



DATA GAP INVESTIGATION WORK PLAN

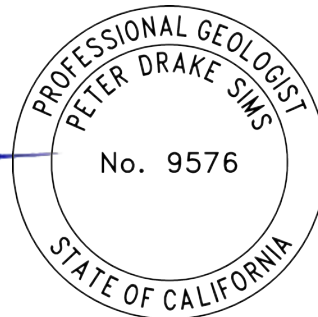
Industrial Parkway and Ruus Road Properties
1571, 1581, 1593, and 1617 Industrial Parkway West and
29469 Ruus Road
Hayward, California

Farallon PN: 1353-070

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ACRONYMS AND ABBREVIATIONS

ACDEH	Alameda County Department of Environmental Health
bgs	below ground surface
CenterPoint	CenterPoint Properties Trust
COC	constituent of concern
ESA	Environmental Site Assessment
ESL	Environmental Screening Level
DRO	total petroleum hydrocarbons as diesel-range organics
Farallon	Farallon Consulting, L.L.C.
GGP	Golden Gate Petroleum
GPS	global positioning system
GRO	total petroleum hydrocarbons as gasoline-range organics
HASP	Health and Safety Plan
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
$\mu\text{g}/\text{l}$	micrograms per liter
mg/kg	milligrams per kilogram
MMP	Media Management Plan
MTBE	methyl tertiary-butyl ether
ORO	total petroleum hydrocarbons as oil-range organics
PCE	tetrachloroethene
PID	photoionization detector
SAP	Sampling and Analysis Plan
TCE	trichloroethene
UST	underground storage tank
VOC	volatile organic compound



Water Board San Francisco Bay Regional Water Quality Control Board

Work Plan Data Gap Investigation Work Plan



1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Data Gap Investigation Work Plan (Work Plan) for CenterPoint Properties Trust (CenterPoint) to present the proposed scope of work for a Data Gap Investigation to be conducted at the property at 1571, 1581, 1593, and 1617 Industrial Parkway West and 29469 Ruus Road in Hayward, California (herein referred to as the Site) (Figure 1). The objective of the proposed scope of work is to further investigate the presence of constituents of concern (COCs) from historical releases at the Site and adjoining properties, as summarized in the *Phase I Environmental Site Assessment Report, 1571, 1581, 1593, and 1617 Industrial Parkway West, and 29469 Ruus Road, Hayward, California* dated August 2, 2022 prepared by Farallon (2022b) (2022 Phase I Report).

The Site is currently entering into the Alameda County Department of Environmental Health (ACDEH) Local Oversight Program for evaluating historical releases and COCs present in subsurface media at the Site. The results of the Data Gap Investigation will be used to determine remedial action and/or monitoring requirements to be performed in conjunction with redevelopment of the Site for commercial/industrial use. The redevelopment plan includes the demolition of existing buildings and underground utilities to construct a new commercial/industrial building on the southern portion of the Site and paved parking areas on the northern portion of the Site. The proposed building footprint is shown on Figure 2.

This Work Plan has been organized into the following sections:

- **Section 2, Site Background**, summarizes pertinent background information regarding the Site including areas of concern identified during previous investigations.
- **Section 3, Physical Setting**, provides the topography, geology, and hydrogeology of the Site.
- **Section 4, Data Evaluation and Data Gaps**, provides regulatory screening levels, COCs, an evaluation of existing data and data gaps, and the proposed scope of work to address the data gaps.
- **Section 5, Data Gap Investigation Field Program**, presents methodologies to be used during the data gap investigation.
- **Section 6, References**, provides a list of the documents cited in this Work Plan.
- **Section 7, Limitations**, presents Farallon's standard limitations applicable to this Work Plan.



2.0 SITE BACKGROUND

This section describes the Site location, current site description, Site operations, and summarizes previous environmental investigations conducted at the Site. This section also summarizes areas of concern identified on the Site.

2.1 SITE LOCATION

The Site is north of Industrial Parkway West and west of Ruus Road, approximately 570 feet northwest of the intersection of Industrial Parkway West and Ruus Road at 1571, 1581, 1593, and 1617 Industrial Parkway West, and 29469 Ruus Road in Hayward, Alameda County, California. The Site is in a mixed commercial, industrial, and residential area approximately 2.2 miles east of San Francisco Bay marshlands, and 2.3 miles west of the eastern San Francisco Bay foothills. Adjoining the property to the east are automotive repair facilities and the Golden Gate Petroleum (GGP) gasoline and diesel fuel station which is an open petroleum release case with documented impacts to soil and groundwater regulated by the Alameda County Water District. The Site vicinity is shown on Figure 1.

2.2 SITE DESCRIPTION

The Site consists of three Alameda County Parcels: No. 464-100-29-2 on the western portion of the Site totaling approximately 2.09 acres (Western Parcel); No. 464-100-31 on the central and southeastern portion of the Site totaling approximately 4.09 acres (Central Parcel); and No. 464-100-30 on the northeastern portion of the Site totaling 1.44 acres (Northeast Parcel).

The Western Parcel is developed with an approximately 17,676-square-foot commercial/industrial building completed in 1993, with the address 1617 Industrial Parkway West (1617 Building). The southern portion of the building consists of two stories of office space totaling approximately 4,200 square feet; the northern portion consists of warehouse space. The Central Parcel is developed with three metal industrial buildings completed primarily in the early 1970s with additions in the 1980s, with the addresses 1571, 1581, and 1593 Industrial Parkway West. The southeastern portion of the parcel is developed with an approximately 17,200-square-foot industrial building with the address 1571 Industrial Parkway West (1571 Building) with roll-up doors along its western side. The northwestern portion of the parcel is developed with an approximately 18,000-square-foot industrial building with the address 1581 Industrial Parkway West (1581 Building) with roll-up doors along its eastern side. The southwestern portion of the parcel is developed with an approximately 11,800-square-foot industrial building with the address 1593 Industrial



Parkway West (1593 Building) with roll-up doors along its eastern side. The Northeast Parcel is developed with a 15,600-square-foot metal industrial building completed in 1983, with the address 29469 Ruus Road (29469 Building) with roll-up doors on its east, south, and west sides. Several metal canopies were present south of the 1581 Building and a large metal canopy is attached to the northern side of the 1571 Building which is accessed from the east-adjointing GGP property. Recessed loading docks are present at the northeastern corner of the 1617 Building and the northeastern corner of the 29469 Building. The exteriors of the Site are used for parking and equipment storage and consist of degraded asphalt pavement with numerous patched areas. Concrete block or chain-linked fencing surrounds the Site boundary, with landscaping along Industrial Parkway West. The Site can be accessed from Industrial Parkway West and Ruus Road.

A Site Plan is shown on Figure 2.

2.3 SITE OPERATIONS

The Site is owned by CenterPoint Properties Trust, a Maryland real estate investment trust; CenterPoint 1571 Industrial LLC, a Delaware Limited Liability Company; and CenterPoint Ruus LLC, a Delaware Limited Liability Company. The Site is occupied primarily by automotive repair and service companies. In general, the majority of the tenants use automotive repair and maintenance chemicals and generate automotive chemical wastes.

2.4 PLANNED REDEVELOPMENT

Current plans for Site redevelopment include demolishing the existing commercial/industrial buildings and underground utilities to construct a commercial/industrial building on the southern portion of the Site with paved parking areas on the northern portion of the Site. The proposed building will consist of a concrete slab foundation at loading dock height above the surrounding grade. It is anticipated that Site redevelopment will require the import of clean fill material and grading/rebalancing of existing Site soil. The proposed building footprint is shown on Figure 2. The Site currently is undergoing entitlements for commercial/industrial redevelopment. Site redevelopment will be performed in accordance with the Media Management Plan (MMP) to be prepared for the Site based on the findings obtained from the implementation of this Work Plan. The MMP is discussed further in Section 4.3, Presumptive Remedies.



2.5 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

In addition to the 2022 Phase I Report, Farallon previously prepared the following environmental reports for the Site:

- *Phase I Environmental Site Assessment Report, 1617 Industrial Parkway West, Hayward, California* dated May 21, 2018 prepared for CenterPoint (Western Parcel Phase I Report).
- *Phase I Environmental Site Assessment Report, 1571, 1581, and 1593 Industrial Parkway West, Hayward, California* dated August 30, 2021 prepared for CenterPoint (Central Parcel Phase I Report).
- *Phase II Environmental Site Assessment Report, 1571, 1581, and 1593 Industrial Parkway West, Hayward, California* dated December 1, 2021 prepared for CenterPoint 1571 Industrial LLC (Central Parcel Phase II Report).
- *Phase I Environmental Site Assessment Report, 29469 Ruus Road, Hayward, California* dated December 8, 2021 prepared for CenterPoint (Northeast Parcel Phase I Report).
- *Phase II Environmental Site Assessment Report, 29469 Ruus Road, Hayward, California* dated January 14, 2022 prepared for CenterPoint (Northeast Parcel Phase II Report).
- *Data Gap Investigation, 29469 Ruus Road, Hayward, California* dated October 20, 2022 prepared for CenterPoint (Northeast Parcel Data Gap Investigation).

The Western Parcel Phase I Report did not identify recognized environmental conditions in connection with the Western Parcel. The Central Parcel Phase I Report and the Northeast Parcel Phase I Report identified releases or potential releases in connection with the Central Parcel, the Northeast Parcel, and the east-adjointing GGP property.

In response to the identified releases or potential releases, Farallon performed Phase II Environmental Site Assessments (ESAs) and a Data Gap Investigation, described in the Central Parcel Phase II Report, the Northeast Parcel Phase II Report, and the Northeast Parcel Data Gap Investigation. The investigations were performed over several phases, and included advancing 50 borings for collection of soil, soil gas, and/or groundwater samples for laboratory analysis. The findings from the Phase II ESAs identified various industrial constituents in subsurface media exceeding the San Francisco Bay Regional Water Quality Control Board (Water Board) Environmental Screening Levels (ESLs). Cumulative laboratory



analytical results are presented in Tables 1 through 8. Sample locations are shown on Figure 2.

Based on the findings from the previous environmental studies, Farallon identified the following areas of concern present on the Site:

- Tetrachloroethene (PCE) and trichloroethene (TCE) in subslab soil gas beneath the 1581 Building at concentrations exceeding the commercial/industrial ESL;
- Naphthalene in subslab soil gas beneath the 29469 Building at concentrations exceeding the commercial/industrial ESL;
- Widespread petroleum impacts to groundwater beneath the Site;
- Residual petroleum impacts associated with the former waste oil underground storage tank (UST) identified as Tank 6 and formerly used by GGP proximate to the 1571 Building;
- Benzene and chloroform in soil gas at concentrations exceeding commercial/industrial ESLs;
- Total petroleum hydrocarbons as oil-range organics (ORO) in shallow soil south of the 1593 Building; and
- Nickel in soil on the northern portion of the Site.

The 2022 Phase I Report was prepared in preparation for redevelopment of the combined properties and the findings were similar to the previous Phase I ESAs.

In addition to the above documents, Farallon performed an interim preferential pathway survey on August 16 and 17, 2022 to locate underground utilities that may act as preferential pathways. A visual survey of the Site was performed to locate cleanouts and drains. Then an in-depth survey crossing the Site on a grid using ground penetrating radar and electromagnetic instruments was performed. Locations of underground utilities were marked on the ground surface using paint and recorded using global positioning system (GPS) equipment. Depths of underground utilities were generally between 2 and 4.5 feet below ground surface (bgs) which was determined by opening sewer cleanouts and storm drain catch basins. Water flow in the sewer and storm drains was observed to be impeded by blockages. Locations of underground utilities investigated are shown on Figure 2.

The above areas of concern are further evaluated in Section 4, Data Evaluation and Data Gaps.



3.0 PHYSICAL SETTING

The topography, geology, and hydrogeology of the Site are described in this section.

3.1 TOPOGRAPHY

As part of the 2022 Phase I Report, Farallon reviewed the U.S. Geological Survey topographic map for Hayward, California dated 2015. The map depicts the Site at an elevation of approximately 14 feet above mean sea level. Site topography is relatively flat. Regional topography is generally flat, with a slight slope down to the south-southwest toward San Francisco Bay.

3.2 GEOLOGY AND HYDROGEOLOGY

The geology in Hayward, California is dominated by the effects of the active Hayward fault, which extends from Berkeley to south of Fremont. Areas west of the fault have been lowered to at least 1,000 feet below sea level; areas east of the fault have been uplifted to produce the Diablo Range. The area west of the fault zone consists of three coalescing alluvial fans known as the San Lorenzo Cone, which extend from Oakland to Fremont. The geology at the Site consists of Quaternary unconsolidated alluvial sediments. The upper 400 feet consists predominantly of blue or yellow silts and clays with variable amounts of sand and gravel.

According to California's Groundwater, Bulletin 118 (California Department of Water Resources 2021), the Site is located within the East Bay Plain hydrologic Basin. The East Bay Plain basin is 25 miles long and 2 to 7 miles wide. The East Bay Plain basin is bound by the San Francisco Bay to the west, San Pablo Bay to the north, the Hayward Fault to the east, and the boundary of the Alameda County Water District to the south. Shallow groundwater bearing units of the East Bay Plain basin are identified as those units above the Yerba Buena Mud, and deeper groundwater-bearing units are defined as those units below the Yerba Buena Mud. The general groundwater gradient is from the east down toward San Francisco Bay in the west. Buried stream channels may influence groundwater flow direction. Shallow groundwater within the East Bay Plain basin is generally not designated for beneficial use.

According to the 2022 Phase I Report, soil in the area consists of Clear Lake clay, which is characterized as having a high runoff potential when saturated, and restricted or very restricted water movement. Evidence of limited fill material being added to the northern portion of the Central Parcel was observed in a 1968 aerial photograph. Soil encountered at the Site during subsurface investigations consists primarily of clay with few thin to thick discontinuous gravel, sand, and silt units. Reportedly, evidence of buried stream channels



was observed in excavations at the east-adjointing GGP property during removal of USTs, but a description of the location or depth of the buried stream channels was not provided (Bonkowski and Associates, Inc. 1999). Cross sections depicting soil conditions at the Site are presented on Figures 3 and 4.

According to California State Water Resources Control Board GeoTracker database (GeoTracker database) data for the east-adjointing GGP property at 1565 Industrial Parkway West, first-encountered groundwater occurs at a depth of approximately 15 feet bgs, and static groundwater in the monitoring wells at the property was measured at depths of approximately 8 to 13 feet bgs. Based on topography, groundwater flow proximate to the Site is expected to be generally to the south-southwest, toward San Francisco Bay. However, according to GeoTracker database data for the east-adjointing GGP property, groundwater flow has been variable and has flowed in two primary directions, to the west-northwest and to the southeast.



4.0 DATA EVALUATION AND DATA GAPS

This section presents screening levels for evaluation of COCs in subsurface media, the COCs identified for the Site, and presumptive remedies under the redevelopment scenario. This section also presents areas of concern identified during previous investigations or potential areas of concern and an evaluation of data gaps for each area along with the proposed scope of work to address data gaps. Proposed sampling locations are shown on Figure 5. Samples will be analyzed in accordance with the Sampling and Analysis Plan (SAP) presented in Table 9.

4.1 REGULATORY SCREENING LEVELS

The regulatory screening levels that are used to evaluate whether a COC represents a potential risk to human health or the environment are the following:

- Soil: commercial/industrial ESLs and construction worker ESLs were selected based on the planned redevelopment of the Site with a commercial/industrial building and paved parking areas.
- Groundwater: Tier 1 ESLs were selected as a conservative initial screening level for characterizing groundwater impacts. The commercial/industrial vapor intrusion human health risk ESLs, gross contamination ESLs, and non-drinking water odor nuisance ESLs were selected as screening levels for groundwater impacts based on the availability of screening levels for a given compound and the likely exposure route.
- Soil gas: commercial/industrial ESLs were selected based on the planned redevelopment of the Site with a commercial/industrial building and paved parking areas.

The screening levels are presented in Tables 1 through 8.

4.2 CONSTITUENTS OF CONCERN

Volatile organic compounds (VOCs) consisting of PCE, TCE, naphthalene, benzene, and chloroform were detected in soil gas at concentrations exceeding the commercial/industrial ESLs. Total petroleum hydrocarbons as gasoline-range organics (GRO), and diesel-range organics (DRO) were detected in groundwater at concentrations exceeding the Tier 1 ESLs. The Tier 1 ESLs are based on drinking water odor nuisance levels. GRO and DRO in groundwater do not have established commercial/industrial vapor intrusion human health risk ESLs. GRO and DRO were detected in groundwater at concentrations less than gross



contamination ESLs and non-drinking water odor nuisance ESLs. Because groundwater at the Site is not used for drinking water, comparison to the Tier 1 ESLs is conservative. Exceedance of the Tier 1 ESL for GRO and DRO does not represent a risk to redevelopment of the Site with commercial/industrial uses. ORO was detected in groundwater but no ESL has been established for ORO in groundwater. Nickel was detected in soil at concentrations exceeding the construction worker ESL.

4.3 PRESUMPTIVE REMEDIES

Based on the commercial/industrial redevelopment scenario, presumptive remedies have been developed for the Site, which include limitations on timing and full access to the Site for implementation of the presumed remedy during the Site redevelopment. The presumptive remedy for known release areas consists of source removal via soil excavation and off-Site disposal. Previous investigations along with the data gap investigation proposed herein will be used to define soil removal actions in known release areas if deemed warranted. For areas of concern that cannot be adequately investigated prior to demolition of current features, or areas that are more practically screened following demolition, an MMP will be developed to define methodologies and cleanup levels that will be implemented during redevelopment. The MMP will also be used to evaluate and remedy unknown conditions that may be encountered during redevelopment. The existing storm and sanitary sewer utilities will be excavated during redevelopment, and the MMP will provide procedures for inspecting the utilities during removal. The MMP will be prepared following completion of the data gap investigation proposed herein.

4.4 PCE AND TCE BENEATH THE 1581 BUILDING

Subslab soil gas data collected from beneath the 1581 Building provided evidence of a release of PCE to shallow subsurface media.

4.4.1 Data Evaluation

PCE was detected in subslab soil gas samples FSS-17 and FSS-18 at concentrations of 760 and 2,200 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), respectively, which exceeds the commercial/industrial ESL of 67 $\mu\text{g}/\text{m}^3$. PCE in soil gas was laterally characterized by soil gas samples collected at locations FSS-1 and F-24 to the north; FSS-16, F-19, F-20, and F-21 to the west; FSS-4 to the south; and F-22, F-23, and F-25 to the east. PCE in soil gas was vertically characterized by soil gas samples collected at locations F-22 and F-23. Analytical results for PCE in soil gas are shown on Figure 6 and presented in Table 8.



TCE was detected in subslab soil gas sample FSS-18 at a concentration of 120 $\mu\text{g}/\text{m}^3$, which exceeds the commercial/industrial ESL of 100 $\mu\text{g}/\text{m}^3$, but is less than the short-term action level for TCE of 270 $\mu\text{g}/\text{m}^3$. TCE in soil gas was laterally characterized by soil gas samples collected at locations F-21 and F-24 to the north; F-20 to the west; F-19, FSS-17, and F-22 to the south; and F-23 and F-25 to the east. TCE appears to be a breakdown product of PCE. Analytical results for TCE in soil gas are shown on Figure 6 and presented in Table 8.

PCE and the breakdown product TCE were not detected at concentrations exceeding the laboratory reporting limits in reconnaissance groundwater samples collected from locations F-1, F-4, F-19, F-21, F-22, F-23, F-24, F-25, and F-26. Based on the lack of detections of PCE and the breakdown product TCE in numerous reconnaissance groundwater samples, the release of PCE has not migrated vertically to groundwater and groundwater is not a source for PCE or TCE in soil gas. No data gaps were identified relating to PCE or TCE in groundwater. Groundwater flow direction beneath the Site will be further evaluated as described in Section 4.6.2. Analytical results for PCE and TCE in groundwater are shown on Figure 6 and presented in Table 6.

PCE and the breakdown product TCE were not detected in soil samples collected beneath the 1581 Building at locations F-1, F-3, and F-4 collected at depths between 4 and 5 feet bgs. Analytical results for PCE and TCE in soil are presented in Table 2.

Beneath the 1581 Building, soil between the depths of 0.5 to 1.5 feet bgs at locations F-1, F-24, and F-23 and soil between the depths of 0.5 to 2.5 feet bgs at location F-4 consists of a lens of coarse-grained soil identified as silty sand and gravelly silt. Beneath the lens of coarse-grained soil is clay with discontinuous lenses of sand and sandy silt. The clay soil is likely preventing further vertical migration of PCE and the breakdown product TCE in the subsurface which explains why PCE and TCE were detected at concentrations exceeding commercial/industrial screening levels in subslab soil gas samples, but not in soil gas samples collected at 5 feet bgs or groundwater samples beneath or in the vicinity of the 1581 Building. A cross section illustrating the soil composition beneath the 1581 Building is shown on Figure 3.

