could be implemented. During reclamation, stormwater from the Quarry pit area and a portion of the stormwater runoff from the WMSA would flow into the Quarry pit, be collected and eventually discharged to Permanente Creek. Stormwater containing selenium in the EMSA could also discharge to Permanente Creek. Therefore, the following mitigation measures are proposed.

Mitigation Measure 4.10-2a: Interim Stormwater Control and Sediment

Management. The Applicant shall implement the following stormwater and sediment management controls in addition to general BMPs required by the SWPPP in active and inactive reclamation areas throughout the duration of the Project. The Applicant shall:

- Segregate limestone materials from the non-limestone materials (breccia, graywacke, chert, and greenstone) by way of operational phasing to ensure that non-limestone materials are placed beneath and are covered by non-limestone materials. A California Professional Geologist shall oversee stockpiling, segregation, and placement of non-limestone materials.
- Stabilize inactive areas, such as temporary stockpiles or dormant excavations that drain directly or indirectly to Permanente Creek using an appropriate combination of BMPs to cover the exposed rock material, intercept runoff, reduce its flow velocity, release runoff as sheet flow, and provide a sediment control mechanism (such as silt fencing, fiber rolls, or hydroseeded vegetation). Standard soil stabilization BMPs include geotextiles, mats, erosion control blankets, vegetation, silt fence surrounding the stockpile perimeter, and fiber rolls at the base and on side slopes.
- Temporarily stabilize active, disturbed reclamation areas undergoing fill placement before and during rain events expected to produce site runoff. Stabilization methods include combined BMPs that protect materials from rain, manage runoff, and reduce erosion. Reclamation activities involving grading, hauling, and placement of backfill materials cannot take place during periods of rain.
- In areas such as the WMSA where fill slopes are steep and composed of loose material, controls shall be in place to prevent material from sloughing off into the PCRA and Permanente Creek Area. These controls shall include debris/silt fencing placed on outer edge of grading and excavation operations back-sloping excavations to prevent grade slope towards the creek, operations buffer areas that require the use of smaller grading equipment, temporary berms along the outer extent of operations closest to the creek, operator training regarding the prevention of triggering debris slides.
- Cover active haul roads with non-limestone materials where exposed limestone surfaces are present. Roads that undergo dust control by watering must have fiber rolls or equivalent runoff protection installed along the road side to reduce runoff and avoid drainage to Permanente Creek.
- Divert all runoff generated from disturbed active and inactive reclamation areas to temporary basins, the Quarry pit, or temporary vegetated infiltration basins and kept away from drainage pathways entering Permanent Creek. To the extent possible, drainage of the non-limestone materials shall be diverted directly to sediment control facilities and natural surface drainages.
- Install up-gradient berms where limestone fines or stockpiles are placed, to protect against stormwater run-on, and install ditches and down-gradient berms to promote infiltration rather than run-off.
- Replace the limestone rock and materials that are currently used in the existing BMP ditches and cover or otherwise separate runoff from limestone rock in the existing sediment pond embankments.
- Cover large limestone surfaces that would remain exposed during the rainy season with interim covers composed of non-limestone rock types.
- Inspected and maintain BMPs after each qualifying storm event (minimum of one-quarter inch of rainfall as measured by onsite device) to ensure their integrity.

- Reconstruct or reline all existing stormwater conveyances and check dam structures that are constructed or lined with limestone rock using non-limestone material (greenstone, breccias, greywacke, metabasalt), available at the Quarry.
- Regularly inspect all stormwater and erosion controls, especially before and following significant run-off-producing rain events.
- Provide adequate erosion control training to all equipment operators, site superintendents, and managers to ensure that stormwater and erosion controls are maintained and remain effective.
- Ensure that all stormwater, erosion, and sediment control BMPs are approved by the California Stormwater Quality Association (CASQA) and are installed, inspected, maintained, and repaired under the direction of a certified erosion control specialist.

