SITE REMEDIATION WORK PLAN

Mount Diablo Mercury Mine
2430 Morgan Territory Road
Contra Costa County, California

01-SUN-050

Prepared For:

SUNOCO

10 Industrial Highway, MS4
Lester, PA 19029

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As	arsenic
AMD	Acid Mine Drainage
BMP	best management practices
Ca	calcium
CEQA	California Environmental Quality Act
cfs	cubic feet per second
cm/sec	centimeter per second
COC	chemical of concern
COPC	chemical of potential concern
Cr	chromium
Cu	copper
CVRWQCB	Central Valley Regional Water Quality Control Board
CSM	conceptual site model
DMEA	Defense Minerals Exploration Agency
Fe	iron
gpm	gallons per minute
GPS	global positioning system
HASP	Health and Safety Plan
K	potassium
km	kilometer
m	meter
Mg	magnesium
Mn	manganese
msl	mean sea level
Na	sodium
Ni	nickel
NOI	Notice of Intent
Pb	lead
PRP	potential responsible party
RCRA	Resource Conversation and Recovery Act
Sb	antimony
Si	silica
STLC	soluble threshold limits concentrations
SWPPP	Stormwater Pollution Prevention Plan

USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WPCB	Water Pollution Control Board
Zn	zinc
°F	Degree Fahrenheit
ng/L	nanograms per liter
µmhos/cm	micromhos per centimeter

PROFESSIONAL GEOLOGIST CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my knowledge and on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Paul D. Horton, P.G., C.HG.
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Signature

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June 8, 1998
Date

1.0 INTRODUCTION

The Source Group, Inc. (SGI), on behalf of Sunoco, Inc. (R&M) (Sunoco), has prepared this Site Remediation Work Plan (Remediation Plan) as required and noted in item 3.0 (Page 5) of the Central Valley Regional Water Quality Control Board (CVRWQCB) December 30, 2009 Revised Technical Reporting Order R5-2009-0869 (Rev. Order) for the former Mount Diablo Mercury Mine in Contra Costa County, California (the Site or Mine). On February 7, 2012, the CVRWQCB issued correspondence approving the Characterization Reports for the Mine and officially setting the due date for submittal of the Remediation Plan as May 8, 2012.

The Revised Technical Reporting Order R5-2009-0869 (Rev. Order) for the former Mount Diablo Mercury Mine was issued to several potentially responsible parties (PRPs), including Jack and Carolyn Wessman, Bradley Mining Co. (Bradley), U.S. Department of the Interior, and Sunoco, which are referred to as Dischargers in the Rev. Order. Sunoco is a named discharger due to its purported connection with the Cordero Mining Company (Cordero) that conducted mercury ore investigations via tunneling and assaying during 1955. Submission of this Remediation Plan on behalf of Sunoco is not a commitment to implement it, which is not required by the Rev. Order, and Sunoco expressly reserves all rights with respect to any obligation to do so.

The Source Group, Inc. has prepared this Remediation Plan, to describe and/or provide the following:

- Site background;
- Characterization of the Mine-related materials to be removed;
- Water quality and human health risk assessment;
- A proposed Mine-related materials removal scope of work;
- A proposed spring/adit water routing and management scope of work;
- The removal design, methods, and procedures;
- A long term maintenance and monitoring plan; and
- A conceptual project schedule.

1.1 Project Objectives

The primary objectives of the removal activities described in this Remediation Plan are to mitigate the migration of particulate material and water potentially containing mercury from Mine-related materials (e.g., waste rock, tailings, and spring/adit discharges) associated with the Site that are potential sources of mercury to Dunn and Marsh Creeks. More specifically, the objectives of this Remediation Plan are to meet the goals specified in the Rev. Order and excerpted as follows:

Order R5-2009-0869, Page 5

3. Within 90 days of staff concurrence with the Characterization Report, submit a Site Remediation Work Plan (hereafter Remediation Plan) for the site. The Remediation Plan shall describe remediation activities to clean up or remediate the mining waste either to background concentrations, or to the lowest level that is technically and economically achievable. The Remediation Plan shall also address long-term maintenance and monitoring necessary to confirm and preserver the long-term effectiveness of the remedies. The potential remediation activities shall comply with all applicable WQOs in the Basin Plan. The Remediation Plan shall also include:

a. An evaluation of water quality risk assessment

b. A human health risk assessment

c. A time schedule to conduct the remediation activities.

The objectives for the Remediation Plan were further discussed and expanded in the February 7, 2012 CVRWQCB correspondence approving Mine Characterization reports excerpted as follows:

"The Reports conclude that groundwater in the Mine workings is chemically no different than background spring water and that Acid Mine Drainage (AMD) discharges are generated by the interaction of water from natural springs, the Mine workings, and rain fall with exposed Mine wastes. The Reports outline a conceptual site remedial plan, which was discussed among Sunoco staff, consultants, and Regional Board staff. The remedial plan could include capturing and re-directing away from Mine waste piles spring/adit discharges. If spring/adit discharges are chemically similar to background native spring discharges then it would be evaluated whether liquid can be released above Dunn Creek as background spring water without further treatment (the Plan should consider an artificial wetlands above the creek to mitigate the discharge). Mine waste may be consolidated where possible and covered to reduce interactions with stormwater. Any Mine wastes or pond solids in the Dunn Creek floodplain should be considered for removal and the Lower Pond SI filled and covered."

This Remediation Plan presents a scope of work designed to address the goals and objectives detailed above. Major scope of work items include the removal, consolidation and capping of Mine wastes of concern, the capture and re-routing of spring/adit discharges, and the restoration of the Dunn Creek Floodplain immediately below the Mine. During execution of the reclamation activities, environmental and health and safety controls would be implemented to ensure the work is completed safely and in accordance with applicable federal, state, and local regulations and permit conditions.

1.2 General Project Approach

The project, as outlined, includes planning, design, permitting, bid specifications, contractor selection, and oversight services during the project development, construction, and post-construction phases. The following summarizes the general approach to each of the project phases and the controls that would be implemented to ensure the work is completed safely and in accordance with applicable federal, state, and local regulations and permit conditions:

- Project Development and Scoping - During this phase, the project will be defined based on the identified objectives and schedule constraints. Applicable county, state, and federal approvals will be attained, bid specifications will be prepared, and the construction contractor selected so construction may be initiated. The implementing parties would work closely with the CVRWQCB, and other regulatory agencies, as needed, to comply with applicable environmental requirements; and identify sustainable business practices that can be integrated into the removal design and implementation. Support from the CVRWQCB through the permitting process to ensure that applications and permits are received in a timely manner will be critical to the overall project success.
- Construction - The construction phase will include Site preparation; removal, consolidation and stabilization of Mine-related waste rock, tailings, and stockpiled ore; removal of Mine-related equipment (if required) and clean capture and routing of Travertine Spring/Adit discharges away from contact with any Mine-related waste materials. During the construction phase, a record of approvals and permit conditions will be created and maintained in a single "*Permit Book*", including all certified and signed permissions and exemptions and a complete list of permit conditions and best management practices (BMPs) that are to be adhered to during construction. In addition, clear lines of communication and project responsibilities will be defined for each construction activity prior to the start of construction. Following completion of removal activities, compliance with permit conditions and requirements will be documented, and the Site will be restored and re-vegetated in working areas, as needed, and a final inspection by CVRWQCB will be scheduled. Following completion of removal and consolidation activities, a long-term maintenance and monitoring plan will be developed as appropriate based on the final disposition of implemented remedial actions concerning capped areas, re-vegetated areas, and water discharge controls.

Descriptions of the removal scope of work and the removal design, methods, and procedures are provided in Sections 3.0 and 4.0 of this Remediation Plan, including the environmental, health and safety controls to be implemented during the project.

1.3 Work Plan Organization

This Remediation Plan is organized as follows:

- Section 2.0 provides background information related to the Site, including an overview of the Site setting, history and development, environmental conditions, and Mine-related material characterization, and conceptual site model (CSM), which provide the basis for the remediation and removal actions.

- Section 3.0 provides the approach and scope of work of the Mine-related material remediation actions.
- Section 4.0 provides detailed descriptions of the removal design, methods, and procedures.
- Section 5.0 discusses the proposed project schedule.

Limitations and list of literature cited in the Remediation Plan are provided in Sections 6.0 and 7.0, respectively.

2.0 BACKGROUND

This section summarizes Site background information relevant to the planned mining-material remediation activities, including the Site setting, history and development, environmental conditions, and characterization of Mine-related material. This information was used to develop the CSM (Section 2.5).

2.1 Site Setting

The Mine is located on the lower flanks of the northeastern environs of Mount Diablo (Figure 2-1). The Site is situated at an elevation of approximately 700 to 1,100 feet above mean sea level (msl) with the general slope of the land down to the east towards Dunn Creek, the eastern border of the property.

The Mine has reportedly been closed since around 1969. Most assay and process equipment has been removed from the Site, yet some abandoned wood structures that were part of the Mine operations remain and are not part of planned remedial actions. Remnants of the Mine visible from Morgan Territory Road include two ponds and bare uncovered tailings piles. The relevant Mine features within the area of focus of this Remediation Plan include the following; collapsed Mine workings area, furnace and processing area, Main Tailings Pile (Bradley Tailings), a series of three ponds on the eastern part of the Mine adjacent to Morgan Territory Road, two springs, and the former Mine portal (165 level Adit).

Currently the Site owners, Jack and Carolyn Wessman, and their lessees, use the Site for residential purposes and small-scale cattle ranching.

2.1.1 Land Use and Ownership

Jack and Carolyn Wessman, additional named dischargers on the Rev. Order, currently own the Mine. The property is used for residential purposes supporting multiple families that include home rentals. Occasionally in the past, the property has been leased for use as an organized paint ball gun battle facility. The property also supports a small herd of cattle owned and managed by Jack Wessman. These cattle are not raised for commercial sale but are used for vegetation control and considered family pets. Jack and Carolyn Wessman have owned the property since 1974 and its use has been primarily the same during this time period. Mr. and Mrs. Wessman purchased the Mine property as part of a larger land purchase in 1974. The property was purchased for residential use. The Wessman family has conducted many modifications to the property over the years during their ownership. This includes the importation of fill materials to fill in Mine openings, covering Mine tailings, and re-directing drainage from the upper Mine area around the exposed eastern Mine tailings as discussed further in Section 2.3.5.

2.1.2 Site Location and Features

The Mine is located in unincorporated eastern Contra Costa County, California at the northeastern base of Mount Diablo. The Mine lies 5 miles east from the town of Clayton and just south of the intersection of Marsh Creek Road and Morgan Territory Road (Figure 2-1). The Site as it pertains to the focus of this Remediation Plan includes the former Mine and its historic working areas that make-up the southeastern quadrant of the property owned by Jack and Carolyn Wessman. The Site is adjoined to the south and west by lands of Mount Diablo State Park, to the north by the remainder of Wessman Property Holdings, and to the east by Morgan Territory Road.

Mine-related features that remain on the Site include buildings associated with the old furnace plant, and various other related Mine buildings including the former electrical shed, the dynamite storage building, a former stack foundation and various other wooden out-buildings (Figure 2-2, Mine Features). The most prominent features that remain include the highly visible Main Tailings Pile located on the eastern slope of the Mine property bounded on the east by the Lower Pond Surface Impoundment (Lower Pond SI). The Main Tailings Pile is highly visible due to the fact that it is a bare, red and orange pile that supports little vegetation. Spring water discharges from the face of the Main Tailings Pile creating a steady source of surface flow that moves across the lower portion of the Main Tailings Pile and into the Lower Pond SI. The source of this continuous spring flow is interpreted to be from two buried Site features. The Main Tailings Pile was placed over a natural spring called the travertine Spring that pre-dates mining activity. This spring has resulted in the deposition of travertine deposits along the slope from the spring emanation point to the valley floor. These travertine deposits underlie on-lapping Mine tailings and derived sediments. Upslope and to the North of the original Travertine Spring emanation point lies the buried portal of the 165 level Adit. The 165 level Adit is buried by approximately 40 feet of tailings material and the location and condition of this portal are unknown. Spring water that emanates from the face of the Main Tailings Pile daylights through one main discharge point supplemented by several seeps below the former locations of both the Travertine Spring and the buried portal of the 165 level Adit (Figure 2-3).

The Lower Pond SI is the location of the historic Mine-constructed surface impoundment that has been upgraded by the current property owner to provide effective containment of historic Mine-derived waste and sediments. The Lower Pond SI contains sediments largely sourced via stormwater flow and Travertine Spring/Adit discharge drainage through and off the Main Tailings Pile. The Middle Pond contains stormwater and flanks the Lower Pond SI to the north. The Middle Pond is not a historic Mine feature but was created by the current property owner, Jack Wessman, as part of stormwater management controls for the Mine conducted under the direction of the CVRWQCB.

2.1.3 Potentially Significant Historical and Archeological Features

The Mine property is currently not listed on the National Register of National Historic Landmarks nor is it listed as a California Historical Landmark. The Mine was developed in the mid to late

1800's and portions of original mining equipment and structures remain at the Site. Remedial actions proposed in this Remediation Plan do not currently include the removal or destruction of any of these historic Site structures.

2.1.4 Regional Geologic Setting

Mount Diablo is a geologic anomaly about 30 miles (50 kilometers [km]) east of San Francisco. The mountain is the result of geologic compression and uplift caused by the movements of the Earth's plates. The mountain lies between converging earthquake faults and continues to grow slowly. The mountain grows from three to five millimeters each year.

The upper portion of the mountain is made up of volcanic and sedimentary deposits of what once was one or more island arcs of the Pacific Plate dating back to the Jurassic and Cretaceous periods, between 90 and 190 million years ago. During this time, the Pacific Plate was subducting beneath the North American continent. These deposits were scraped off the top and accreted onto the North American Plate. This resulted in the highly distorted and fractured basalt and serpentine of the Mount Diablo Ophiolite and metasediments of the Franciscan complex around the summit. East of the subduction zone, a basin was filling with sediment from the ancestral Sierra further to the east. Up to 60,000 feet (18,000 meters [m]) of sandstone, mudstone, and limestone of the Great Valley Sequence were deposited from 66 to 150 million years ago. These deposits are now found faulted against the Ophiolite and Franciscan deposits.

Over the past 20 million years continental deposits have been periodically laid down and subsequently jostled around by the newly-formed San Andreas Fault system, forming the Coast Ranges. Within the last four million years, local faulting has resulted in compression, folding, buckling, and erosion, bringing the various formations into their current juxtaposition. This faulting action continues to change the shape of Mount Diablo, along with the rest of the Coast Ranges.

The following describes the regional geology for Mount Diablo, as reported by Pampeyan (1963).

> "The Coast Ranges of California east of San Francisco consist of Mesozoic and Cenozoic rocks, folded into a series of northwest-striking anticlines and synclines that are in some places overturned to the west. The Diablo Range, which forms the east edge of the Coast Ranges, is made up of a number of folds lying en echelon for more than 150 miles south of the Bay Area; Mount Diablo is at the north end of the Diablo Range and on the crest of one of these anticlines.
>
> The rocks of Mount Diablo and vicinity can be divided into four groups: (1) a basement complex of broken and jumbled sedimentary, igneous, and metamorphic rocks; (2) a section of younger sedimentary rocks, more than 35,000 feet thick, in fault contact with the basement complex; (3) volcanic rocks which locally cut and overlie the younger sedimentary rocks; and (4) landslides, alluvium, and travertine which in places cover the older rocks.

The rocks of the basement complex make up the main mass of Mount Diablo, which occupies an area of about 18 square miles. They are in fault contact with the surrounding sedimentary rocks and form a semicircular plug which has been upthrust through the overlying strata. This plug is divided into two parts by a narrow northeast-trending band of serpentine. South of this band, greenstone, chert, graywacke, shale, limestone, schist, and conglomerate of the Franciscan formation, cut by a few small bodies of serpentine, crop out in an area of 11 square miles. North of the serpentine band, an area of 5 square miles is occupied mainly by diabase but includes a few exposures of pillow basalt and vesicular diabase. The exact age relations of the rocks composing the basement complex are unknown; but it appears that first the diabase and then the serpentine intruded the Franciscan rocks before the plug was emplaced.

The sedimentary rocks overlying the basement complex consist mainly of fossiliferous clastic marine beds ranging in age from late Jurassic to late Miocene, but fresh-water Pliocene deposits overlie the Miocene beds south of Mount Diablo.

On the northeast side of Mount Diablo, Cretaceous rocks are cut by dikes and plugs of rhyodacite probably of late Tertiary or early Quaternary age. South and east of Mount Diablo, along the periphery of the plug, numerous recent landslides obscure much of the bedrock geology."

2.1.5 Mine Geology

The Mount Diablo Mine area geology discussed below is summarized from Knox (1938), Ross (1940), Division of Water Resources (1952), Pampeyan (1963), and Dibblee (1980), and Iovenetti (1989). The most recent geologic maps of the area are in Pampeyan (1963) and Dibblee (1980).

The rocks of the Mount Diablo basement complex are separated from the Jurassic and younger rocks by what Pampeyan (1963) called the boundary fault, which is actually a fault zone. In most places, the boundary fault consists of highly sheared material up to 100 feet wide. In discussing the Mount Diablo Mercury Mine, Pampeyan and Sheahan (1957) reported that, "*The Mine is located in a fault zone that separates Franciscan sandstone and minor chert, greenstone, and shale on the west from Cretaceous shales and calcareous sandstone on the east (Figure 2-4). Two fault trends were mapped in the area. The mercury ore body that sourced the Mount Diablo Mercury Mine is within a northwest trending fault zone consisting of four traces (Knox, 1938). A north-south trending fault zone, approximately 200 feet east of the surface impoundment, was mapped by Dibblee (1980). He also reported that, "The quicksilver deposits form only in Franciscan formation, in serpentine and silica-carbonate rock which is an alteration product of serpentine.*"

Ross (1940) reported that, "*The lodes are in fracture zones near the footwalls of inclined, more or less tabular serpentine masses in Franciscan rock. They are thought to be formed by hot springs so recent that it is still giving rise to sulphurous gases and methane. The lodes are unique in that* *meta-cinnabar is an abundant primary ore mineral. The ore shoots are in zones of intense brecciation and are controlled in part by cross-fractures.*"

The mercury mineralization at the Mine principally occurs in silicacarbonate rocks which are a product of hydrothermal alteration of the Franciscan serpentine. The primary ores in the Mine are metacinnabar and cinnabar. The gangue minerals are quartz, calcite, marcasite, pyrite, chalcopyrite, and stibnite. The iron sulfides, marcasite, and pyrite are commonly present and locally abundant. Hydrogen sulfide, sulfur dioxide, and methane gases were encountered during mining operations in considerable amounts. Several types of sulfates were also widespread throughout the Mine workings especially in portions of the Mine that were relatively undisturbed for a long time.

A relatively large hot spring deposit, which has been variously described as calcareous tufa, calcareous sinter or travertine, is southeast of the Mine. The hot spring is no longer active, but a small spring with continuous flow was reported by Ross (1940) near this deposit and it was mapped as a Travertine Spring by Knox (1938). Neither the water chemistry nor temperature for this spring was documented; however, Pampeyan (1963) reported that the location of this spring was near the portal of the 165 level Adit (Figure 2-4).

Southwest of the Lower Pond SI, a significant but relatively low flow spring complex occurs on the Mount Diablo State Park land (the State Park Spring). This spring complex is apparently on one of the northwest trending faults associated with the mercury mineralization.

The Lower Pond SI is located in the small valley which contains Dunn Creek, a tributary to Marsh Creek. The former channel for Dunn Creek longitudinally traverses the Lower Pond SI. In the area of the "*travertine*" deposit, the base of Dunn Creek is "*travertine*" cemented alluvial gravel. Virtually this entire travertine deposit is presently overlain by Mine tailings to the west and the Lower Pond SI to the east.

2.1.6 Hydrogeology

Groundwater presence and movement in the area is neither predictable nor continuous due to the highly distorted and fractured nature of the Mount Diablo Ophiolite and meta-sediments of the Franciscan complex around the summit. However, the presence of many springs around the base of Mount Diablo attests to the accumulation and movement of groundwater recharged on the slopes of the mountain.

Well drillers in the area report that water production in the Cretaceous shale formations (like those adjacent to the ore zone at the Mine) are very unpredictable. Very often, no water is found. When it is produced, production is generally low and water quality degrades during the summer months. This is corroborated by the findings produced by a study of the Division of Water Resources (1952) when investigating conditions around the Mine.

Groundwater is present in the Mine workings. Two monitoring wells completed within the Mine workings indicate an upward hydraulic gradient in this area of Mount Diablo (see Section 2.3.4).

The presence of springs along the fault trace that defines the mercury ore zone at the Mine indicates the movement of groundwater sourced in the environs of Mount Diablo is moving down slope and forced to the surface as it encounters the highly sheared material within the 100 foot thick fault zone. Groundwater emerging as spring water contains a large mineral load consistent with movement within the highly mineralized rock of the fault zone at the Mine. Monitoring well DMEA-1, located within the Cretaceous shale and calcareous sandstone formations north and east of the fault zone, was dry and devoid of groundwater until the fault zone was encountered at depth (Section 2.3.4 and SGI, 2011).

Hydraulic head conditions combined with water quality data from these monitoring wells confirm the vertical movement of groundwater up through the fault zone on its path to discharge via the springs, and potentially via near-surface sub-flow that is not visible. Under the direction of the CVRWQCB, Jack Wessman conducted an investigation of sub-flow at a location just west of the Lower Pond SI. Jack Wessman constructed the trench on June 5, 1989. Water was found at a depth of 6 feet below grade with a field ph of 4.44 and electrical conductance of 13,620 micromhos per centimeter (µmhos/cm). This is similar to the water quality of current spring water seeps on the face of the Main Tailings Pile (SGI, 2011) and indicates the presence of near-surface sub-flow in the area between the Lower Pond SI and the Main Tailings Pile lying above and west.

One residential supply well is located to the northwest of the Mine area providing potable water supply to the Wessman Family residence. Jack Wessman reports that this well makes plenty of water and has been tested by the Wessman family for suitability as a potable water supply. This well has been the source of water supply to the Wessman family since 1974. Additional residential properties located within the Wessman property tract north of the Mine are provided water by the local water company.