Based on the data collected during previous investigations, a release of PCE impacting shallow soil and soil gas appears to have occurred, which originated either from a surface release during historical operations within the 1581 Building or from a release to the sewer system beneath and adjacent to the west of the 1581 Building.



4.4.2 Data Gaps

Soil gas and groundwater have been sufficiently characterized and no data gaps were identified. Insufficient soil data are available to evaluate source removal of the presumed PCE impacted soil, which represents a data gap. Farallon proposes advancing 18 borings (F-27 through F-44) beneath and in the vicinity of the 1581 Building to address the data gap. Proposed sampling locations are shown on Figure 5. Soil samples will be collected at depths of 0.5, 1.5, 3.0, and 5.0 feet bgs. Modifications to the depths at which soil samples are to be collected will be made if evidence of impacts such as staining, odors, or elevated photoionization detector (PID) readings are observed. Soil samples will be analyzed in accordance with the SAP presented in Table 9.

4.5 NAPHTHALENE BENEATH THE 29469 BUILDING

Subslab soil gas data collected from beneath the 29469 Building provided evidence of a release of naphthalene to shallow subsurface media.

4.5.1 Data Evaluation

Naphthalene was detected in subslab soil gas samples R-7 and R-22 at concentrations of 17 and 39 $\mu\text{g}/\text{m}^3$, respectively, which exceeds the commercial/industrial ESL of 12 $\mu\text{g}/\text{m}^3$. Naphthalene in soil gas was laterally characterized by soil gas samples collected at locations R-23 to the west; R-8 and R-24 to the south; and R-21 to the east. Naphthalene in soil gas was vertically characterized by the 5-feet bgs soil gas sample collected at location R-20. Analytical results for naphthalene in soil gas are shown on Figure 7.

Naphthalene was not detected in reconnaissance groundwater samples collected from locations R-1, R-2, and R-3 to the west, east, and south of the 29469 Building, respectively. Based on the lack of detections of naphthalene in reconnaissance groundwater samples, groundwater is not the source for naphthalene in soil gas. Analytical results for naphthalene in groundwater are shown on Figure 7 and presented in Table 6.

Naphthalene was not detected in the soil samples collected from location R-7 at a depth of 2 feet bgs or from location R-20 at depths of 2 and 5 feet bgs located beneath the 29469 Building. Naphthalene was not detected in the soil samples collected from locations R-1, R-2, or R-3 at depths of 5, 2, and 2 feet bgs, respectively. Locations R-1, R-2, and R-3 are to the west, east, and south of the 29469 Building, respectively. Analytical results for naphthalene in soil are presented in Table 2.



Based on the data collected during previous investigations, a release of naphthalene impacting shallow subsurface media appears to have occurred, which likely originated from a minor surface release during historical operations within the 29469 Building.

4.5.2 Data Gaps

Data gaps were not identified for the presence of naphthalene beneath the 29469 Building, with the exception of characterizing shallow soil gas at the Site boundary north of location R-22. Farallon proposes installing a subslab probe and advancing one boring for the installation of a 5.0 feet bgs soil gas probe at one location (F-45) at the northern Site boundary. Proposed sample locations are shown on Figure 5. Soil gas samples will be collected at depths of 0.5 and 5.0 feet bgs. Soil gas samples will be analyzed in accordance with the SAP presented in Table 9. The potential presence of a naphthalene soil source location beneath the 29469 Building will be evaluated using procedures outlined in the MMP.

4.6 WIDESPREAD PETROLEUM IMPACTS TO GROUNDWATER

Groundwater across the Site has been impacted with petroleum hydrocarbons likely originating from historical operations at the east-adjointing GGP property and/or other automotive repair businesses on east-adjointing properties.

4.6.1 Data Evaluation

GRO was detected in the reconnaissance groundwater sample collected from location R-5 at a concentration of 956 micrograms per liter ($\mu\text{g/l}$) which exceeds the Tier 1 ESL of 100 $\mu\text{g/l}$. Reporting limits for GRO in reconnaissance groundwater samples R-2 through R-4, R-6, and R-12 exceeded the Tier 1 ESL. During the most recent groundwater monitoring event at the GGP property in May 2022, GRO was detected in samples collected from groundwater monitoring wells MW-8 and MW-9, proximate to the Site boundary, at concentrations of 270 and 260 $\mu\text{g/l}$, respectively, which exceed the Tier 1 ESL of 100 $\mu\text{g/l}$ (Broadbent and Associates, Inc. 2022).

DRO was detected in reconnaissance groundwater samples collected from locations R-1 through R-6, R-12, and R-16 through R-19 on the northeastern portion of the Site at concentrations ranging from 115 to 595 $\mu\text{g/l}$ which exceeds the Tier 1 ESL of 100 $\mu\text{g/l}$. During the most recent groundwater monitoring event at the GGP property in May 2022, DRO was detected in samples collected from groundwater monitoring wells MW-8, MW-9, and MW-10 at concentrations ranging from 730 to 1,300 $\mu\text{g/l}$ which exceed the Tier 1 ESL of 100 $\mu\text{g/l}$ (Broadbent and Associates, Inc. 2022).



Elevated concentrations of ORO were detected in the reconnaissance groundwater samples collected at locations F-8 and R-6 at concentrations of 1,900 and 2,350 µg/l, respectively. No groundwater ESL has been established for ORO. Groundwater samples collected from monitoring wells at the GGP property have not been analyzed for ORO since 2008. ORO has not been detected in groundwater samples collected from the GGP property since 2002. ORO is further discussed in Section 4.6, Residual Petroleum Soil Impacts at Former Waste Oil UST.

Methyl tertiary-butyl ether (MTBE) was detected in the reconnaissance groundwater samples collected from locations F-8, F-9, F-10, and F-12 at concentrations ranging from 0.56 to 1.7 µg/l, which are less than the Tier 1 ESL of 5 µg/l. During the most recent groundwater monitoring event at the GGP property in May 2022, MTBE was detected in samples collected from groundwater monitoring wells MW-3, MW-2, MW-7, MW-8, MW-9 and MW-10 at concentrations ranging from 2.0 to 16 µg/l. Detected concentrations in monitoring wells MW-2, MW-7, and MW-10 exceed the Tier 1 ESL of 5 µg/l. Concentrations of MTBE are highest at monitoring well MW-2, located on the eastern portion of the GGP property and MTBE concentrations decrease from east to west (Broadbent and Associates, Inc. 2022).

Analytical results for GRO, DRO, ORO, and MTBE in groundwater are shown on Figure 8. Analytical results for GRO, DRO, and ORO in groundwater are presented in Table 5. Analytical results for MTBE in groundwater are presented in Table 6.

The source of the petroleum hydrocarbon impacts to groundwater is likely and predominantly associated with the historical releases from leaking USTs at the east-adjointing GGP property and/or other automotive repair businesses on east-adjointing properties, although contributions from historical operations on the Site remains possible.

4.6.2 Data Gaps

Reconnaissance groundwater sampling is a screening tool, but does not provide reproducible results. Analytical results of reconnaissance groundwater samples are subject to a positive bias as a result of excessive dissolved solids that commonly occur when reconnaissance groundwater sampling methodology is used. Reliable on-Site groundwater quality and flow direction have not been established, which represents a data gap. Farallon proposes installing groundwater monitoring wells FMW-1, FMW-2, and FMW-3 near locations R-5, R-6, and F-8, respectively, where the greatest petroleum hydrocarbon impacts were found in groundwater at the Site. Proposed monitoring well locations are shown on Figure 5. Site monitoring wells will be gauged and sampled as part of the Data Gap Investigation to



further evaluate water quality and establish groundwater flow direction beneath the Site. Groundwater samples will be analyzed in accordance with the SAP presented in Table 9.

4.7 RESIDUAL PETROLEUM IMPACTS AT FORMER WASTE OIL UST

Residual petroleum impacts to soil associated with the former waste oil UST identified as Tank 6 were reportedly left in place to avoid damaging the footings on the northwestern corner of the 1571 Building when the former waste oil UST was removed. Residual petroleum impacts to soil left in place were characterized as DRO and ORO (Bonkowski and Associates, Inc. 1999). The former waste oil UST was owned by and associated with operations at the east-adjointing GGP property. Further evaluation of the residual soil impact proximate to Tank 6 cannot be completed at this time due to the presence of the 1571 Building.

4.7.1 Data Evaluation

GRO in the soil sample collected from location F-8 at 7 feet bgs, and DRO and ORO in soil samples collected from locations F-7 and F-8 at depths of 5 and 7 feet bgs, respectively, were detected at concentrations less than the commercial/industrial ESLs. Analytical results for GRO, DRO, and ORO in soil are presented in Table 1.

GRO and DRO in the reconnaissance groundwater sample collected from location F-8 were not detected at concentrations exceeding the laboratory reporting limit. ORO was detected in the reconnaissance groundwater sample collected at location F-8 at a concentration of 1,900 µg/l. No groundwater ESL has been established for ORO. Analytical results for GRO, DRO, and ORO in groundwater are shown on Figure 8 and presented in Table 5.

GRO and VOCs were not detected in the subslab soil gas sample collected at location FSS-7 at concentrations exceeding the commercial/industrial ESLs. Analytical results for GRO and VOCs in soil gas are presented in Table 8.

The source of petroleum hydrocarbon impacts to subsurface media in this area is likely the former waste oil UST identified as Tank 6.

4.7.2 Data Gaps

Soil impacted by residual petroleum hydrocarbons is not accessible for evaluation at this time due to the presence of the 1571 Building, which represents a data gap. During site redevelopment, procedures outlined in the MMP will be used to evaluate residual conditions proximate to former Tank 6, and source removal actions will be performed if warranted.



Implementation of the MMP to evaluate and manage known and unknown impacted subsurface media during site redevelopment will address the data gap presented by the residual petroleum hydrocarbon impacts to soil related to the former waste oil UST identified as Tank 6.

Reconnaissance groundwater sampling is a screening tool, but does not provide reproducible results. Analytical results of reconnaissance groundwater samples are subject to a positive bias as a result of excessive dissolved solids that commonly occur when reconnaissance groundwater sampling methodology is used. Reliable on-site groundwater quality and flow direction have not been established, which represents a data gap. Farallon proposes installing groundwater monitoring well FMW-3 near location F-8 where the ORO impacts were found in groundwater at the Site. Proposed monitoring well locations are shown on Figure 6. This monitoring well will be gauged and sampled as part of the Data Gap Investigation to further evaluate water quality and establish groundwater flow direction beneath the Site. Groundwater samples will be analyzed in accordance with the SAP presented in Table 9.

4.8 BENZENE AND CHLOROFORM IN SOIL GAS

Benzene and chloroform were detected in soil gas samples collected from select locations across the Site at concentrations exceeding commercial/industrial ESLs.

4.8.1 Data Evaluation

Benzene was detected in soil gas samples collected from 5 feet bgs soil gas probes at locations F-23, F-24, and F-25 on the northern portion of the Site at concentrations of 21, 25, and 32 $\mu\text{g}/\text{m}^3$, respectively, which exceed the commercial/industrial ESL of 14 $\mu\text{g}/\text{m}^3$. Benzene was not detected in subslab soil gas probes at concentrations exceeding the commercial/industrial ESL. Benzene was not detected in reconnaissance groundwater samples collected at the Site. Based on existing data, the likely sources for benzene in soil gas are releases to and from storm and sanitary sewers and preferential pathway migration along subsurface utility corridors.

Chloroform was detected in soil gas samples collected from subslab soil gas probes at locations FSS-13 and FSS-16 at concentrations of 37 and 50 $\mu\text{g}/\text{m}^3$, respectively, and in soil gas samples collected from 5-foot bgs soil gas probes at locations F-21 and F-25 at concentrations of 55 and 69 $\mu\text{g}/\text{m}^3$, respectively, which exceed the commercial/industrial ESL of 18 $\mu\text{g}/\text{m}^3$. Chloroform is a common by-product of chlorinated drinking water and is



commonly found proximate to sanitary sewer lines or areas where drinking water is discharged.

Analytical results for benzene and chloroform in soil gas are shown on Figure 9 and presented in Table 8.

4.8.2 Data Gaps

The detections of benzene and chloroform in soil gas samples exceeding commercial/industrial ESLs are not a threat to planned use of the Site under the redevelopment scenario since the detections occurred on the northern portion of the Site that will have no building structures. The only exception to this is the detection of chloroform in location FSS-13 on the southern portion of the Site, which is also outside the planned building footprint. Potential unknown sources will be further evaluated during redevelopment using procedures outlined in the MMP, including the removal and inspection of storm and sanitary sewers. Consequently, no data gaps exist for the current detections of benzene and chloroform. However, soil gas data has not been collected within the proposed building footprint to document that the current building design is adequately protective of future Site occupants, which represents a data gap. Farallon proposes advancing three borings (F-46, F-47, and F-48) within the proposed building footprint for the installation of 5 feet bgs soil gas probes and collection of soil gas samples. Proposed boring locations are shown on Figure 5. Soil gas samples will be analyzed in accordance with the SAP presented in Table 9.

Results of the Data Gap Investigation will be used to confirm that engineering controls are not needed for the proposed building.

4.9 ORO IN SHALLOW SOIL SOUTH OF 1593 BUILDING

ORO was detected in a soil sample collected from location F-15 near where dark staining was observed on the southern exterior of the 1593 Building.

4.9.1 Data Evaluation

ORO was detected in the soil sample collected from location F-15 at a depth of 3 feet bgs at a concentration of 1,100 milligrams per kilogram (mg/kg) which is less than the commercial/industrial ESL of 180,000 mg/kg, and the construction worker ESL of 54,000 mg/kg. Location F-15 was advanced to investigate staining observed on this portion of the Site. Analytical results for ORO in soil are presented in Table 1.



4.9.2 Data Gaps

The ORO impact to soil was not vertically delineated, which represents a data gap. To address the vertical delineation, Farallon proposes advancing a boring (F-49) to a total depth of approximately 20 feet bgs at the F-15 location near the staining observed on the 1593 Building. The proposed boring location is shown on Figure 5. Soil samples will be collected at depths of 1.0, 5.0, and 10 feet bgs. A reconnaissance groundwater sample will be collected at the first encountered groundwater which is estimated to be between 15 and 20 feet bgs. Samples will be analyzed in accordance with the SAP presented in Table 9. Lateral delineation of the ORO in soil will be completed during redevelopment in accordance with procedures outlined in the MMP.

4.10 NICKEL IN SOIL ON THE NORTHERN PORTION OF THE SITE

An aerial photograph from 1968 showed evidence of fill material being placed on the northern portion of the Site. Nickel was detected in select soil samples collected from this area of the Site at concentrations that exceed the construction worker ESL.

4.10.1 Data Evaluation

Nickel was detected in soil samples collected from locations F-3, F-4, and R-2 at depths of 4.0, 5.0, and 2.0 feet bgs, respectively, at concentrations of 140, 140, and 90.0 mg/kg, respectively, which exceed the construction worker ESL of 86 mg/kg. The impacted soil is likely associated with fill material placed on the northern portion of the Site. Nickel occurs naturally in California soil at concentrations ranging from 9 to 509 mg/kg with an average concentration of 57 mg/kg (Kearney Foundation of Soil Science 1996). Nickel in soil results are presented in Table 4.

4.10.2 Data Gaps

The presence of naturally occurring nickel in soil exceeding the construction worker ESL on the northern portion of the Site does not warrant further evaluation but should be managed through dust mitigation during construction of the parking lot on the northern portion of the Site. Procedures for dust mitigation will be outlined in the MMP.



5.0 DATA GAPS INVESTIGATION FIELD PROGRAM

A description of the data gap investigation field program is detailed in the following sections. Samples will be collected from the locations shown on Figure 5 in accordance with the SAP presented in Table 9. The field program will be implemented in accordance with the standard operating procedures presented in Appendix A and described below.

5.1 HEALTH AND SAFETY

In accordance with 29 CFR 1910, a Health and Safety Plan (HASP) is required for all field activities due to the potential for exposure to hazardous substances; however, ACDEH approval of the HASP is not required. The HASP will comply with the requirements of the Occupational Safety and Health Act of 1970 and has not been included as a component of this Work Plan.

5.2 PRE-FIELD ACTIVITIES

Prior to performing the subsurface investigation, Farallon will complete the following tasks:

- Farallon will mark the boring locations with white paint and contact USA North 811 72 hours prior to drilling, as required by law. Farallon also will contract with a private professional utility locating service to assess the proposed boring locations for the potential presence of underground utilities.
- Drilling permits will be obtained from ACDEH for the borings, soil gas probes, and monitoring wells.

5.3 BORING ADVANCEMENT

Farallon will contract with a California-licensed C-57 drilling subcontractor to advance borings for soil sampling, reconnaissance groundwater sampling, and/or installation of soil gas probes. The borings will be advanced with a hand auger or direct-push technology drill rig. Prior to each use, the drilling equipment and down-hole sampling equipment will be washed in a solution of non-phosphate detergent, double rinsed with potable water, and allowed to dry.

Borings will be continuously cored to allow Farallon staff to observe lithology. Soil cores will be collected from boreholes for logging purposes using an approximately 4-foot-long sampler that contains new acetate liners to retain relatively undisturbed soil cores. A Farallon scientist under the supervision of a California-licensed Professional Geologist or Engineer will log Site soil using the visual-manual procedures of ASTM International Standard D2488-09a for guidance, which is based on the United Soil Classification System. Soil moisture,



occurrence of groundwater, physical indications of potential contamination (e.g., odor, staining), and field-screening results obtained using a PID will be recorded on boring logs.

During drilling, soil cores will be field-screened using a PID to evaluate the potential presence of VOCs. To initiate this procedure, a sample of soil from selected depths will be placed into a ziplock bag or glass jar and covered with aluminum foil to allow for vapor buildup. After the soil is given time to off-gas, the probe tip of the PID will be inserted into the bag or through the aluminum foil and stabilized, and a reading will be recorded. Measurements of the headspace will be obtained in the parts per million by volume range for total VOCs. Soil samples will be collected in laboratory supplied glass jars or in accordance with U.S. Environmental Protection Agency Method 5035 using Terracore samplers if they are to be analyzed for VOCs. Reconnaissance groundwater samples will be collected using polyethylene tubing and a low-flow peristaltic pump.

Borings may be used for collection of soil samples, reconnaissance groundwater samples, or construction of soil gas probes for collection of soil gas samples. Upon completion, borings will be backfilled to the surface with neat cement grout using a tremie method, in accordance with applicable jurisdictional requirements.

5.4 SOIL GAS SAMPLING

The subslab and 5 feet bgs soil gas probes will be sampled in compliance with the *Advisory – Active Soil Gas Investigations* dated July 2015, prepared by the California Environmental Protection Agency (Advisory) (2015), as described below. Soil gas probes will be purged using a 6-liter Summa canister. The soil gas samples will be collected in individually certified 1-liter Summa canisters under a helium shroud following successful completion of leak-checking procedures and well purging.

5.4.1 Soil Gas Probe Installation

The soil gas probes will be installed by advancing a 2-inch-diameter boring to 6 inches below the target probe depth. One small-diameter (0.25-inch) Teflon tube with non-reactive screen attached will be inserted into the borehole. Approximately 12 inches of filter pack sand will be placed in the bottom of the boring (e.g., from depths of 5.5 to 4.5 feet bgs), with the bottom of the Teflon tubing placed midway through the filter pack sand. Following installation of the sand pack, the borehole will be grouted to the surface in approximately 6-inch lifts with hydrated bentonite; approximately 6 inches of dry granular bentonite will be emplaced between the sand pack and the hydrated bentonite grout to prevent infiltration of the hydrated bentonite into the sand pack.



A valve will be fitted to each of the aboveground ends of the tubing and will be kept closed prior to purging and sampling. Following installation, a permanent cover will be placed over each soil vapor probe for probe protection prior to sampling. The soil gas sampling probes will be allowed to equilibrate in accordance with the Advisory prior to purging and sampling.

5.4.2 Subslab Soil Gas Probe Installation

Subslab soil gas probes will be installed using a hand-held rotary hammer with a 1.5-inch-diameter drill bit to first drill a borehole to a depth of approximately 1.75 inches into the concrete slab. Second, a 5/8-inch-diameter drill bit will be used to drill a borehole to penetrate the slab and drill to a depth of approximately 1 inch into the underlying soil. A subslab soil gas probe will then be installed in the resulting borehole according to the Standard Operating Procedure, Installation and Removal of the Vapor Pin dated September 9, 2016, prepared by Cox-Colvin & Associates, Inc., provided in Appendix A.