Mitigation Measure 4.10-2b: EMSA Interim Stormwater Monitoring Plan. The Applicant shall develop a stormwater sampling plan that would supplement preexisting surface water monitoring required by General Industrial Storm Water and Sand and Gravel NPDES Permit and be designed specifically to monitor surface water during reclamation activities in active and inactive excavation and backfill areas. The purpose of this plan is to evaluate performance of temporary BMPs and completed reclamation phases at the EMSA and to identify areas that are sources of selenium, sediment, or high TDS. At a minimum, the plan shall require the Applicant to inspect BMPs and collect water samples for analysis of TDS and metals, including selenium, within 24 hours after a storm event and sample non-stormwater discharges when they occur. If elevated selenium, sediment, or TDS is identified through sample analysis, the Applicant shall identify the source and apply any new or modified CASQA-approved standard BMPs available. BMPs that show sign of failure or inadequate performance shall be repaired or replaced with a more suitable alternative. Following implementation, the Applicant shall re-test surface water to determine the effectiveness of such modifications, and determine whether additional BMPs are necessary.

Significance after Mitigation: Implementation of Mitigation Measure 4.10-2a would establish additional BMPs to ensure that over the 20-year duration of the Project, a rigorous stormwater and sediment control implementation plan is developed to reduce the potential for stormwater runoff to deliver sediment and selenium to Permanente Creek. Mitigation Measure 4.10-2b develops a specific stormwater monitoring plan that would monitor the effectiveness of the interim BMPs and completed phases of reclamation and requires the Applicant to repair sources of selenium runoff, excessive sediment, and TDS. Although implementation of this mitigation is expected to reduce selenium-containing runoff, sediment, and TDS to acceptable levels, there is insufficient evidence at this time regarding the efficacy of these measures. Therefore, additional mitigation was evaluated to determine whether any available water treatment technologies could address this issue.

There are commercially available treatment technologies that have been demonstrated to remove selenium and that can effectively and consistently reduce selenium levels to below 5 µg/l (4-day basin Plan Benchmark). These technologies include ferrihydrite adsorption (iron co-precipitation), ferrous hydroxide, ion exchange, or fluidized cell reactors. However, these systems can be very costly. A cost estimate for a water treatment system sized to handle the flows from the WMSA, Quarry pit, and EMSA was developed. The system was estimated to have a total installed cost of

approximately \$86 million, and to cost approximately \$2.8 million per year to operate and maintain (Sandy, 2011).¹⁴ Due to the high estimated costs, this potential mitigation was determined to be infeasible. As a result of these factors, the County has determined the impact to water quality in Permanente Creek from selenium runoff would be significant and unavoidable during the interim period until final reclamation is completed.

Impact 4.10-3: The Permanente Creek Reclamation Area (PCRA) reclamation activities would contribute concentrations of selenium, Total Dissolved Solids (TDS), and sediment in Permanente Creek. (*Less than Significant Impact*)

Sediment yield downstream from Permanente Creek has been estimated to be chronically about 3.5 times higher than it would be under natural basin conditions (Nolan and Hill, 1989), potentially contributing to flooding and other adverse effects downstream, and potentially compromising downstream beneficial uses as established in the Basin Plan. Currently, pre- and post-SMARA slopes within the PCRA are eroding into Permanente Creek. In addition, the pre- and post-SMARA slopes and mining disturbances with the seven areas of PCRA areas may be delivering selenium and high TDS to Permanente Creek.

The remedies and treatments in the RPA include improving slope conditions, stabilizing slopes, reconditioning and installing drainage basins, and installing BMPs to control sedimentation and run off. The actions proposed for the PCRA would stabilize slopes adjacent to the creek, remove active sources of selenium (i.e., removal of limestone boulders) and TDS, revegetate eroded soil areas, remove in-stream improvements, and regrade and restore the creek within several reaches. The proposed instream restoration work that would be required would be conducted during periods low stream flow to avoid adverse impact to water quality. The instream work, such as removing boulders, would be temporary and would not permanently alter the flow of the creek. Best Management Practices, such as silt fencing, temporary coffer dams, ground covers for erosion protection, and immediate replacement of scarified areas would be used to reduce disturbance of creek sediments thus reducing the possibility for water quality degradation. Because these actions would be an overall improvement to the hydrologic regime along Permanente Creek and would result in less erosion and greater long term slope stability, this impact is considered less than significant.