2.1.7 Hydrology

The Mine lies within the upper reaches of the 128 square mile Marsh Creek Watershed (Figure 2-5). The Mine is bordered on the east by Dunn Creek, a minor tributary to Marsh Creek. On the north, a feeder stream to Dunn Creek called "*My Creek*" drains the northern portion of the Mine Site. Two perennially flowing springs are located in the Mine area and are designated the "*State Park*" Spring and the "*Travertine/Adit*" Spring. The State Park Spring is located near the Mine property boundary on lands of the Mount Diablo State Park. The Travertine/Adit Spring emerges on the eastern slope of Mine tailings mid-way between the top of the tailings mound and Dunn Creek floodplain (Figure 2-3). Evaluation of flow from the Travertine/Adit Spring in summer and late fall is based on field observation estimates conducted by SGI are on the order of 3 to 5 gallons per minute (gpm).

One ephemeral spring, the Ore House Spring, is located near the historic Mine Furnace Plant. The Ore House Spring is a low flow spring and has not been observed to have enough flow to cause notable overland flow from the spring's emanation point. Flow from this spring currently moves into a drainage ditch that is channeled with other surface water in the area that ultimately flows into the

Upper Pond and then to Dunn Creek. The only known measurement of flow from the Ore House Spring was made by Slotton (1996) at 0.01 cubic feet per second (cfs) in late March of 1995 following an extensive period of storms (Slotton, 1996). As a result of the timing of measurement by Slotton, this flow rate can likely be considered on the high side of the range for spring base flow at this location.

Two perennial ponds exist in the Dunn Creek floodplain directly below the area of exposed Mine tailings. Both of these ponds drain directly into Dunn Creek. A third ephemeral pond (the Upper Pond), created by the current property owner as part of stormwater controls, is located on the slopes of the Mine above Middle Pond and drains directly into the Middle Pond.

All surface water leaving the Mine is ultimately captured by Dunn Creek. Dunn Creek flows south from the Mine Site to join Marsh Creek 0.5 miles downstream. Marsh Creek then flows approximately 11 miles to discharge into the Marsh Creek Reservoir and then into the western San Joaquin Delta at Big Break.

Surface flow that originates at the Mine takes one of three paths as depicted on Figure 2-6 as follows:

1. Surface flow on the northern portion of the Mine area drains north into the ephemeral feeder stream called My Creek. My Creek then drains into Dunn Creek in the northeastern corner of the Mine area;
2. Flow that originates in the upper reaches of the Mine including the old Mine workings areas is captured via stormwater control features installed by the current property owner and ultimately discharged into the Upper Pond which in turn flows into the Middle Pond. The Middle Pond drains directly into Dunn Creek along the northern boundary of the Lower Pond SI. Dunn Creek then flows along the eastern boundary of the Lower Pond SI south towards Marsh Creek bypassing the Lower Pond SI; and
3. Surface flow and spring flow that originates from the exposed eastern Mine tailings and the Travertine/Adit Spring area drains directly east and flows into the Lower Pond SI. The Lower Pond SI overflows into a channel and flows into Dunn Creek below the southern impoundment berm.

The State Park Spring emerges as a perennial spring on the adjacent Mount Diablo State Park. The spring flows directly east to join Dunn Creek just below the southern bank of the Lower Pond SI impoundment. Some stormwater flow from the southernmost extent of Mine tailings may join State Park Spring water as it migrates downslope towards Dunn Creek.

Above the Lower Pond SI, Dunn Creek is an ephemeral stream. Drainage from the Lower Pond SI and the State Park Spring create a condition of perennial flow in Dunn Creek below the Lower Pond SI as it moves downstream to discharge into Marsh Creek.

Although the primary objective of the Remediation Plan is to control erosion and minimize sediment and dissolved phase mineral discharge into Dunn and Marsh Creeks, the remediation program is not a Dunn Creek stream restoration project.

2.1.8 Climate

The climate in eastern Contra Costa County is "*mediterranean*," characterized by mild to moderately cold, wet winters and hot, dry summers. Mt. Diablo represents the border between the cool summer climate type found along the Pacific coast and the hot summer climate type found in the Central Valley.

The National Weather Service maintains a weather station at Mount Diablo Junction, 2,170 feet (661 m) above sea level. The warmest month at the station is July, with an average high of 85.2 degrees Fahrenheit (°F) and an average low of 59.6°F. The coolest month is January, with an average high of 55.6°F and an average low of 39.3°F. The highest temperature recorded was 111°F on July 15, 1972. The lowest temperature recorded was 14°F on February 6, 1989, and on December 14, 1990. (The San Francisco Chronicle reported that the temperature dropped to 10°F at the summit on January 21, 1962.) Temperatures reach 90°F or higher on an average of 36.0 days each year and 100°F or higher on 3.3 days each year. Lows of 32°F or lower occur on an average of 15.4 days annually.

Annual precipitation averages 23.96 inches. The most precipitation recorded in a month was 13.54 inches in February 1998. The greatest 24-hour precipitation was 5.02 inches on January 21, 1972. The average annual days with measurable precipitation is 65.3 days.

Snowfall at Mount Diablo Junction averages 1.2 inches each year. Prior to 2009, the most snowfall observed in a month was 17.0 inches in April 1975; that same month saw 6.0 inches in one day (April 4, 1975). Measurable snowfall does not occur every year, so the annual average days with measurable snowfall is only 0.5 days. Snow is more common in the upper reaches of the mountain. On December 7, 2009, Mount Diablo received a rare snow event of 18.0 inches, receiving more in one day than what it normally receives in one year. (Mount Diablo Junction Station Data supplied by the Western Regional Climate Center).

2.1.9 Vegetation

Vegetation in the environs of the Mine and Mount Diablo is mixed oak woodland and savannah and open grassland with extensive areas of chaparral and a number of endemic plant species, such as the Mount Diablo manzanita (*Arctostaphylos auriculata*), Mount Diablo fairy-lantern (*Calochortus pulchellus*), chaparral bellflower (*Campanula exigua*), Mount Diablo bird's beak (*Cordylanthus nidularius*), and Mount Diablo sunflower (*Helianthella castanea*). The area can include a mixed ground cover of western poison-oak that is toxic via skin contact to most people.

2.2 Site History and Development

Historically, mercury has been mined at several localities around Mount Diablo. By far the largest amount was at the Mount Diablo Mine, which operated intermittently between 1863 to the late 1950s.

2.2.1 Mining History

Between 1863 and 1936, various operators removed approximately 1,739 flasks of mercury from the Site. Bradley produced more than 10,000 flasks of mercury during its 15 years of mining operations at the Site between 1936 to 1951. At the end of Bradley's operations, the underground Mine workings consisted of four levels in a steeply dipping shear zone. The Bradley workings were accessed by a main shaft and had an adit that exited to the surface on the 165 level (the 165 level Adit; Pampeyan, 1963).

Bradley generated 78,188 cubic yards of milled tailings and 24,815 cubic yards of waste rock from the Mine tunnels (Ross, 1940). The material generated by Bradley represents 97.3 percent of all waste material generated, and nearly 100 percent of all mill tailings, as documented in the attached Table 2-1. In addition to the materials generated from the Mine, Bradley also operated a rock quarry to the west of the Mine. Waste rock generated from Bradley's quarry operation is reported to have been placed in the area called the "*Waste Dump*" on maps produced by the California Division of Mines and Geology (Pampeyan, 1963). Historical records indicate that Bradley's mining waste and tailings piles at the Site match the waste pile configuration reflected in the 1953 California Division of Mines and Geology's Site mapping (Pampeyan, 1963). Figure 2-4 provides a map depicting the locations of the tailings and waste rock piles that Bradley generated on the Site. The area that received Bradley's quarry waste rock is north (northern waste rock) and is circled in a green outline (figure 2-4).

Following the period of extensive Bradley operations, Mt. Diablo Quicksilver Co., Ltd. (Mt. Diablo Quicksilver) leased the Mine to Ronnie B. Smith and partners (Smith, 1951). Using surface (open pit) mining methods, Smith, et al. produced an estimated 125 flasks of mercury in a rotary furnace. In 1953, the Defense Minerals Exploration Agency (DMEA) granted Smith, et al. a loan to explore the deeper parts of the shear zone (Schuette, 1954). With DMEA's grant money, and under the DMEA's supervision, Smith, et al. constructed a 300-foot-deep shaft (historically referred to as the DMEA Shaft) during the period from August 15, 1953 to January 16, 1954 (Schuette, 1954). The DMEA Shaft and workings flooded on February 18, 1954 and, subsequently, Smith, et al. abandoned the project (Schuette, 1954).

Cordero leased the Site from Mt. Diablo Quicksilver on November 1, 1954, and began re-conditioning the DMEA Shaft in January 1955 before discontinuing operations in December 1955. Cordero conducted its underground mining efforts from the pre-existing DMEA Shaft (Pampeyan and Sheahan, 1957). The total volume of waste rock generated by Cordero was approximately 1,228 cubic yards (Table 2-1). Cordero generated an estimated 100 to 200 tons of ore with a grade of 3 to 10 pounds of mercury per ton (Pampeyan and Sheahan, 1957), which equates to approximately 50 to 100 cubic yards of ore material.

In 1956 the Nevada Scheelite Corp. leased the Mine and installed a deep-well pump (550 gpm) to remove water which had risen to a point 112 feet below the collar of the shaft. Since the downstream ranchers objected to the discharge of acid Mine water into the creek this work was suspended. Attention was then directed to the open pit where some exploration was done using wagon drills. A small tonnage of retort-grade ore was developed. Since this was not sufficient to satisfy the requirements of the company, the lease was relinquished (California Division of Mines, 1958).

A June 1958 State Water Pollution Control Board (WPCB) inspection report states the Mine was leased to John E. Johnson and that he was operating it, but he apparently died later that year and the Site ceased operation. Welty and Randall Mining Co. subsequently operated an unidentified portion of the Site from approximately 1965 to 1969. They apparently re-worked Mine tailings at the Site under a lease from Victoria Resources Company (Victoria Resources), which purchased the Mine from Mt. Diablo Quicksilver in May 1962. On or about December 9, 1969, Guadalupe Mining Co. (Guadalupe) purchased the Mine from Victoria Resources. It is unclear whether Guadalupe actually operated the Mine. In June 1974, the current owners, Jack and Carolyn Wessman and the Wessman Family Trust purchased the Site from Guadalupe. In 1977, the Wessmans sold the portion of the Site containing the settlement pond to Ellen and Frank Meyer, but subsequently re-purchased it in 1989.

2.3 Previous Investigations

The potential for contamination of Marsh Creek from the Site has long been of concern, resulting in considerable sampling of Marsh Creek, Dunn Creek, Horse Creek, pond effluent, and other surface waters, over the past 50 plus years (WPCB Document Log) by the following:

- CVRWQCB and its predecessor, the WPCB, as part of inspection visits to the Mine since the late 1930's;
- J.L. Iovenitti, Weiss Associates, and J. Wessman, as part of *Mount Diablo Mine Surface Impoundment Technical Report* dated June 30, 1989;
- Professor Darell G. Slotton, U.C. Davis, as part of the *Marsh Creek Watershed Mercury Assessment Project* conducted in March 1996, July 1997, and June 1998; and
- Sunoco Inc, via The Source Group, Inc – Site Characterization Report, August 2, 2010 and Additional Site Characterization Report, December 7, 2011.

The following sections briefly summarize these previous investigations.

2.3.1 State Water Pollution Control Board / California Regional Water Quality Control Board Investigations

Sampling events conducted by the CVRWQCB and its predecessor, the WPCB, have consisted of collecting grab samples under varying conditions (ranging from high run-off periods, to periods of little or no run-off). Samples have been collected since the early 1950's at the following locations:

- Dunn Creek (at various locations);
- Horse Creek (upstream of pond outlet);
- Perkins Creek (above the confluence with Marsh Creek);
- Curry Creek (above the confluence with Marsh Creek);
- Marsh Creek (at various locations);

- Drainage from Mine/tailings on Wessman property;
- Drainage from ponded area, north of tailings;
- Springs on State Park Land;
- Alkali Spring below and east of pond/dam;
- Mine pond;
- Zuur well;
- Prison Farm well; and
- Marsh Creek Springs Resort well.

These samples were analyzed for general water quality parameters and metals. The Site Characterization Report (SGI 2010a) includes a summary of these water sample results. In general, these results documented the continuous discharge of high concentrations of minerals and metals derived from surface water interactions with tailings materials and from spring discharges at the Mine.

2.3.2 J.L. Iovenitti, Weiss Associates, and J. Wessman, *Mount Diablo Mine Surface Impoundment Technical Report*

In 1989, a technical report evaluating the geohydrochemical setting of the Lower Pond SI, the source of contaminants in the Lower Pond SI, waste control alternatives, and preliminary cost estimates for these alternatives was prepared as part of the application to qualify for an exemption authorized by the Amendment to the Toxic Pits Cleanup Act of 1984 (Iovenitti, 1989).

The report characterized the contaminants in the Lower Pond SI based on historical data obtained from 11 water samples collected from the surface impoundment from 1953 through 1988. The surface water samples were analyzed for general water quality parameters and metals. The results indicated that the metals concentrations detected in the water within the surface impoundment exceeded primary drinking water standards and that sediment contained mercury and nickel in exceedance of soluble threshold limits concentrations (STLCs).

2.3.3 Professor Darell G. Slotton, Marsh Creek Watershed Mercury Assessment Project

Contra Costa County sponsored a three-year study (Slotton,1996; 1997; and 1998) of the Marsh Creek Watershed to comprehensively determine the sources of mercury in the Marsh Creek Watershed, both natural and anthropogenic. These studies also documented mercury concentrations in indicator species, surface water, and sediment to evaluate mercury bioavailability within the Marsh Creek Watershed. These studies were designed to characterize baseline conditions of the Marsh Creek Watershed and to evaluate the relative effectiveness of potential future remedial actions at the Mine.

The results of the 1995 study are summarized in a March 1996 report titled "*Marsh Creek Watershed 1995 Mercury Assessment Project – Final Report*" prepared by Darell G. Slotton, Shaun M. Ayers, and John E. Reuter (Slotton, et al., 1996). The 1995 study evaluated aspects of mercury loading within the Marsh Creek Watershed. As part of this Mercury Assessment Project, sampling was conducted at the Site, including the Lower Pond SI, the spring on State Park property, the spring emanating from the tailings pile, and other locations upstream in Dunn Creek and downstream along Marsh Creek.

The results of the 1996 study are summarized in a July 1997, report titled "*Marsh Creek Watershed Mercury Assessment Project – Second Year (1996) Baseline Data Report*" prepared by Darell G. Slotton, Shaun M. Ayers, and John E. Reuter (Slotton, et al., 1997). The 1996 study, (the second year of the three-year baseline study), evaluated mercury availability in indicator species and sediment within stream sites and the Marsh Creek Reservoir by collecting 175 individual and composite samples of invertebrates, sediment, and young fish from 13 stream sites and the Marsh Creek Reservoir (Slotton, et al., 1997).

The results of the 1997 study are summarized in a June 1998 report titled "*Marsh Creek Watershed Mercury Assessment Project – Third Year (1997) Baseline Data Report with 3-Year Review of Selected Data*" prepared by Darell G. Slotton, Shaun M. Ayers, and John E. Reuter (Slotton, et al., 1998). As with the 1996 study, the 1997 study (i.e., final year of the three-year baseline study) focused on evaluating mercury availability in indicator species and sediments within stream sites and the Marsh Creek Reservoir and involved the collection of 137 individual and composite samples of invertebrates, sediment, and young fish from 12 stream sites and the Marsh Creek Reservoir (Slotton, et al., 1998).

As part of this Mercury Assessment Project, sampling was also conducted at the Mine area including the Lower Pond SI, the spring on State Park property, the spring emanating from the waste rock, and other locations upstream in Dunn Creek and downstream along Marsh Creek. Based on the results of the 3-year study and extensive sampling of the entire Marsh Creek watershed, the Slotton report concluded that the Mount Diablo Mercury Mine, and specifically the exposed tailings and waste rock (Bradley's waste) above the existing pond combined with acidic discharge from the spring emanating from the waste rock above the pond, was the dominant source of mercury in the watershed. Sampling of Dunn Creek above the Lower Pond SI indicated minimal sourcing of mercury was occurring from the watershed immediately above the Lower Pond SI.

As specifically stated by Slotton, et al. (1996) the data indicates that *"the great majority of the mercury load emanating from the tailings is initially mobilized in the dissolved state. This dissolved mercury rapidly partitions onto particles as it moves downstream. The bulk of downstream mercury transport is thus particle-associated."* The Slotton report also states that *"…major mitigation focus should be directed toward source reduction from the tailings piles themselves, with subsequent containment of the remaining mobile mercury fraction being a secondary consideration."*

Slotton, et al.'s three-year study and extensive sampling of the entire Marsh Creek Watershed (Slotton, 1996) specifically concluded that the Mt. Diablo Mercury Mine region contributed the great majority of the entire watershed's mercury loading (95 percent with 88 percent directly traceable to the ongoing drainage from exposed tailings, [Bradley's waste]) at the Site (Slotton, et al., 1996).

The results of the Slotton studies were incorporated in the design of follow on studies implemented by Sunoco as described in the following Section 2.3.4.

2.3.4 2010 Site Characterization

Initial Investigation

Initial work conducted by SGI on behalf of Sunoco included research, acquisition, review and analysis of existing published information and data related to the former Mine and attendant water quality impacts, field surveys of the Mine conducted over a period of two years, property owner interviews, and two surface water sampling events at the Mine Site. This work is documented in the Site Characterization Report (SGI, 2010a).

A total of 23 surface water samples were collected at the following 16 locations during the two sampling events conducted in April and May of 2010:

- Bradley Tailing Piles (four locations, SW-01, SW-02, SW-03, and SW-15);
- Springs (three locations, including the Adit Spring [SW-01, SW-15], Mount Diablo State Park Spring [SW-04] and the Ore House Spring [SW-14]);
- Run-off water between the Bradley Tailings Piles and the Lower Pond SI (SW-05);
- Storm Water Retention Ponds (three locations, including the Upper Pond [SW-06], the Middle Pond [SW-10], and the Lower Pond [SW-09]);
- Dunn Creek (three locations, including downstream of the Lower Pond SI [SW-07], between the Middle Pond and My Creek [SW-08], and upstream of My Creek [SW-16]); and
- My Creek (three locations, including upstream, within, and downstream of the Northern Waste Dump [SW-12, SW-11, and SW-13, respectively]).

Upstream surface water sampling locations SW-12 and SW-16 were considered background locations. The 2010 surface water sampling locations are presented on Figure 2-7.

Additional Investigations

In response to the results of a Site Characterization Report (SGI, 2010a) technical review meeting with the CVRWQCB and subsequent correspondence, SGI, on behalf of Sunoco, conducted additional investigations (SGI, 2011).

This work supplemented SGI's initial investigation (SGI, 2010a), which identified data gaps and recommended work elements to complete characterization of the Site pursuant to the Rev. Order. CVRWQCB staff concurred with the proposed additional elements in its August 30, 2010 letter to Sunoco. SGI then presented a detailed scope of work in its Additional Characterization Work Plan (SGI, 2010b), which included the following activities:

- Performance of a detailed 2-foot topographic survey;
- Installation of two groundwater monitoring wells: 1) a well within the Bradley Mine workings, specifically, in the 165 level (completed at a total depth of 85 feet below ground surface

[bgs] and; 2) a well into the former DMEA/Cordero underground Mine workings, specifically, into the Cordero 360 level lateral tunnel (completed at a total depth of 275 feet bgs);

- Sampling and analysis of groundwater and evaluation of gradients within these wells; and
- Surface water sampling at 16 locations to determine and/or confirm sources of mercury to Site surface waters to assist the CVRWQCB's evaluation of remedial alternatives.

The 2011 surface water sampling locations are presented on Figure 2-8.

The data collected during this phase of investigation enabled a more complete understanding of the relationships between different water sources and overland flow patterns at the Site. Specifically, water sampling results from the two monitoring wells (ADIT-1 and DMEA-1) enabled comparison of these results to the surface water sampling events that have been carried out in 2010 and 2011. This comparison and evaluation has resulted in more holistic understanding of the sources of surface water present at the Site, which specifically falls into three general categories: water sourced from underground Mine workings (i.e., the Bradley Mine workings); water sourced from overland flow through Mine tailings and waste rock; and surface water which does not come in contact with Mine tailings.

The review of historical data (including scientific studies, corporate records and regulatory reports), the georeferencing of historical features with the current physical disposition of the Mine Site, the physical mapping of Site features such as tailings piles and surface water drainage, and the collection of surface water samples, including the comparison to historical data set, combine to paint a detailed physical picture of current Mine Site conditions (SGI, 2010a).

As represented in the Site Characterization Report, both historical documentation and surface water analytical data collected in 2010 support the conclusion that the majority (93 percent based on Slotton [1995] calculations) of the mercury mass loading into the Marsh Creek Watershed originates via run-off over and through Bradley's operation-derived waste rock and tailings piles. The Mine wastes contain trace amounts of pyrite and other sulfur-containing minerals. These minerals, when exposed to air, oxidize to form sulfates. The sulfates, once dissolved in water, form sulfuric acid which depresses the pH. This low pH drainage is able to solubilize minerals and release metals such as mercury. The cycle of wetting and drying of soils, promotes the formation of acid and the release of minerals from the Mine waste.

The primary path from the mining waste is through overland flow into the Lower Pond SI into nearby Dunn Creek that subsequently leads into the greater Marsh Creek Watershed. The works of Slotton (Slotton, 1996) and of SGI's surface water sampling in 2010 quantified the concentrations of mercury and other chemical constituents emanating from the various Mine Site features via overland water flow. The water from My Creek, along with the Dunn Creek water above the Lower Pond SI, have no detectable mercury concentrations and have a chemical signature distinct from the water that had come in contact with the Bradley tailings piles. My Creek collects drainage water from the Northern Waste Dump. Water Quality data from My Creek indicates that material present in the Northern Waste Dump do not contribute mercury or other chemicals of concern (COCs) to surface water runoff in that area.

The Site surface water sampling locations (Figure 2-8) associated with run-off of surface water through the Bradley Tailings Piles and into the Lower Pond SI (SW-15, SW-02, SW-03, SW-05 and SW-09) fairly consistently exceeded water quality criteria for total and dissolved mercury, nickel, lead, and zinc, and less consistently exceeded the same criteria for methyl mercury, arsenic and chromium (e.g., Lower Pond SI sample location SW-09 had no methyl mercury, arsenic or chromium exceedances).