5.5 GROUNDWATER MONITORING WELL INSTALLATION, DEVELOPMENT, AND SAMPLING

The groundwater monitoring wells will be advanced by a California-licensed C-57 contractor using a hollow-stem auger drill rig to an estimated maximum depth of 25 feet bgs. A Farallon scientist under the supervision of a California-licensed Professional Geologist or Engineer will log Site soil using the visual-manual procedures of ASTM International Standard D2488-09a for guidance, which is based on the United Soil Classification System. Soil moisture, occurrence of groundwater, physical indications of potential contamination (e.g., odor, staining), and field-screening results obtained using a PID will be recorded on boring logs. Based on soil sample analytical results obtained during previous investigations, soil samples will be submitted for laboratory analysis only if evidence of significant chemical impact is identified by the Farallon scientist. Any soil cuttings generated during the groundwater monitoring well installation will be containerized pending characterization for off-Site disposal.

Groundwater monitoring wells will be constructed using 2-inch polyvinyl chloride with 15 feet of 0.010-inch slotted screen starting approximately 5 feet above the water table. The groundwater monitoring wells will then be developed and, at least 72 hours after well development, Farallon will collect groundwater level measurements and groundwater samples from each well using low-flow groundwater sampling procedures. The top of casing elevation of the monitoring wells will be surveyed by a licensed surveyor to establish groundwater flow direction.



5.6 SAMPLE COLLECTION AND HANDLING PROCEDURES

Samples will be collected and handled in accordance with the procedures listed below:

- Soil, groundwater, and soil gas samples will be collected in laboratory provided containers.
- The sample container will be labeled with the medium, the date, the time sampled, the sample identification and number, the project name, the project number, and the sampler's initials.
- Samples will be logged on a Chain of Custody form and placed into a chilled cooler for transport to the analytical laboratory under standard chain-of-custody protocols.
- The sample location will be recorded using a portable GPS, as practical, and plotted on a georeferenced figure. Digital photographs of each sample location will be taken.

5.7 EQUIPMENT DECONTAMINATION PROCEDURES

Reusable or non-dedicated equipment that will be used in the collection of samples and will be in direct contact with soil, groundwater, and soil gas samples will be decontaminated before Farallon's arrival at the Site, between samples collected, upon transition between sample locations, and upon exit from the Site. Reusable or non-dedicated equipment will be:

- Rinsed and pre-cleaned with potable or distilled water;
- Washed in a solution of laboratory-grade non-phosphate-based soap (i.e., Alconox);
- Rinsed three times with potable or distilled water;
- Rinsed three times with laboratory-grade distilled deionized water; and
- Air dried.

If decontaminated equipment is not immediately used, it will be wrapped in aluminum foil with the dull side facing the equipment to prevent recontamination.

Field technicians will wear disposable powder-free nitrile gloves during sample collection and processing. The gloves will be replaced between sample intervals to minimize potential cross-contamination.

5.8 WASTE DISPOSAL

Disposable sampling and health and safety supplies and equipment will be disposed of in an appropriate waste dumpster. Soil cuttings, excess groundwater, and decontamination water generated during the Data Gap Investigation field program will be temporarily contained in



55-gallon U.S. Department of Transportation approved steel drums with locking lids pending receipt of laboratory analytical results. Drum storage will be coordinated with the Site owner. Laboratory analytical results from the Data Gap Investigation field program activities will be used to profile the waste and identify appropriate disposal options.

5.9 DATA GAP INVESTIGATION REPORTING

Following completion of the Data Gap Investigation field program and receipt and review of laboratory analytical reports, the data will be evaluated to support the development of the MMP and source removal. If necessary, Farallon will develop an addendum to this Work Plan to address any remaining data gaps to enable completion of the Data Gap Investigation.

A Data Gap Investigation Report describing the scope of work and procedures employed for the Data Gap Investigation will be prepared. The Data Gap Investigation Report will include:

- Background information, including a description of the Site and adjoining properties, surrounding land use and zoning, and area geology and hydrogeology;
- A summary of existing data and the phases of field investigation completed to characterize the Site;
- A discussion of the sources and nature and extent of contamination, COCs, and affected media;
- A summary of the Data Gap Investigation results and conclusions;
- Figures depicting the extent of COCs in soil, groundwater, and soil gas; and
- Tables summarizing soil, groundwater, and soil gas analytical results.



6.0 REFERENCES

- Bonkowski and Associates, Inc. 1999. *Underground Storage Tank Closure – Interim Remedial Measures Report, Golden Gate Petroleum, Hayward Bulk Petroleum Distribution Facility*. Prepared for City of Hayward Fire Department. April 21.
- Broadbent and Associates, Inc. 2022. *Second Quarter 2022 Groundwater Monitoring Report, Golden Gate Petroleum Facility #5, 1565 Industrial Parkway West, Hayward, California*. Prepared for Golden Gate Petroleum. July 31.
- California Department of Water Resources. 2021. *California’s Groundwater (Bulletin 118), Update 2020*. November 17.
- California Environmental Protection Agency, California Department of Toxic Substances Control, Los Angeles Regional Water Quality Control Board, and San Francisco Bay Regional Water Quality Control Board. 2015. *Advisory – Active Soil Gas Investigations*. July.
- Farallon Consulting, L.L.C. (Farallon). 2018. *Phase I Environmental Site Assessment Report, 1617 Industrial Parkway West, Hayward, California*. Prepared for CenterPoint Properties Trust. May 21.
- . 2021a. *Phase I Environmental Site Assessment Report, 1571, 1581, and 1593 Industrial Parkway West, Hayward, California*. Prepared for CenterPoint Properties Trust. August 30.
- . 2021b. *Phase II Environmental Site Assessment Report, 1571, 1581, and 1593 Industrial Parkway West, Hayward, California*. Prepared for CenterPoint Properties Trust. December 1.
- . 2021c. *Phase I Environmental Site Assessment Report, 29469 Ruus Road, Hayward, California*. Prepared for CenterPoint Properties Trust. December 8.
- . 2022a. *Phase II Environmental Site Assessment Report, 29469 Ruus Road, Hayward, California*. Prepared for CenterPoint Properties Trust. January 14.
- . 2022b. *Phase I Environmental Site Assessment Report, 1571, 1581, and 1593, and 1617, Industrial Parkway West and 29469 Ruus Road, Hayward, California*. Prepared for CenterPoint Properties Trust. August 2.



———. 2022b. *Data Gap Investigation, 29469 Ruus Road, Hayward, California. Prepared for CenterPoint Properties Trust.* October 20.

Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California. 1996. *Background Concentrations of Trace and Major Elements in California Soils.* March.

San Francisco Bay Regional Water Quality Control Board. 2019. *Environmental Screening Levels, Rev. 2.* July.



7.0 LIMITATIONS

7.1 GENERAL LIMITATIONS

The conclusions contained in this report/assessment are based on professional opinions with regard to the subject matter. These opinions have been arrived at in accordance with currently accepted hydrogeologic and engineering standards and practices applicable to this location. The conclusions contained herein are subject to the following inherent limitations:

- **Accuracy of Information.** Farallon obtained, reviewed, and evaluated certain information used in this report/assessment from sources that were believed to be reliable. Farallon's conclusions, opinions, and recommendations are based in part on such information. Farallon's services did not include verification of its accuracy or authenticity. Should the information upon which Farallon relied prove to be inaccurate or unreliable, Farallon reserves the right to amend or revise its conclusions, opinions, and/or recommendations.
- **Reconnaissance and/or Characterization.** Farallon performed a reconnaissance and/or characterization of the Site that is the subject of this report/assessment to document current conditions. Farallon focused on areas deemed more likely to exhibit hazardous materials conditions. Contamination may exist in other areas of the Site that were not investigated or were inaccessible. Site activities beyond Farallon's control could change at any time after the completion of this report/assessment.

For the foregoing reasons, Farallon cannot and does not warrant or guarantee that the Site is free of hazardous or potentially hazardous substances or conditions, or that latent or undiscovered conditions will not become evident in the future. Farallon's observations, findings, and opinions can be considered valid only as of the date of the report.

This report/assessment has been prepared in accordance with the contract for services between Farallon and CenterPoint, and currently accepted industry standards. No other warranties, representations, or certifications are made.

7.2 LIMITATION ON RELIANCE BY THIRD PARTIES

Reliance by third parties is prohibited. This report/assessment has been prepared for the exclusive use of CenterPoint to address the unique needs of Centerpoint at the property at 1571, 1581, 1593, and 1617 Industrial Parkway West and 29469 Ruus Road in Hayward, California at a specific point in time.

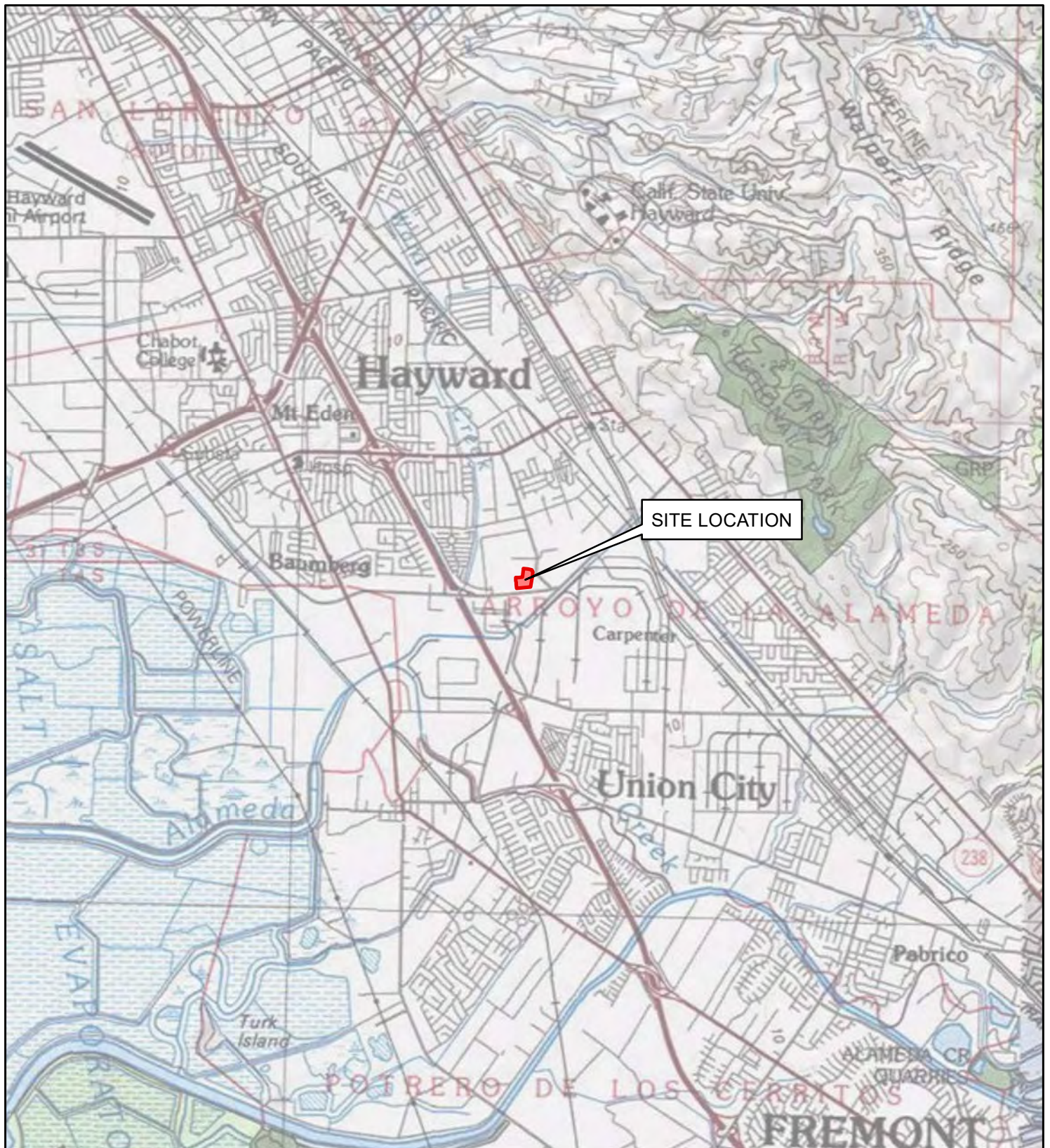


This is not a general grant of reliance. No one other than CenterPoint may rely on this report unless Farallon agrees in advance to such reliance in writing. Any unauthorized use, interpretation, or reliance on this report/assessment is at the sole risk of that party and Farallon will have no liability for such unauthorized use, interpretation, or reliance.

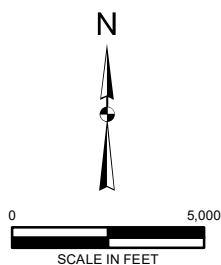
FIGURES

DATA GAP INVESTIGATION WORK PLAN
Industrial Parkway and Ruus Road Properties
1571, 1581, 1593, and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California

Farallon PN: 1353-070



REFERENCE: 7.5 MINUTE USGS QUADRANGLE NEWARK, CALIFORNIA, DATED 2013



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Issaquah | Bellingham | Seattle

Oregon
Portland | Baker City

California
Oakland | Irvine

Drawn By: Imurock

Checked By: PS

Date: 1/24/2023

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FIGURE 1

SITE VICINITY MAP
1571, 1581, 1593, AND 1617
INDUSTRIAL PARKWAY WEST
AND 29469 RUUS ROAD
HAYWARD, CALIFORNIA

FARALLON PN:1353-070



LEGEND

- | | |
|--|--|
|  MONITORING WELL ASSOCIATED WITH 1565 INDUSTRIAL PARKWAY |  MANHOLE |
|  BORING |  CLARIFIER/OIL-WATER SEPARATOR |
|  MATRIX SAMPLED |  STORM WATER CATCH BASIN |
|  SOIL |  CROSS SECTION |
|  GROUNDWATER |  STORM DRAIN |
|  SOIL GAS |  SEWER |
| UST = UNDERGROUND STORAGE TANK |  PROPOSED BUILDING FOOTPRINT |
| |  ALAMEDA COUNTY PARCEL BOUNDARY |
| | SITE BOUNDARY |

- NOTES:
1. ALL LOCATIONS ARE APPROXIMATE.
2. FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.



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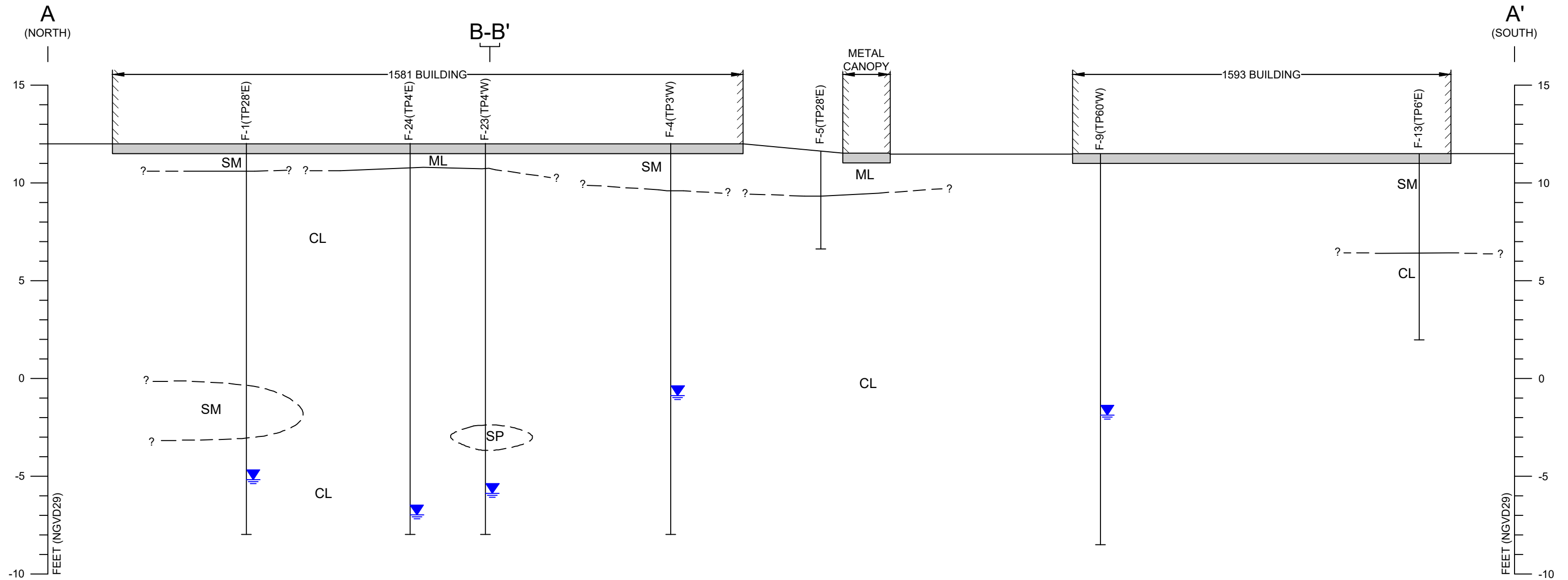
FIGURE 2

SITE PLAN
1571, 1581, 1593, AND 1617
INDUSTRIAL PARKWAY WEST
AND 29469 RUUS ROAD
HAYWARD, CALIFORNIA

FARALLON PN: 1353-070

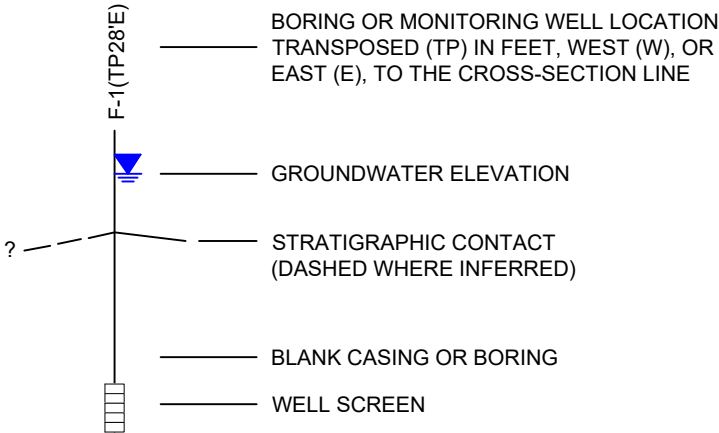
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(NGVD29) = NATIONAL GEODETIC VERTICAL DATUM OF 1929
ML, SM, SP = SOIL PRIMARILY CONSISTING OF GRAVEL, SAND, AND/OR SILT
CL = SOIL PRIMARILY CONSISTING OF CLAY



NOTES:
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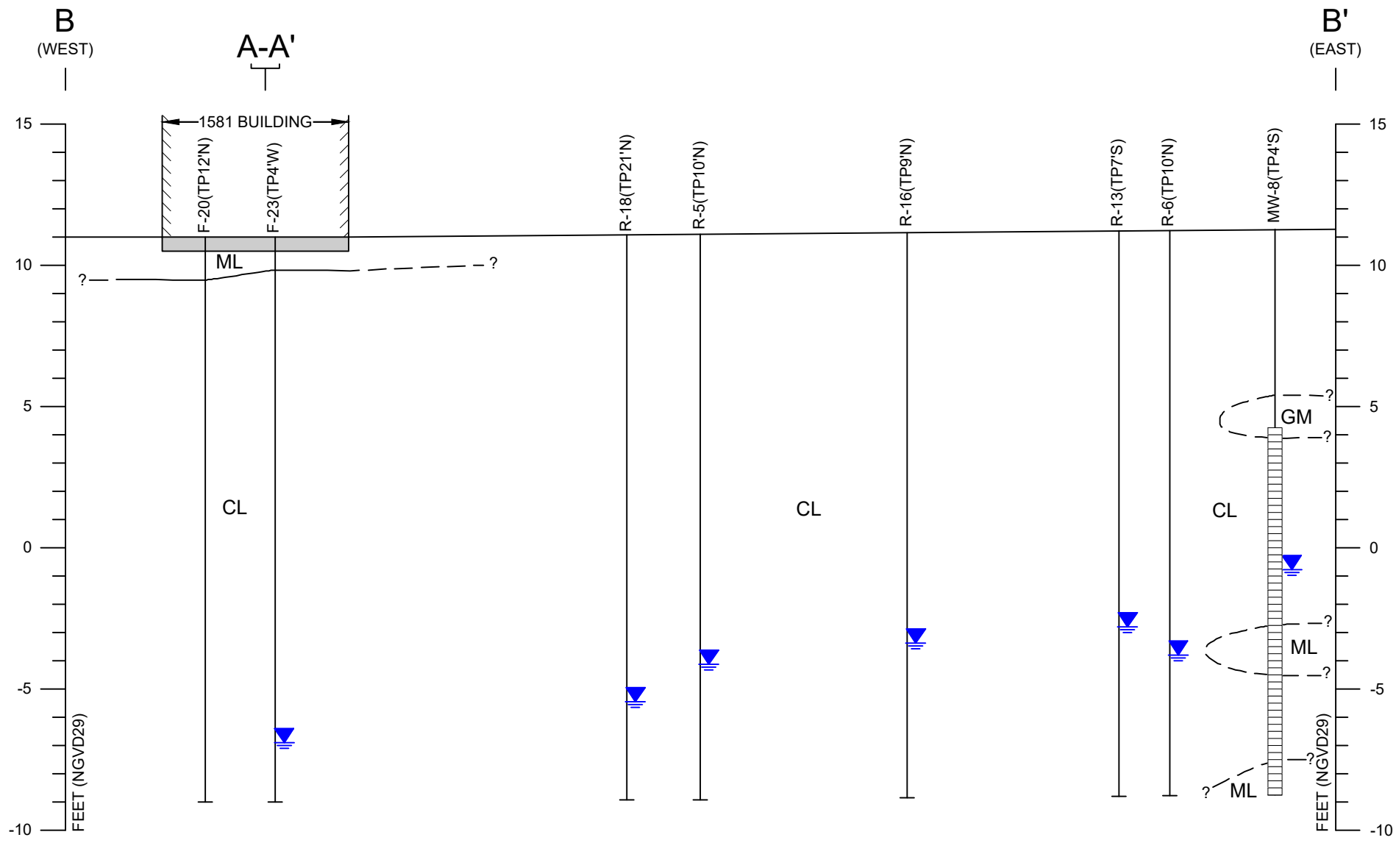
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FIGURE 3
CROSS SECTION A-A'
1571, 1581, 1593, AND 1617
INDUSTRIAL PARKWAY WEST
AND 29469 RUUS ROAD
HAYWARD, CALIFORNIA