¹⁴ This treatment system assumes treatment of the selenium primarily in the form of selenate as well as treatment to meet conventional pH, D.O., BOD, and TSS discharge limitations. These are Class 5 cost estimates (+100%, -50%) as defined by the Association of the Advancement of Cost Estimating International, and include a 25 percent contingency. The cost estimates also assume that stormwater detention facilities would be constructed to divert and equalize the runoff into a storage impoundment, thereby resulting in an equalized flow of 8 cfs or 3,590 gpm and limiting the size of the treatment system.

Impact 4.10-4: The Project would alter the existing drainage pattern of the site, which could result increased stormwater runoff rates and on- or offsite flooding. (*Significant and Unavoidable Impact*)

The County of Santa Clara requires that new storm drain systems and channels be designed to convey the design 10-year flow without surcharge and that a safe release be provided for the design 100-year flow. SMARA requires that erosion control methods be designed for the 20-year storm. The County Drainage Manual provides parameters for the 25-year event but not for the 20-year event. The 25-year event was analyzed in the Applicant's Drainage Report (Chang Consultants, 2011) to satisfy the requirement for the 10-year and 20-year events. The results of the hydrologic analyses in the Drainage Report are consistent with the Santa Clara County Drainage Manual, the SCVURPPP C.3 Stormwater Handbook (SCVURPPP, 2004), and SMARA.

Permanente Creek is known to have flooding problems downstream of the Quarry. Adjacent to Permanente Road along the existing Aluminum Plant, Permanente Creek is mapped as a Zone AE Special Flood Hazard Area (SFHA) with base flood elevations (BFEs) defined in a detailed flood insurance study. This area is shown on Figure 4.10-1. The effective Flood Insurance Study for Santa Clara County dated May 18, 2009 identifies the drainage area "downstream of Permanente Road" (the upstream end of the FIRM study) as 3.40 square miles and the 100-year flow at this location as 1,480 cubic feet per second (cfs).

Chang Consultants, in a letter dated December 16, 2011 discussed further review of the FEMA flood values and handling of the Quarry area in the FEMA Flood Study. Additional analyses presented with this report support the position that the increased flows to Permanente Creek resulting from the Project would not increase 100-year flows above the FEMA flows, and that the FEMA Study did not include the storage effects of the Quarry pit. The Santa Clara Valley Water District (SCVWD) is currently working on flood control improvements for Permanente Creek downstream of the Project. The 100-year design flow being used by SCVWD for Permanente Creek includes detention in the Quarry pit as the existing condition (SCVWD, 2011).

Under existing conditions, the Quarry pit captures drainage from 361.5 acres, which includes the Quarry pit and about 60 percent of the WMSA. Pit water is pumped to Permanente Creek at an approved maximum discharge of 4.5 cfs per the NPDES permit. This condition is proposed to continue during Phase 1 of the RPA, and then discontinue during Phase 2, when the Quarry pit is backfilled, and during Phase 3, when final reclamation is completed. The Quarry pit will continue to capture drainage until it is backfilled, and thus the effect to downstream flooding during Phase 2 is similar to the baseline condition. After the Quarry is backfilled, the Quarry floor is proposed to drain to Permanente Creek. A desiltation basin is proposed to be installed to detain runoff from the Quarry floor prior to conveying it to the creek. The proposed desiltation basin would be sized to meet County and SMARA standards but it is not proposed to function as a detention basin and mitigate stormflow increases to Permanente Creek. The 100-year discharge to the Quarry floor was calculated in the Drainage Report at 235 cfs for the proposed reclaimed condition in Phase 3. Without detention, this peak flow would discharge to Permanente Creek and constitute a 230.5 cfs increase from the approved maximum discharge of 4.5 cfs under existing conditions. This magnitude of increased run-off from the site would result in potential

downstream flooding, hydromodification effects along Permanente Creek, and potential adverse flow effects at the Permanente Diversion structure. Considering the potential impacts on downstream, offsite drainage, under the current RPA, this impact is considered significant.

The severity of this impact would be reduced and the impact could be avoided by implementing the following mitigation measure, if it is deemed feasible.