In summary, data analysis indicates that groundwater in the Mine workings is chemically no different than background spring water and that Acid Mine Drainage (AMD) discharges may be solely generated by the interaction of water from natural springs, the Mine workings, and rainfall in contact with exposed Mine wastes.

Dunn Creek Surface Water Quality

Surface sample location SW-07 (Figure 2-8) was collected in Dunn Creek, downstream of surface water from the Site, and is considered a point-of-compliance sampling point. As such, the analytical results from this sampling location and all other surface sampling locations were compared to water quality criteria developed for bodies of freshwater by the CVRWQCB and the USEPA. The comparisons indicated several key points including:

- Mercury and arsenic were not detected above water quality criteria in SW-07;
- Methyl mercury, alkalinity, total dissolved solids, chloride, iron, and nickel were detected above water quality criteria in SW-07; and
- With the exception of methyl mercury, all of these compounds were also detected at concentrations exceeding the water quality criteria in SW-04, at the background State Park Spring sample location.

As reported by Dr. Slotton of the University of California at Davis, methyl mercury is pervasively present in aquatic systems that include any oxic/anoxic interface. Sampling of surfaces waters in and around the Mt. Diablo mercury mine have confirmed the consistent and natural presence of methyl mercury in site and background waters. Methyl mercury has only been detected in down-gradient surface water sample SW-07 (detected at maximum of 6.56 nanograms per liter [ng/l]) above water quality criteria (3 ng/l) on one of five sampling events (SGI, 2011). This sampling event was conducted in late October corresponding with the driest part of the year. This one time exceedance is likely related to the subsurface discharge of waters through the toe of the Lower Pond Surface Impoundment mixing with State Park Spring waters flowing at normal reduced dry-season flows.

This point of compliance and water quality criteria evaluation shows that in general, water downgradient of the Mine exceeds water quality criteria only for compounds present in background samples above water quality criteria. Although COCs from the Mine are travelling into Dunn Creek, the volume contribution of the water from these sources is so small compared to other sources (i.e., State Park Spring, normal watershed run-off that does not come in contact with tailings), the presence of these compounds are reduced to background or near background levels at point of compliance sampling location SW-07.

2.3.5 Previous Remedial Actions

The current property owner, Jack Wessman, over the period of his ownership since 1974, has conducted work in an effort to minimize the impact of exposed Mine waste material to surface water run-off. This work has included earth moving at the Site involving the importation of a large quantity of fill material (reported by Jack Wessman to be on the order of 50,000 cubic yards), and the movement and grading of this fill material around the Site to cover Mine waste. In 1978, Order No. 78-114, Waste Discharge Requirements for the Mount Diablo Quicksilver Mine, was issued to Mr. and Mrs. Wessman, prohibiting the direct discharge of Mine waste to surface waters or surface water drainage courses. That same year, a cleanup and Abatement Order was issued ordering the Wessmans to, among other things, (1) "*...redivert the springs from the Mine overburden...back to the storage reservoir [surface impoundment] to abate further discharge", and (2) "...complete the repair of the storage reservoir...*". In compliance with this order, the surface impoundment was rebuilt in 1978/1979 by the Wessmans.

Based on SGI's discussions with Jack Wessman during Site inspections in 2008, this work has specifically included: 1) infilling and covering of the original collapsed Mine workings area, 2) filling of the DMEA Shaft and filling and capping of waste rock below the shaft toward the furnace, 3) filling and capping of a small pond located west of the DMEA Shaft, 4) grading of waste rock and tailings piles located to the east of and overlying the Mine workings as part of surface drainage control actions, 5) re-configuring, enhancing and maintaining impoundments around the lower waste ponds, and 6) installing drains and drainage pipe for the purpose of re-directing surface rainfall run-off in the upper Mine area around the exposed tailings and waste rock into Dunn Creek directly bypassing flow through the Lower Pond SI.

Current surface drainage for the higher elevations of the Site, including the Cordero operations around the DMEA Shaft area, is captured and routed around the exposed tailings and waste rock, and around the Lower Pond SI, emptying directly into Dunn Creek at a location upgradient of the Lower Pond SI (Figure 2-6).

Sunoco conducted follow on work relating to stabilization of the surface impoundment in 2008/2009. In response to a Unilateral Administrative Order for the Performance of Removal Action from the United States Environmental Protection Agency (USEPA), Sunoco conducted an emergency stabilization of the southeastern wall of the Lower Pond SI's impoundment dam to prevent continued storm flow erosion of the impoundment in 2008/2009. This work was documented in the SGI report titled "*Final Summary Report for Removal Action to Stabilize the Impoundment Berm*" (SGI, 2009).

2.4 Mining-Related Material Waste Characterization

2.4.1 Material Classification

Three main categories of Mine-related waste are targeted for remediation within this Remediation Plan. These wastes have been categorized based on the characterization work conducted by SGI in 2010/2011, which included a review of historic Mine operational documents in combination with field inspections and near surface material examination by tailings experts. In the order of significance, these three waste categories are defined as follows:

1. Main Tailings Pile and Waste Rock Dump. The Main Tailings Pile is located in the eastern perimeter of the Mine workings area as shown on Figure 2-2. The Main Tailings Pile is composed of general Mine tailings including calc-silicate ore zone waste rock that is well graded from small grain processed material to large boulders. Additional waste rock is present in this tailings pile composed of shale and sandstone materials derived from the country rock that surrounds the ore zone. These waste rock materials are inter-mixed with processed tailings and calcines.
2. Pond Sediments. The Lower Pond SI sediments were characterized in 1989 (Iovenetti, 1989). The Lower Pond SI receives run-off from the Main Tailings Pile combined with the steady flow from the Travertine/Adit Spring that emerges from the Main Tailings Pile and travels through and over the Main Tailings Pile on its path to the impoundment. Volume calculations on the Lower Pond SI sediments provided in Table 2-2 include the volume of the impoundment berm.
3. Calcines. North of the Main Tailings Pile and immediately east and down-slope of the old furnace plant is a free-standing calcines pile not apparently mixed with other Mine waste. The calcines consist of the well sorted and highly processed roasted waste material.

2.4.2 Estimation of Mining-Related Material Volumes and Areal Extent of Material

The locations and extent of Mine-related wastes that will be addressed as part of this Remediation Plan are shown in Figure 2-9. An inventory of the Mine-related materials, including volume estimates, is included in Table 2-2.

Volumes of waste rock and tailings piles were estimated using the following procedure:

- The ground topography was surveyed to a 2-foot contour level by a licensed surveyor;
- The pre-accumulation ground surface topography provided on historic DMEA maps was utilized where possible, combined with interpolation of surrounding topography based on the available geolocated base map; and
- Based on a comparative analysis on a point-by-point basis of pre-existing to current topography, a tailing's pile thickness map was developed. Tailings pile volumes were then calculated based on these known and/or estimated thickness determinations.

The preliminary total volume of Mine-related materials to be managed is approximately 124,000 cubic yards. The bulk of this material is made up of waste rock and tailings from the former Bradley Tailings Pile located on the eastern scarp of the Mine Site (102,245 cubic yards). Approximately 7,500 cubic yards of the total is composed of calcines. Approximately 14,089 cubic yards of material is made up of pond sediments from the Lower Pond SI and the impoundment berm. The Lower Pond SI estimate includes the removal of Mine wastes located at the southern foot of the impoundment as shown on Figure 2-9.

2.5 Conceptual Site Model Overview

The conceptual site model (CSM) summarizes available information about potential sources, release mechanisms, contaminant fate and transport, exposure pathways, and potential receptors at the Site. This CSM presented in this section is focused on Mine-related materials within the remedial action area of the Site (Figure 2-9), and is based on SGI's current understanding of Site conditions.

The CSM incorporates the following components:

- Mine-related sources;
- Future land and resource uses; and
- Exposure pathways and receptors of concern.

2.5.1 Mining-Related Sources

Visible Mine-related features that remain on the Site include various Mine buildings, bare uncovered tailings piles, a Middle Pond, and a Lower Pond SI. The Main Tailings Pile is located on the eastern slope of the Mine property bounded on the east by the Lower Pond SI. Spring water discharges from the face of the Main Tailings Pile creating a steady source of surface flow that moves across the lower portion of the Main Tailings Pile and into the Lower Pond SI. The Lower Pond SI is the location of the historic Mine constructed surface impoundment that has been upgraded by the current landowner to provide effective containment of historic Mine derived waste and sediments. The Lower Pond SI contains sediments largely sourced via stormwater flow and Travertine Spring/Adit discharge drainage through and off the Main Tailings Pile. Residual Mine features that are contributing mercury loading to the Marsh Creek watershed are the subject of the actions proposed in this Remediation Plan as depicted on Figure 2-9.

The Middle Pond is not a historic Mine feature but was created by the property owner, Jack Wessman, as part of stormwater management controls for the Mine conducted under the direction of the CVRWQCB. The Middle Pond contains stormwater and flanks the Lower Pond SI to the north and, based on characterization data, is not currently considered a source of significant mercury loading to Marsh Creek.

2.5.2 Potential Future Land and Resources Uses

The Mine has reportedly been closed since around 1969. The Wessmans have owned the property since 1972 and it has been primarily used for residential purposes, supporting multiple families that include home rentals. No residences are located in the remedial action area (former Mine work area). Occasionally in the past, the property has been leased for recreational activities such as paint ball. The property also supports a small herd of cattle owned and managed by Jack Wessman. These cattle are not raised for commercial sale but are used for vegetation control and considered family pets. Future land use is expected to remain the same.

2.5.3 Potential Exposure Pathways and Receptors of Concern

This section provides a scientifically defensible basis for the selection of potentially exposed hypothetical receptors and the most likely ways they might be exposed to chemicals at the Site. To develop a conceptual understanding of the Site, information regarding potential chemical source, chemical release and transport mechanisms, locations of potentially exposed receptors, and potential exposure routes were assessed. This information is outlined schematically in a CSM shown on Figure 2-10. The CSM associates source of chemicals with potentially exposed receptors and associated complete exposure pathways. In this way, the CSM assists in quantifying potential impacts to human and ecological health.

As defined by USEPA (1989), all of the following four components are necessary for a chemical exposure pathway to be considered complete and for chemical exposure to occur:

- A chemical source and a mechanism of chemical release to the environment;
- An environmental transport medium (e.g., soil) for the released chemical;
- A point of contact between the contaminated medium and the receptor (i.e., the exposure point); and
- An exposure route (e.g., dermal contact with chemically-impacted soils) at the exposure point.

The following sections describe these components and provide a basis for the CSM.

2.5.3.1 Chemical Release Mechanisms and Identification of Transport Media

In this section, the first two components necessary for a complete exposure pathway are addressed. Chemical properties of the detected chemicals and the physical characteristics of the Site were reviewed to identify factors that might allow the release and transport of a chemical in the environment. Other than the on-site residential properties, which are outside the remedial action area, the Site remains undeveloped. The Site is on the lower flanks of the northeastern environs of Mount Diablo and is generally unpaved. The Site landscape is not expected to change in the future except as described in remedial actions proposed in this Remediation Plan.

The chemicals of potential concern (COPCs) at the Site are mercury and arsenic. Release of COPCs can potentially occur through wind and/or mechanical erosion (i.e., during construction), infiltration of chemicals into the groundwater, or lateral migration of chemicals in groundwater.

These types of releases may result in dust (with sorbed chemicals) emissions in air, or the movement of chemicals downward into groundwater with infiltrating rain water or stormwater run-off into surface water. The COPCs are not particularly mobile in soil; therefore, soil to groundwater is not considered a likely transfer mechanism. However, groundwater that flows from the underground Mine workings does contain COPCs. The groundwater is interpreted to daylight via springs or seeps on the face of the Main Tailings Pile.

2.5.3.2 Potential Exposure Points

The third component necessary for an exposure pathway to be complete is a point of contact between the contaminated medium and the receptor (i.e., the exposure point). For soil, the exposure point for potential receptors is defined as the remedial action area (former Mine work area).

As mentioned previously, other than the two groundwater monitoring wells installed into the Mine workings by SGI, only one additional groundwater well is located at the Site. This well is referred to as the "*Wessman Well*". The groundwater from the Wessman Well is used for domestic purposes by the residents located at the top of the hill well above the historic Mine workings. This well is located outside the remedial action area (former Mine work area). As such, the water from this well is not expected to be impacted by the Mine workings or actions proposed in this Remediation Plan. According to Jack Wessman, groundwater from the Wessman Well has been tested in the past and has been deemed potable. Residents located on the lower portions of the Site are connected to a public water supply system. Groundwater from the remedial action area (Figure 2-9) is not being used for domestic purposes and groundwater use is not expected to change in the future.

Although it is possible that a hypothetical outdoor construction worker receptor could contact shallow groundwater during excavation, this contact is expected to be very infrequent and involve only minor contact, if any, with contaminated groundwater. In general, any hypothetical construction worker receptor will be performing activities consistent with a site health and safety plan (HASP). This HASP and BMPs would require control measures to limit and preclude any direct contact with groundwater for workers at the Site.

Additionally, surface run-off and near-surface groundwater is assumed to discharge via ephermeral streams, springs, or seeps into surface waters adjacent to the Site (i.e., Dunn Creek). Dunn Creek is seasonal and intermittent adjacent to the Site and not used for recreational purposes in the stretch adjacent to the Mine. Intermittent presence of water is considered unlikely to support fish suitable for human consumption. Dunn Creek flows south from the Mine Site to join Marsh Creek 0.5 miles downstream, then flows approximately 11 miles to discharge into the Marsh Creek Reservoir, and then into the western San Joaquin Delta at Big Break. Metals (e.g., mercury) may move from the Site to adjacent waterways in dissolved and particulate form. As mentioned previously in Section 2.3.3, 95 percent of the total input of mercury to the upper watershed has been estimated to come from Dunn Creek, with 88 percent traceable to exposed tailings piles of the Mount Diablo Mercury Mine (Slotton, 1996, 1997, 1998). However, 95 percent of the watershed's suspended sediment load is from non-Mine, low mercury source regions. Although Site-related contaminants may flow to potential drinking water sources further downstream from the Site, concentrations are expected to be significantly diluted.

2.5.3.3 Potential Receptors

In addition to exposure points, potential receptors at the Site are necessary for an exposure pathway to be complete. Hypothetical receptors identified for evaluation in this assessment were identified on the basis of proximity to the remedial action area of the Site, proposed activities that could possibly result in direct or indirect contact with chemicals. On the basis of current and potential future uses of the Site, the following hypothetical receptors were evaluated in this risk assessment:

On-Site

- Hypothetical Future Construction Worker Receptor; and
- Hypothetical Current/Future Recreational Visitor Receptor.

Off-Site

- Hypothetical Current/Future Recreational Angler Receptor; and
- Hypothetical Current/Future Aquatic Biota.

2.5.3.4 Exposure Pathways Considered Potentially Complete and Significant

The fourth and final component, a complete exposure pathway (i.e., route of exposure) is discussed in combination with the third component (i.e., presence of receptors) to define those exposure pathways considered to be complete and significant. As indicated in the CSM (Figure 2-10), contact with COPCs at the Site could occur via exposure to soil, groundwater, and surface water. The following sections separately summarize those pathways considered complete and significant for each receptor.

2.5.3.4.1. Hypothetical On-Site Construction Worker Receptor

The hypothetical construction worker receptor is included in this CSM due to planned future construction at the Site. Future construction may occur during installation, monitoring, and maintenance of remedial actions implemented at the Site as proposed and detailed in this Remediation Plan. Therefore, future hypothetical construction worker receptors are expected to perform soil invasive activities. This receptor is expected to be a short-term outdoor worker (i.e., 2 weeks to 7 years [USEPA, 1989]) for a single construction or development project at the Site. This receptor spends the workday outdoors performing construction-related tasks. The exposure pathways assumed to be complete and significant for the hypothetical outdoor construction worker receptor include:

- Incidental ingestion of soil;
- Dermal contact with soil; and

- Inhalation of dust in outdoor air generated from the subsurface.

2.5.3.4.2. Hypothetical On-Site Recreational Visitor Receptor

The hypothetical recreational visitor receptor is included in this CSM in the event any recreational activities occur at the Site. The Site is accessible through privately owned lands and is blocked from public access by fencing and locked gates. Due to access restrictions in place at the Site, the number of visitors is anticipated to be minimal and infrequent and of short duration. This receptor may also include an unauthorized visitor (or trespasser). Conservatively, this receptor is expected to be a long-term recreational receptor that includes exposures as both a child and adult recreational visitor. Exposure to surface water is not expected due to the intermittent presence of surface water and the infrequent and limited time spent at the Site by the recreational visitor. The exposure pathways assumed to be complete and significant for the hypothetical recreational visitor receptor include:

- Incidental ingestion of soil;
- Dermal contact with soil; and
- Inhalation of dust in outdoor air generated from the subsurface.

Areas of the Site outside of the remedial action area are currently used for residential purposes, but these areas are not expected to be impacted by Site-related contaminants from the remedial action area. However, as residents on the property, they may walk or hike on the property. This on-site recreational visitor receptor will address any potential exposures to a potential resident receptor conducting recreational activities in the remedial action areas.

2.5.3.4.3. Hypothetical Off-Site Recreational Angler Receptor

The hypothetical recreational angler receptor is included in this CSM in the event recreational angling is conducted in downgradient waterways that support fish. This hypothetical recreational angler receptor includes both a child and adult. Conservatively, this receptor is expected to be a long-term recreational receptor. The exposure pathways assumed to be complete and significant for the hypothetical recreational angler receptor include:

- Ingestion of fish.

2.5.3.4.4. Hypothetical Off-Site Aquatic Biota

Due to the ecological concerns associated with mercury and formation of methyl mercury in aquatic systems and the presence of surface water that receives run-off from the Site, aquatic biota are included in this CSM. The exposure pathways assumed to be complete and significant for the hypothetical aquatic biota include:

- Uptake of surface water by aquatic biota (i.e., aquatic plants, water-column invertebrates, fishes); and
- Uptake of sediments by sediment dwelling invertebrates.

2.5.4 Summary of Potential Human Health Risks

For the hypothetical on-site human receptors, potential exposure to COPCs in Mine-related materials is possible through direct contact (i.e., incidental ingestion or dermal contact) with contaminated material and inhalation of airborne dust particulates. The Site-related contaminants may pose a risk to human health as a result of work performed at the Site (i.e., construction worker exposure scenario) or recreational activities conducted at or near the Site (i.e., hiking, biking, and other outdoor activities). In general, any hypothetical construction worker receptor will be performing activities consistent with a site HASP and BMPs, which would require proper personal protective equipment to limit direct contact with soil for workers at the Site. In the current exposure scenario, recreational visitor receptor exposures are expected to be infrequent and of short duration; therefore, reducing actual exposure to the Site. In the future exposure scenario, the Mine waste will be capped. As a result, future recreational visitor receptors will not be exposed to Mine waste at the Site.

For the hypothetical off-site recreational angler receptor, water quality criteria for human health (i.e., consumption of water and organisms and consumption of organism only) were lower than the analytical detection limit for surface water samples. Surface water sample location SW-07 (Figure 2-8) in Dunn Creek is the natural point of compliance sampling location for monitoring run-off impacts from the Site. In sample location SW-07, arsenic was not detected above the analytical detection limit and mercury (total and dissolved) were detected below or slightly above the analytical detection limit. Because analytical detection limits are above the water quality criteria, arsenic impacts cannot be evaluated. Site-related contaminant concentrations are expected to be diluted significantly by the time they reach the Marsh Creek Reservoir. Mitigation of sourcing of Site-related contaminants into Dunn Creek and its tributaries and subsequently the Marsh Creek watershed with remedial actions at the Site coupled with ongoing dilution will reduce any potential risks to hypothetical off-site recreational angler receptors from Site-related contaminants.

2.5.5 Summary of Potential Ecological Risks

As mentioned previously, water from the Site eventually flows into Dunn Creek and its tributaries. Although chemistry results fluctuate based on seasonal nature of precipitation events which result in more or less dilution of the waters flowing from the Site, no mercury (total or dissolved) or arsenic have been detected at concentrations that have exceeded the water quality criteria (SGI, 2011). Water quality criteria that have been exceeded at sample location SW-07 include methyl mercury, alkalinity, total dissolved solids, chloride, iron, and nickel. With the exception of methyl mercury, all of these compounds exceed the water quality criteria in the State Park Spring sample location (SW-04), which has no known connection to the Mine and likely reflects natural chemistry of waters that would flow from background areas around the Site. Therefore, these exceedances would occur independent of the any impacts caused by former Mine operations in the remedial action area of the Site. In Dunn Creek (SW-07), methyl mercury concentrations ranged from 0.68 to 6.56 ng/l. However, background concentrations for methyl mercury ranged from 0.077 to 0.980 ng/l. Due to the endemic presence of trace levels of mercury in the environment at some trace level, in aquatic systems with any oxic-anoxic interface (i.e., subsurface in sediments), some small fraction of mercury will inevitably be methylated.

Potential aquatic receptors in surface waters downstream of the Site may be impacted by exposure to methyl mercury, which also has the potential to bioaccumulate in biota. However, remedial actions for the Site are designed to mitigate sourcing of Site-related contaminants into Dunn Creek and its tributaries and subsequently the Marsh Creek watershed.

3.0 REMEDY APPROACH AND SCOPE OF WORK

This section describes the planned remediation activities of Mine-related material at the Site, including permitting, Site preparation and control, Mine-related material removal and in-place management, waste management, removal confirmation, and Site restoration.

3.1 Remedial Action Overview and Approach

Mining waste targeted for remedial action was identified via characterization activities that have essentially been ongoing over the last 50 years (Section 2.3). Recent characterization activities were conducted by SGI on behalf of Sunoco to expand and refine historic characterization activities as detailed in SGI's Additional Characterization Report of December 7, 2011 (Summarized in Section 2.3.4). The focus of characterization activities has been to identify Mining waste based on its demonstrated contribution of sediment and COCs to Dunn Creek and the Marsh Creek watershed. Characterization activities have all indicated that the continuing source of mercury impact to lower Dunn Creek and Marsh Creek and its environs emanates from the Lower Pond that is filled via spring discharge and surface run-off that flows over the Main Tailings and waste rock pile (Bradleys' eastern tailings piles) at the Mine. As a result, the focus of this Remediation Plan is to effectively remediate this condition and reduce discharges into Dunn Creek from the Mine Site to be consistent with natural background specific to the Mine Site. Since the Mine Site and the adjacent State Park contain highly mineralized natural springs that pre-date mining activities, restoration of natural background surface water discharges is focused on activities that reduce and eliminate contribution of Mine derived additional COCs and mineral content to the natural highly mineralized background water quality.