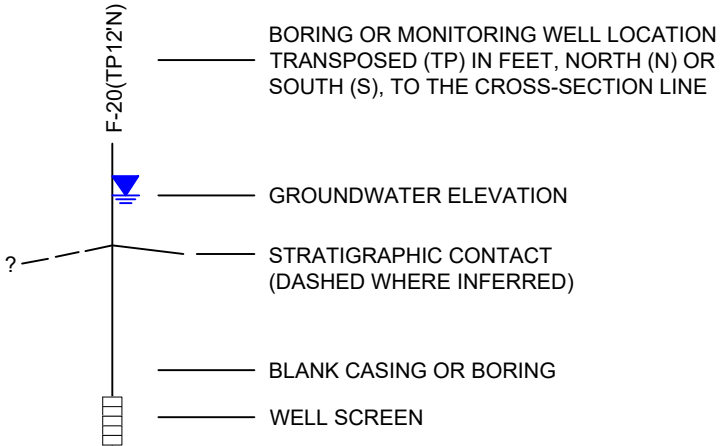
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LEGEND

(NGVD29) = NATIONAL GEODETIC VERTICAL DATUM OF 1929
GM,ML = SOIL PRIMARILY CONSISTING OF GRAVEL, SAND, AND/OR SILT
CL = SOIL PRIMARILY CONSISTING OF CLAY



- NOTES:
- ALL LOCATIONS ARE APPROXIMATE
 - FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.

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Drawn By: NM Checked By: PS

FIGURE 4
CROSS SECTION B-B'
1571, 1581, 1593, AND 1617
INDUSTRIAL PARKWAY WEST
AND 29469 RUUS ROAD
HAYWARD, CALIFORNIA
FARALLON PN: 1353-070



LEGEND

- PROPOSED SAMPLING LOCATION
- MONITORING WELL ASSOCIATED WITH GOLDEN GATE PETROLEUM PROPERTY
- BORING
- MANHOLE
- CLARIFIER/OIL-WATER SEPARATOR
- STORM WATER CATCH BASIN
- STORM DRAIN
- SEWER
- PROPOSED BUILDING FOOTPRINT
- ALAMEDA COUNTY PARCEL BOUNDARY
- SITE BOUNDARY
- UST = UNDERGROUND STORAGE TANK

NOTES:
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2. FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.



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FIGURE 5
SITE PLAN WITH
PROPOSED SAMPLING LOCATIONS
1571, 1581, 1593, AND 1617
INDUSTRIAL PARKWAY WEST
AND 29469 RUUS ROAD
HAYWARD, CALIFORNIA

FARALLON PN: 1353-070

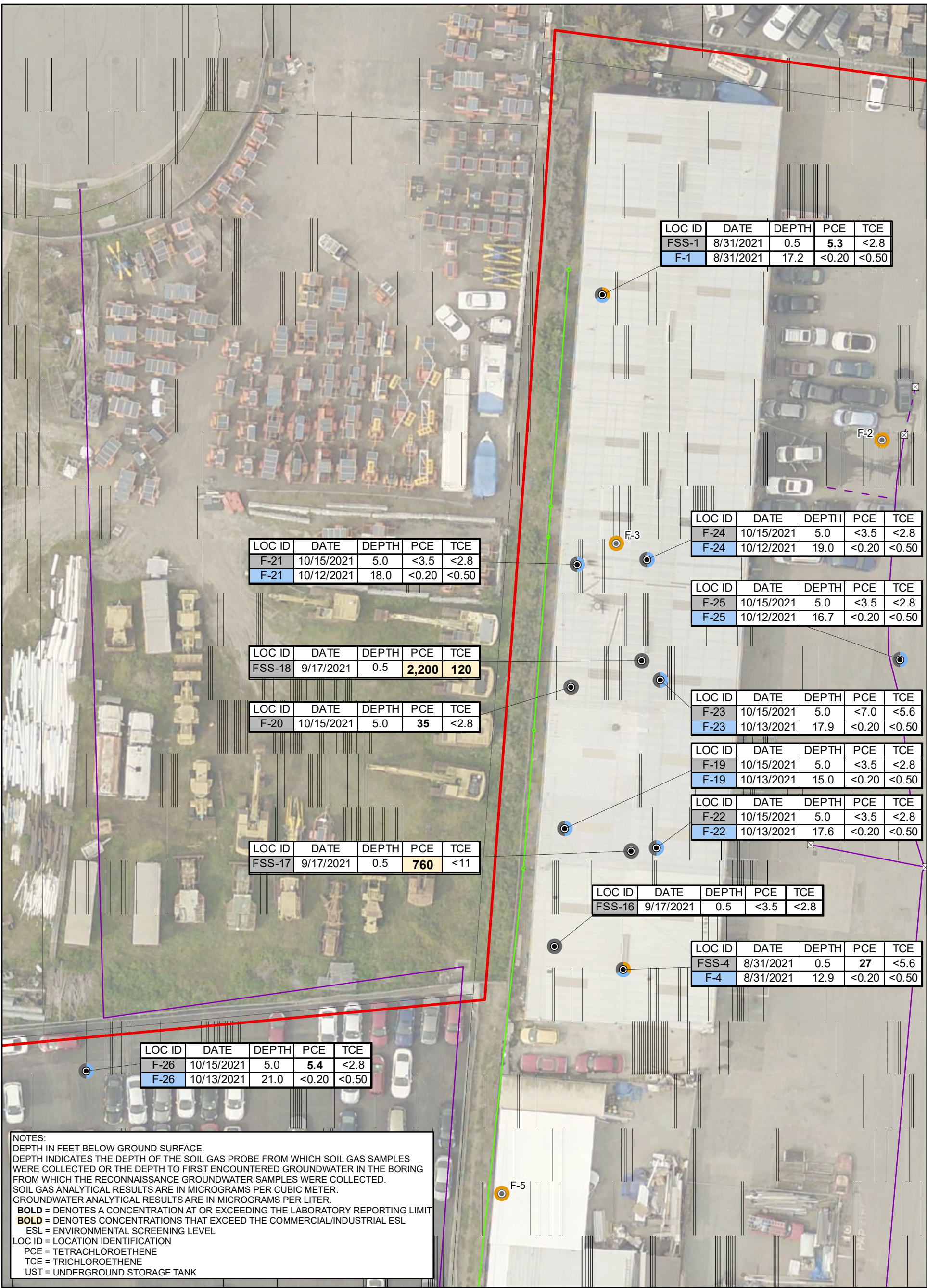
Drawn By: Imurock

Checked By: PS

Date: 1/23/2023

Disc Reference:

Path: Q:\Projects\1353 CenterPoint\070 Indust Pkwy Ruus Update\Mapfiles\003_Data_Gap_WP\Figure-05_Proposed_SampleLocs.mxd



● BORING

● BORING LOCATION NOT SAMPLED

☒ STORM WATER CATCH BASIN

MATRIX SAMPLED

● SOIL

● GROUNDWATER

● SOIL GAS

— STORM DRAIN

— SEWER

ALAMEDA COUNTY PARCEL BOUNDARY

SITE BOUNDARY

030

SCALE IN FEET

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Drawn By: jjones

Checked By: PS

Date: 1/24/2023

FIGURE 6

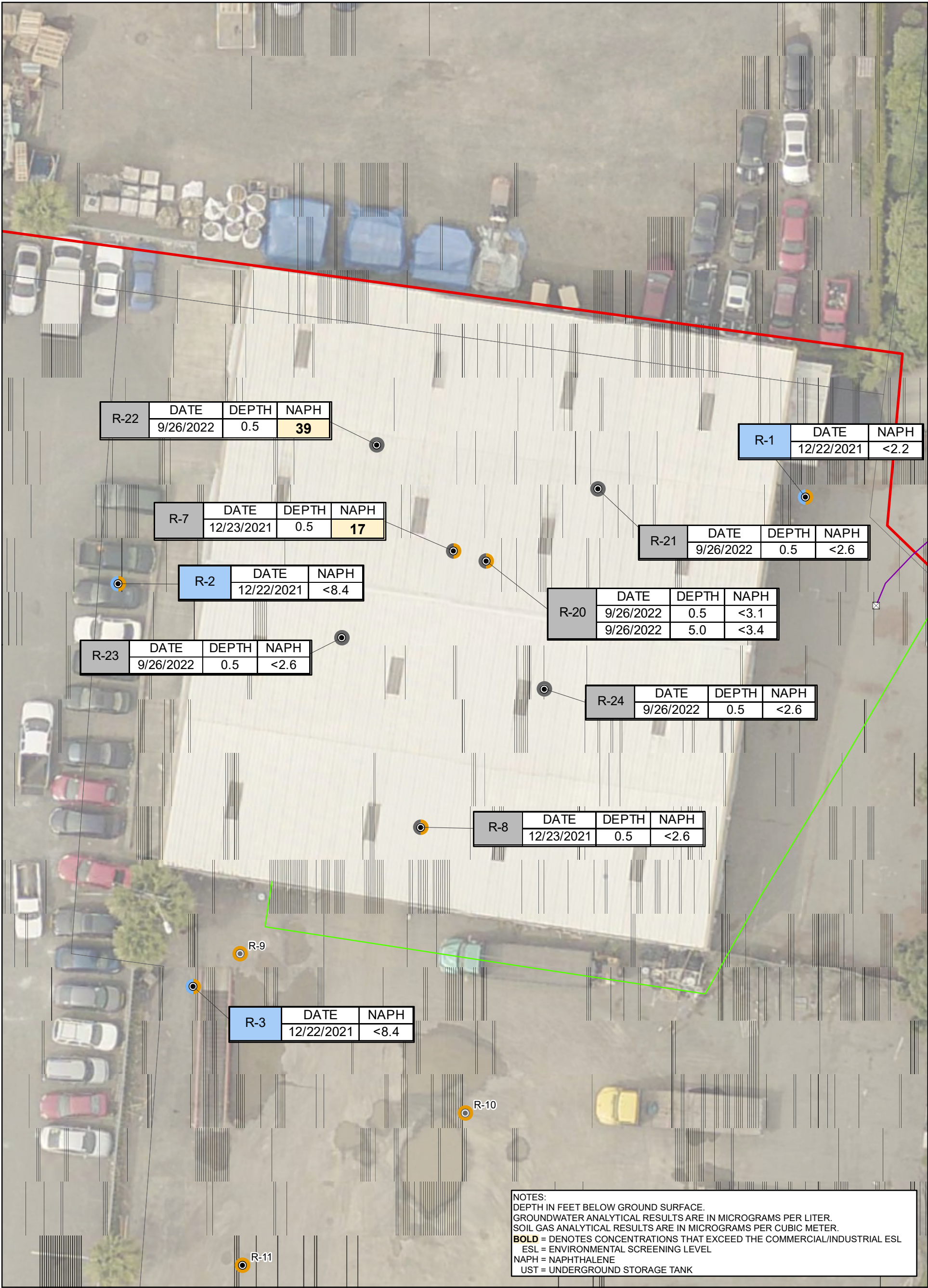
SITE PLAN INSET WITH PCE AND TCE IN GROUNDWATER AND SOIL GAS

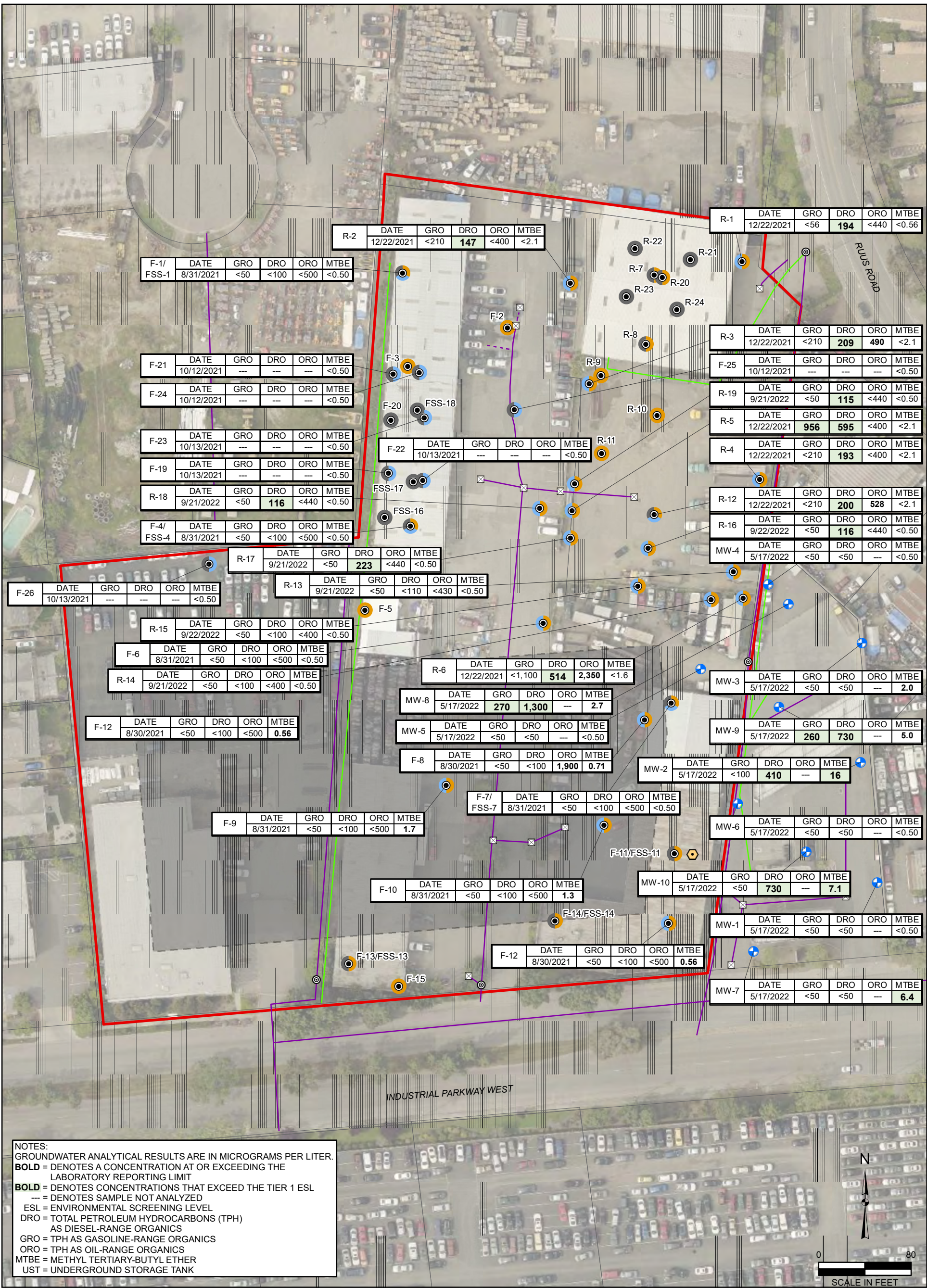
1571, 1581, 1593, AND 1617 INDUSTRIAL PARKWAY WEST AND 29469 RUUS ROAD HAYWARD, CALIFORNIA

FARALLON PN: 1353-070

Disc Reference:

Path: Q:\Projects\1353 CenterPoint\070 Indust Pkwy Ruus Update\Mapfiles\003_Data_Gap_WP\Figure-06_GW_SG_PCE_TCE.mxd





NOTES:
GROUNDWATER ANALYTICAL RESULTS ARE IN MICROGRAMS PER LITER.
BOLD = DENOTES A CONCENTRATION AT OR EXCEEDING THE LABORATORY REPORTING LIMIT
BOLD = DENOTES CONCENTRATIONS THAT EXCEED THE TIER 1 ESL
--- = DENOTES SAMPLE NOT ANALYZED
ESL = ENVIRONMENTAL SCREENING LEVEL
DRO = TOTAL PETROLEUM HYDROCARBONS (TPH) AS DIESEL-RANGE ORGANICS
GRO = TPH AS GASOLINE-RANGE ORGANICS
ORO = TPH AS OIL-RANGE ORGANICS
MTBE = METHYL TERTIARY-BUTYL ETHER
UST = UNDERGROUND STORAGE TANK

LEGEND

- BORING
- MONITORING WELL ASSOCIATED WITH 1565 INDUSTRIAL PARKWAY
- MATRIX SAMPLED
- SOIL
- GROUNDWATER
- SOIL GAS
- MANHOLE
- CLARIFIER/OIL-WATER SEPARATOR
- STORM WATER CATCH BASIN
- STORM DRAIN
- SEWER
- PROPOSED BUILDING FOOTPRINT
- ALAMEDA COUNTY PARCEL BOUNDARY
- SITE BOUNDARY

NOTES:
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2. FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.