Mitigation Measure 4.10-4: Construction of Onsite Detention Facility. The Applicant shall design and construct detention facilities that would 1) manage increased runoff caused by the reclaimed Quarry pit, 2) reduce excessive discharges to Permanente Creek, and 3) develop the capacity to detain and release the 100-year flow using onsite detention ponds while optimizing groundwater infiltration. The final drainage design shall ensure that offsite, downstream flows would not cause an increased flooding potential or lead to hydromodification effects. In addition to the detention facilities for the Quarry pit, the Applicant shall ensure that the desiltation ponds proposed in other smaller project areas such as the EMSA, are engineered to function as detention basins and manage 100-year peak flow to the extent practical. The Applicant shall also consider a broader watershed approach and consult with SCVWD on ways to detain peak flows offsite in relation areas of existing flooding and to the current SCVWD flood control improvement project.

Significance after Mitigation: Implementation of Mitigation Measure 4.10-4 would provide the necessary facilities to reduce offsite stormwater discharge to Permanente Creek during the 100-year storm event. However, as of the time that this EIR was published, it is unknown if a basin or other detention measure of sufficient size could be feasibly constructed onsite to reduce this impact to less than significant levels. If this is not determined to be feasible, the impact would remain significant and unavoidable.

Impact 4.10-5: Groundwater discharge from the Quarry pit after backfilling and reclamation is complete would adversely alter surface water flows to Permanente Creek. (*Less than Significant Impact*)

The Quarry pit currently captures groundwater that would potentially discharge to Permanente Creek. After entering the Quarry pit, the water is pumped back to the creek via a detention basin up to a maximum capacity of 1,150 gallons per minute (gpm) or 2.56 cubic feet per second (cfs); 4.5 cfs is the maximum discharge allowed and the pumping capacity. This flow occurs throughout the year and increases dry-season baseflow in Permanente Creek downstream. Upstream of the discharge, the stream currently dries up adjacent to the Quarry pit during the dry season. Further upstream, beyond the influence of the Quarry pit, it reportedly flows year-round.

Permanente Creek is at an elevation of 1,000 to 1,100 feet above mean sea level (amsl) adjacent to the Quarry pit. Analysis by the Applicant's engineer, Golder Associates, predicts that additional groundwater capture would occur as the Quarry pit is deepened from its current elevation of 750 to 440 feet amsl, during Phase 1 of the revised RPA. Deepening the Quarry to 440 feet amsl would increase the groundwater inflow into the Quarry pit by a predicted 60 gallons per minute (gpm).

The operation and reclamation of the Quarry pit is not predicted to have a measurable effect on groundwater discharge to Monte Bello Creek and to the upper reaches of Permanente Creek. However, it is estimated that a decrease in groundwater discharge to the middle reach of Permanente Creek (i.e., adjacent to the Quarry) of 0.1 cfs (40 gpm) would occur as Quarry pit excavation approaches the 440 foot amsl elevation. When this occurs, the creek reach adjacent to the quarry areas would continue to dry back; this dry back would potentially expand longitudinally and for a longer time during the dry season (Balance Hydrologic, 2011). Once the Quarry pit is reclaimed and fully backfilled, then the middle reach of Permanente Creek would receive about 0.5 cfs (206 gpm) more groundwater discharge than under current conditions. Golder's analysis predicts that groundwater capture would decrease and ultimately cease as the Quarry pit is backfilled during Phase 2 and 3 of the revised RPA. As the quarry areas are reclaimed and as pit-water discharge to Permanente Creek diminishes, the dry-season baseflow to the creek from Quarry pit dewatering would logically recede naturally to considerably lower levels than currently maintained. Considering that groundwater would be discharged to Permanente Creek from the reclaimed Quarry pit, it is a reasonable assumption that perennial or near-perennial flow would resume in the reach adjacent to the Quarry that currently runs dry. Given that Permanente Creek flows are not predicted to increase more than 1 cfs (remaining under the 4.5 cfs allowable limit), and considering that perennial or near-perennial stream flow may resume after the Quarry pit reclamation is complete, this impact is considered less than significant.