Characterization has identified three main categories of solid Mine waste material that are the focus of this Remediation Plan. The primary focus is concerned with the Main Tailings Pile that has been demonstrated to be providing the bulk of COC loading to Dunn creek via storm flow, seepage and movement of recharge through the pile, and the discharge and movement through and on the pile of the Travertine/Adit Spring. The secondary focus is the presence of sediments in the Mine surface impoundment located below the Main Tailings Pile. A third and minor item is the calcines located north of the Main Tailings Pile. The locations and extent of the materials targeted for remedial action are depicted on Figure 3-1. Volumes of these materials are summarized in Table 2-2.

The Main Tailings Pile is made up of both capped and uncapped Mine-related wastes as indicated on Figure 3-1. Surface water sampling has indicated that COC sourcing is occurring on the lower, uncapped portion of the Main Tailings Pile. The remedial approach for the Main Tailings Pile is to remove the portion of these tailings that are uncapped and consolidate them within the area of the former Mine workings as shown on Figure 3-1. The former Mine workings area is located directly west of the Main Tailings Pile and consists of a flat base made up of compacted fill placed over the collapsed Mine workings by the current property owner. The Mine workings area is bounded on the north, south and west sides by the steep slopes of the mountainside as a result of historic Mine-related excavations in the Mine workings area. The Mine workings area thus forms an ideal location for the consolidation and capping of Mine wastes away from the Dunn Creek environs. Figure 3-2 presents a cross section demonstrating the nature of the disposition of Mine wastes and the selected area for consolidation and capping.

The sediments and berm materials of the Lower Pond SI will also be excavated and consolidated with materials from the Main Tailings Pile in the Mine workings area. Additionally, a smaller volume of processed ore (calcines), located north of the Main Tailings Pile will be excavated and consolidated with the other material (Figure 3-1). These consolidated materials will then be capped and appropriate surface water drainage controls implemented.

Excavation and removal of these Mine waste materials will expose the portal of the 165 level Adit and any associated Mine water discharge as well as the pre-mining emanation point of the former Travertine spring. The relationship of these discharge locations to Mine waste and remedial actions is shown on the cross section of Figure 3-2 and on Figure 3-3. Discharge waters encountered from these sources will be sampled and analyzed as detailed in section 4.1. The short-term solutions implemented as part of this Remediation Plan will include the capture and routing of these groundwater discharges away from and around all contact with Mine waste materials prior to discharge into Dunn Creek below the Lower Pond SI. Based on characterization data, it is anticipated that elimination of contact of these waters with Bradley Mine wastes will likely reduce COCs to natural background conditions. Regardless, these groundwater discharges will be evaluated to determine if additional remedial action concerning them is warranted.

The general approach described above for Mine-related material remediation is consistent with previous federal and state recommendations for similar settings in California. In the case of the Sulfur Creek Mercury Mining District, the United States Geological Survey (USGS, 2004) and Churchill and Clinkenbeard (2003) reports concluded that effective Mine Site remediation should be based on general Site erosion control and Mine-related material isolation measures. Similarly, a CalFED Bay-Delta Program (CalFED) Report regarding the Sulfur Creek Mercury Mining District also recommended that Mine-related wastes with elevated mercury levels be excavated and removed off-site and/or consolidated and stabilized on-site, with the implementation of institutional and surface water run-on/run-off controls to reduce the potential for erosion into nearby surface water (CalFed, 2003).

3.2 Permitting

All necessary approvals must be obtained prior to initiating the remediation activities described in this Remediation Plan to ensure the project is completed in compliance with applicable regulatory requirements. Mine and mill wastes are specifically excluded from regulation as hazardous wastes under the Bevill Amendment and as such, RCRA Subtitle C regulations do not apply. The general approach to the permitting process will be to:

- Identify potentially applicable approvals required from regulatory agencies and private parties;
- Meet with key regulatory agencies for pre-application meetings to confirm the potential requirements, and establish early communication with agencies and adjust data needs as required; and
- Facilitate the approval process from pre-application to submittal and approval.

Tracking of the approval status and compliance with the potential requirements will be conducted including:

- Use of a permit-tracking matrix to manage submittal of materials and status of approvals. A master permit list with more detailed information on permit requirements and planned dates will be prepared and will be updated throughout the project for use as a tracking and management tool as part of pre-implementation.
- Development of specific oversight plans and documentation as required for permit compliance.
- Implementation of field monitoring requirements, as needed. Work monitoring and inspection activities (e.g., monitoring of BMPs) required by applicable permits during field work/construction will be implemented into the bid specifications.

3.3 Site Preparation and Control

This section describes the Site preparation and control activities to be completed prior to and during remediation and restoration work at the Site, including Site access agreements, mobilization and demobilization, material and equipment staging, road construction and improvements, and transportation.

3.3.1 Site Access Agreements

Updated Site access agreements will be required with the current property owners at the Site by all parties involved in implementation of the remedy. In addition, a Site access agreement will be required with the Mount Diablo State Park to allow removal of waste material that overlaps the property border to the south (Figure 3-1 illustrates the State Park boundary overlap).

3.3.2 Mobilization and Demobilization

Mobilization and demobilization will include all work necessary to manage operations for the duration of the project. Mobilization will be an ongoing task as new resources are needed for specific operations. The project-specific HASP will be completed as part of the mobilization phase. A draft HASP will be finalized prior to beginning field activities, with input from the selected remediation contractor during the pre-mobilization phase of work. During mobilization, equipment will be cleaned to limit noxious weed transport to the Site. A stormwater pollution prevention plan (SWPPP) will be prepared prior to the initiation of any soil disturbing activities at the Site.

Demobilization will include the removal of all equipment and personnel mobilized to the Site and waste generated during the duration of the project. Final demobilization will include cleanup and restoration of all staging areas to pre-existing conditions. At the conclusion of the construction season, work areas will be secured and appropriate stormwater BMPs will be implemented to reduce the potential for Site activities to impact stormwater run-off.

3.3.3 Erosion Control

Remediation of the Mine-related materials will require establishing equipment access and the excavation, loading, and haulage of the materials. The disturbance associated with these activities will need to be mitigated to prevent erosion. A notice of intent (NOI) and storm water pollution prevention plan (SWPPP) will be prepared and certified through the CVRWQCB. This mitigation will involve the re-grading and reclamation of the natural ground surface and the temporary placement of erosion control BMPs.

BMPs will be selected based on the planned reclamation activities and include categories related to erosion control, sediment control, tracking control, wind erosion, non-stormwater controls, and waste management and materials control. These BMPs can include, but are not limited to:

- Grading;
- Silt Fences;
- Straw Bales;
- Biodegradable Fiber Rolls;
- Loose Straw, Mulch;
- Grass Filters;
- Sand/Gravel Bags;
- Dust Control Moderation;
- Good Housekeeping Practices;
- Site Entrances and Exit Maintenance; and
- Management of Construction-Related Wastes.

The combination of the above-listed BMPs will protect the stormwater quality during reclamation activities. Procedures to ensure proper implementation of erosion control BMPs during remediation will be identified and described in the SWPPP. The SWPPP will be established prior to starting any soil disturbing activities associated with construction work at the Site, and will be included as necessary in permitting documentation. Specific construction activities likely to require erosion control measures are addressed in the task descriptions in the following sections. Erosion control materials will be on standby for use if rainfall events occur during construction activities.

3.3.4 Material and Equipment Staging

All materials and equipment will be staged on the Mine Site. Each work area will have a temporary staging area for equipment and personnel. These areas will be determined and approved by the current property owners and the Site engineer prior to mobilization.

3.3.5 Road Improvements and Construction

Mine access road construction and improvement will be required throughout the project. Proposed locations of access routes and roads are preliminary and will be revised as necessary pending final approvals by the property owners and the Site Engineer. Access improvements will be located to minimize disturbance.

In the event that any roads cross a drainage channel, existing culvert, or small tributary, a replacement culvert will be installed or temporary steel plating will be placed across to keep drainage areas open.

3.3.6 Transportation Plan

A Site transportation plan will be prepared during pre-mobilization activities and will cover on-site transport of Mine-related material and other material generated during Site removal and restoration activities. The transportation plan establishes procedures to minimize the environmental and health and safety risks associated with material transportation conducted for the project.

3.3.7 Dust Control

Reclamation activities anticipated to generate dust during the project include construction vehicle traffic and ground disturbance activities associated with material removal, consolidation and re-contouring. Routine dust control measures will consist of water spray to moisten disturbed areas, on-site haul roads and other areas, as needed (e.g., unpaved construction roads are commonly watered three or more times per day during the dry season). If dust emissions are visible, dust control practices will be modified or other corrective measures will be implemented immediately.

3.4 Mining-Related Material Remediation

This section describes in greater detail the remediation (e.g., removal and management-in-place) of Mine-related materials including waste rock and tailings, calcines, spring water discharge and Lower Pond SI sediments.

3.4.1 Main Tailings Pile and Calcines

The Main Tailings Pile is generally laid at a slope of 3:1 (18 degrees) from the Lower Pond SI up to the beginning of the capped area near the top of the slope (Figure 3-1). The waste is covered in places with boulders up to 6 feet in diameter. The internal character of the waste in the Main Tailings Pile has not been investigated by intrusive activities. The thickness of the material in the Main Tailings Pile has been determined via comparison of historic topography with the current surveyed Site topography as demonstrated on Figures 3-2 and 3-3. The average thickness of the western portion of the Main Tailings Pile targeted for removal is 24 feet. The eastern portion of waste extending from the lower reaches of Main Tailings Pile to the Lower Pond SI is estimated to be as little as three feet thick or less. Along the east-west edge of the upper portion of the Main Tailings Pile, the slope is very steep - on the order of 1:1. The waste area extends into the adjacent State Park to the south.

The top surface of the Main Tailings Pile is essentially level with a grade to the west for the capture of surface water as designed by the landowner. The tailings have been capped with 10 to 20 feet of fill as estimated by the landowner (Figure 3-2). The capping material extends down the face of the Tailings a significant distance. The cap material is reported to be from a local pool contractor who has stored excess soils on the Site for many years. The leading downhill slope of the stockpile is quite steep and likely is on the order of 2:1 (26.5 degrees) or steeper. The estimated volume of wastes proposed for removal from the Main Tailings Pile, as depicted on Figure 3-1, is 102,245 cubic yards.

A small area of calcines is located to the north of the Bradley wastes (Figure 3-1). The gravel-size material was roasted to drive off the mercury as a vapor. The calcines are distinctive and their extent is readily discernable on the ground. The estimated volume of these materials is 7,500 cubic yards based on topographic analysis.

The remedy proposed is the removal and transport of these uncapped exposed Mine waste materials as depicted on Figure 3-1 to the former Mine workings area for consolidation and capping. Figure 3-4 depicts cross sections of the expected configuration of the Mine waste after all waste has been consolidated in the former Mine workings area. The cross sections depict Mine waste extending to an elevation of 930 feet. The planned footprint of consolidated waste in the former Mine workings area extends from the base of the floor at approximately 875 feet to the 930-foot contour interval as shown on Figure 3-1. The volume capacity of this consolidation area is calculated to be approximately 150,000 cubic yards.

Removal of the waste footprint from the Main Tailings Pile as depicted on Figures 3-1 and 3-2 will result in the exposure of the toe of the capped waste that lies above. During the pre-implementation planning phase of the proposed project, an approach for the stabilization and capping of the exposed toe of the capped waste material will be developed by the Site engineer in consultation with an appropriate geotechnical expert. Currently, insufficient data combined with the unknown condition of the base rock under the tailings preclude the development of a detailed plan. The capping and grading plan developed will be based on appropriate field sampling and investigation conducted during the pre-implementation phase of the project and will be submitted to the CVRWQCB for review and approval.

3.4.2 Lower Pond Surface Impoundment

A surface impoundment at the location of the Lower Pond SI has been present at the Mount Diablo Mine since at least the late 1930s. Division of Water Resources (1952) reports the results of a chemical analysis of "*final*" pond outflow from 1939. It is believed that this final pond occupies the same approximate footprint as the present day surface impoundment. The current condition of the Lower Pond SI at the Mine is a result of upgrade and modifications conducted by the current property owner. The Lower Pond SI was re-built in 1978/1979 by Jack Wessman as one of the requirements of the Waste Discharge Requirements and the Cleanup and Abatement Order issued in 1978. Jack Wessman has stated that the Lower Pond SI levee material was derived from local soils that were not in contact with the Mine tailings with the bulk of the material derived on-site from an area north and east of the Lower Pond SI. The lower pond was designed to have an effective storage capacity of 3.0 acre-feet.

A small secondary pond (herein referred to as the Middle Pond) was also constructed by Jack Wessman, immediately north of the Lower Pond SI. This Middle Pond was built by Jack Wessman to capture the stormwater drainage as part of his work to manage stormwater flow away from exposed Mine waste as discussed in Section 2.1.7. Removal of the Middle Pond is not part of this Remediation Plan.

Removal of the Lower Pond SI and berm materials is estimated to generate approximately 14,189 cubic yards of solid waste material form the area depicted on Figure 3-1. Of this total, approximately 9,400 cubic yards are estimated to be sediment contained within the impoundment. Additionally, approximately 2,400 cubic yards of waste material that is observable below the southern levee of the surface impoundment is included in the total.

In its current configuration, the Lower Pond SI drains directly into Dunn Creek. De-watering of the Lower Pond SI will be conducted via pumping and on-site treatment to remove sediment load and reduce total metals loading to Dunn creek. Estimated water volume in the pond at the time of project implementation will be dependent on the time of year and the total winter rainfall preceding the project start. Water volume is estimated to be on the order of 2 to 3 million gallons. Based on the requirements determined during the permitting stage of the Remediation Plan implementation process, a de-watering plan for the impoundment will be developed and submitted to the CVRWQCB for review and approval.

The Lower Pond SI is bounded on the west by a large area of open ground with a gentle slope that is already covered and impacted with Mine waste materials. During sediment excavation, staging and amendment of sediments will be conducted in this area such that run-off from the staging and processing area will naturally be contained within the catchment of the Lower Pond SI.

Lower Pond SI sediments will be excavated and amended via the addition of cement and/or other satisfactory pozzolonic material to stabilize them and allow transport to the consolidation area. Initial estimates indicate the need for 1200 tons of dry cement for application to the pond sediments in order to stabilize and condition the sediments.

The footprint of the excavated Lower Pond SI will be restored via implementation of a re-vegetation plan as discussed in Sections 3.7 and 4.4.

3.4.3 Mine Adits and Shafts

Based on review of Site mining history information and interviews with the current property owners, no mineshafts are known to exist in the area of planned tailings removal. Removal of the Main Tailings Pile is expected to uncover the former 165 level Adit as shown on Figure 3-2. The condition of the adit opening is unknown. Historic information indicates that this adit may be the source of some or all of the spring water currently exiting the Main Tailings Pile and called the Travertine/Adit Spring. Based on the condition of the adit when uncovered, a plan will be developed to; 1) remove Mine waste in the adit mouth that could contribute mercury loading to spring water, 2) stabilize and plug the adit opening, and 3) construct a catchment to capture any water drainage effectively and route it away from all Mine waste as detailed in following Section 3.4.4.

3.4.4 Travertine Spring /Adit Discharge

Removal of the Main Tailings Pile will allow access to the historic emanation location of the Travertine Spring and the possible groundwater discharge from the portal of the 165 level Adit (Figure 3-2 and 3-3). Through access to these areas, the sources of current groundwater discharge that emerges as the spring and seeps will be determined. Based on the determination of the source of the spring water, appropriate catchment/s will be designed. The catchment/s will be designed to allow complete capture of these groundwater discharges allowing competent routing of the flow away from contact with Mine waste. During project implementation, a temporary catchment will be designed by the Site engineer to route the groundwater discharge away from the on-going work areas. This flow will be diverted to Dunn Creek and bypass any further contact with existing Mine waste. Due to the planned removal actions that will be occurring in the vicinity of these groundwater discharges, the likely routing direction for this flow is to the south in the vicinity of the State Park Spring. As a result of this planned re-routing, it is expected that the groundwater discharge water quality will be significantly improved in comparison to the current discharge of these waters to Dunn Creek.

A spring water catchment and routing plan will be developed and submitted to CVRWQCB for review and approval. During the intervening time, a temporary catchment and routing plan will be developed and immediately implemented by the Site engineer in consultation with CVRWQCB staff. Maintenance of this temporary discharge routing will be conducted throughout the implementation process. Construction of permanent catchment and routing structures will be conducted following approval of the developed plan by the CVRWQCB and the effective completion of removal and stabilization activities in the area.

3.5 Material Management Plan

This section describes the material management plan for Site Mine-related material, including structures and equipment, waste rock, tailings, calcines, and mercury-enriched sediments.

3.5.1 Recycling and Disposal of Structures and Equipment

The Remediation Plan does not include the removal of Mine-related equipment. However, it is possible that during the process of excavation and consolidation of Mine waste, Mine-related equipment will be encountered.

Mine-related equipment that is encountered, such as pipes and retort remnants, will be consolidated within the consolidation area if feasible. Where inclusion of Mine-related equipment encountered is considered by the Site engineer to be infeasible, the Mine-related equipment will be further evaluated to determine if removal is necessary. If equipment or structures encountered cannot be included in the consolidation area, then the procedures that would be followed are described below.

Where possible, based on the available material characterization data, remnants of former Mine-related structures and equipment will be recycled. Only those materials demonstrated to contain concentrations of mercury below applicable regulatory limits will be considered for recycling. Materials will be sorted by type (i.e., brick/concrete, dimension stone, wood, and metal) in the staging area as they are removed. Brick, dimension stone, and concrete debris will be transferred to a recycling facility or disposed as construction waste, depending on condition. Wood will either be recycled or disposed of as construction waste depending on condition. Steel will be transferred to a recycling facility as general scrap metal.

3.5.2 On-Site Stabilization and Capping

Mine waste consolidation and stabilization will be completed so that the consolidated and capped materials will not be actively eroding material directly to Dunn creek or its minor tributaries. In general, materials that are moved for consolidation will be placed in lifts, keyed into existing slopes and compacted between lifts. Water trucks will provide water that will be used for dust control as well as to enhance soil compactability. Lifts will be keyed in for stability and erosion control. Once final grading is complete, the materials will be capped with soil. The source of the borrow soil will be determined prior to contractor selection and detailed in a capping plan. The cap material will be keyed into the surrounding native material and proof rolled for compaction.

A licensed geotechnical engineer under the direction of the Site engineer will perform a geotechnical investigation. The investigation will include slope stability, seismic stability, and design of the capping area. Furthermore, the licensed geotechnical engineer will provide drainage recommendations to be installed within the consolidated waste material. Based on this pre-implementation design, a general Capping Plan will be prepared by the Site engineer and submitted to the CVRWQCB for review and approval.

3.5.3 Hazardous Waste

Mine-related waste that is the subject of this Remediation Plan is by its nature considered to fall under the Bevill exclusion. In October, 1980, Resource Conservation and Recovery Act (RCRA) was amended by adding section 3001(b)(3)(A)(ii), known as the Bevill exclusion, to exclude "*solid waste from the extraction, beneficiation, and processing of ores and minerals*" from regulation as hazardous waste under Subtitle C of RCRA.

No waste is planned for off-site disposal as a result of the actions described in the Remediation Plan. Although not anticipated, if hazardous wastes are generated during the project and they do not meet the Bevill exclusion requirements, these wastes will be transported to an appropriate hazardous waste landfill facility for disposal. In this event, a transportation plan will be developed. The transportation plan will include, if required, trucking routes and manifest required for the hazardous waste facility. The final hazardous waste disposal facility will be determined based on the waste characteristics, waste profile, and the acceptance criteria for the available disposal facilities.

3.6 Removal Confirmation

The extent of excavation of Mine-related waste rock, and tailings at the Site will be determined in the field using qualitative (visual) techniques before and during excavation activities. Samples for laboratory analysis will not be collected to confirm removal and/or stabilization limits or boundaries.

The horizontal and vertical limits of the waste rock, and tailings piles will be identified and confirmed using the following guidelines:

- Topographical expression (many material piles have well-defined topographic profiles);
- Color change (calcine tailings have a distinctive reddish color);
- Presence of buried soil horizons, as evidenced by the presence of organic material, roots, and developed soil horizons;
- Presence of in-place bedrock;
- Presence of laminated or bedded fine-grained material indicative of natural overbank deposits; and
- Presence of an abundance of rounded gravel and cobbles indicative of former streambed or stream terrace deposits.

Delineation of the horizontal and vertical limits of the waste rock, ore, and tailings piles will be conducted by or under the direction of registered Professional Geologists with relevant expertise in accordance with California Business and Professions Code sections 6735, 7835, and 7835.1. The delineation tasks will also be documented and reported to the CVRWQCB.

In order to distinguish Mine-related materials from natural soils and rock materials, the following guides will be used; the soil classification guidelines published in American Society for Testing and Materials Standard D-2487 and the standard practice for classification of soils for engineering purposes (Unified Soil Classification System). The available guidelines will be applied in a manner that allows for the removal or stabilization of all targeted Mine-related materials while minimizing the removal or disruption of in-place naturally occurring materials.

3.7 Site Restoration Approach

This section describes the Site restoration approach, including temporary road removal; re-grading, slope stabilization and bank stabilization; and re-vegetation that will be conducted in accordance with the NOI storm water discharge permit.

3.7.1 Temporary Road Removal

All Mine access roads or constructed temporary roads, bridges, or steel plates used during construction will be removed and the area restored upon the completion of work in that area as described in Sections 3.7.2 and 3.7.3. Unless required for future access or requested by the property owner, culverts placed or repaired during the construction of the roads will be removed and disposed of in accordance the recycling plan described in Section 3.5.1.