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FIGURE 8

SITE PLAN WITH GRO, DRO, ORO AND MTBE IN GROUNDWATER 1571, 1581, 1593, AND 1617 INDUSTRIAL PARKWAY WEST AND 29469 RUUS ROAD HAYWARD, CALIFORNIA

FARALLON PN: 1353-070

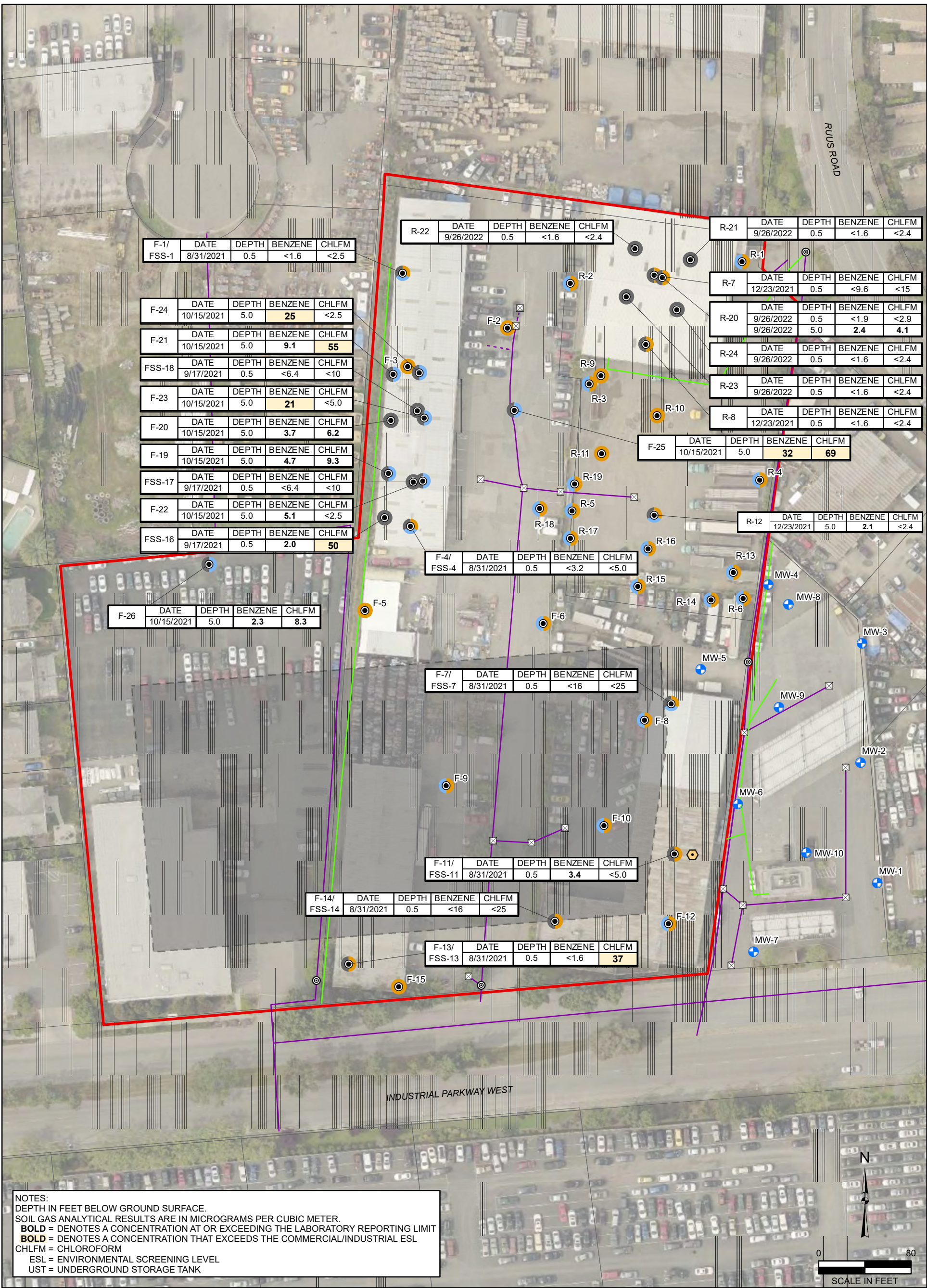
Drawn By: jjones

Checked By: PS

Date: 1/24/2023

Disc Reference:

Path: Q:\Projects\1353 CenterPoint\070 Indust Pkwy Ruus Update\Mapfiles\003_Data_Gap_WP\Figure-08_GW_TPH_MTBE.mxd



NOTES:
DEPTH IN FEET BELOW GROUND SURFACE.
SOIL GAS ANALYTICAL RESULTS ARE IN MICROGRAMS PER CUBIC METER.
BOLD = DENOTES A CONCENTRATION AT OR EXCEEDING THE LABORATORY REPORTING LIMIT
BOLD = DENOTES A CONCENTRATION THAT EXCEEDS THE COMMERCIAL/INDUSTRIAL ESL
CHLFM = CHLOROFORM
ESL = ENVIRONMENTAL SCREENING LEVEL
UST = UNDERGROUND STORAGE TANK

LEGEND

- BORING
- MONITORING WELL ASSOCIATED WITH 1565 INDUSTRIAL PARKWAY
- MATRIX SAMPLED
- SOIL
- GROUNDWATER
- SOIL GAS
- MANHOLE
- CLARIFIER/OIL-WATER SEPARATOR
- ⊠

STORM WATER CATCH BASIN
- STORM DRAIN
- SEWER
- PROPOSED BUILDING FOOTPRINT
- ALAMEDA COUNTY PARCEL BOUNDARY
- SITE BOUNDARY

NOTES:
1. ALL LOCATIONS ARE APPROXIMATE.
2. FIGURES WERE PRODUCED IN COLOR. GRAYSCALE COPIES MAY NOT REPRODUCE ALL ORIGINAL INFORMATION.

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Date: 1/23/2023

Disc Reference:

Path: \\edges02\GIS\Projects\1353 CenterPoint\070 Indust Pkwy Ruus Update\Mapfiles\003_Data_Gap_WP\Figure-09_SG_Benzene_CHLFM.mxd

FIGURE 9

SITE PLAN WITH BENZENE AND CHLOROFORM IN SOIL GAS
1571, 1581,1593, AND 1617
INDUSTRIAL PARKWAY WEST
AND 29469 RUUS ROAD
HAYWARD, CALIFORNIA

FARALLON PN: 1353-070

TABLES

DATA GAP INVESTIGATION WORK PLAN
Industrial Parkway and Ruus Road Properties
1571, 1581, 1593, and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California

Farallon PN: 1353-070

Table 1
Soil Analytical Results for Total Petroleum Hydrocarbons and BTEX
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (milligrams per kilogram)						
				GRO ²	DRO ³	ORO ³	Benzene ²	Toluene ²	Ethylbenzene ²	Xylenes ²
1571, 1581, and 1593 Industrial Parkway West										
F-1	F-1-5.0	5.0	8/31/2021	< 0.25	4.3	36	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-2	F-2-5.0	5.0	8/31/2021	< 0.25	43	260	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-3	F-3-4.0	4.0	8/31/2021	< 0.25	< 2.0	< 10	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-4	F-4-5.0	5.0	8/31/2021	< 0.25	< 2.0	< 10	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-5	F-5-5.0	5.0	8/31/2021	< 0.25	28	440	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-6	F-6-5.0	5.0	8/31/2021	< 0.25	< 2.0	22	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-7	F-7-5.0	5.0	8/31/2021	< 0.25	2.2	51	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-8	F-8-7.0	7.0	8/30/2021	1.1	7.4	25	< 0.0050	< 0.0050	0.0085	< 0.0050
F-9	F-9-5.0	5.0	8/31/2021	< 0.25	< 2.0	15	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-10	F-10-5.0	5.0	8/31/2021	< 0.25	< 2.0	< 10	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-11	F-11-5.0	5.0	8/30/2021	2.6	7.4	110	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-12	F-12-5.0	5.0	8/30/2021	< 0.25	12	93	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-13	F-13-5.0	5.0	8/30/2021	< 0.25	4.5	200	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-14	F-14-5.0	5.0	8/30/2021	< 0.25	4.5	120	< 0.0050	< 0.0050	< 0.0050	< 0.0050
F-15	F-15-3.0	3.0	8/31/2021	0.90	42	1,100	< 0.0050	< 0.0050	< 0.0050	< 0.0050
29469 Ruus Road										
R-1	R-1-5.0	5.0	12/22/2021	< 0.1	5.29	31.8	< 0.01	< 0.01	< 0.01	< 0.02
R-2	R-2-2.0	2.0	12/22/2021	< 0.1	13.6	15.8	< 0.01	< 0.01	< 0.01	< 0.02
R-3	R-3-2.0	2.0	12/22/2021	< 0.1	24.9	29.3	< 0.01	< 0.01	< 0.01	< 0.02
R-4	R-4-2.0	2.0	12/22/2021	< 0.1	5.68	57.4	< 0.01	< 0.01	< 0.01	< 0.02
R-5	R-5-2.0	2.0	12/22/2021	< 0.1	7.06	64.4	< 0.01	< 0.01	< 0.01	< 0.02
R-6	R-6-2.0	2.0	12/22/2021	< 0.1	10.2	92.1	< 0.01	< 0.01	< 0.01	< 0.02
R-7	R-7-2.0	2.0	12/23/2021	< 0.1	2.75	< 10	< 0.01	< 0.01	< 0.01	< 0.02
R-8	R-8-2.0	2.0	12/23/2021	< 0.1	3.12	22.9	< 0.01	< 0.01	< 0.01	< 0.02
R-9	R-9-2.0	2.0	12/23/2021	< 0.1	46.2	389	< 0.01	< 0.01	< 0.01	< 0.02
R-10	R-10-2.0	2.0	12/23/2021	< 0.1	6.15	96.2	< 0.01	< 0.01	< 0.01	< 0.02
San Francisco Bay RWQCB ESLs Commercial: Shallow Soil Exposure ⁴				2,000	1,200	180,000	1.4	5,300	26	2,500
San Francisco Bay RWQCB ESLs Construction Worker Soil Exposure ⁴				1,100	54,000	54,000	33	4,700	540	2,400

Table 1
Soil Analytical Results for Total Petroleum Hydrocarbons and BTEX
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (milligrams per kilogram)						
				GRO ²	DRO ³	ORO ³	Benzene ²	Toluene ²	Ethylbenzene ²	Xylenes ²
29469 Ruus Road (continued)										
R-11	R-11-2.0	2.0	12/23/2021	< 0.1	6.98	86.9	< 0.01	< 0.01	< 0.01	< 0.02
R-12	R-12-2.0	2.0	12/23/2021	< 0.1	6.90	44.9	< 0.01	< 0.01	< 0.01	< 0.02
R-13	R-13-5.0	5.0	9/21/2022	< 0.1	3.94 x	9.85	< 0.01	< 0.01	< 0.01	< 0.02
R-14	R-14-5.0	5.0	9/21/2022	< 0.1	6.68 x	79.2	< 0.01	< 0.01	< 0.01	< 0.02
R-15	R-15-5.0	5.0	9/22/2022	< 0.1	4.66 x	20.4	< 0.01	< 0.01	< 0.01	< 0.02
R-16	R-16-5.0	5.0	9/22/2022	< 0.1	4.26 x	28.1	< 0.01	< 0.01	< 0.01	< 0.02
R-17	R-17-5.0	5.0	9/21/2022	22.7 z	306 y	< 50	< 0.05	< 0.05	< 0.05	< 0.10
R-18	R-18-5.0	5.0	9/22/2022	< 0.1	11.6 x	54.1	< 0.01	< 0.01	< 0.01	< 0.02
R-19	R-19-5.0	5.0	9/21/2022	< 0.1	34.0 y	13.4	< 0.01	< 0.01	< 0.01	< 0.02
R-20	R-20-2.0	2.0	9/22/2022	< 0.1	2.61 y	9.87	< 0.01	< 0.01	< 0.01	< 0.02
	R-20-5.0	5.0	9/22/2022	< 0.1	4.09 x	16.4	< 0.01	< 0.01	< 0.01	< 0.02
San Francisco Bay RWQCB ESLs Commercial: Shallow Soil Exposure ⁴				2,000	1,200	180,000	1.4	5,300	26	2,500
San Francisco Bay RWQCB ESLs Construction Worker Soil Exposure ⁴				1,100	54,000	54,000	33	4,700	540	2,400

NOTES:

Bold denotes a concentration exceeding the laboratory reporting limit.

< denotes analyte not detected at or exceeding the laboratory reporting limit listed.

¹Depth in feet below ground surface.

²Analyzed by U.S. Environmental Protection Agency (EPA) Method 8260B.

³Analyzed by EPA Method 8015B.

⁴San Francisco Bay Regional Water Quality Control Board (RWQCB) Direct Exposure Human Health Risk Levels (Table S-1), dated 2019 (Rev. 2).

BTEX = benzene, toluene, ethylbenzene and xylenes

DRO = total petroleum hydrocarbons (TPH) as diesel-range organics

GRO = TPH as gasoline-range organics

ORO = TPH as oil-range organics

x = result due to overlap of oil-range into the diesel-range

y = result not typical of a diesel reference standard; peaks within the diesel-range quantified as diesel

z = does not match gasoline reference standard; result elevated due to overlap of heavier range hydrocarbons

Table 2 Soil Analytical Results for VOCs 1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road Hayward, California Farallon PN: 1353-070																				
Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (milligrams per kilogram) ²																
				1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	2-Butanone (Methyl Ethyl Ketone)	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Bromodichloromethane	Carbon Disulfide	Chloroform	cis-1,2-Dichloroethene	Methyl Tertiary-Butyl Ether	Naphthalene	Styrene	tert-Butyl Alcohol	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Vinyl Chloride
1571, 1581, and 1593 Industrial Parkway West																				
F-1	F-1-5.0	5.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-2	F-2-5.0	5.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-3	F-3-4.0	4.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-4	F-4-5.0	5.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-5	F-5-5.0	5.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-6	F-6-5.0	5.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-7	F-7-5.0	5.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-8	F-8-7.0	7.0	8/30/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-9	F-9-5.0	5.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-10	F-10-5.0	5.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-11	F-11-5.0	5.0	8/30/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-12	F-12-5.0	5.0	8/30/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	0.49	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-13	F-13-5.0	5.0	8/30/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-14	F-14-5.0	5.0	8/30/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
F-15	F-15-3.0	3.0	8/31/2021	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.20	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.050	< 0.0050	< 0.0050	< 0.00025
San Francisco Bay RWQCB ESLs Commercial: Shallow Soil Exposure ³				NE	NE	200,000	NE	140,000	670,000	1.3	NE	1.4	85	210	17	33,000	NE	2.7	6.1	0.15
San Francisco Bay RWQCB ESLs Construction Worker Soil Exposure ³				NE	NE	120,000	NE	140,000	270,000	28	NE	34	78	4,100	400	25,000	NE	33	130	3.4

Table 2 Soil Analytical Results for VOCs 1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road Hayward, California Farallon PN: 1353-070																				
Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (milligrams per kilogram) ²																
				1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	2-Butanone (Methyl Ethyl Ketone)	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Bromodichloromethane	Carbon Disulfide	Chloroform	cis-1,2-Dichloroethene	Methyl Tertiary-Butyl Ether	Naphthalene	Styrene	tert-Butyl Alcohol	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Vinyl Chloride
29469 Ruus Road																				
R-1	R-1-5.0	5.0	12/22/2021	< 0.01	< 0.01	0.0164	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-2	R-2-2.0	2.0	12/22/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-3	R-3-2.0	2.0	12/22/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-4	R-4-2.0	2.0	12/22/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-5	R-5-2.0	2.0	12/22/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-6	R-6-2.0	2.0	12/22/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-7	R-7-2.0	2.0	12/23/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-8	R-8-2.0	2.0	12/23/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-9	R-9-2.0	2.0	12/23/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-10	R-10-2.0	2.0	12/23/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-11	R-11-2.0	2.0	12/23/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-12	R-12-2.0	2.0	12/23/2021	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-13	R-13-5.0	5.0	9/21/2022	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-14	R-14-5.0	5.0	9/21/2022	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-15	R-15-5.0	5.0	9/22/2022	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-16	R-16-5.0	5.0	9/22/2022	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-17	R-17-5.0	5.0	9/21/2022	< 0.05	< 0.05	< 0.0500	---	---	---	< 0.05	---	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.25	< 0.05	< 0.05	< 0.05
R-18	R-18-5.0	5.0	9/22/2022	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
San Francisco Bay RWQCB ESLs Commercial: Shallow Soil Exposure ³				NE	NE	200,000	NE	140,000	670,000	1.3	NE	1.4	85	210	17	33,000	NE	2.7	6.1	0.15
San Francisco Bay RWQCB ESLs Construction Worker Soil Exposure ³				NE	NE	120,000	NE	140,000	270,000	28	NE	34	78	4,100	400	25,000	NE	33	130	3.4

Table 2
Soil Analytical Results for VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (milligrams per kilogram) ²																
				1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	2-Butanone (Methyl Ethyl Ketone)	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Bromodichloromethane	Carbon Disulfide	Chloroform	cis-1,2-Dichloroethene	Methyl Tertiary-Butyl Ether	Naphthalene	Styrene	tert-Butyl Alcohol	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Vinyl Chloride
29469 Ruus Road (continued)																				
R-19	R-19-5.0	5.0	9/21/2022	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
R-20	R-20-2.0	2.0	9/22/2022	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
	R-20-5.0	5.0	9/22/2022	< 0.01	< 0.01	< 0.0100	---	---	---	< 0.01	---	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
San Francisco Bay RWQCB ESLs Commercial: Shallow Soil Exposure ³				NE	NE	200,000	NE	140,000	670,000	1.3	NE	1.4	85	210	17	33,000	NE	2.7	6.1	0.15
San Francisco Bay RWQCB ESLs Construction Worker Soil Exposure ³				NE	NE	120,000	NE	140,000	270,000	28	NE	34	78	4,100	400	25,000	NE	33	130	3.4

NOTES:
Bold denotes a concentration exceeding the laboratory reporting limit.
< denotes analyte not detected at or exceeding the reporting limit listed.
— denotes sample not analyzed.

NE = not established

¹Depth in feet below ground surface.
²Analyzed by U.S. Environmental Protection Agency Method 8260B. Only detected and select analytes shown in table; see laboratory reports for full list of analytes.
³San Francisco Bay Regional Water Quality Control Board (RWQCB) Direct Exposure

Table 3
Soil Analytical Results for PAHs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (milligrams per kilogram) ²																	
				1-Methylnaphthalene	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(b)Fluoranthene	Benzo(g,h,i)Perylene	Benzo(k)Fluoranthene	Chrysene	Dibenzo(a,h)Anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
1571, 1581, and 1593 Industrial Parkway West																					
F-1	F-1-5.0	5.0	8/31/2021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.21	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	0.053	< 0.040	< 0.21	< 0.021	< 0.080	< 0.040
F-2	F-2-5.0	5.0	8/31/2021	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.10	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.037	< 0.020	< 0.10	< 0.010	< 0.040	< 0.020
F-3	F-3-4.0	4.0	8/31/2021	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.013	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.013	< 0.0013	< 0.0050	< 0.0025
F-4	F-4-5.0	5.0	8/31/2021	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.013	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	0.0044	< 0.0025	< 0.013	< 0.0013	< 0.0050	0.0025
F-5	F-5-5.0	5.0	8/31/2021	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 2.1	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 2.1	< 0.21	< 0.80	< 0.40
F-6	F-6-5.0	5.0	8/31/2021	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.10	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.027	< 0.020	< 0.10	< 0.010	< 0.040	< 0.020
F-7	F-7-5.0	5.0	8/31/2021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.21	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	< 0.21	< 0.021	< 0.080	< 0.040
F-8	F-8-7.0	7.0	8/30/2021	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.10	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.027	< 0.020	< 0.10	< 0.010	< 0.040	< 0.020
F-9	F-9-5.0	5.0	8/31/2021	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.10	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	0.033	< 0.020	< 0.10	< 0.010	< 0.040	< 0.020
F-10	F-10-5.0	5.0	8/31/2021	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.013	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.0025	< 0.013	< 0.0013	< 0.0050	< 0.0025
F-11	F-11-5.0	5.0	8/30/2021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.21	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	0.054	< 0.040	< 0.21	< 0.021	< 0.080	< 0.040
F-12	F-12-5.0	5.0	8/30/2021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.21	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	< 0.040	0.056	< 0.040	< 0.21	< 0.021	< 0.080	< 0.040
F-13	F-13-5.0	5.0	8/30/2021	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 1.0	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 1.0	< 0.10	< 0.40	< 0.20
F-14	F-14-5.0	5.0	8/30/2021	< 0.052	< 0.052	< 0.052	< 0.052	< 0.052	< 0.52	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.13	< 0.10	< 0.52	< 0.052	< 0.20	< 0.10
F-15	F-15-3.0	3.0	8/31/2021	< 0.21	< 0.21	< 0.21	< 0.21	< 0.21	< 2.1	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 2.1	< 0.21	< 0.80	< 0.40
29469 Ruus Road																					
R-1	R-1-5.0	5.0	12/22/2021	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	0.0048	< 0.0040	< 0.0040	0.0054	< 0.0040	0.0084	< 0.0040	< 0.0040	0.0044	0.0057	0.0043
R-2	R-2-2.0	2.0	12/22/2021	0.02	0.033	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	0.0040	< 0.0040	0.0044	0.025	< 0.0040	0.0074	0.068	< 0.0040
R-3	R-3-2.0	2.0	12/22/2021	0.0065	0.0097	0.012	0.0074	0.0026	0.0021	< 0.00057	0.0035	0.0012	0.00047	0.0025	< 0.00055	0.0022	0.0045	0.00071	0.0050	0.043	0.0031
R-4	R-4-2.0	2.0	12/22/2021	< 0.00092	0.0012	< 0.00081	< 0.00093	< 0.0027	0.0059	0.0015	0.0056	0.0028	< 0.0011	0.0064	< 0.0014	0.0042	< 0.0013	0.0019	< 0.0026	0.0038	0.0034
R-5	R-5-2.0	2.0	12/22/2021	0.00078	0.0012	0.00070	< 0.00037	< 0.0011	0.0024	0.00060	0.0022	0.0017	< 0.00045	0.0016	< 0.00055	0.0016	< 0.00054	0.00087	0.0050	0.0018	0.0015
R-6	R-6-2.0	2.0	12/22/2021	0.0011	0.0030	< 0.00081	< 0.00093	< 0.0027	0.0069	0.0017	0.0068	0.0034	< 0.0011	0.0078	< 0.0014	0.0056	< 0.0013	0.0021	0.0031	0.0071	0.0051
R-7	R-7-2.0	2.0	12/23/2021	< 0.0040	0.0047	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	0.011	< 0.0040	< 0.0040	0.0093	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	0.015	0.0055
R-8	R-8-2.0	2.0	12/23/2021	< 0.0018	0.0022	< 0.0016	< 0.0019	< 0.0053	0.01	0.0029	0.013	0.0069	< 0.0023	0.021	0.0034	< 0.0053	< 0.0027	< 0.0022	< 0.0051	< 0.0059	0.0057
R-9	R-9-2.0	2.0	12/23/2021	0.0022	0.0028	< 0.0016	< 0.0019	< 0.0053	0.0098	0.0032	0.014	0.0056	< 0.0024	0.025	< 0.0027	< 0.0053	< 0.0027	< 0.0022	< 0.0051	0.014	0.0083
R-10	R-10-2.0	2.0	12/23/2021	< 0.0018	0.0032	< 0.0016	< 0.0019	< 0.0053	0.012	0.0057	0.010	0.0067	< 0.0023	0.0090	< 0.0027	< 0.0053	< 0.0027	0.0045	< 0.0051	< 0.0059	< 0.0055
R-11	R-11-2.0	2.0	12/23/2021	< 0.00092	0.0011	< 0.00081	< 0.00093	< 0.0027	0.0051	< 0.0014	0.0026	0.0018	< 0.0011	< 0.0025	< 0.0014	< 0.0027	< 0.0013	< 0.0011	< 0.0026	< 0.0030	< 0.0027
R-12	R-12-2.0	2.0	12/23/2021	0.00096	0.0029	< 0.00081	< 0.00093	< 0.0027	0.0061	0.0022	0.0053	0.0026	0.0011	0.0054	< 0.0014	0.0048	< 0.0013	0.0020	0.0038	0.0041	0.0040
San Francisco Bay RWQCB ESLs Commercial: Shallow Soil Exposure ³				NE	3,000	45,000	NE	230,000	20	2.1	21	NE	210	2,100	2.1	30,000	30,000	21	17	NE	23,000
San Francisco Bay RWQCB ESLs Construction Worker Soil Exposure ³				NE	670	10,000	NE	50,000	110	10	110	NE	910	9,100	11	6,700	6,700	110	400	NE	5,000