Impact 4.10-6: The Project would alter the existing drainage pattern of the site, which could result in increased stormwater ponding, accumulation of selenium, and flooding. (*Less than Significant Impact with Mitigation Incorporated*)

The water level in the Quarry pit after mining and backfilling is projected to reach a maximum elevation equal to the surface of the backfill at 990 ft amsl. This elevation represents the low-point surface water overflow to Permanente Creek. Once the groundwater reaches equilibrium, the estimated total average annual inflow of groundwater, surface water, and precipitation into the backfilled and reclaimed Quarry pit is 169 gpm (Golder, 2011). This quantity of water is expected to discharge to Permanente Creek as groundwater depending on how effectively water flows through the materials separating the Quarry backfill from the creek. However, during periods of intense rainfall or high rainfall years, the groundwater level beneath the surface of the reclaimed Quarry pit may rise above the 990-foot amsl level resulting in reduced infiltration or flooding and excess stormwater runoff. Considering that some of the runoff originated from exposed limestone slopes on the north side of the Quarry, there is a potential for the localized accumulation of selenium containing runoff. Pondered runoff containing selenium could cause high selenium levels to accumulate in the vegetative cover layers or be discharged as surface runoff to Permanente Creek. This is considered a significant impact. Implementation of water management strategies could reduce this impact to less than significant.

Mitigation Measure 4.10-6: Stormwater Control to Avoid Pondered Water and Selenium Accumulation. The Applicant shall incorporate drainage features into the final drainage design for the Quarry pit area to eliminate the potential for surface ponding on the

floor of the Quarry pit once it has reached its final elevation (990 amsl). The drainage design for the finished Quarry pit fill shall include engineered elements (e.g. conveyance channels, infiltration galleries) that facilitate groundwater recharge and percolation from limestone areas to groundwater in the Quarry backfill with the objective of accommodating high groundwater elevation without creating surface water bodies that may contain elevated levels of selenium. These measures shall be incorporated into the design of the proposed additional basin proposed for the floor of the Quarry pit once the floor is raised to its final elevation.

Significance after Mitigation: Implementation of Mitigation Measure 4.10-6 would ensure that the final designs of the final Quarry pit reclamation provides surface water controls to reduce the potential for surface ponding during large storm events thereby reducing the potential for areas of selenium accumulation in soils and vegetation. With implementation of this mitigation measure, this impact would be less than significant.

4.10.6 Alternatives

4.10.6.1 Alternative 1: Complete Backfill Alternative

Impacts to hydrology would be similar to those described under the Project analysis except that under Alternative 1, the EMSA would remain intact and not undergo reclamation until 2023, thereby extending the amount of time that limestone remains exposed and selenium is discharged to the surface water. However, by removing the EMSA altogether by 2027, there is no potential that the EMSA would leach selenium to the environment over the long term. Impacts related to interim sedimentation and potential runoff are similar to the Project but may be slightly worse because, rather than reclaiming the EMSA in place, the material would have to be transported to the Quarry pit for backfilling. Excavation, hauling, and conveyors increase the potential for sedimentation, erosion, and the release of selenium, sediment and metals to surface water. Impacts associated with the WMSA would be similar to the impacts considered under the Project except that under Alternative 1, the WMSA would remain unreclaimed for a longer period of time thereby increasing the risk for selenium to be discharged to Permanente Creek. Alternative 1 would have similar impacts with regards to post-reclamation drainage. Without adequate detention, the increase in surface flows from the RPA would increase downstream flows exceeding the design of the current SCVWD flood control project located downstream and mitigation would be needed. Under Alternative 1 and similar to the Project, this impact would be significant and unavoidable unless it was determined that the Applicant could construct an appropriately sized detention basin to detain 100-year flood flows. Given that the Quarry pit would be filled under this alternative, groundwater impacts would be similar to those identified by the Project. Alternative 1 would cover exposed limestone slopes within the pit thereby reducing selenium concentrations in surface water ultimately discharging to Permanente Creek.

Alternative 1 would have similar impacts as the Project and would likely utilize similar mitigation measures to control runoff, reduce selenium concentrations, manage drainage and reduce groundwater impacts. While Alternative 1 could reduce the potential for long term selenium leaching to surface water due to coverage of exposed slopes, the drainage issues due to the larger

area and higher slopes in addition to the longer interim periods that the WMSA and EMSA remain in an unreclaimed state could result in more severe impacts to water quality.