3.7.2 Re-grading, Slope Stabilization, and Bank Stabilization

Disturbed areas and temporary roads will be restored upon completion of all removal and/or on-site stabilization activities. Slopes and roads will be graded to a natural line that limits run-off and drainage. Fill material will be borrowed from on-site as need for grading and stabilization. Positive drainage will be achieved to minimize ponding of water. Slopes will be stabilized by eliminating run-off from the top of the slope, or cutting the slope back to slow stormwater run-off. Grading around on-site stabilized materials will be used to divert stormwater away from the stabilized material. Grading near creeks will be completed to limit streambed disturbance and maintain the natural flow. The grading of Site areas will remain above the Dunn Creek elevation to minimize the potential for undercutting.

Temporary bank stabilization measures may be necessary at the Dunn Creek drop adjacent to the southeast corner of the Lower Pond SI to minimize lateral creek migration following removal of the pond and associated berms.

3.7.3 Re-vegetation and Monitoring

A re-vegetation plan will be developed for the project that focuses on the seeding of early succession herbaceous grasses and/or forbs upon completion of the Site removal actions.

Disturbed Site areas will be re-vegetated following the completion of the construction season just prior to the first rain events. Re-vegetation will include hydro seeding, or other techniques where more appropriate, with an appropriate soil stabilization seed mix. Upon completion of re-vegetation activities, a Site inspection with the CVRWQCB will be scheduled. See Section 4.4.5 for additional details of the re-vegetation plan.

4.0 REMOVAL DESIGN, METHODS AND PROCEDURES

This section describes the removal design, methods and procedures, including sample collection and analysis, Site preparation and control, Mine-related material removal, Site restoration design, equipment decontamination, geolocation, and recordkeeping.

4.1 Sample Collection and Analysis

Sample collection during project implementation is anticipated for both soil and water as follows:

1. Geotechnical evaluations discussed in Section 3.5.2 will be required during the removal, consolidation, and capping of Mine waste material. Sample collection and analysis specifications for soil samples will be described in the capping and grading plan developed before and during project implementation.
2. Water sampling will be conducted at the Lower Pond SI to evaluate water treatment and discharge options during planned de-watering.
3. Additionally, water samples will be collected from spring discharge upon uncovering of the former Travertine spring and the portal of the 165 level Adit. These samples will be collected and analyzed to aid in the management of these spring waters during and after completion of the removal actions specified in this Remediation Plan. All water samples will be collected under chain-of-custody protocols and transported to a State-certified laboratory for analysis. Samples will be analyzed for the following constituents using the appropriate test method:

Constituent	Test Method
Total/Dissolved Mercury	EPA 245.1
Methyl Mercury	EPA 1630
pH/Specific Conductivity/Turbidity	SM18 4500H+/2510B/2130B
Alkalinity (Bicarbonate, Carbonate, Total)	SM18 2320B
Total Organic Carbon	SM18 5310C
Total Dissolved Solids	SM18 2540C
Chloride, Bromide, Fluoride, Nitrate	EPA 300/SW846 9056A
Metals (Sb, As, B, Ca, Cr, Cu, Fe, Pb, Mg, Mn, Ni, K, Si, Na, Zn)	SW846 6010B

4.2 Site Preparation and Control

This section outlines the Site preparation and control methods and procedures to be implemented during Site removal and restoration activities, including mobilization and demobilization, materials and equipment staging, and road construction and improvements.

4.2.1 Mobilization and Demobilization

Mobilization and demobilization includes all work necessary to manage operations for the duration of the project. Mobilization tasks will include, but are not limited to:

- Project management of all construction operations;
- Completion and maintenance of the HASP;
- Delivery of all equipment and materials to support work and health and safety requirements;
- General Site preparation, including fencing, and signage, to support operations for the duration of the project; and
- Installation and maintenance of all stormwater BMPs.

Demobilization tasks will include, but are not limited to:

- Removal of temporary Site controls and facilities established by the subcontractor;
- Removal of any damage caused by temporary Site controls and/or removal work;
- Verification that post-construction SWPPP BMPs are in place at the conclusion of the project;
- Decontamination of all equipment leaving the Site; and
- Final inspection by CVRWQCB at the conclusion of the project.

4.2.2 Materials and Equipment Staging

Material and equipment staging areas will be located on the valley floor near the entrance to the Mine property and on the Mine terrace area located as shown on Figure 4-1. The staging areas will house field offices, equipment and material storage, and heavy equipment staging areas.

The valley floor staging area will be located in an area that is not impacted by past mining operations. Only minor or emergency equipment repair or maintenance will be completed in the staging area. Activities will be conducted within the staging areas in a safe manner that is protective of the environment. All generators used for power will have secondary containment for fueling and a spill response kit available at all times. The equipment maintenance area will also have secondary containment as well as stormwater BMPs in place to protect the surrounding area. Note non-emergency maintenance will be conducted off-site.

Storm water BMPs will be in place anytime material is being stored in the stockpile portion of staging areas. Stockpiles will be covered if substantial rain is in the forecast and run-off is possible.

At a minimum, BMPs will consist of straw wattles around the base of the pile and silt fence around the perimeter of the stockpile area.

Both the materials and equipment staging areas will be restored as described in Section 4.4 upon completion of the project.

4.2.3 Road Construction and Improvements

Road construction and improvements will be an ongoing task during the project. Mine access roads will be constructed or existing roads repaired on an as needed basis. Conceptual plans for road construction and improvements are shown in Figure 4-1. Tasks that will be performed for Mine access road construction include the following:

- Grading of existing roads for use by off-road trucks and equipment will be kept to a minimum. Roads will only be scraped to remove ruts, large rocks, or widened for safe passage of the largest piece of equipment using the road. These roads will be constructed by using a dozer to create a road and berm the spoils along the outer edge of the road for use later. The maximum road width will be 14 feet except in turn out areas. Roads will be re-contoured to minimize the disturbance of existing slopes.
- Replacing or extending drainage culverts may be required to accommodate larger vehicles.
- New culverts, steel trench plates, or a combination of the two will be used at locations where existing culverts or drainage channels require additional support.
- New access roads will be constructed only when needed. Each road will be constructed with a dozer just deep enough to remove vegetation and wide enough for the largest piece of equipment to access. Any material removed from the road will be bermed on the side for re-vegetation use when the work is complete. Roads will be constructed along contour as much as possible while providing safe passage of trucks and equipment. Turns will be kept wide so that additional rutting and damage to the area does not occur.

4.3 Mining-Related Material Remediation

This section describes the Mine-related material remediation methods (i.e., removal and managed-in-place) and procedures to be implemented during Site removal and restoration activities, including required equipment; structures and equipment removal and staging; waste rock, tailings, and sediment removal segregation, and staging; on-site management of Mine-related materials; and transportation.

4.3.1 Required Equipment

The removal of Mine-related materials (e.g., rock, tailings, and debris) will require at a minimum the use of heavy equipment, including:

- Excavator with thumb;
- Excavator with straight edge bucket;

- Multiple 10-wheel truck or off-road trucks;
- Water truck, all wheel drive;
- Drop tank for water;
- Loader;
- Dozer, D-6; and
- Dozer, D-6 LGP.

4.3.2 Structures and Equipment Removal and Staging

The removal of Mine-related structures is currently not anticipated as part of this Remediation Plan. If required due to encountered conditions, the removal of former Mine structures will be completed with an excavator with thumb with minor cutting. If hot work is need to dismantle steel structures, a separate job safety analysis form will be completed and included in the project HASP.

4.3.3 Waste Rock, Tailings, and Sediment Removal, Segregation, and Staging

Waste rock, tailings, and sediment will be removed from the Site using a systematic approach. Excavators will be used to excavate the material and load into haul trucks. The material will be removed using a straight edge bucket working from the outside edges of dumps and piles inward. The process will minimize the mixing of native material with the tailings, the over excavation of material, and the spreading of material into adjacent creeks and clean areas. To the extent possible, work will proceed from the furthest location of the Mine back toward the staging area. Material will be directly loaded into trucks and transported to the consolidation area in the former Mine workings for placement.

During sediment excavation, staging and amendment of sediments will be conducted in the area located immediately west of the pond as shown on Figure 4-1. Pond sediments will be excavated and amended via the addition of dry cement to stabilize them and condition the sediments allowing transportation to the consolidation area. Care will be taken to prevent generation of cement dust using a water buffalo during mixing activities. Mixing will also occur during sunny and low wind conditions. If average wind velocities are greater than 25 miles per hour, then lime stabilization activities will cease until conditions stabilize to stabilize them and allow transport to the consolidation area.

4.3.4 On-Site Management of Mine-Related Materials

The Mine-related material will be spread in thin lifts and compacted. The final surface shall be graded to match the surrounding surface, have positive drainage, and seeded with the approved upland seed mix to vegetate the finished surface. The final specifications for the consolidation and capping of waste materials will be detailed in the capping and grading plans developed as discussed in Section 3.4.1.

4.3.5 Transportation Plan

A Site transportation plan will be prepared during pre-mobilization to identify potential health and safety risks resulting from on- and off-site movement of materials, equipment, and debris. The preliminary transportation plan outlines appropriate procedures and precautions that will be taken to minimize potential risks, and will be modified during the project to reflect changing conditions, improved procedures, and expanded scope, as needed, including additional off-site disposal locations, if necessary.

4.4 Site Restoration Design

This section describes the Site restoration design, including required equipment, temporary road removal, re-grading and slope stabilization, sediment controls, and re-vegetation.

4.4.1 Required Equipment

Equipment required for Year 1 Site restoration may include the following:

- Water truck, all wheel drive;
- Dozer, D-6, with rippers; and
- Hydro seeder.

4.4.2 Restoration of Temporary Roads

All temporary roads used or constructed as part of this project will be removed when all construction is completed. Using excavating equipment and starting at the furthest extent of the access road, the roadway shall be graded to match existing grade and contour as the equipment "*backs out*" of the access road alignment. Road areas shall be graded such that no ponding of stormwater will occur and seeded with the approved seed mix to re-establish the vegetative cover. Restoration activities will include:

- Removal of culverts installed for creek crossings;
- Removal of signs or markers installed during mobilization;
- Removal of new temporary bridges, anchor blocks, and support blocks in creek;
- Rip the soil compacted during road construction to facilitate re-vegetation;
- Re-grade the road location to minimize visual evidence of the road;
- Re-grade to minimize run-off and erosion, per Sections 4.4.3 and 4.4.4; and
- Re-vegetate area per Section 4.4.5.

4.4.3 Regrading and Slope Stabilization

The restoration of disturbed areas and temporary roads will be completed by grading the area to blend with the surrounding grades and natural slopes to the extent practicable. Areas that have been compacted and abandoned will be graded and/or ripped to facilitate vegetation growth. All slopes and graded areas will minimize channeled stormwater run-off and erosion.

Slopes will be stabilized by track rolling with the dozer, will comply with stormwater BMPs, and will be finished with hydro seeding per the re-vegetation plan. For areas requiring fill along slopes, the material will be keyed in and compacted.

Where appropriate, grass filters may be employed to facilitate stabilization and mitigate sediment run-off to the creek. A grass filter is essentially a vegetated buffer zone lying on the flat to gently sloping terrace surface between the toe of the slope and the top of the main channel bank. The vegetation slows the velocity of sediment laden run-off causing the sediment to deposit on the surface within the limits of the vegetation coverage before reaching the edge of the stream bank. It relies on a high cover density of grass or grass-like vegetation (a dense cover of weeds will also be effective). The grass filter can be formed either by preserving an existing stand of dense vegetative cover (i.e., leaving a buffer zone) or by re-establishing a dense vegetative cover on a newly disturbed surface.

4.4.4 Potential Channel Sediment Controls at Dunn Creek

Dunn Creek flows on the eastern portion of the Site, and flow is toward the south. Dunn Creek's drainage on the northern portion of the Site is relatively topographically flat and near the northern portion of the Lower Pond SI, Dunn Creek is funneled into a narrow channel, which increases stream velocity and erosive energy. Near the southern end of the Lower Pond SI, Dunn Creek topographically drops approximately 4 feet, which has resulted in moderate to severe erosion at this location. At the request of Sunoco, SGI concreted with shotcrete the western portion of Dunn Creek as it bounds the Lower Pond SI to prevent erosion from damaging the southeast corner of the surface impoundment (SGI, 2009). The eastern portion of Dunn Creek at this location has since experienced moderate erosion and BMPs will be deployed to reduce the velocity of the channelized water before and after falling over the topographically higher ledge. BMPs will include inert rip-rap, energy dissipaters, and splash preventers. All BMPs will be selected and designed by a Professional Geologist/Professional Engineer prior to deployment.

4.4.5 Re-vegetation

A re-vegetation plan will be developed during the implementation phase of the project. The goal will be to introduce early succession stage vegetation that will (a) control soil erosion and (b) promote future succession of plant communities at the Mine. As underlying substrate and slope of areas following remediation cannot be accurately determined at this time, the re-vegetation plan will be developed during project implementation following completion of excavation and removal activities.

4.4.6 Maintenance and Monitoring Plan

Due to the unknown nature of the final design of some of the specific remedial actions described herein, development of a maintenance and monitoring plan will be conducted following completion of removal and consolidation activities. The maintenance and monitoring plan will be developed as appropriate based on the final known and/or designed disposition of implemented remedial actions concerning capped areas, re-vegetated areas, and water discharge controls. The maintenance and monitoring plan will be submitted to the CVRWQCB for review and approval consistent with the approach for the multiple implementation plans specified for development in this Remediation Plan.

4.5 Equipment Decontamination

Equipment decontamination will occur anytime a piece of equipment or truck that was in contact with contaminated material leaves the Mine area (boundaries to be determined in the field) or the Site. Mine area and staging area decontamination will be conducted in accordance with the following procedures:

- Contaminated material with be knocked off all equipment tracks and/or tires prior to leaving work area;
- Bulk transporters or on-site trucks will load in a single area outside of the contaminated zone to prevent material from being tracked out;
- Bulk transporters and on-site trucks will keep loads below the rail and will clean rails prior to proceeding on haul road; and
- Support vehicles will not enter contaminated zones.

Equipment and or trucks leaving the project Site will adhere to the following procedures:

- Equipment will be decontaminated in the staging area prior to leaving the Site. The bid specifications will include specific demobilization decontamination procedures.
- Bulk transport trucks will verify that rails and fenders of trucks are clear of soil and that tires are clean prior to leaving staging area. Knock-off pads will be constructed if necessary.
- Pickup trucks leaving the Site will have clean tires prior to leaving the Site on the access road.
- All vehicles leaving the property will have clean tires prior to entering Morgan Territory Road. Knock-off pads will be constructed if needed.

4.6 Geolocation

The limits of removal actions at the Mine will be photo-documented in the field and will be geolocated using a portable global positioning system (GPS) unit. The GPS data will be used to develop as-built maps of the construction effort using the existing project base maps, and will be augmented by a series of before-and-after photographs of all of the working areas.

4.7 Recordkeeping

This section describes recordkeeping procedures that will be followed during the removal and restoration activities at the Site, including daily field notes, the project permit book, and field and laboratory material characterization activities.

4.7.1 Daily Field Notes

Daily field notes, consisting of the following forms, will be produced during Site removal and restoration activities:

- Site visitor form – All site visitors will be required to sign in and out of the Site.
- Daily tailgate form - The daily tailgate form will document the days planned activities and health and safety discussions. This form will be signed by all Site visitors (form included in Site HASP).
- Field log - The field log will document Site activities, which includes, but not limited to, work completed, volumes excavated, materials leaving the Site, phone log, and decisions made in the field.
- Air monitoring log - Real time air monitoring and dust monitoring will be recorded daily (log included in the Site HASP).
- Off-site truck log - Off-site truck logs will contain the date, time, truck, material leaving the Site and the manifest for the load, if appropriate. It will be paired with a receiving log for materials imported to the Site, such as cap fill material.
- Photo log - Photo logs will be digital images of the progress of work throughout the day. Site photos as well as detailed photos will be organized chronologically and maintained electronically.

All of the Site daily field logs will be kept by the construction manager during Site construction activities, and will be provided to the project manager following completion of construction, for placement into the project file.

4.7.2 Permit Book

A record of all project approvals and permit conditions will be created as they are obtained and a "*Permit Book*" will be developed that contains all certified and signed permissions and exemptions, and a complete list of conditions and BMPs that are to be adhered to during construction. A hard copy of the Permit Book will remain on Site during construction, and copies will be distributed to appropriate responsible parties and contractor leads.

Following completion of removal and restoration activities, the Permit Book will be incorporated into the project file by the project manager.

4.7.3 Field and Laboratory Material Characterization Data Management

Data generated in the field may include field logbook entries, sample dates, field parameter measurements, observations, and additional information (such as field duplicate number). These data will be manually entered into an electronic format, and then checked by a second person, before final inclusion in the database. Following review and acceptance, analytical data generated by the subcontract laboratories will be obtained as an electronic data deliverable for import into the project database.

5.0 PROJECT SCHEDULE

Due to the nature of the removal actions presented herein, the implementation of the bulk of fieldwork will be limited to the dry construction season months of May through October. Considering these conditions, a conceptual project implementation schedule has been prepared based on potential implementation during the 2013 construction season as the earliest possible implementation time-frame. The project schedule is presented on Figure 5-1.

6.0 LIMITATIONS

This document was prepared for the exclusive use of Sunoco (R&M) Inc. (Sunoco) and the Central Valley Regional Water Quality Control Board (CVRWQCB) for the express purpose of complying with a regulatory directive for environmental investigation and development of a Site Remediation Work Plan. SGI and Sunoco must approve any re-use of this work product in whole or in part for a different purpose or by others in writing. If any such unauthorized use occurs, it shall be at the user's sole risk without liability to SGI or Sunoco. To the extent that this report is based on information provided to SGI by third parties, including Sunoco, their direct contractors, previous workers, and other stakeholders, SGI cannot guarantee the completeness or accuracy of this information, even where efforts were made to verify third-party information. SGI has exercised professional judgment to collect and present findings and opinions of a scientific and technical nature. The opinions expressed are based on the conditions of the Site existing at the time of the field investigation, current regulatory requirements, and any specified assumptions. The presented findings and recommendations in this report are intended to be taken in their entirety to assist Sunoco and the CVRWQCB personnel in applying their own professional judgment in making decisions related to the property. SGI cannot provide conclusions on environmental conditions outside the completed scope of work. SGI cannot guarantee that future conditions will not change and affect the validity of the presented conclusions and recommended work. No warranty or guarantee, whether expressed or implied, is made with respect to the data or the reported findings, observations, conclusions, and recommendations.