NOTES:
Bold denotes a concentration exceeding the laboratory reporting limit.
< denotes analyte not detected at or exceeding the reporting limit listed.
NE = not established
PAHs = polycyclic aromatic hydrocarbons

¹Depth in feet below ground surface.
²Analyzed by U.S. Environmental Protection Agency Method 8270C or 8270C/SIM.
³San Francisco Bay Regional Water Quality Control Board (RWQCB) Direct Exposure Human

Table 4 Soil Analytical Results for Metals 1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road Hayward, California Farallon PN: 1353-070																				
Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (milligrams per kilogram) ²																
				Antimony	Arsenic	Barium	Beryllium	Cadmium	Total Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
1571, 1581, and 1593 Industrial Parkway West																				
F-1	F-1-5.0	5.0	8/31/2021	< 0.50	8.8	180	< 0.50	< 0.50	56	15	43	29	0.16	0.57	57	1.3	< 0.50	< 0.50	88	80
F-2	F-2-5.0	5.0	8/31/2021	< 0.50	3.9	170	< 0.50	0.56	41	8.9	19	34	0.044	< 0.50	36	1.6	< 0.50	< 0.50	38	57
F-3	F-3-4.0	4.0	8/31/2021	< 0.50	6.8	290	< 0.50	< 0.50	110	18	59	7.7	0.23	< 0.50	140	1.7	< 0.50	< 0.50	99	98
F-4	F-4-5.0	5.0	8/31/2021	< 0.50	4.5	210	< 0.50	< 0.50	120	18	62	15	0.26	< 0.50	140	1.6	< 0.50	< 0.50	100	69
F-5	F-5-5.0	5.0	8/31/2021	0.51	7.3	180	< 0.50	< 0.50	40	12	35	26	0.10	0.51	44	1.1	< 0.50	< 0.50	61	72
F-6	F-6-5.0	5.0	8/31/2021	< 0.50	7.5	190	0.53	< 0.50	44	15	60	15	0.15	< 0.50	42	1.6	< 0.50	< 0.50	95	77
F-7	F-7-5.0	5.0	8/31/2021	< 0.50	7.1	170	0.58	< 0.50	51	10	47	13	0.058	< 0.50	44	1.7	< 0.50	< 0.50	74	74
F-8	F-8-7.0	7.0	8/30/2021	< 0.50	5.0	170	< 0.50	< 0.50	45	8.6	32	14	0.029	< 0.50	38	1.5	< 0.50	< 0.50	39	50
F-9	F-9-5.0	5.0	8/31/2021	< 0.50	6.4	200	< 0.50	< 0.50	58	11	30	10	0.16	< 0.50	58	1.7	< 0.50	< 0.50	58	59
F-10	F-10-5.0	5.0	8/31/2021	0.71	9.7	150	0.54	< 0.50	39	10	30	14	0.090	0.58	40	1.9	< 0.50	< 0.50	50	77
F-11	F-11-5.0	5.0	8/30/2021	< 0.50	7.0	170	< 0.50	< 0.50	50	10	31	120	0.14	0.51	45	1.3	< 0.50	< 0.50	53	66
F-12	F-12-5.0	5.0	8/30/2021	< 0.50	8.7	180	< 0.50	< 0.50	56	12	36	15	0.090	< 0.50	54	1.9	< 0.50	< 0.50	72	63
F-13	F-13-5.0	5.0	8/30/2021	< 0.50	6.0	110	< 0.50	< 0.50	41	11	38	45	0.12	< 0.50	37	1.3	< 0.50	< 0.50	62	62
F-14	F-14-5.0	5.0	8/30/2021	< 0.50	7.2	180	< 0.50	< 0.50	50	13	40	26	0.17	< 0.50	55	1.4	< 0.50	< 0.50	72	87
F-15	F-15-3.0	3.0	8/31/2021	0.56	10	260	< 0.50	< 0.50	65	14	49	31	0.80	0.73	61	1.6	< 0.50	< 0.50	83	150
29469 Ruus Road																				
R-2	R-2-2.0	2.0	12/22/2021	< 5.00	4.15	199	< 5.00	< 5.00	49.5	18.2	53.5	5.55	< 0.50	< 5.00	90.0	< 5.00	< 1.00	< 5.00	61.5	41.9
R-3	R-3-2.0	2.0	12/22/2021	< 5.00	8.00	138	< 5.00	< 5.00	38.9	13.3	37.7	7.55	< 0.50	< 5.00	39.2	< 5.00	< 1.00	< 5.00	64.0	58.5
R-7	R-7-2.0	2.0	12/23/2021	< 5.00	6.15	164	< 5.00	< 5.00	55.0	13.9	30.6	6.00	< 0.50	< 5.00	65.5	< 5.00	< 1.00	< 5.00	46.6	52.0
R-8	R-8-2.0	2.0	12/23/2021	< 5.00	6.55	161	< 5.00	< 5.00	36.6	15.5	55.5	8.20	< 0.50	< 5.00	34.3	< 5.00	< 1.00	< 5.00	86.5	59.5
R-9	R-9-2.0	2.0	12/23/2021	< 5.00	8.15	157	< 5.00	< 5.00	34.8	16.6	40.9	9.20	< 0.50	< 5.00	37.8	< 5.00	< 1.00	< 5.00	66.5	61.0
R-10	R-10-2.0	2.0	12/23/2021	< 5.00	10.7	176	< 5.00	< 5.00	36.0	13.4	44.5	21.4	< 0.50	< 5.00	36.5	< 5.00	< 1.00	< 5.00	72.5	70.5
R-11	R-11-2.0	2.0	12/23/2021	< 5.00	2.50	21.3	< 5.00	< 5.00	35.9	21.1	66.0	< 3.00	< 0.50	< 5.00	26.8	< 5.00	< 1.00	< 5.00	95.0	14.3
R-12	R-12-2.0	2.0	12/23/2021	< 5.00	9.20	154	< 5.00	< 5.00	47.6	12.9	58.0	13.3	< 0.50	< 5.00	46.9	< 5.00	< 1.00	< 5.00	86.0	68.5
San Francisco Bay RWQCB ESLs Commercial: Shallow Soil Exposure ³				160	11 ⁴	220,000	230	1,100	NE	350	47,000	320	190	5,800	11,000	5,800	5,800	12	5,800	350,000
San Francisco Bay RWQCB ESLs Construction Worker Soil Exposure ³				50	11 ⁴	3,000	27	51	NE	28	14,000	160	44	1,800	86	1,700	1,800	3.5	470	110,000

NOTES:

Bold denotes a concentration exceeding the laboratory reporting limit. NE = not established

Bold and highlighted **yellow** denote concentrations exceeding Construction Worker ESLs.

< denotes analyte not detected at or exceeding the laboratory reporting limit listed.

¹Depth in feet below ground surface.

²Analyzed by U.S. Environmental Protection Agency Methods 6010B/6020/7471B.

³San Francisco Bay Regional Water Quality Control Board (RWQCB) Direct Exposure Human Health Risk Levels (Table S-1) dated 2019 (Rev. 2).

⁴San Francisco Bay Area background arsenic concentration in soil. *Establishing Background Arsenic in Soil of the Urbanized San Francisco Bay Region* dated December 2011

Table 5
Groundwater Analytical Results for Total Petroleum Hydrocarbons and BTEX
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Date	Sample Identification	Analytical Results (micrograms per liter) ¹						
			GRO ¹	DRO ²	ORO ^{2,3}	Benzene ¹	Toluene ¹	Ethylbenzene ¹	Xylenes ¹
1571, 1581, and 1593 Industrial Parkway West									
F-1	8/31/2021	FGW-1	< 50	< 100	< 500	< 0.20	< 0.50	< 0.50	< 0.50
F-4	8/31/2021	FGW-4	< 50	< 100	< 500	< 0.20	< 0.50	< 0.50	< 0.50
F-6	8/31/2021	FGW-6	< 50	< 100	< 500	< 0.20	< 0.50	< 0.50	< 0.50
F-7	8/31/2021	FGW-7	< 50	< 100	< 500	< 0.20	< 0.50	< 0.50	< 0.50
F-8	8/30/2021	FGW-8	< 50	< 100	1,900	< 0.20	< 0.50	< 0.50	< 0.50
F-9	8/31/2021	FGW-9	< 50	< 100	< 500	< 0.20	< 0.50	< 0.50	< 0.50
F-10	8/31/2021	FGW-10	< 50	< 100	< 500	< 0.20	< 0.50	< 0.50	< 0.50
F-12	8/30/2021	FGW-12	< 50	< 100	< 500	< 0.20	< 0.50	< 0.50	< 0.50
F-19	10/13/2021	FGW-19	---	---	---	< 0.20	< 0.50	< 0.50	< 0.50
F-21	10/12/2021	FGW-21	---	---	---	< 0.20	< 0.50	< 0.50	< 0.50
F-22	10/13/2021	FGW-22	---	---	---	< 0.20	< 0.50	< 0.50	< 0.50
F-23	10/13/2021	FGW-23	---	---	---	< 0.20	< 0.50	< 0.50	< 0.50
F-24	10/12/2021	FGW-24	---	---	---	< 0.20	< 0.50	< 0.50	< 0.50
F-25	10/12/2021	FGW-25	---	---	---	< 0.20	< 0.50	< 0.50	< 0.50
F-26	10/13/2021	FGW-26	---	---	---	< 0.20	< 0.50	< 0.50	< 0.50
San Francisco Bay RWQCB Tier 1 ESLs for Groundwater ⁴			100	100	NE	0.42	40	3.5	20
San Francisco Bay RWQCB ESLs Vapor Intrusion Human Health Risk Levels: Commercial/Industrial ⁵			NE	NE	NE	1.8	4,900	15	1,600
San Francisco Bay RWQCB ESLs Gross Contamination Levels ⁵			50,000	2,500	NE	50,000	50,000	50,000	50,000
San Francisco Bay RWQCB ESLs Odor Nuisance Levels Non-Drinking Water ⁵			5,000	5,000	NE	20,000	400	300	5,300

Table 5
Groundwater Analytical Results for Total Petroleum Hydrocarbons and BTEX
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Date	Sample Identification	Analytical Results (micrograms per liter) ¹						
			GRO ¹	DRO ²	ORO ^{2,3}	Benzene ¹	Toluene ¹	Ethylbenzene ¹	Xylenes ¹
29469 Ruus Road									
R-1	12/22/2021	R-1-GW	< 56	194	< 440	< 0.56	< 0.56	< 0.56	< 1.66
R-2	12/22/2021	R-2-GW	< 210	147	< 400	< 2.1	< 2.1	< 2.1	< 6.3
R-3	12/22/2021	R-3-GW	< 210	209	490	< 2.1	< 2.1	< 2.1	< 6.3
R-4	12/22/2021	R-4-GW	< 210	193	< 400	< 2.1	< 2.1	< 2.1	< 6.3
R-5	12/22/2021	R-5-GW	956	595	< 400	< 2.1	< 2.1	< 2.1	< 6.3
R-6	12/22/2021	R-6-GW	< 1,100	514	2,350	< 1.4	< 3.0	< 4.1	< 11.5
R-12	12/22/2021	R-12-GW	< 210	200	528	< 2.1	< 2.1	< 2.1	< 6.3
R-13	9/21/2022	R-13-GW	< 50	< 110	< 430	< 0.50	< 0.50	< 0.50	< 1.50
R-14	9/21/2022	R-14-GW	< 50	< 100	< 400	< 0.50	< 0.50	< 0.50	< 1.50
R-15	9/22/2022	R-15-GW	< 50	< 100	< 400	< 0.50	< 0.50	< 0.50	< 1.50
R-16	9/22/2022	R-16-GW	< 50	116 x	< 440	< 0.50	< 0.50	< 0.50	< 1.50
R-17	9/21/2022	R-17-GW	< 50	223 x	< 440	< 0.50	< 0.50	< 0.50	< 1.50
R-18	9/21/2022	R-18-GW	< 50	116 x	< 440	< 0.50	< 0.50	< 0.50	< 1.50
R-19	9/21/2022	R-19-GW	< 50	115 x	< 440	< 0.50	< 0.50	< 0.50	< 1.50
San Francisco Bay RWQCB Tier 1 ESLs for Groundwater ⁴			100	100	NE	0.42	40	3.5	20
San Francisco Bay RWQCB ESLs Vapor Intrusion Human Health Risk Levels: Commercial/Industrial ⁵			NE	NE	NE	1.8	4,900	15	1,600
San Francisco Bay RWQCB ESLs Gross Contamination Levels ⁵			50,000	2,500	NE	50,000	50,000	50,000	50,000
San Francisco Bay RWQCB ESLs Odor Nuisance Levels Non-Drinking Water ⁵			5,000	5,000	NE	20,000	400	300	5,300

NOTES:

Bold denotes a concentration detected at or exceeding the laboratory reporting limit.

Bold and highlighted **green** denotes concentrations exceeding Tier 1 Environmental Screening Levels (ESLs).

< denotes analyte not detected at or exceeding the reporting limit listed.

--- denotes sample not analyzed.

¹ Analyzed by U.S. Environmental Protection Agency Method 8260B.

² Analyzed by U.S. Environmental Protection Agency Method 8015B.

³ ORO is composed of long-chain compounds (C24-C36+) having negligible solubility. Detections in water samples typically are petroleum hydrocarbon oxidation products, nonaqueous-phase liquid (NAPL or free product), and/or

⁴ San Francisco Bay Regional Water Quality Control Board (RWQCB) Tier 1 Environmental Screening Levels (ESLs) for groundwater dated 2019 (Rev. 2).

⁵ San Francisco Bay RWQCB Groundwater Vapor Intrusion Human Health Risk Levels (Table GW-3), Gross Contamination Levels (Table GW-4), and Odor Nuisance Levels (Table GW-5), dated 2019 (Rev. 2).

BTEX = benzene, toluene, ethylbenzene, and xylenes

NE = not established

DRO = total petroleum hydrocarbons (TPH) as diesel-range organics

GRO = TPH as gasoline-range organics

ORO = TPH as oil-range organics

x = result not typical of a diesel reference standard; peaks within the diesel-range quantified as diesel

Table 6
Groundwater Analytical Results for VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Date	Sample Identification	Analytical Results (micrograms per liter) ¹										
			1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	2-Butanone (Methyl Ethyl Ketone)	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Bromodichloromethane	Bromomethane	Carbon Disulfide	Chloroform	cis-1,2-Dichloroethene
1571, 1581, and 1593 Industrial Parkway West													
F-1	8/31/2021	FGW-1	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-4	8/31/2021	FGW-4	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-6	8/31/2021	FGW-6	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-7	8/31/2021	FGW-7	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-8	8/30/2021	FGW-8	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-9	8/31/2021	FGW-9	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-10	8/31/2021	FGW-10	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-12	8/30/2021	FGW-12	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-19	10/13/2021	FGW-19	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-21	10/12/2021	FGW-21	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	0.98	< 0.50	< 0.10	< 0.50
F-22	10/13/2021	FGW-22	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	0.97	< 0.50	< 0.10	< 0.50
F-23	10/13/2021	FGW-23	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	1.1	< 0.50	< 0.10	< 0.50
F-24	10/12/2021	FGW-24	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
F-25	10/12/2021	FGW-25	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	1.2	< 0.50	< 0.10	< 0.50
F-26	10/13/2021	FGW-26	< 0.50	< 0.50	< 5.0	< 0.50	< 0.50	< 40	< 0.050	< 0.50	< 0.50	< 0.10	< 0.50
San Francisco Bay RWQCB Tier 1 ESLs for Groundwater ²			NE	NE	5,600	NE	120	1,500	0.87	7.5	NE	0.81	6.0
San Francisco Bay RWQCB ESLs Vapor Intrusion Human Health Risk Levels: Commercial/Industrial ³			NE	NE	9,500,000	NE	2,300,000	97,000,000	3.8	73	NE	3.6	210

Table 6
Groundwater Analytical Results for VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Date	Sample Identification	Analytical Results (micrograms per liter) ¹										
			1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	2-Butanone (Methyl Ethyl Ketone)	2-Hexanone	4-Methyl-2-Pentanone	Acetone	Bromodichloromethane	Bromomethane	Carbon Disulfide	Chloroform	cis-1,2-Dichloroethene
29469 Ruus Road													
R-1	12/22/2021	R-1-GW	< 0.56	< 0.56	---	---	---	---	< 0.56	< 0.56	---	< 0.56	< 0.56
R-2	12/22/2021	R-2-GW	< 2.1	< 2.1	---	---	---	---	< 2.1	< 2.1	---	< 2.1	< 2.1
R-3	12/22/2021	R-3-GW	< 2.1	< 2.1	---	---	---	---	< 2.1	< 2.1	---	< 2.1	< 2.1
R-4	12/22/2021	R-4-GW	< 2.1	< 2.1	---	---	---	---	< 2.1	< 2.1	---	< 2.1	< 2.1
R-5	12/22/2021	R-5-GW	< 2.1	< 2.1	---	---	---	---	< 2.1	< 2.1	---	< 2.1	< 2.1
R-6	12/22/2021	R-6-GW	< 4.9	< 5.1	---	---	---	---	< 1.6	< 4.5	---	< 2.6	< 3.2
R-12	12/22/2021	R-12-GW	< 2.1	< 2.1	---	---	---	---	< 2.1	< 2.1	---	< 2.1	< 2.1
R-13	9/21/2022	R-13-GW	< 0.50	< 0.50	---	---	---	---	< 0.50	< 0.50	---	< 0.50	< 0.50
R-14	9/21/2022	R-14-GW	< 0.50	< 0.50	---	---	---	---	< 0.50	< 0.50	---	< 0.50	< 0.50
R-15	9/22/2022	R-15-GW	< 0.50	< 0.50	---	---	---	---	< 0.50	< 0.50	---	< 0.50	< 0.50
R-16	9/22/2022	R-16-GW	< 0.50	< 0.50	---	---	---	---	< 0.50	< 0.50	---	< 0.50	< 0.50
R-17	9/21/2022	R-17-GW	< 0.50	< 0.50	---	---	---	---	< 0.50	< 0.50	---	< 0.50	< 0.50
R-18	9/21/2022	R-18-GW	< 0.50	< 0.50	---	---	---	---	< 0.50	< 0.50	---	< 0.50	< 0.50
R-19	9/21/2022	R-19-GW	< 0.50	< 0.50	---	---	---	---	< 0.50	< 0.50	---	< 0.50	< 0.50
San Francisco Bay RWQCB Tier 1 ESLs for Groundwater ²			NE	NE	5,600	NE	120	1,500	0.87	7.5	NE	0.81	6.0
San Francisco Bay RWQCB ESLs Vapor Intrusion Human Health Risk Levels: Commercial/Industrial ³			NE	NE	9,500,000	NE	2,300,000	97,000,000	3.8	73	NE	3.6	210