4.10.6.2 Alternative 2: Central Materials Storage Area Alternative

Impacts from Alternative 2 would be similar to those described under the Project. Alternative 2 would result in the reclamation of the EMSA sooner than under the proposed Project, thereby reducing the potential for selenium discharges to Permanente Creek from the EMSA. However, overburden placement on the CMSA would commence when the EMSA is no longer used and would continue through the cessation of mining. Grading and overburden placement activities associated with the CMSA could result in similar potential water quality impacts as would be realized with the Project. The CMSA would be reclaimed similar to the EMSA (i.e., 1-foot of run-of-mine non-limestone material with an overlying growth medium) and would be monitored for selenium, TDS and other potentially waterborne pollutants. Given the similar reclamation approach, Alternative 2 would not cause more severe impacts nor would it reduce impacts from the proposed Project.

4.10.6.3 No Project Alternative

The No Project Alternative would extend the period of time that reclamation would begin on the EMSA and WMSA, thereby increasing the potential for selenium to leach out of the stockpiled materials and enter the Permanente Creek in stormwater runoff. Discontinued use of the EMSA would lessen the water quality impacts associated with selenium because no new selenium-containing material would be added; however, water quality impacts associated with selenium leaching from existing overburden material at that location could continue without immediate reclamation. Drainage impacts (i.e. increased offsite drainage and flooding) related to Quarry infilling would be similar to those under the Project although offsite, downstream effects due to increased runoff from the site would occur several years later. Therefore, because conditions would likely exist for a greater period of time under the No Project Alternative, impacts related to drainage and water quality would, overall, be greater than those under the proposed Project.

References – Hydrology and Water Quality

Andersen, D.W., *Natural Levels of Nickel, Selenium, and Arsenic in the Southern San Francisco Bay Area*, San Jose State University, Institute for Research in Environmental Engineering and Science, June 30, 1998.

BLM, USFS, and IDEQ (Bureau of Land Management, U.S. Forest Service, and Idaho Department of Environmental Quality) 2007. Final Environmental Impact Statement. Available at: <http://www.smokycanyon.com/scm/feis.html>

California Stormwater Quality Association (CASQA), *Stormwater Best Management Practice Handbook, New Development and Redevelopment*, January 2003.

- CH2MHill, *Peer Review of Reclamation Water Quality Report and Recommended Mitigation Measures*, Draft Technical Memorandum, November 28, 2011.
- Chang Consultants, *Drainage Report for Permanente Quarry East Materials Storage Area*, April 14, 2009 (2009a).
- Chang Consultants, *Drainage Report for Permanente Quarry East Materials Storage Area*, December 6, 2011.
- County of Santa Clara, *General Plan, Charting a Course for Santa Clara County's Future: 1995-2010*, adopted Dec 1994, amended July 2002.
- County of Santa Clara, *Santa Clara County, California, Drainage Manual 2007*, Draft, July 2007.
- Department of Water Resources (DWR), *California's Groundwater Bulletin 118, Santa Clara Valley Groundwater Basin, Santa Clara Subbasin*, February 27, 2004.
- EnviroMINE, Inc., 2011. Reclamation Plan Amendment for Permanente Quarry (State Mine ID #91-43-0004), December 7, 2011.
- Federal Emergency Management Agency (FEMA), Digital Flood Insurance Rate Map Database, Santa Clara County, California, November 30, 2007.
- Federal Emergency Management Agency (FEMA), *Flood Insurance Study, Santa Clara County, California, and Incorporated Areas*, Volumes 1 through 4, May 18, 2009.
- Golder Associates, *Slope Stability Evaluation for Compliance with SMARA, East Materials Storage Area, Permanente Quarry, Santa Clara County, California*, April 2009.
- Golder Associates, *Hydrologic Investigation, Permanente Quarry Reclamation Plan Update, Santa Clara County, California*, May 2010, Rev. 1, November 2011.
- ITRC (Interstate Technology Regulatory Council). 2011. Mining Waste Treatment Technology Selection. Available on-line: http://www.itrcweb.org/miningwaste-guidance/to_insitu.htm
- Kirk, L.M.B. *Insitu Microbial Reduction of Selenate in Backfilled Phosphate Mine Waste, S.E. Idaho*. Doctoral dissertation, Montana State University, Bozeman MT. In Preparation 2011
- Lehigh Heidelberg Cement Group (Lehigh). Lehigh Southwest Cement Company Letter report on surface water sampling. April 7, 2011.
- Nolan, K.M, and B.R. Hill, *Effects of Limestone Quarrying and Cement-Plant Operations on Runoff and Sediment Yields in the Upper Permanente Creek Basin, Santa Clara County, California*, U.S. Geological Survey, Water-Resources Investigations Report 89-4130, 1989.
- Park, B. 2008. Mine Waste Technology Program Activity III, Project 34 Bioremediation of Pit Lakes – Gilt Edge Mine. EPA 540/R-09/002. Prepared by MSE Technology Applications, Inc. Mike Mansfield Advanced Technology Center Butte, Montana. September.
- SAPSM (Strategic Advisory Panel on Selenium Management). 2010. The Way Forward: A Strategic Plan for the Management of Selenium at Teck Coal Operations. June 30. Available on-line:

<http://teck.com/Generic.aspx?PAGE=Teck+Site%2fResponsibility+Pages%2fSustainability+Pages%2fEnvironment+Pages%2fSelenium&portalName=tc>

San Francisco Bay Regional Water Quality Control Board (RWQCB), *Cleanup and Abatement Order, Hanson Permanente Cement Company, Inc. (Formerly Kaiser Cement Corporation), Cupertino, Santa Clara County, California*, Order No. 99-018, 1999.

San Francisco Bay Regional Water Quality Control Board (RWQCB), *Water Quality Monitoring and Bioassessment in Nine San Francisco Bay Region Watersheds: Walker Creek, Lagunitas Creek, San Leandro Creek, Wildcat Creek/San Pablo Creek, Suisun Creek, Arroyo Las Positas, Pescadero Creek/Butano Creek, San Gregorio Creek, and Stevens Creek/Permanente Creek, 2001-2003 Final Report*, Surface Water Ambient Monitoring Program, June 2007. 2007a.

San Francisco Bay Regional Water Quality Control Board (RWQCB), *2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments*, approved by the U.S. Environmental Protection Agency (USEPA) on June 28, 2007. 2007b.

San Francisco Bay Regional Water Quality Control Board (RWQCB), *San Francisco Bay Basin (Region 2) Water Quality Control Plan*, January 18, 2007. 2007c.

San Francisco Bay Regional Water Quality Control Board (RWQCB), *Recommending Changes to the List of Water Bodies as Required in Section 303(d) of the Clean Water Act*, Resolution No. R2-2009-0008 (incl. Staff Report), February 11, 2009.

Sandy, Tom. Email from Tom Sandy, CH2MHill, to Rob Eastwood, County of Santa Clara. December 15, 2011.

Santa Clara Basin Watershed Management Initiative (SCBWMI), *Watershed Management Plan, Volume One, Watershed Characteristics Report, Unabridged 2003 Revision*, August 2003.

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), *C.3 Stormwater Handbook*, May 2004.

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), Watershed Monitoring and Assessment Program, *Monitoring and Assessment Summary Report Santa Clara Basin Creeks (2002-2007)*, prepared by EOA, Inc., September 15, 2007.

Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), About SCVURPPP, www.scvurppp-w2k.com/about_scvrppp.shtml, accessed November 4, 2010.

Santa Clara Valley Water District (SCVWD), Personal Communication with Afshin Rouhani Project Manager for Permanente Creek, December 19, 2011.

State Water Resources Control Board (SWRCB), *National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRS) for Discharges of Storm Water Runoff Associated with Construction Activity*, Order No. 99-08-DWQ, 1999.

State Water Resources Control Board (SWRCB), *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California*, Resolution No. 2000-015 (as amended), March 2, 2000.

Strategic Engineering & Science, Inc. (SES), *Operational and Reclaimed Water Quality, Permanente Quarry, Santa Clara County, California*, May 2010.

Strategic Engineering & Science, Inc. (SES), *Reclamation Water Quality, Permanente Quarry, Santa Clara County, California*, December 2011.

URS Corporation (URS), *Storm Water Pollution Prevention Plan Lehigh Southwest Cement Company Cupertino, California*, March 4, 2010.

U.S. Environmental Protection Agency (USEPA), *California Toxics Rule Factsheet*, water.epa.gov/lawsregs/rulesregs/ctr/factsheet.cfm, accessed November 4, 2010.

WRA Environmental Consultants, *Revegetation Plan Permanente Quarry, Cupertino, Santa Clara County California*, December 2011.