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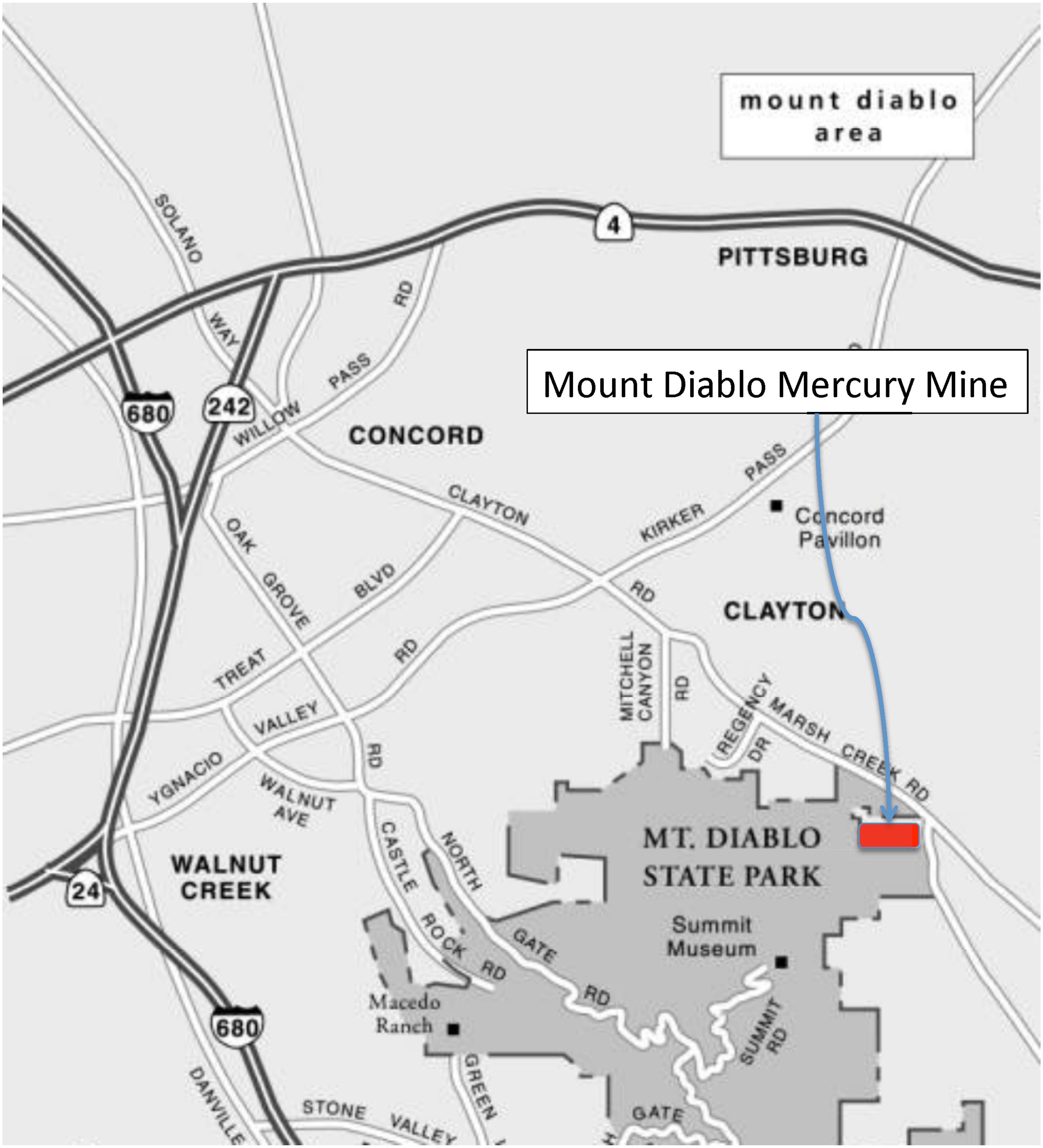
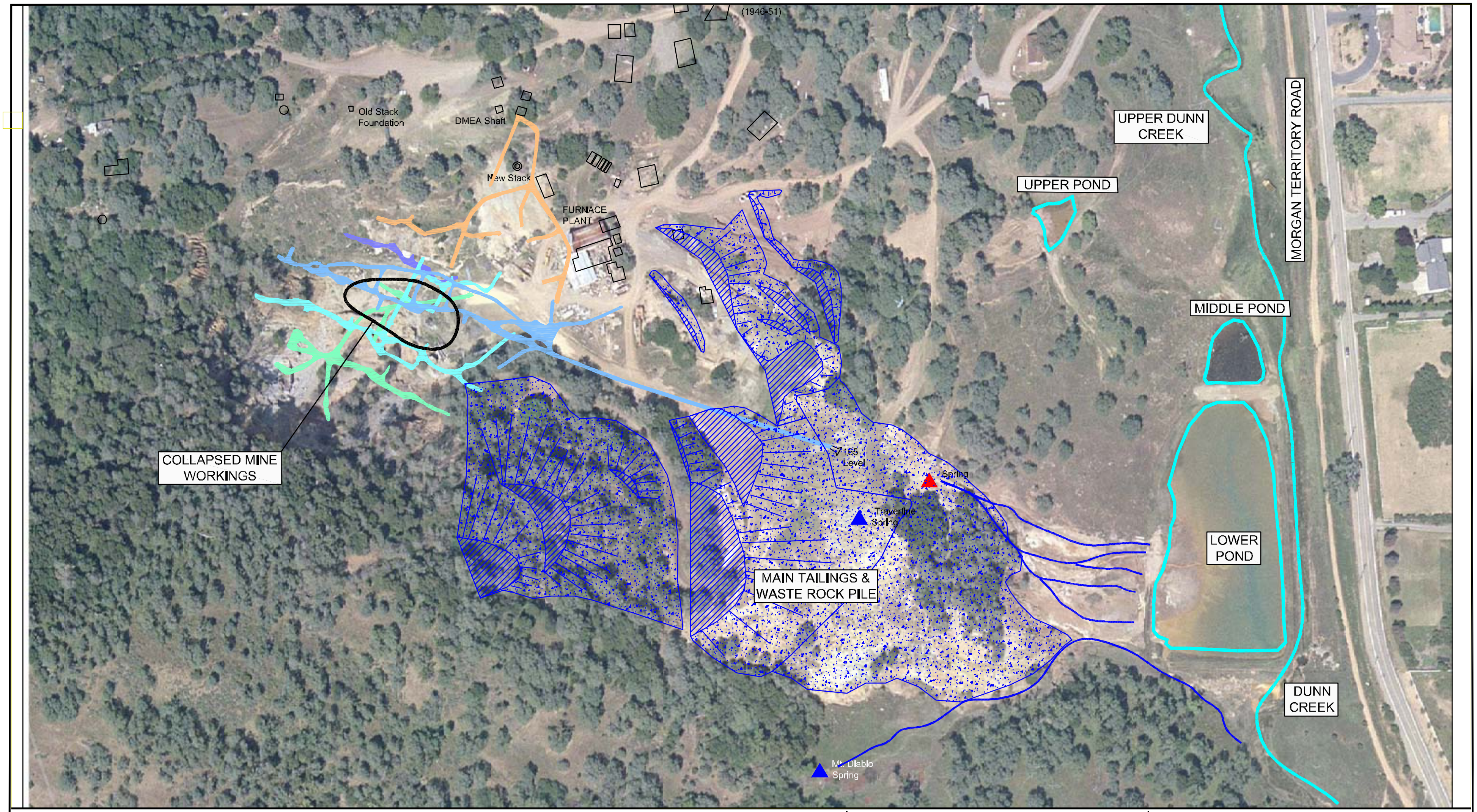
FIGURES



SGI environmental THE SOURCE GROUP, INC. 3478 BUSKIRK AVENUE, SUITE 100 PLEASANT HILL, CA 94523	MOUNT DIABLO MERCURY MINE 2430 Morgan Territory Road Contra Costa County, Calif			SITE LOCATION MAP		
	FILE NAME Diablo RP Figures Landscape.pptx	DATE 05/08/12	DR. BY: PDH	APP..BY: PDH	PROJECT No. 01-SUN-050	FIGURE 2-1



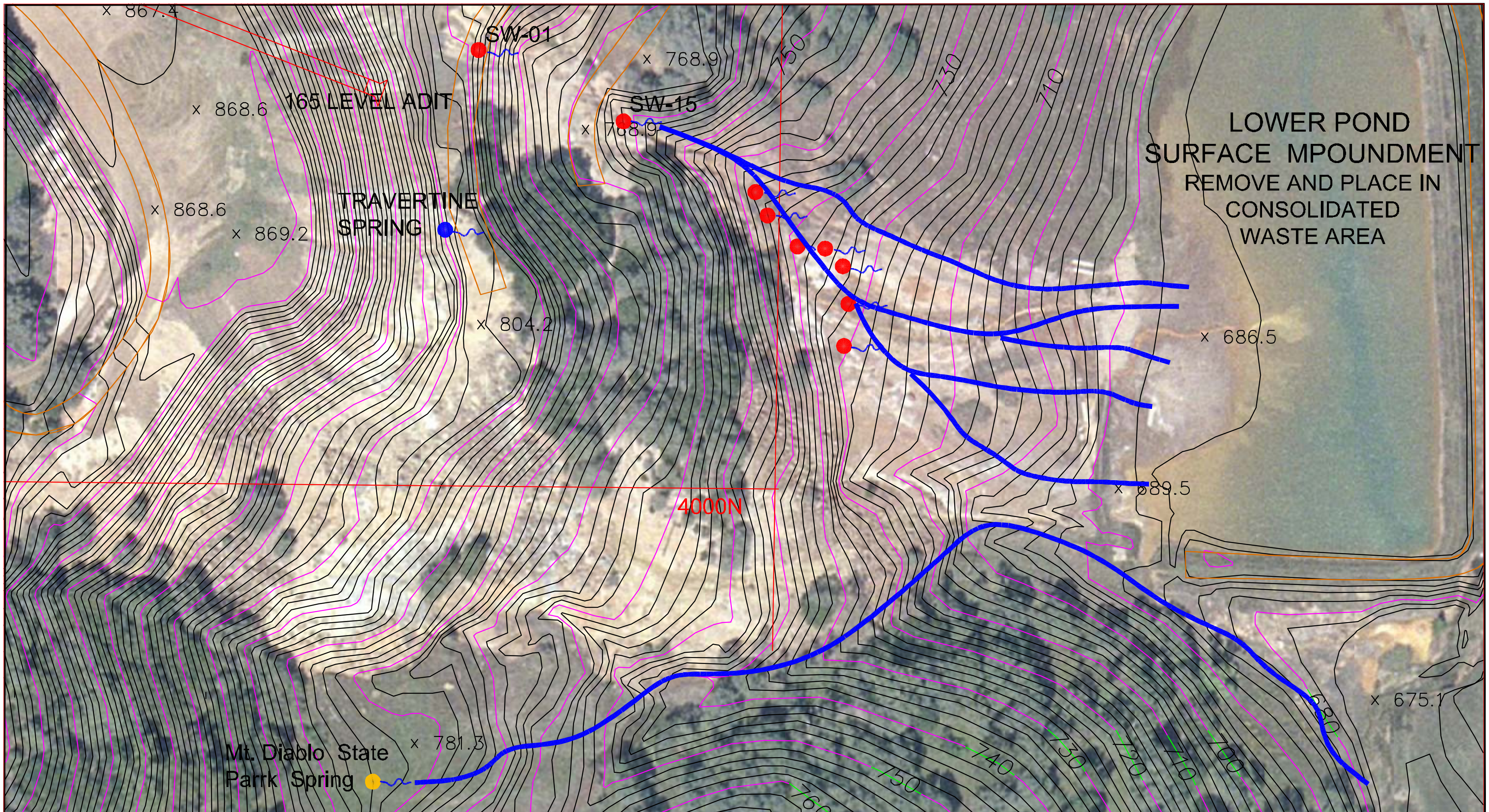
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

2004 AERIAL PHOTO WITH MINE FEATURES

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE
2-2



LEGEND

- SPRING DISCHARGE & SEEPS
- PRE-MINING LOCATION OF TRAVERTINE SPRING
- 165 LEVEL ADIT BURIED PORTAL
- TOPOGRAPHIC CONTOUR INTERVAL = 2 ft
- MT. DIABLO STATE PARK SPRING
- SPRING SEEPS FLOW DIRECTION

N

0 60 120
HORIZONTAL SCALE IN FEET

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
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MINE SPRINGS AND SEEPS

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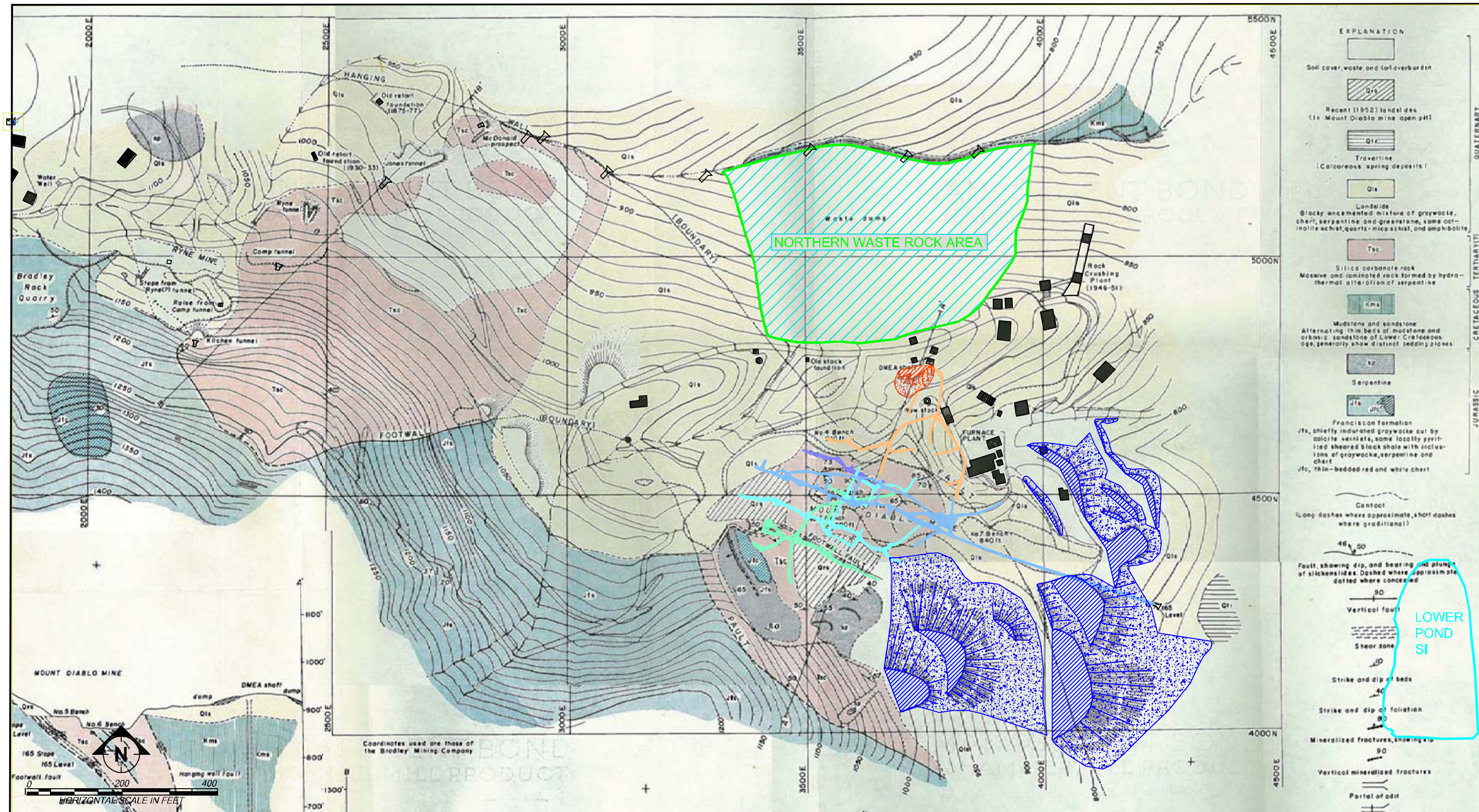
FIGURE 2-3



LEGEND

- Mine Structure (1953)
- Tailings/Waste Rock (Bradley)
- Tailings/Waste Rock (DMEA/Cordero)
- *Adit Level*
- 80-ft Level
- 165-ft Level
- 270-ft Level
- 360-ft Level

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

SITE GEOLOGY FROM PAMPEYAN

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

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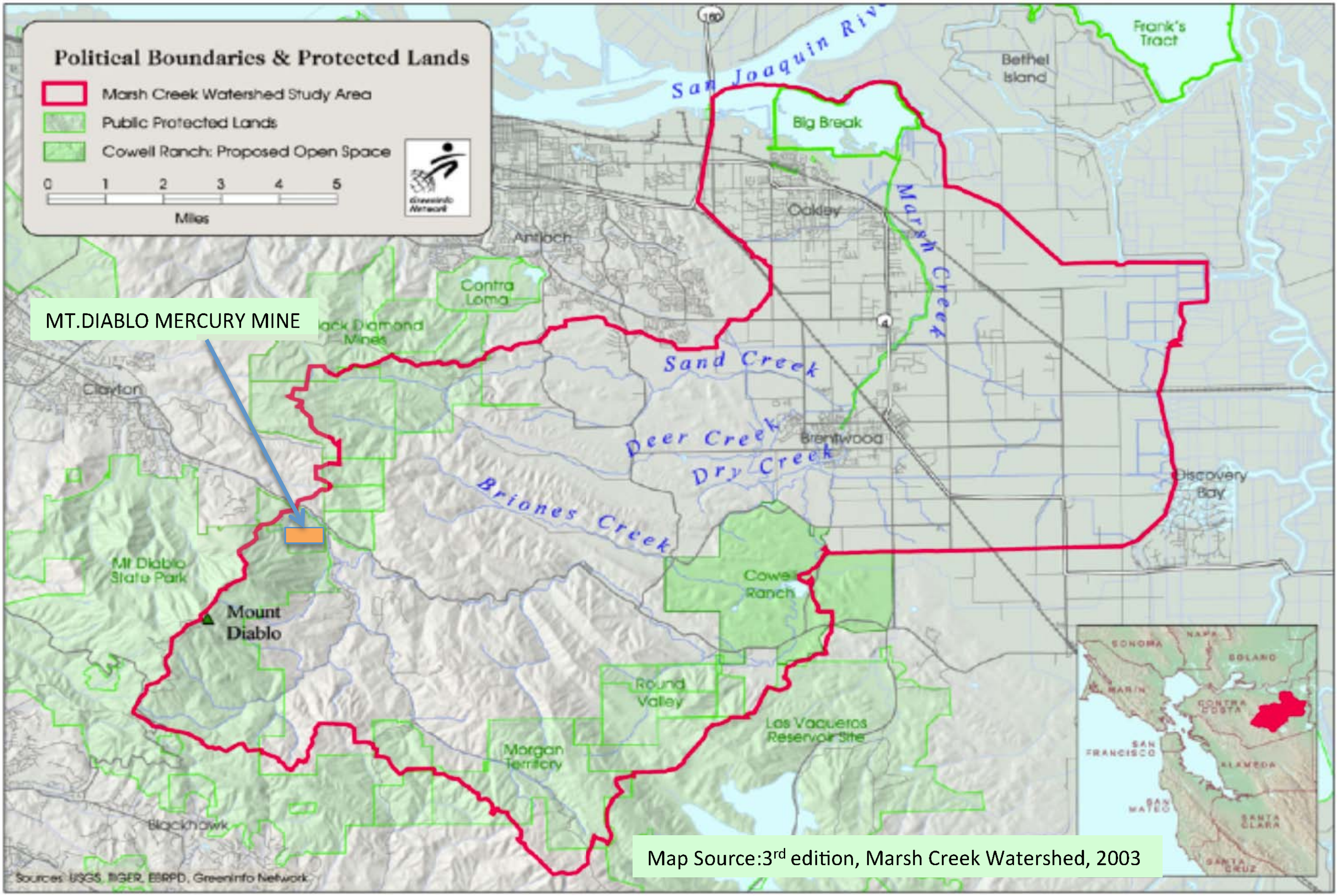
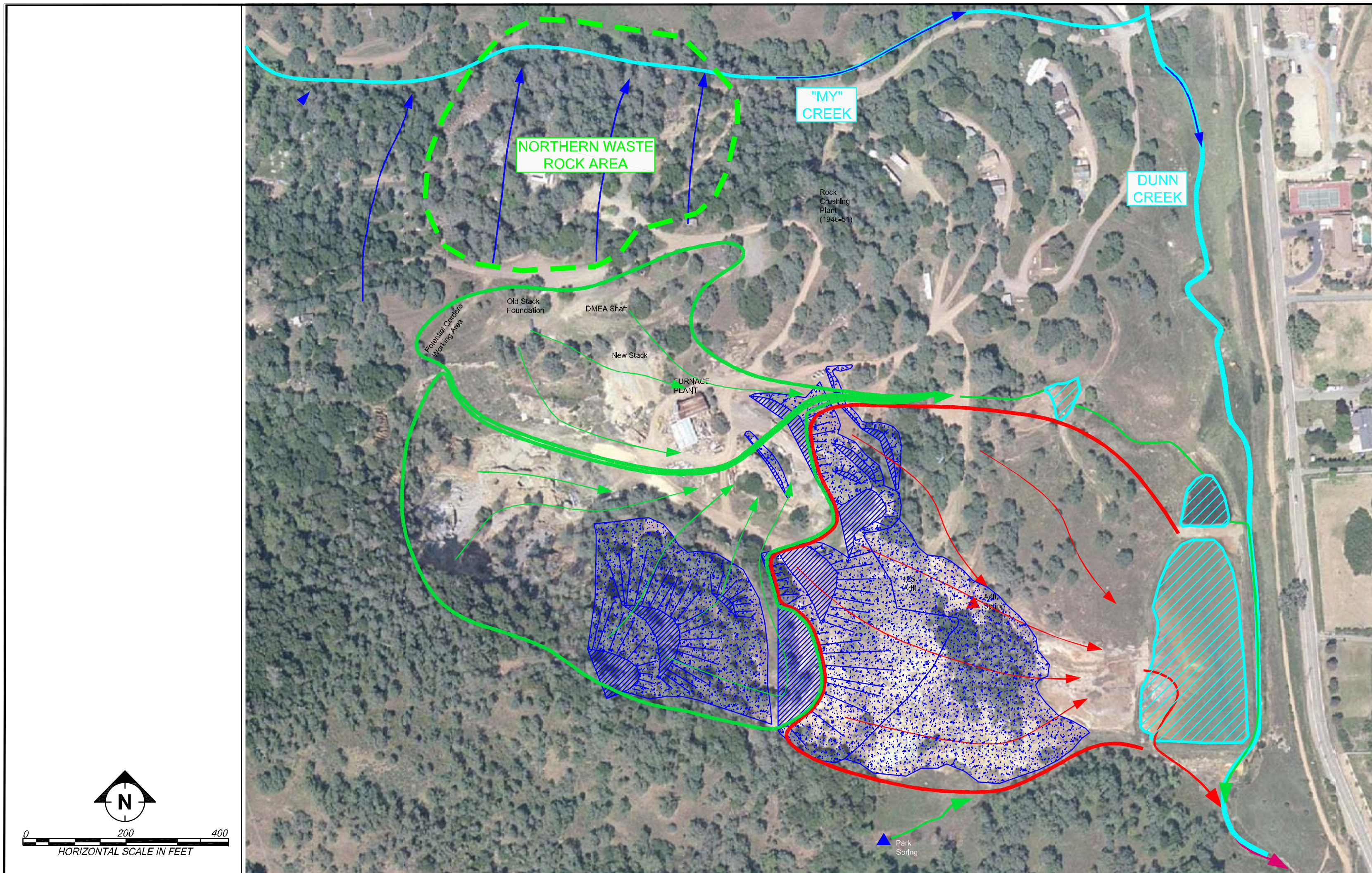
PLEASANT HILL, CA 94523

FIGURE 2-4



SGI environmental THE SOURCE GROUP, INC.	MOUNT DIABLO MERCURY MINE 2430 Morgan Territory Road Contra Costa County, California		MARSH CREEK WATERSHED		
3478 BUSKIRK AVENUE, SUITE 100 PLEASANT HILL, CA 94523	FILE NAME Diablo RP Figures Landscape.PPTX	DATE 05/07/12	DR. BY: PDH	APP. BY: PDH	PROJECT No. 01-SUN-050	FIGURE 2-5



LEGEND

- Mine Structure
- Spring
- Pond (2004 Configuration)
- Tailings/Waste Rock (Bradley)
- Surface flow (green)
- Surface flow (red)