Table 6
Groundwater Analytical Results for VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Date	Sample Identification	Analytical Results (micrograms per liter) ¹						
			Methyl Tertiary-Butyl Ether	Naphthalene	Styrene	tert-Butyl Alcohol	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Vinyl Chloride
1571, 1581, and 1593 Industrial Parkway West									
F-1	8/31/2021	FGW-1	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-4	8/31/2021	FGW-4	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-6	8/31/2021	FGW-6	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-7	8/31/2021	FGW-7	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-8	8/30/2021	FGW-8	0.71	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-9	8/31/2021	FGW-9	1.7	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-10	8/31/2021	FGW-10	1.3	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-12	8/30/2021	FGW-12	0.56	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-19	10/13/2021	FGW-19	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-21	10/12/2021	FGW-21	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-22	10/13/2021	FGW-22	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-23	10/13/2021	FGW-23	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-24	10/12/2021	FGW-24	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-25	10/12/2021	FGW-25	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
F-26	10/13/2021	FGW-26	< 0.50	< 0.30	< 2.0	< 5.0	< 0.20	< 0.50	< 0.0050
San Francisco Bay RWQCB Tier 1 ESLs for Groundwater ²			5.0	0.17	10	12	0.64	1.2	0.0086
San Francisco Bay RWQCB ESLs Vapor Intrusion Human Health Risk Levels: Commercial/Industrial ³			2,000	20	36,000	NE	2.8	7.5	0.14

Table 6
Groundwater Analytical Results for VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Date	Sample Identification	Analytical Results (micrograms per liter) ¹						
			Methyl Tertiary-Butyl Ether	Naphthalene	Styrene	tert-Butyl Alcohol	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Vinyl Chloride
29469 Ruus Road									
R-1	12/22/2021	R-1-GW	< 0.56	< 2.2	< 0.56	< 5.6	< 0.56	< 0.56	< 0.56
R-2	12/22/2021	R-2-GW	< 2.1	< 8.4	< 2.1	< 21	< 2.1	< 2.1	< 2.1
R-3	12/22/2021	R-3-GW	< 2.1	< 8.4	< 2.1	< 21	< 2.1	< 2.1	< 2.1
R-4	12/22/2021	R-4-GW	< 2.1	< 8.4	< 2.1	< 21	< 2.1	< 2.1	< 2.1
R-5	12/22/2021	R-5-GW	< 2.1	< 8.4	< 2.1	< 21	< 2.1	< 2.1	< 2.1
R-6	12/22/2021	R-6-GW	< 1.6	< 25	< 2.3	< 62	< 5.0	< 3.1	< 4.4
R-12	12/22/2021	R-12-GW	< 2.1	< 8.4	< 2.1	< 21	< 2.1	< 2.1	< 2.1
R-13	9/21/2022	R-13-GW	< 0.50	< 2.0	< 0.50	< 5.0	< 0.50	< 0.50	< 0.50
R-14	9/21/2022	R-14-GW	< 0.50	< 2.0	< 0.50	< 5.0	< 0.50	< 0.50	< 0.50
R-15	9/22/2022	R-15-GW	< 0.50	< 2.0	< 0.50	< 5.0	< 0.50	< 0.50	< 0.50
R-16	9/22/2022	R-16-GW	< 0.50	< 2.0	< 0.50	< 5.0	< 0.50	< 0.50	< 0.50
R-17	9/21/2022	R-17-GW	< 0.50	< 2.0	< 0.50	< 5.0	< 0.50	< 0.50	< 0.50
R-18	9/21/2022	R-18-GW	< 0.50	< 2.0	< 0.50	< 5.0	< 0.50	< 0.50	< 0.50
R-19	9/21/2022	R-19-GW	< 0.50	< 2.0	< 0.50	< 5.0	< 0.50	< 0.50	< 0.50
San Francisco Bay RWQCB Tier 1 ESLs for Groundwater ²			5.0	0.17	10	12	0.64	1.2	0.0086
San Francisco Bay RWQCB ESLs Vapor Intrusion Human Health Risk Levels: Commercial/Industrial ³			2,000	20	36,000	NE	2.8	7.5	0.14

NOTES:

Bold denotes a concentration detected at or exceeding the laboratory reporting limit.

NE = not established

< denotes analyte not detected at or exceeding the reporting limit listed.

— denotes sample not analyzed.

¹Analyzed by U.S. Environmental Protection Agency Method 8260B.
Only detected and select analytes shown in table; see laboratory reports

²San Francisco Bay Regional Water Quality Control Board (RWQCB)
Tier 1 Environmental Screening Levels (ESLs) for groundwater dated

³San Francisco Bay RWQCB Groundwater Vapor Intrusion Human
Health Risk Levels (Table GW-3) dated 2019 (Rev. 2).

Table 7
Groundwater Analytical Results for PAHs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Date	Sample Identification	Analytical Results (micrograms per liter) ¹																	
			1-Methylnaphthalene	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)Anthracene	Benzo(a)Pyrene	Benzo(b)Fluoranthene	Benzo(g,h,i)Perylene	Benzo(k)Fluoranthene	Chrysene	Dibenzo(a,h)Anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)Pyrene	Naphthalene	Phenanthrene	Pyrene
1571, 1581, and 1593 Industrial Parkway West																				
F-1	8/31/2021	FGW-1	< 0.0053	< 0.011	< 0.0053	< 0.0053	< 0.011	< 0.053	< 0.0053	< 0.021	< 0.021	< 0.011	< 0.011	< 0.011	< 0.011	< 0.011	< 0.021	< 0.053	< 0.021	< 0.011
F-4	8/31/2021	FGW-4	< 0.0097	< 0.019	< 0.0097	< 0.0097	< 0.019	< 0.097	< 0.0097	< 0.039	< 0.039	< 0.019	< 0.019	< 0.019	< 0.019	< 0.019	< 0.039	< 0.097	< 0.039	< 0.019
F-6	8/31/2021	FGW-6	< 0.011	< 0.023	< 0.011	< 0.011	< 0.023	< 0.11	< 0.011	< 0.046	< 0.046	< 0.023	< 0.023	< 0.023	0.045	< 0.023	< 0.046	< 0.11	< 0.046	0.025
F-7	8/31/2021	FGW-7	< 0.011	< 0.022	< 0.011	< 0.011	< 0.022	< 0.11	< 0.011	< 0.043	< 0.043	< 0.022	< 0.022	< 0.022	< 0.022	< 0.022	< 0.043	< 0.11	< 0.043	< 0.022
F-8	8/30/2021	FGW-8	< 0.011	< 0.021	< 0.011	< 0.011	< 0.021	< 0.11	< 0.011	< 0.043	< 0.043	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	< 0.043	< 0.11	< 0.043	< 0.021
F-9	8/31/2021	FGW-9	< 0.010	< 0.020	< 0.010	< 0.010	< 0.020	< 0.10	< 0.010	< 0.040	< 0.040	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.040	< 0.10	< 0.040	< 0.020
F-10	8/31/2021	FGW-10	< 0.010	< 0.020	< 0.010	< 0.010	< 0.020	< 0.10	< 0.010	< 0.040	< 0.040	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.040	< 0.10	< 0.040	< 0.020
F-12	8/30/2021	FGW-12	< 0.0097	< 0.019	0.011	< 0.0097	< 0.019	< 0.097	< 0.0097	< 0.039	< 0.039	< 0.019	< 0.019	< 0.019	< 0.019	< 0.019	< 0.039	< 0.097	< 0.039	< 0.019
29469 Ruus Road																				
R-1	12/22/2021	R-1-GW	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44
R-2	12/22/2021	R-2-GW	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
R-3	12/22/2021	R-3-GW	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44	< 0.44
R-4	12/22/2021	R-4-GW	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
R-5	12/22/2021	R-5-GW	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
R-6	12/22/2021	R-6-GW	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
R-12	12/22/2021	R-12-GW	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
San Francisco Bay RWQCB Tier 1 ESLs for Groundwater ²			NE	2.1	15	15	0.73	0.017	0.014	0.049	0.10	0.049	0.049	0.025	8.0	3.9	0.049	0.17	4.6	2.0
San Francisco Bay RWQCB ESLs Vapor Intrusion Human Health Risk Levels: Commercial/Industrial ³			NE	NE	NE	NE	NE	230	NE	NE	NE	NE	NE	NE	NE	NE	NE	20	NE	NE

NOTES:
Bold denotes a concentration detected at or exceeding the laboratory reporting limit.
< denotes analyte not detected at or exceeding the reporting limit listed.
¹Analyzed by U.S. Environmental Protection Agency Method 8270C or 8270C/SIM.
²San Francisco Bay Regional Water Quality Control Board (RWQCB) Tier 1 Environmental
³San Francisco Bay RWQCB Groundwater Vapor Intrusion Human Health Risk Levels (Table GW-3) dated 2019 (Rev. 2).

PAHs = polycyclic aromatic hydrocarbons

Table 8
Soil Gas Analytical Results for Detected VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (micrograms per cubic meter) ²														
				1,1-Difluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	2-Butanone	2-Hexanone	2-Propanol	4-Ethyltoluene	4-Methyl-2-Pentanone	Acetone	Acrolein	Acrylonitrile	Benzene	Bromodichloromethane	Bromomethane	Carbon Disulfide
1571, 1581, and 1593 Industrial Parkway West																		
FSS-1	FSS-1	0.5	8/31/2021	100	3.1	< 2.5	<15	< 2.1	---	< 2.5	< 2.1	66	< 5.8	<1.1	< 1.6	< 1.4	< 1.9	< 1.6
FSS-4	FSS-4	0.5	8/31/2021	1,500	< 5.0	< 5.0	<30	< 4.2	---	< 5.0	< 4.2	470	< 12	<2.2	< 3.2	< 2.8	< 3.8	< 3.2
FSS-7	FSS-7	0.5	8/31/2021	470	< 25	< 25	<150	< 21	---	< 25	< 21	890	< 58	<11	< 16	< 14	< 19	< 16
FSS-11	FSS-11	0.5	8/31/2021	74,000	< 5.0	< 5.0	<30	8.5	---	< 5.0	< 4.2	130	< 12	<2.2	3.4	< 2.8	< 3.8	< 3.2
FSS-13	FSS-13	0.5	8/31/2021	1,400	5.8	< 2.5	<15	< 2.1	---	< 2.5	< 2.1	< 60	< 5.8	<1.1	< 1.6	2.6	< 1.9	< 1.6
FSS-14	FSS-14	0.5	8/31/2021	< 280	< 25	< 25	<150	< 21	---	< 25	110	4,500	< 58	<11	< 16	< 14	< 19	18
FSS-16	FSS-16	0.5	9/17/2021	< 28	< 2.5	< 2.5	< 15	< 2.1	---	< 2.5	< 2.1	140	< 5.8	4.6	2.0	< 1.4	< 1.9	< 1.6
FSS-17	FSS-17	0.5	9/17/2021	< 110	< 10	< 10	72	25	---	< 10	22	810	< 23	< 4.4	< 6.4	< 5.6	< 7.6	< 6.4
FSS-18	FSS-18	0.5	9/17/2021	< 110	< 10	< 10	< 60	< 8.4	---	< 10	< 8.4	1,200	< 23	< 4.4	< 6.4	< 5.6	< 7.6	< 6.4
F-19	FSG-19-5.0	5.0	10/15/2021	< 28	29	14	17	< 2.1	---	6.9	8.3	< 60	< 5.8	< 1.1	4.7	< 1.4	< 1.9	7.0
F-20	FSG-20-5.0	5.0	10/15/2021	< 28	41	20	< 15	< 2.1	---	13	9.1	< 60	< 5.8	< 1.1	3.7	< 1.4	< 1.9	6.6
F-21	FSG-21-5.0	5.0	10/15/2021	< 28	68	31	32	3.5	---	16	16	100	< 5.8	< 1.1	9.1	< 1.4	< 1.9	80
F-22	FSG-22-5.0	5.0	10/15/2021	1,200	40	15	25	< 2.1	---	8.0	13	72	< 5.8	< 1.1	5.1	< 1.4	< 1.9	75
F-23	FSG-23-5.0	5.0	10/15/2021	< 56	56	23	35	< 4.2	---	12	14	< 120	< 12	3.5	21	< 2.8	< 3.8	72
F-24	FSG-24-5.0	5.0	10/15/2021	< 28	52	19	58	< 2.1	---	11	23	140	24	< 1.1	25	< 1.4	< 1.9	68
F-25	FSG-25-5.0	5.0	10/15/2021	520	300	160	62	< 2.1	---	85	55	150	< 5.8	1.6	32	< 1.4	< 1.9	350
F-26	FSG-26-5.0	5.0	10/15/2021	< 28	44	20	< 15	< 2.1	---	9.4	4.0	< 60	< 5.8	< 1.1	2.3	< 1.4	< 1.9	2.7
San Francisco Bay RWQCB ESLs for Subslab/Soil Gas - Commercial/Industrial ³				NE	NE	NE	730,000	NE	NE	NE	440,000	4,500,000	NE	NE	14	11	730	NE

Table 8
Soil Gas Analytical Results for Detected VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (micrograms per cubic meter) ²														
				1,1-Difluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	2-Butanone	2-Hexanone	2-Propanol	4-Ethyltoluene	4-Methyl-2-Pentanone	Acetone	Acrolein	Acrylonitrile	Benzene	Bromodichloromethane	Bromomethane	Carbon Disulfide
29469 Ruus Road																		
R-7	R-7-SG	0.5	12/23/2021	170	< 15	< 15	< 8.9	< 12	< 74	< 15	< 12	530	---	---	< 9.6	< 20	< 12	< 9.3
R-8	R-8-SG	0.5	12/23/2021	< 14	< 2.5	< 2.5	3.9	< 2.1	66	< 2.5	< 2.1	40	---	---	< 1.6	< 3.4	< 1.9	31
R-12	R-12-SG	5.0	12/23/2021	< 14	14	11	< 1.5	< 2.1	15	10	< 2.1	37	---	---	2.1	< 3.4	2.3	< 1.6
R-20	R-20-SG-0.5	0.5	9/26/2022	< 16	< 3.0	< 3.0	3.4	< 2.5	< 15	< 3.0	< 2.5	19	---	---	< 1.9	< 4.0	< 2.3	< 1.9
	R-20-SG-5.0	5.0	9/26/2022	< 18	19	8.5	4.4	< 2.7	< 16	27	< 2.7	33	---	---	2.4	< 4.4	< 2.5	3.6
R-21	R-21-SG-0.5	0.5	9/26/2022	< 14	< 2.5	< 2.5	14	< 2.1	15	< 2.5	< 2.1	55	---	---	< 1.6	< 3.4	< 1.9	6.6
R-22	R-22-SG-0.5	0.5	9/26/2022	< 14	< 2.5	< 2.5	4.9	< 2.1	< 12	< 2.5	< 2.1	46	---	---	< 1.6	< 3.4	< 1.9	< 1.6
R-23	R-23-SG-0.5	0.5	9/26/2022	< 14	< 2.5	< 2.5	3.7	< 2.1	< 12	< 2.5	< 2.1	22	---	---	< 1.6	< 3.4	< 1.9	3.0
R-24	R-24-SG-0.5	0.5	9/26/2022	< 14	< 2.5	< 2.5	11	< 2.1	< 12	< 2.5	< 2.1	230	---	---	< 1.6	< 3.4	< 1.9	< 1.6
San Francisco Bay RWQCB ESLs for Subslab/Soil Gas - Commercial/Industrial ³				NE	NE	NE	730,000	NE	NE	NE	440,000	4,500,000	NE	NE	14	11	730	NE

Table 8
Soil Gas Analytical Results for Detected VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (micrograms per cubic meter) ²														
				Chloroform	cis-1,2-Dichloroethene	Cyclohexane	Ethanol	Ethyl Acetate	Ethylbenzene	Gasoline Range Organics	Hexane	Methyl Tertiary Butyl Ether	Methylene Chloride	Naphthalene	n-Heptane	Styrene	tert-Butyl Alcohol	Tetrachloroethene (PCE)
1571, 1581, and 1593 Industrial Parkway West																		
FSS-1	FSS-1	0.5	8/31/2021	< 2.5	< 2.0	< 18	< 95	< 1.9	2.2	< 720	< 18	< 1.9	< 8.8	< 2.7	< 21	< 2.2	<16	5.3
FSS-4	FSS-4	0.5	8/31/2021	< 5.0	< 4.0	< 36	190	< 3.8	< 4.4	4,100	< 36	< 3.8	< 18	< 5.4	< 42	< 4.4	<32	27
FSS-7	FSS-7	0.5	8/31/2021	< 25	< 20	< 180	< 950	< 19	< 22	< 7,200	< 180	< 19	< 88	< 27	< 210	< 22	<160	< 35
FSS-11	FSS-11	0.5	8/31/2021	< 5.0	< 4.0	< 36	640	3.8	< 4.4	2,700	< 36	< 3.8	< 18	< 5.4	< 42	< 4.4	<32	< 7.0
FSS-13	FSS-13	0.5	8/31/2021	37	< 2.0	< 18	140	3.2	3.7	11,000	< 18	< 1.9	< 8.8	< 2.7	< 21	2.2	<16	< 3.5
FSS-14	FSS-14	0.5	8/31/2021	< 25	< 20	< 180	< 950	< 19	40	11,000	< 180	< 19	< 88	< 27	< 210	29	<160	< 35
FSS-16	FSS-16	0.5	9/17/2021	50	< 2.0	< 18	170	4.0	< 2.2	4,700	< 18	< 1.9	< 8.8	< 2.7	< 21	< 2.2	< 16	< 3.5
FSS-17	FSS-17	0.5	9/17/2021	< 10	< 8.0	< 72	< 380	< 7.6	< 8.8	< 2,900	< 72	< 7.6	< 35	< 11	< 84	< 8.8	180	760
FSS-18	FSS-18	0.5	9/17/2021	< 10	< 8.0	< 72	400	< 7.6	< 8.8	3,000	< 72	< 7.6	< 35	< 11	< 84	< 8.8	< 64	2,200
F-19	FSG-19-5.0	5.0	10/15/2021	9.3	< 2.0	< 18	< 95	< 1.9	12	---	< 18	< 1.9	< 8.8	< 2.7	< 21	< 2.2	< 16	< 3.5
F-20	FSG-20-5.0	5.0	10/15/2021	6.2	< 2.0	< 18	< 95	< 1.9	22	---	< 18	< 1.9	< 8.8	< 2.7	< 21	4.3	< 16	35
F-21	FSG-21-5.0	5.0	10/15/2021	55	< 2.0	33	< 95	< 1.9	28	---	< 18	< 1.9	< 8.8	< 2.7	26	< 2.2	< 16	< 3.5
F-22	FSG-22-5.0	5.0	10/15/2021	< 2.5	< 2.0	99	< 95	< 1.9	13	---	29	< 1.9	< 8.8	3.5	31	< 2.2	< 16	< 3.5
F-23	FSG-23-5.0	5.0	10/15/2021	< 5.0	< 4.0	< 36	< 190	< 3.8	20	---	< 36	< 3.8	< 18	< 5.4	< 42	< 4.4	< 32	< 7.0
F-24	FSG-24-5.0	5.0	10/15/2021	< 2.5	9.2	110	< 95	< 1.9	13	---	30	< 1.9	< 8.8	5.7	< 21	< 2.2	< 16	< 3.5
F-25	FSG-25-5.0	5.0	10/15/2021	69	< 2.0	< 18	< 95	< 1.9	120	---	< 18	14	< 8.8	6.5	35	< 2.2	< 16	< 3.5
F-26	FSG-26-5.0	5.0	10/15/2021	8.3	< 2.0	< 18	< 95	< 1.9	13	---	< 18	< 1.9	< 8.8	< 2.7	< 21	< 2.2	< 16	5.4
San Francisco Bay RWQCB ESLs for Subslab/Soil Gas - Commercial/Industrial ³				18	1,200	NE	NE	NE	160	83,000	NE	1,600	410	12	NE	130,000	NE	67