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

SURFACE WATER DRAINAGE AND FLOW PATTERNS

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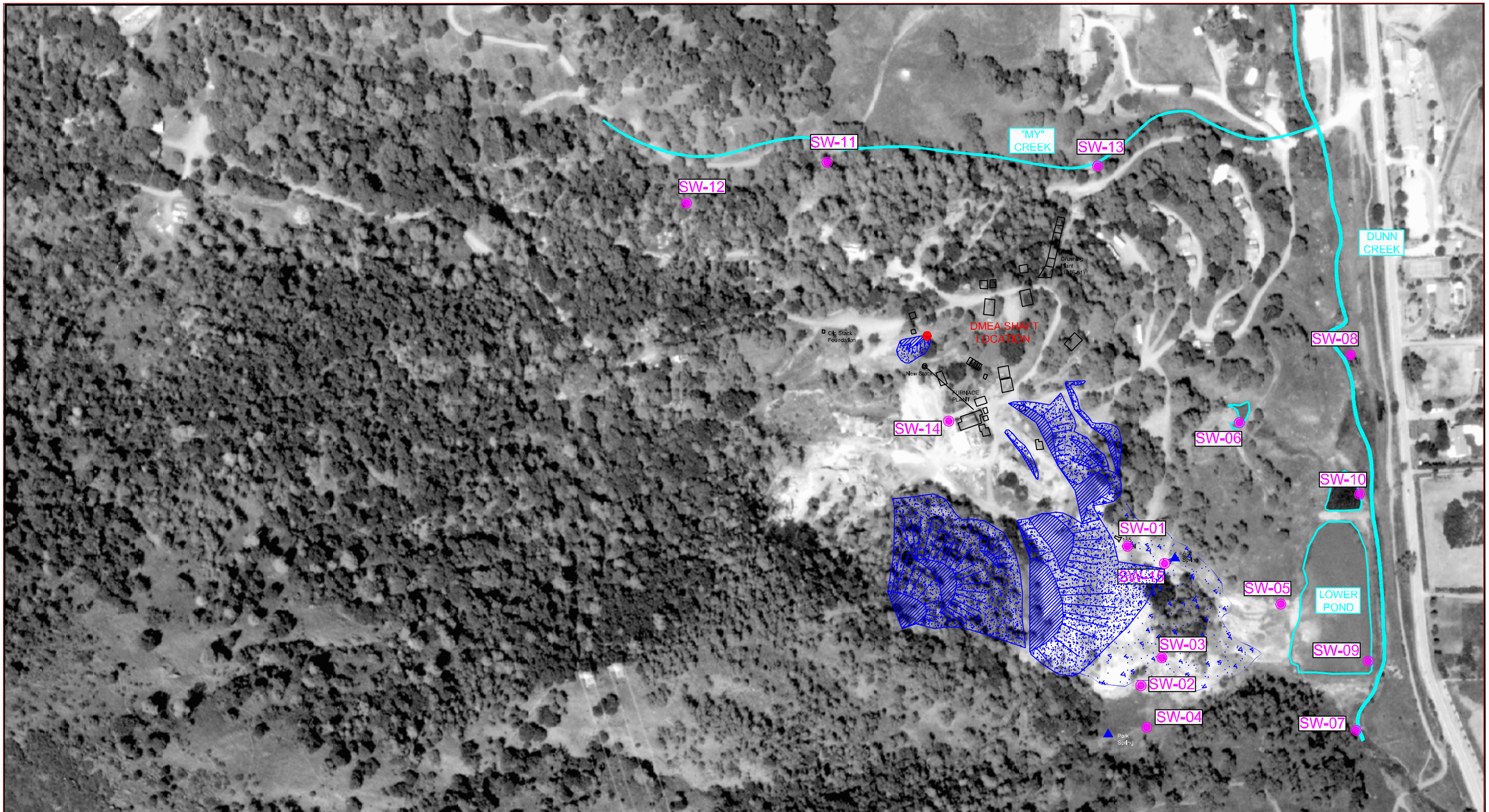
PLEASANT HILL, CA 94523

FIGURE 2-6



LEGEND

Mine Structure (1953)

Tailings/Waste Rock (BRADLEY)

Surface Water Sample Locations

HORIZONTAL SCALE IN FEET (0, 250, 500)

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

SGI SURFACE WATER SAMPLING LOCATIONS 2010

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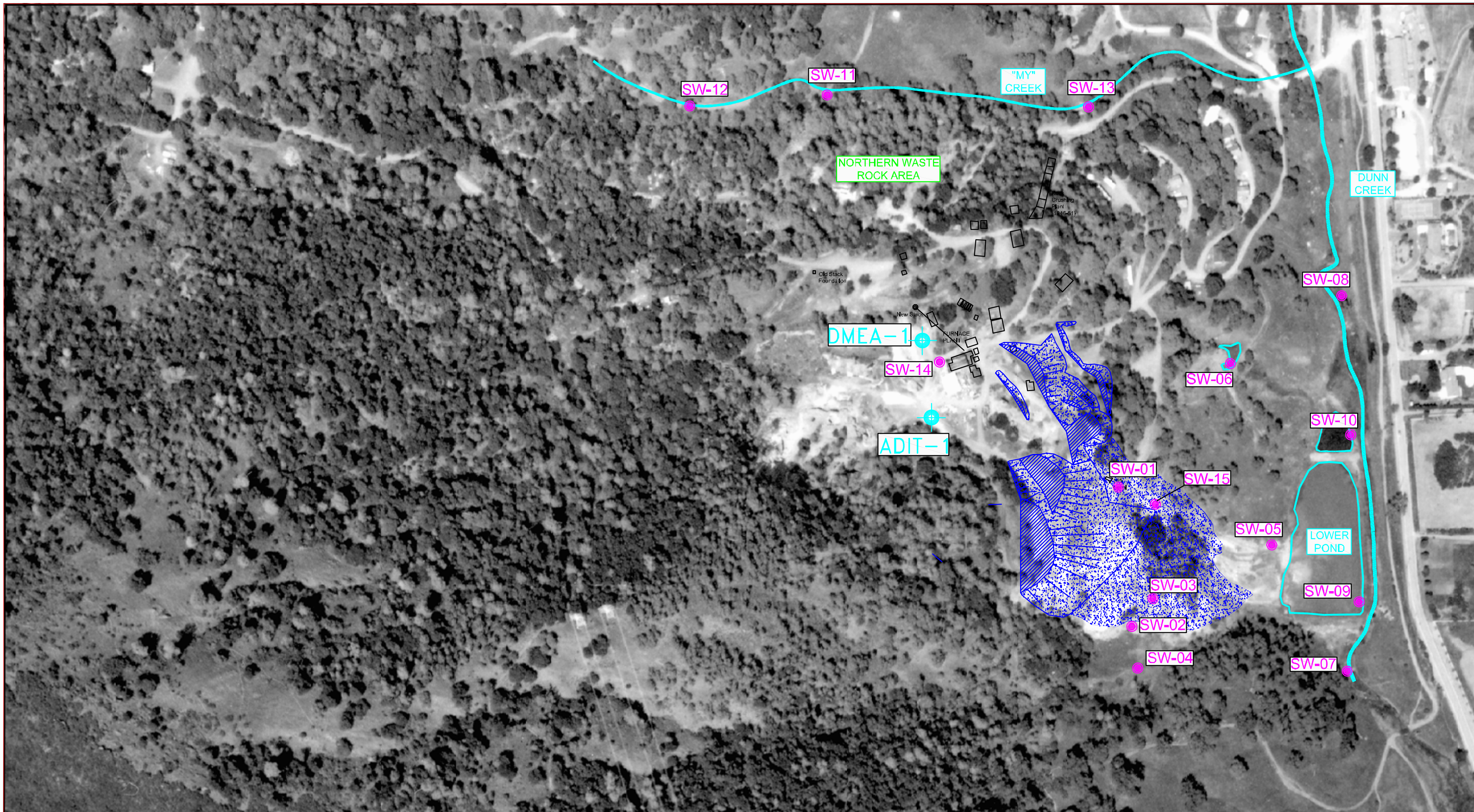
PLEASANT HILL, CA 94523

FIGURE 2-7



LEGEND

- Mine Structure (1953)
- Tailings/Waste Rock (BRADLEY)
- Monitoring Well Location
- Surface Water Sample Location

N

0 250 500
HORIZONTAL SCALE IN FEET

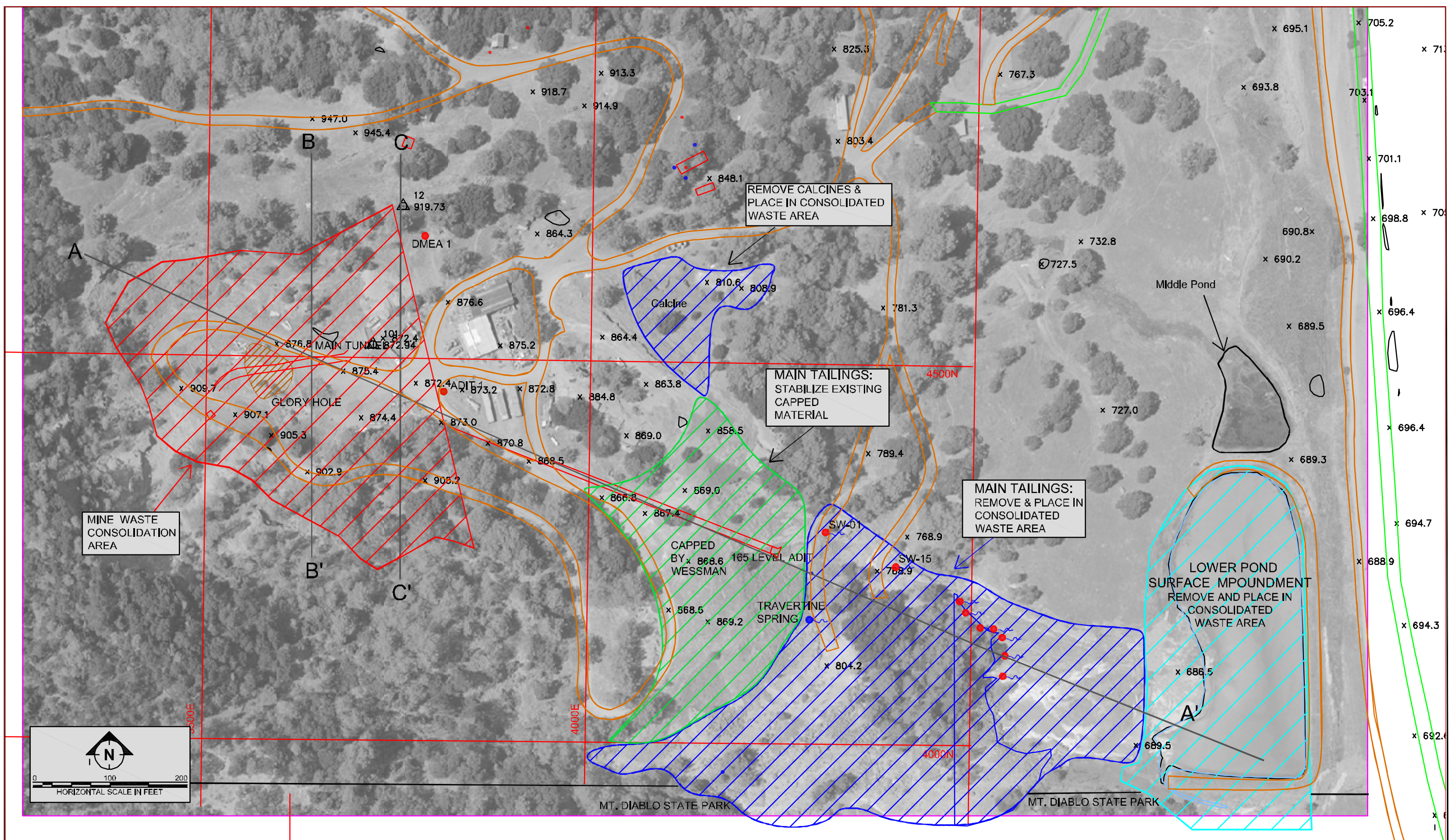
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/03/12	GT	PH

SGI SURFACE WATER SAMPLING LOCATIONS 2011

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE 2-8



LEGEND

AREA OF MAIN TAILINGS PROPOSED FOR REMOVAL AND CONSOLIDATION IN MAIN PIT AREA

AREA OF CAPPED TAILINGS

AREA OF LOWER POND FOR REMOVAL

AREA OF CALCINES TO BE REMOVED AND PLACED IN CONSOLIDATED WASTE AREA

MINE WASTE CONSOLIDATION FOOTPRINT

OUTLINE MIDDLE POND

CROSS SECTIONS LOCATIONS

SPRING DISCHARGE & SEEPS

PRE-MINING LOCATION OF TRAVERTINE SPRING

165 LEVEL ADIT BURIED PORTAL

TOPOGRAPHIC CONTOUR INTERVAL = 2 ft

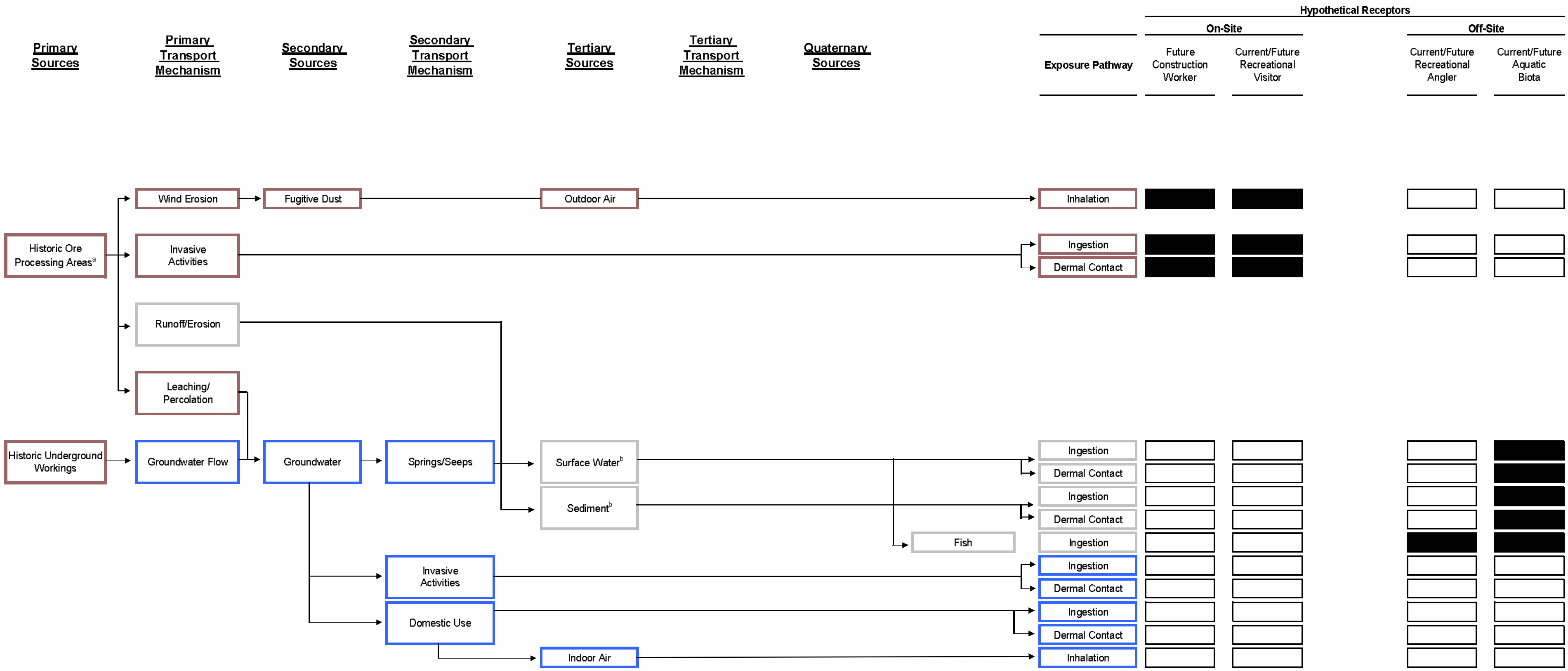
MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/07/12	GT	FH

REMEDIAL PLAN FEATURES MAP

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE
2-9



CSM components related to soil.

CSM components related to groundwater.

CSM components related to surface water and sediment.

Receptor likely to be exposed via this route, so pathway is considered potentially complete.

Receptor may be exposed via this route, so pathway is considered potentially complete; however, pathway is considered minor.

Pathway is incomplete, no further evaluation required.

[a] Historic ore processing areas include buildings, process tailings, waste rock.

[b] All surface water leaving the Mine is ultimately captured by Dunn Creek. Dunn creek flows south from the Mine Site to join Marsh Creek 0.5 miles downstream. Marsh Creek then flows approximately 11 miles to discharge into the Marsh Creek Reservoir and then into the western San Joaquin Delta at Big Break.

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY	APP. BY
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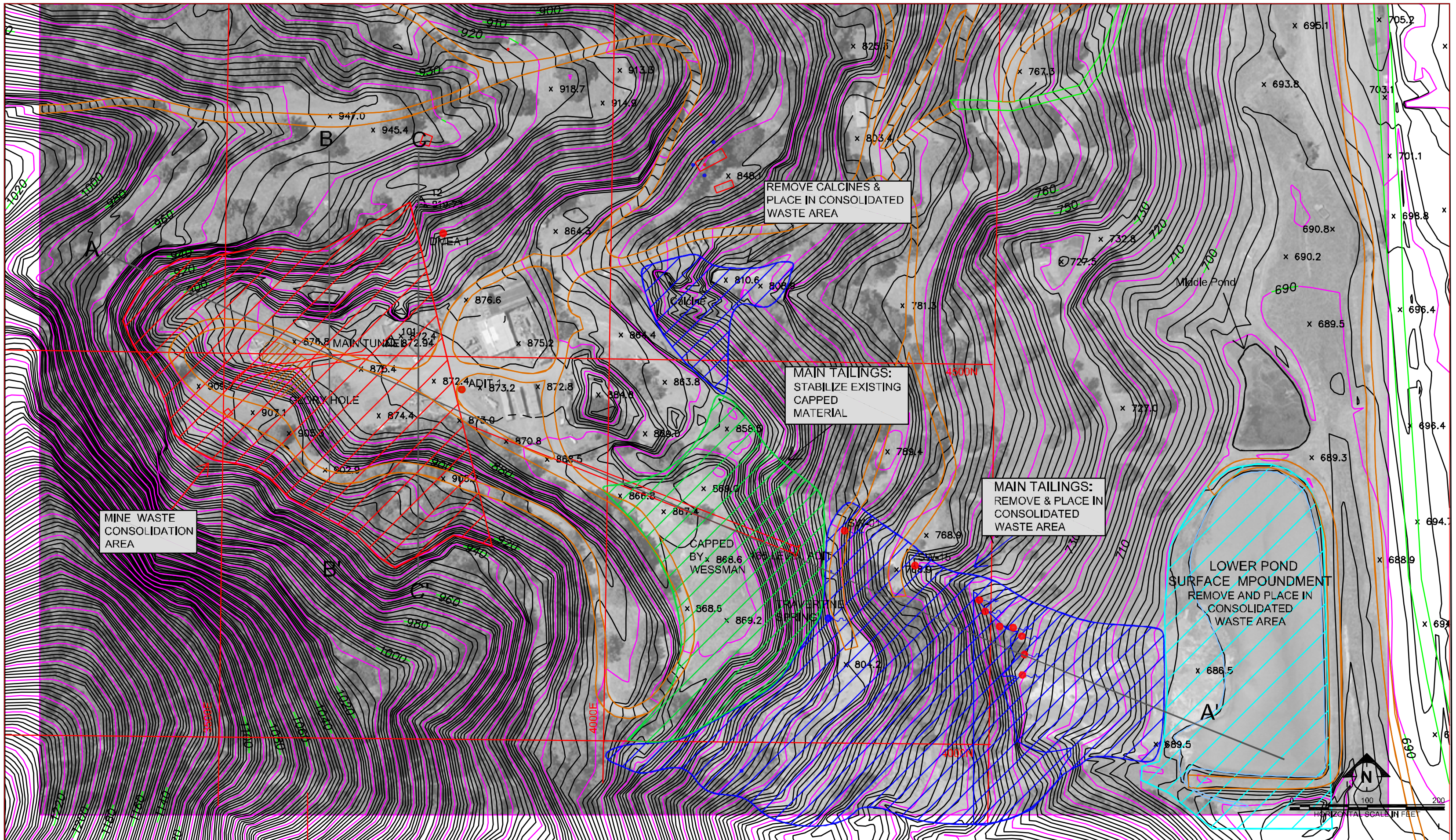
RISK SCREENING CONCEPTUAL SITE MODEL

SGI environmental THE SOURCE GROUP, INC.
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE 2-10



LEGEND

AREA OF MAIN TAILINGS PROPOSED FOR REMOVAL AND CONSOLIDATION IN MAIN PIT AREA

AREA OF CAPPED TAILINGS

AREA OF LOWER POND FOR REMOVAL

AREA OF CALCINES TO BE REMOVED AND PLACED IN CONSOLIDATED WASTE AREA

MINE WASTE CONSOLIDATION FOOTPRINT

OUTLINE MIDDLE POND

CROSS SECTIONS LOCATIONS

SPRING DISCHARGE & SEEPS

PRE-MINING LOCATION OF TRAVERTINE SPRING

165 LEVEL ADIT BURIED PORTAL

TOPOGRAPHIC CONTOUR INTERVAL = 2 ft

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/05/12	GT	PH

REMEDIAL PLAN FEATURES WITH TOPOGRAPHY

SGI environmental
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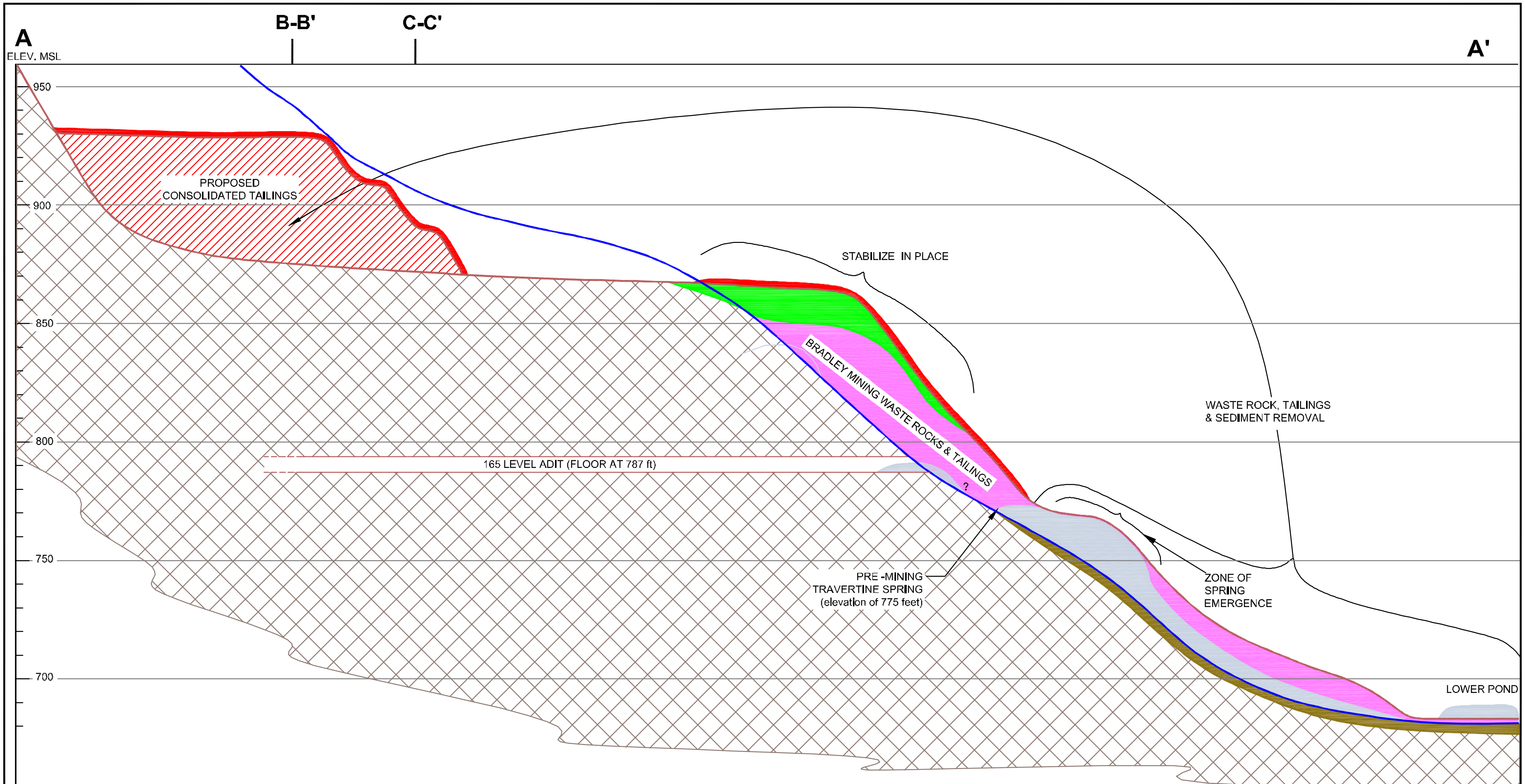
3478 BUSKIRK AVE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE 3-1



LEGEND

- SITE TOPOGRAPHY 2010
- SITE TOPOGRAPHY 1938
- PROPOSED CONSOLIDATED TAILINGS AND SEDIMENT
- BRADLEY MINING ROCK AND TAILINGS
- POND AND/OR SPRING WATER
- CAPPING BY WESSMAN
- PROPOSED CAPPING
- TRAVERTINE DEPOST
- BEDROCK

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=40'

N

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CALIFORNIA

TOPOGRAPHIC CROSS SECTION A-A'

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
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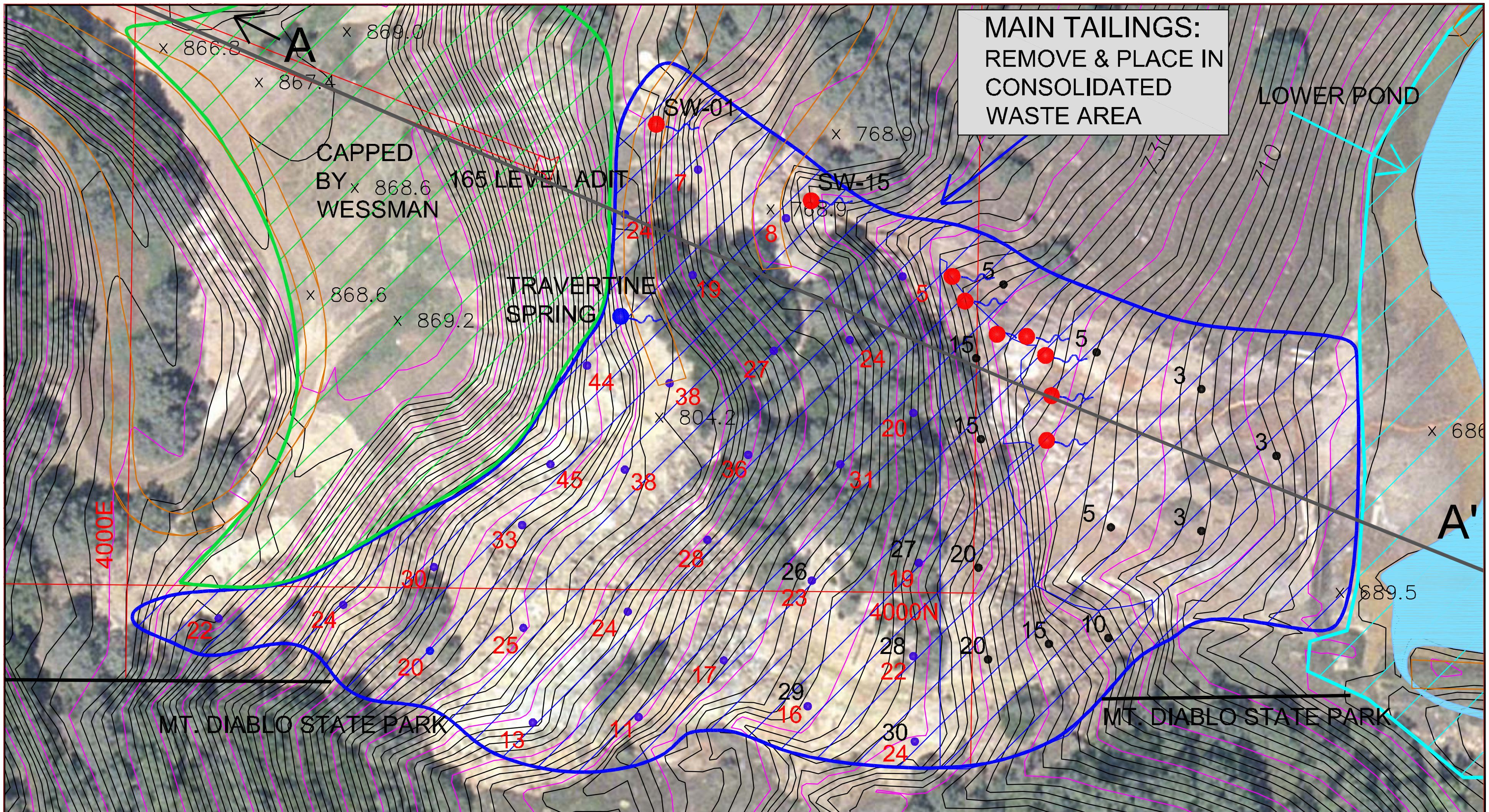
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

FIGURE
3-2



LEGEND

OUTLINE OF AREA OF MAIN TAILINGS PROPOSED FOR REMOVAL AND CONSOLIDATION IN MAIN PIT AREA

AREA OF MAIN TAILING USED TO STABILIZE EXISTING CAPPED MATERIAL

TOPOGRAPHIC CONTOUR INTERVAL = 2 ft

N

0 50 100
HORIZONTAL SCALE IN FEET

9 WASTE THICKNESS (ft)

9 ESTIMATED WASTE THICKNESS

SPRING DISCHARGE & SEEPS

PRE-MINING LOCATION OF TRAVERTINE SPRING

165 LEVEL ADIT BURIED PORTAL

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-055	05/07/12	GT	PH

THICKNESS MAP / MAIN TAILINGS
PROPOSED FOR REMOVAL

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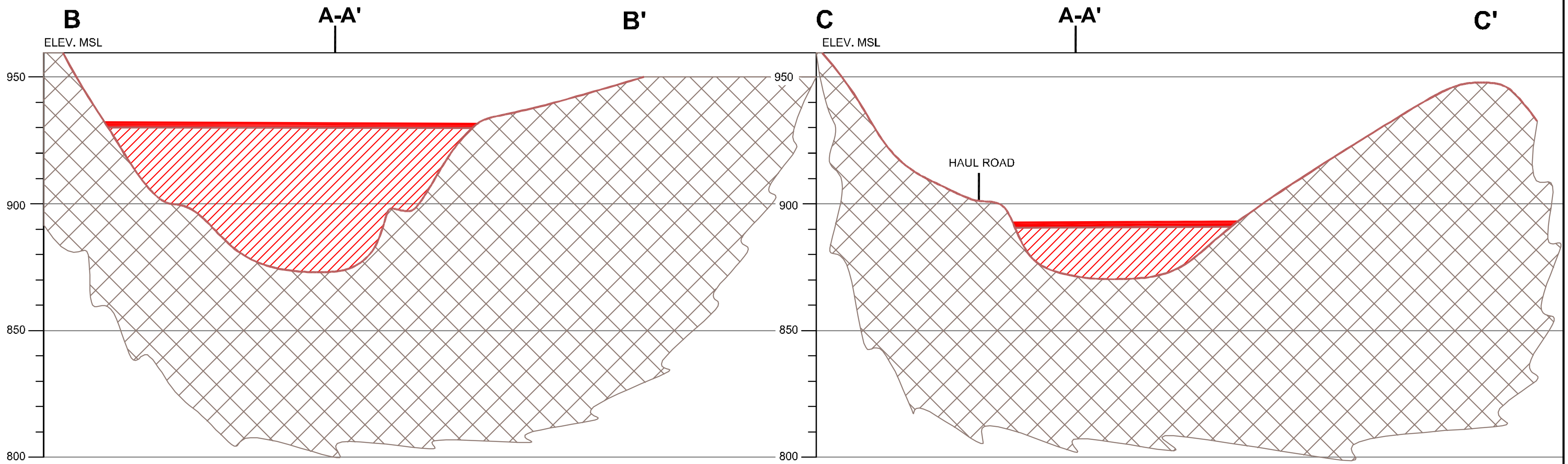
PLEASANT HILL, CA 94523

FIGURE
3-3



LEGEND

SITE TOPOGRAPHY 2010

PROPOSED CAPPING

PROPOSED CONSOLIDATED TAILINGS AND SEDIMENT

BEDROCK

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=40'

N

MOUNT DIABLO MERCURY MINE
2430 MORGAN TERRITORY ROAD
CONTRA COSTA COUNTY, CALIFORNIA

PROJECT NO.	DATE	DRAWN BY:	APP. BY:
01-SUN-0050	04/23/12	ZA	PDH

CROSS SECTION B-B'
CROSS SECTION C-C'

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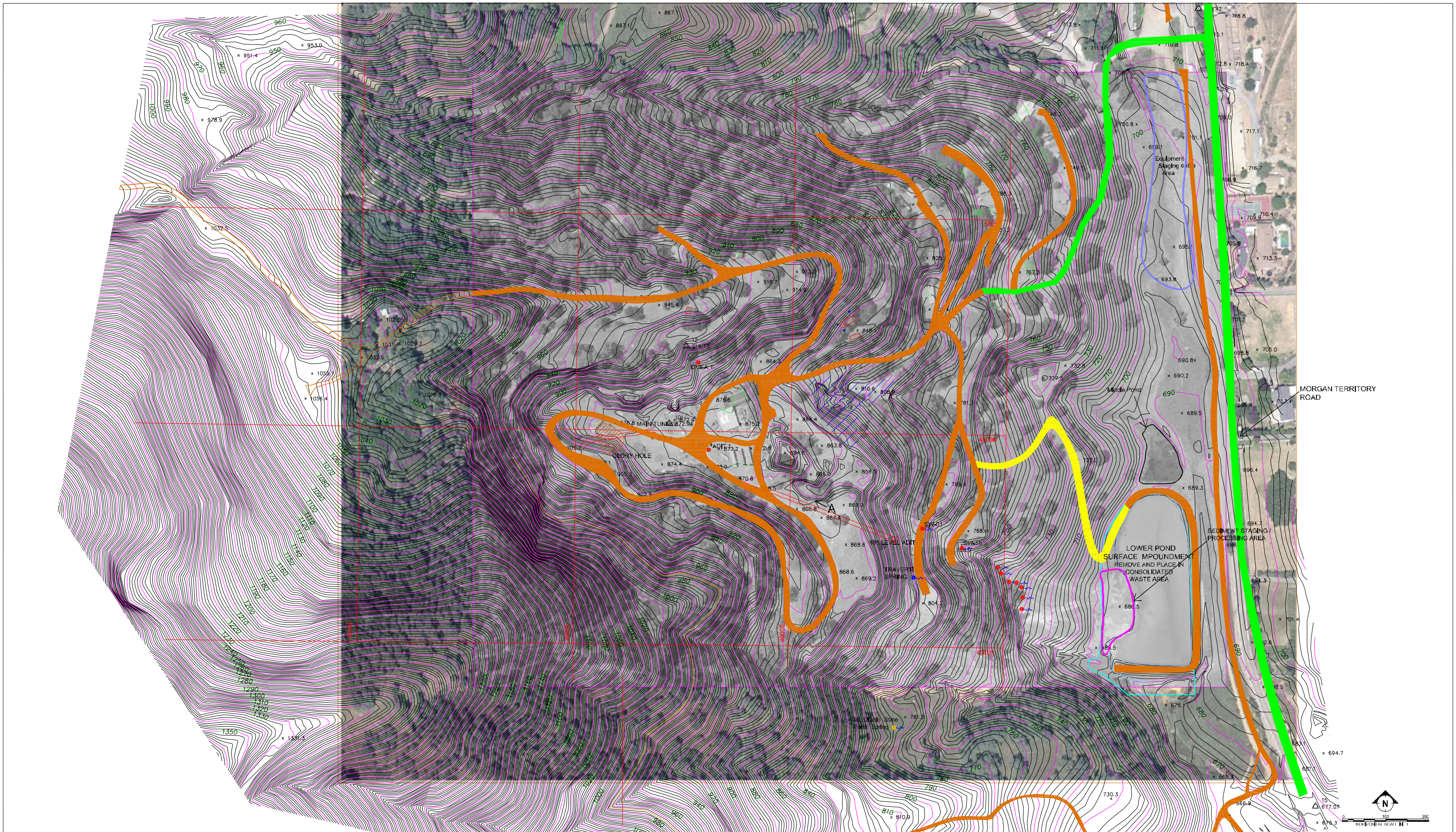
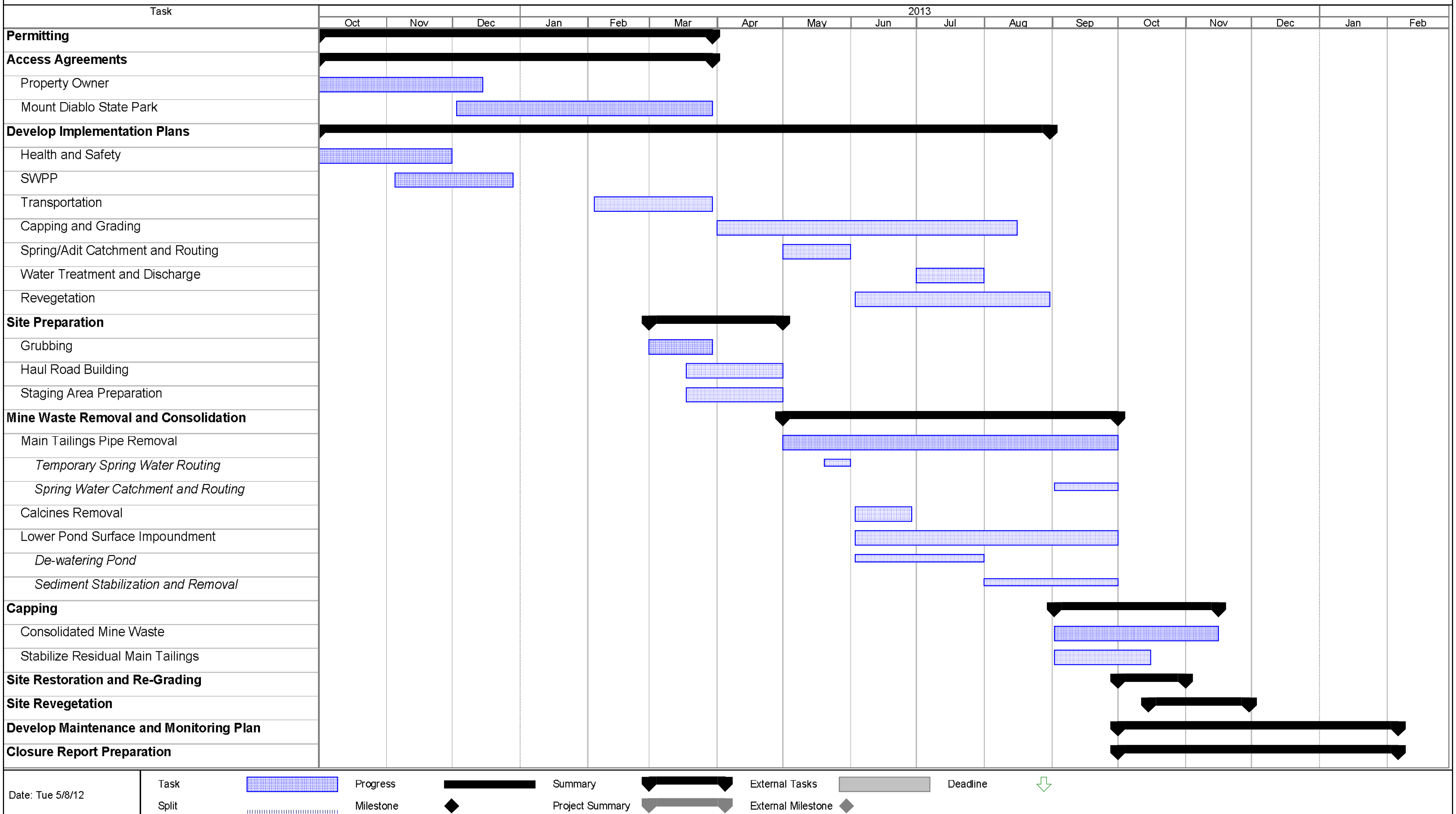
PLEASANT HILL, CA 94523

FIGURE
3-4



MOUNT DIABLO MERCURY MINE 2430 MORGAN TERRITORY ROAD CONTRA COSTA COUNTY, CA				Roads and Staging Areas	
PROJECT NO.	DATE	DRAWN BY:	APP. BY:	THE SOURCE GROUP, INC. 3478 BUSKIRK AVE, SUITE 100 PLEASANT HILL, CA 94523	FIGURE 4-1
[illegible]	04/23/12	GT	PH		

Figure 5-1
Conceptual Project Schedule



The Source Group, Inc.

TABLES

Table 2-1
Mine Production Statistics
Mount Diablo Mercury Mine
Contra Costa County, California

PRODUCTION STATISTICS- MOUNT DIABLO MINE "MILL WORKINGS"					
Operator	**Date**	**Cubic Yards of Ore Milled**	**Waste rock from tunnels, crosscuts,raises,shafts and stopes (cubic yards)**	**Dewater volume (acre-feet)**	**Mercury Produced, flasks**
Welch	1863	shaft and placer	NA	none	NA
Unknown	1875-1877	NA	NA	NA	1000
Mt. Diablo Quicksilver MC, operator Ericson	1930-1936	NA	NA	NA	739
leased to Bradley MC	1936-1951	78,188 (1)	24,815 (2)	161 (3)	10,455
leased Ronnie B. Smith	Sept 1951- June 1953	920 (4)	NA	NA	125 (5)
DMEA and Smith	June 1953 - Jan 1954	none	630 (6)	minor	none
DMEA, Johnson and Jonas	Jan 1954 - Feb 1954	none	67 (7)	NA	none
leased to Cordero MC	Nov 1954 - Dec 1955	none	1,228 (8)	19.5 (9)	none
leased to Nevada Scheelite Corp.	1956	none	see note (10)	see note (10)	none
Total Cubic Yards of Material Taken Out			105,848 (11)		

Notes:

(1) Table 4, Ross 1958, reported 126,664 tons of ore milled. Converted here to cubic yards above based on conversion of 1.62 tons per cubic yard (cy).

(2) Total length of workings 4,570 ft (Pampeyan 1963. p 25) x 5 feet x 7 feet x bulking factor plus 20% = 7,108 cy less (2) and (3). Included 550 ft of shafts and raises (935 cy) and stopes of 19,000 cy (Pampeyan, Plate 5).

(3) Estimate 10 gpm for 10 years.

(4) Used the ratio of ore milled to flasks produced for Bradley to estimate the amount of ore milled by Smith.

(5) DMEA internal memo dated 2/4/57. ref doc no. 2:88/384

(6) 300-ft DMEA shaft 4.5 ft x 8.5 ft (Ross 1958) plus 77 ft of tunnel at 5 ft x 7 ft on the 360 level w/ bulking factor of 20%.

(7) 43 ft of tunnel on the 360 level x 5 feet x 7 feet w/ bulking factor of 20% .

(8) 790 ft of crosscuts and drifts on the 360 level (Pampeyan, and Sheahan 1957) x 5 feet x 7 feet w/ bulking factor of 20%.

(9) Best guess; 90 gpm for 27 days to dewater the mine (ref: DMEA payment records to Smith for same) and 200 days at 10 gpm.

(10) In 1956 the Nevada Scheelite Company leased the mine and installed a deep-well pump to remove water which had risen to a point 112 feet below the collar of the shaft. Since the downstream ranchers objected to the discharge of acid mine water into the creek this work was suspended. Attention was then directed to the open pit where some exploration was done using wagon drills. A small tonnage of retort-grade ore was developed. Since this was not sufficient to satisfy the requirements of the company the lease was relinquished (Division of Mines, 1958).

(11) Sum of Ore Milled and Waste Rock

Table 2-2
Estimated Waste Volumes
Mount Diablo Mercury Mine
Contra Costa County, California

Waste Material For Removal and Consolidation	Surface Area (Square Feet)	Thickness (Feet)	Volume (Cubic Yards)
Main Tailings Pile (uncapped portion)			
Area 1 - Known Thickness	98,604	24	87,648
Area 2 - Estimated Thickness	17,650	15	9,806
Area 3 - Estimated Thickness	36,964	3.5	4,792
Calcines	20,364	10	7,542
Pond Sediments	72,570	3.5	9,407
Pond Impoundment Materials	8,112	8	2,404
Waste Below Impoundment	21,400	3	2,378
Total Waste For Removal			**123,976**

Notes:
1) Area 1 thickness determined by 1938 topo map comparison to 2010 topo map. Coverage was limited.
2) Pond sediment thickness is based on estimate provided by Iovenetti, 1989.
3) Remaining thickness values are estimates based on site review and topographic interpolation.