Table 8
Soil Gas Analytical Results for Detected VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (micrograms per cubic meter) ²														
				Chloroform	cis-1,2-Dichloroethene	Cyclohexane	Ethanol	Ethyl Acetate	Ethylbenzene	Gasoline Range Organics	Hexane	Methyl Tertiary Butyl Ether	Methylene Chloride	Naphthalene	n-Heptane	Styrene	tert-Butyl Alcohol	Tetrachloroethene (PCE)
29469 Ruus Road																		
R-7	R-7-SG	0.5	12/23/2021	< 15	< 12	---	---	< 11	< 13	< 1,100	< 11	< 11	< 62	17	---	< 13	< 9.1	< 20
R-8	R-8-SG	0.5	12/23/2021	< 2.4	< 2.0	---	---	< 1.8	< 2.2	384	3.8	< 1.8	23	< 2.6	---	< 2.1	2.1	< 3.4
R-12	R-12-SG	5.0	12/23/2021	< 2.4	< 2.0	---	---	< 1.8	< 2.2	1,130	18	21	< 10	< 2.6	---	< 2.1	15	< 3.4
R-20	R-20-SG-0.5	0.5	9/26/2022	< 2.9	< 2.4	---	---	< 2.2	< 2.6	---	< 2.1	< 2.2	< 12	< 3.1	---	< 2.6	< 1.8	< 4.1
	R-20-SG-5.0	5.0	9/26/2022	4.1	< 2.6	---	---	< 2.3	25	---	< 2.3	< 2.3	< 14	< 3.4	---	< 2.8	5.4	< 4.4
R-21	R-21-SG-0.5	0.5	9/26/2022	< 2.4	< 2.0	---	---	< 1.8	< 2.2	---	< 1.8	< 1.8	< 10	< 2.6	---	< 2.1	5.3	13
R-22	R-22-SG-0.5	0.5	9/26/2022	< 2.4	< 2.0	---	---	< 1.8	< 2.2	---	< 1.8	< 1.8	< 10	39	---	< 2.1	< 1.5	< 3.4
R-23	R-23-SG-0.5	0.5	9/26/2022	< 2.4	< 2.0	---	---	< 1.8	< 2.2	---	< 1.8	< 1.8	< 10	< 2.6	---	< 2.1	< 1.5	< 3.4
R-24	R-24-SG-0.5	0.5	9/26/2022	< 2.4	< 2.0	---	---	< 1.8	< 2.2	---	< 1.8	< 1.8	< 10	< 2.6	---	< 2.1	5.2	< 3.4
San Francisco Bay RWQCB ESLs for Subslab/Soil Gas - Commercial/Industrial ³				18	1,200	NE	NE	NE	160	83,000	NE	1,600	410	12	NE	130,000	NE	67

Table 8
Soil Gas Analytical Results for Detected VOCs
1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (micrograms per cubic meter) ²								Analytical Results (percent) ³
				Tetrahydrofuran	Toluene	Trichloroethene (TCE)	Trichlorofluoromethane	Vinyl Chloride	m,p-Xylene	o-Xylene	Xylenes	Helium
1571, 1581, and 1593 Industrial Parkway West												
FSS-1	FSS-1	0.5	8/31/2021	< 3.0	< 1.9	<2.8	< 2.9	< 0.26	7.3	< 2.2	7.3	---
FSS-4	FSS-4	0.5	8/31/2021	9.3	< 3.8	<5.6	< 5.8	< 0.52	< 8.8	< 4.4	< 4.4	---
FSS-7	FSS-7	0.5	8/31/2021	< 30	< 19	<28	< 29	< 2.6	< 44	< 22	< 22	---
FSS-11	FSS-11	0.5	8/31/2021	< 6.0	14	<5.6	< 5.8	< 0.52	14	< 4.4	14	---
FSS-13	FSS-13	0.5	8/31/2021	< 3.0	33	<2.8	< 2.9	< 0.26	12	3.6	16	---
FSS-14	FSS-14	0.5	8/31/2021	< 30	51	<28	< 29	< 2.6	240	190	430	---
FSS-16	FSS-16	0.5	9/17/2021	< 3.0	2.3	< 2.8	< 2.9	< 0.26	< 4.4	< 2.2	< 2.2	---
FSS-17	FSS-17	0.5	9/17/2021	< 12	< 7.6	< 11	< 12	< 1.0	< 18	< 8.8	< 8.8	---
FSS-18	FSS-18	0.5	9/17/2021	< 12	< 7.6	120	< 12	< 1.0	< 18	< 8.8	< 8.8	---
F-19	FSG-19-5.0	5.0	10/15/2021	4.7	30	< 2.8	< 2.9	< 0.26	49	14	63	---
F-20	FSG-20-5.0	5.0	10/15/2021	5.1	31	< 2.8	< 2.9	< 0.26	94	28	120	---
F-21	FSG-21-5.0	5.0	10/15/2021	< 3.0	66	< 2.8	< 2.9	< 0.26	120	34	150	---
F-22	FSG-22-5.0	5.0	10/15/2021	< 3.0	30	< 2.8	< 2.9	< 0.26	55	18	73	---
F-23	FSG-23-5.0	5.0	10/15/2021	< 6.0	42	< 5.6	< 5.8	< 0.52	80	27	110	---
F-24	FSG-24-5.0	5.0	10/15/2021	< 3.0	32	< 2.8	< 2.9	0.49	55	17	72	---
F-25	FSG-25-5.0	5.0	10/15/2021	27	240	< 2.8	< 2.9	< 0.26	470	130	600	---
F-26	FSG-26-5.0	5.0	10/15/2021	< 3.0	19	< 2.8	< 2.9	< 0.26	56	18	74	---
San Francisco Bay RWQCB ESLs for Subslab/Soil Gas - Commercial/Industrial ³				NE	44,000	100	NE	5.2	15,000		15,000	NE

Table 8
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1571, 1581, 1593 and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California
Farallon PN: 1353-070

Sample Location	Sample Identification	Sample Depth (feet) ¹	Sample Date	Analytical Results (micrograms per cubic meter) ²								Analytical Results (percent) ³
				Tetrahydrofuran	Toluene	Trichloroethene (TCE)	Trichlorofluoromethane	Vinyl Chloride	m,p-Xylene	o-Xylene	Xylenes	Helium
29469 Ruus Road												
R-7	R-7-SG	0.5	12/23/2021	< 8.9	< 11	< 16	28	< 7.7	< 13	< 13	---	---
R-8	R-8-SG	0.5	12/23/2021	< 1.5	2.8	< 2.7	35	< 1.3	2.2	< 2.2	---	---
R-12	R-12-SG	5.0	12/23/2021	< 1.5	4.2	< 2.7	< 2.8	< 1.3	8.3	6.7	---	---
R-20	R-20-SG-0.5	0.5	9/26/2022	< 1.8	< 2.3	< 3.2	< 3.4	< 1.5	3.0	< 2.6	---	< 0.041
	R-20-SG-5.0	5.0	9/26/2022	< 1.9	50	< 3.5	< 3.7	< 1.7	88	29	---	< 0.040
R-21	R-21-SG-0.5	0.5	9/26/2022	< 1.5	4.6	< 2.7	< 2.8	< 1.3	7.1	2.3	---	< 0.022
R-22	R-22-SG-0.5	0.5	9/26/2022	< 1.5	< 1.9	< 2.7	< 2.8	< 1.3	4.7	< 2.2	---	< 0.0049
R-23	R-23-SG-0.5	0.5	9/26/2022	< 1.5	< 1.9	< 2.7	< 2.8	< 1.3	< 2.2	< 2.2	---	< 0.019
R-24	R-24-SG-0.5	0.5	9/26/2022	150	2.1	4.1	< 2.8	< 1.3	3.8	< 2.2	---	< 0.016
San Francisco Bay RWQCB ESLs for Subslab/Soil Gas - Commercial/Industrial ³				NE	44,000	100	NE	5.2	15,000		15,000	NE

NOTES:

Bold denotes a concentration detected at or exceeding the laboratory reporting limit.

NE = not established

Bold and highlighted **yellow** denote concentrations exceeding Commercial/Industrial ESLs.

< denotes analyte not detected at or exceeding the reporting limit listed.

--- denotes sample not analyzed.

¹Depth in feet below ground surface.

²Analyzed by U.S. Environmental Protection Agency Method TO-15. Only detected analytes are shown in table; see lab reports for full list of analytes.

³San Francisco Bay RWQCB Subslab/Soil Gas Vapor Intrusion: Human Health Risk Levels (Table SG-1) dated 2019 (Rev 2).

Table 9
Sampling and Analysis Plan
1571, 1581, and 1593 Industrial Parkway West
Hayward, California
Farallon PN: 1353-062

Sample Location	Sample Matrix	Sample Depth ¹	Laboratory Analyses			
			GRO ²	DRO ³	ORO ³	VOCs ⁴
F-27	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-28	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-29	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-30	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-31	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-32	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-33	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-34	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold

Table 9
Sampling and Analysis Plan
1571, 1581, and 1593 Industrial Parkway West
Hayward, California
Farallon PN: 1353-062

Sample Location	Sample Matrix	Sample Depth ¹	Laboratory Analyses			
			GRO ²	DRO ³	ORO ³	VOCs ⁴
F-35	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-36	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-37	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-38	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-39	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-40	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-41	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-42	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold

Table 9
Sampling and Analysis Plan
1571, 1581, and 1593 Industrial Parkway West
Hayward, California
Farallon PN: 1353-062

Sample Location	Sample Matrix	Sample Depth ¹	Laboratory Analyses			
			GRO ²	DRO ³	ORO ³	VOCs ⁴
F-43	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-44	Soil	0.5	---	---	---	X
		1.5	---	---	---	X
		3.0	---	---	---	X
		5.0	---	---	---	Hold
F-45	Soil Gas	0.5	---	---	---	X
	Soil Gas	5.0	---	---	---	X
F-46	Soil Gas	5.0	X	---	---	X
F-47	Soil Gas	5.0	X	---	---	X
F-48	Soil Gas	5.0	X	---	---	X
F-49	Soil	1.0	---	---	X	---
	Soil	5.0	---	---	X	---
	Soil	10	---	---	X	---
	Groundwater	20	---	---	X	---
FMW-1	Groundwater	20	X	X	X	X
FMW-2	Groundwater	20	X	X	X	X
FMW-3	Groundwater	20	X	X	X	X

NOTES:

X denotes sample collected for analysis.

--- denotes sample not collected for analysis.

¹Depth in feet below ground surface.

²Analyzed by U.S. Environmental Protection Agency (EPA) Method 8260B.

³Analyzed by EPA Method 8015.

⁴Analyzed by EPA Method 8260B or TO-15.

DRO = total petroleum hydrocarbons (TPH) as diesel-range organics

GRO = TPH as gasoline-range organics

ORO = TPH as oil-range organics

VOCs = volatile organic compounds

APPENDIX A
STANDARD OPERATING PROCEDURES

DATA GAP INVESTIGATION WORK PLAN
Industrial Parkway and Ruus Road Properties
1571, 1581, 1593, and 1617 Industrial Parkway West and 29469 Ruus Road
Hayward, California

Farallon PN: 1353-070



Standard Operating Procedure Installation and Extraction of the Vapor Pin®

Updated September 9, 2016

Scope:

This standard operating procedure describes the installation and extraction of the VAPOR PIN® for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the VAPOR PIN® for the collection of sub-slab soil-gas samples or pressure readings.

Equipment Needed:

- Assembled VAPOR PIN® [VAPOR PIN® and silicone sleeve(Figure 1)]; Because of sharp edges, gloves are recommended for sleeve installation;
- Hammer drill;
- 5/8-inch (16mm) diameter hammer bit (hole must be 5/8-inch (16mm) diameter to ensure seal. It is recommended that you use the drill guide). (Hilti™ TE-YX 5/8" x 22" (400 mm) #00206514 or equivalent);
- 1½-inch (38mm) diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch (19mm) diameter bottle brush;
- Wet/Dry vacuum with HEPA filter (optional);
- VAPOR PIN® installation/extraction tool;
- Dead blow hammer;
- VAPOR PIN® flush mount cover, if desired;
- VAPOR PIN® drilling guide, if desired;

- VAPOR PIN® protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel for repairing the hole following the extraction of the VAPOR PIN®.



Figure 1. Assembled VAPOR PIN®

Installation Procedure:

- 1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.
- 2) Set up wet/dry vacuum to collect drill cuttings.
- 3) If a flush mount installation is required, drill a 1½-inch (38mm) diameter hole at least 1¾-inches (45mm) into the slab. Use of a VAPOR PIN® drilling guide is recommended.
- 4) Drill a 5/8-inch (16mm) diameter hole through the slab and approximately 1-inch (25mm) into the underlying soil to form a void. Hole must be 5/8-inch (16mm) in diameter to ensure seal. It is recommended that you use the drill guide.

VAPOR PIN® protected under US Patent # 8,220,347 B2, US 9,291,531 B2 and other patents pending

- 5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.
- 6) Place the lower end of VAPOR PIN® assembly into the drilled hole. Place the small hole located in the handle of the installation/extraction tool over the vapor pin to protect the barb fitting, and tap the vapor pin into place using a dead blow hammer (Figure 2). Make sure the installation/extraction tool is aligned parallel to the vapor pin to avoid damaging the barb fitting.



Figure 2. Installing the VAPOR PIN®

During installation, the silicone sleeve will form a slight bulge between the slab and the VAPOR PIN® shoulder. Place the protective cap on VAPOR PIN® to prevent vapor loss prior to sampling (Figure 3).



Figure 3. Installed VAPOR PIN®

- 7) For flush mount installations, cover the vapor pin with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover (Figure 4).



Figure 4. Secure Cover Installed

- 8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.
- 9) Remove protective cap and connect sample tubing to the barb fitting of the VAPOR PIN®. This connection can be made using a short piece of Tygon™ tubing to join the VAPOR PIN® with the Nylaflo tubing (Figure 5). Put the

Nylaflow tubing as close to the VAPOR PIN® as possible to minimize contact between soil gas and Tygon™ tubing.



Figure 5. VAPOR PIN® sample connection

- 10) Conduct leak tests in accordance with applicable guidance. If the method of leak testing is not specified, an alternative can be the use of a water dam and vacuum pump, as described in SOP Leak Testing the VAPOR PIN® via Mechanical Means (Figure 6). For flush-mount installations, distilled water can be poured directly into the 1 1/2 inch (38mm) hole.



Figure 6. Water dam used for leak detection

- 11) Collect sub-slab soil gas sample or pressure reading. When finished, replace the protective cap and flush mount cover

until the next event. If the sampling is complete, extract the VAPOR PIN®.

Extraction Procedure:

- 1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the VAPOR PIN® (Figure 7). Turn the tool clockwise continuously, don't stop turning, the VAPOR PIN® will feed into the bottom of the installation/extraction tool and will extract from the hole like a wine cork, DO NOT PULL.
- 2) Fill the void with hydraulic cement and smooth with a trowel or putty knife.



Figure 7. Removing the VAPOR PIN®

- Prior to reuse, remove the silicone sleeve and protective cap and discard. Decontaminate the VAPOR PIN® in a hot water and Alconox® wash, then heat in an oven to a temperature of 265° F (130° C) for 15 to 30 minutes. For both steps, STAINLESS – 1/2 hour, BRASS 8 minutes
- 3) Replacement parts and supplies are available online.

STANDARD OPERATING PROCEDURE (SOP) CA-SL-01

SUBSLAB SOIL GAS VAPOR PIN INSTALLATION AND SAMPLING

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the information needed to collect and document subslab soil gas samples through Vapor Pins to ensure representative sampling and accurate documentation of the data collection process.

The step-by-step guidelines provided in this SOP are to be followed by the field crew installing and collecting subslab soil gas samples from Vapor Pins. This SOP was prepared in accordance with the *Advisory–Active Soil Gas Investigations* dated July 2015, prepared by the California Department of Toxic Substances Control (California Environmental Protection Agency 2015) (DTSC Advisory), the *Standard Operating Procedure Installation and Extraction of the Vapor Pin* prepared by Cox-Colvin & Associates, Inc. (2016), and additional guidance documents provided in the bibliography.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly conduct subslab soil gas sampling through Vapor Pins:

- A laboratory- or subcontractor-provided shroud. The shroud will enclose the 1-liter Summa canister used to collect the sample while allowing leak testing to be performed using analytical-grade helium.
- An analytical-grade helium MGD 2002 dielectric helium detector (or equivalent helium detection device).
- New 0.25-inch-outside-diameter Teflon tubing and Swagelok 0.25-inch-outside-diameter compression fittings for dedicated sampling at each sampling location.
- A hand-held rotary hammer drill with 1.5-inch- and 5/8-inch-diameter bits to penetrate the slab.
- Aquarium-grade silicone or suitable volatile organic compound (VOC)–free substance to seal the slab borehole annulus and sample tubing, as needed.
- A sufficient number of 1-liter Summa canisters supplied by the analytical laboratory, as specified by the project sampling plan. Each canister will be equipped with a dedicated manifold with T-fitting that includes appropriate filters, pressure gauges, valves, and flow controllers set for a sample collection rate of 200 milliliters per minute or less (depending on the desired sampling-time interval), and/or accessories to collect samples required by the project sampling plan.
- Equipment required to collect samples using 1-liter Summa canisters, including appropriate wrenches and other tools and/or fittings.



- A lung box, Tedlar bags, and a low-volume purge pump or syringe for evaluating leaks in the sampling train prior to initiating sampling using helium tracer gas.
- Laboratory-provided shipping containers for the Summa canisters.
- Patch material to restore the area of the drilled hole to its original condition.
- Field notes to record sampling procedures and data.

DECONTAMINATION

Use dedicated soil gas sampling supplies and equipment at each location. No decontamination of equipment in the field is required.

PROCEDURES

Implement the following to collect soil gas samples representative of conditions beneath the building slab.

Preparation for Installation

Perform the following steps to prepare and stage the sampling equipment prior to performing leak-detection testing and sample collection at each sampling location:

- Ensure that access agreements are in place and the building owner and/or operator is aware that sampling will be performed.
- Clear the sampling locations for utilities. Building slabs may contain conduits for electrical wires, structural cables, and/or other utilities that could be encountered when the slab is cored for sampling. Retain a private utility location service for each sampling location at sites where utility locations have not been documented.
- Install the Vapor Pin according to the *Standard Operating Procedures Installation and Extraction of the Vapor Pin* prepared by Cox-Colvin & Associates, Inc. (2016).
- Apply aquarium-grade silicone or a similar VOC-free substance inside the borehole to seal the core annulus around the Vapor Pin, if needed.
- Place the sample canister assembly near the sampling point inside of the shroud. Use the laboratory-supplied manifold with T-fitting to connect the tubing and the fittings so there is a feed from the subslab sample collection tubing into the sampling canister and also to the connection exiting the shroud for leak detection.
- Configure the helium supply, helium detector, and sampling shroud for monitoring using a sampling train similar to that illustrated on Figure C-1 of the DTSC Advisory.

Equilibration Time

Subsurface conditions are disturbed during drilling and probe placement. Follow recommended equilibration times to allow the subsurface conditions to equilibrate back to representative pre-disturbance conditions detailed in Section 4.0, Soil Gas Sample Collection of the DTSC Advisory.



Install Vapor Pins using a rotary hammer and allow them to equilibrate for at least 2 hours prior to sampling.

Leak-Detection Protocols

Make provisions to eliminate or minimize leakage of ambient air into the subslab soil gas sample. Helium concentrations measured in the sample must not exceed 5 percent of the helium concentration in the shroud (e.g., 1 percent helium in the sample at a 20 percent shroud concentration). Introduction of ambient air into the soil gas sample may dilute the sample results or may bias the soil gas sample high if ambient air contains concentrations of the target hazardous substance(s). Use of a tracer gas enables detection of ambient air incursion from above the slab if the soil gas probe and/or the sampling canister assembly is not completely sealed. Farallon uses analytical-grade helium as the tracer gas. Collect a preliminary soil gas sample in a Tedlar bag and screen using the helium detector before opening the 1-liter Summa canister. If helium is detected during real-time Tedlar bag sample collection, indicating potential ambient air leakage, make modifications and/or adjustments of sampling equipment prior to soil gas sampling.

Leak-Detection Testing for Manifolds

Several days before sampling commences, test for leaks in the laboratory-supplied manifolds and/or flow controllers to allow time to obtain new canisters, manifolds, and/or flow controllers if the equipment fails the testing. Follow the instructions below for the leak-detection testing:

- Verify that the number engraved on each Summa canister matches the number listed on the certified-clean tag attached to the canister to ensure that the canister was properly decontaminated. Ensure that documentation of the laboratory certification for the canister(s) is included on a tag attached to the canister and in the paperwork that accompanies the canister shipment from the laboratory.
- Confirm that the Summa canister valves are closed (i.e., the knob is tightened clockwise).
- Attach the manifold—including the filter, flow controller, and pressure gauge—to the canister.
- Confirm that a brass cap is secured at the inlet of the manifold/flow controller, creating an air-tight sampling train.
- Quickly open and close the sample canister valve and observe the gauge reading. If the initial gauge reading is less than the minimum canister pressure necessary to collect a sample that will meet the required practical quantitation limit/method detection limit, discontinue leak testing, and obtain additional canisters. Repeat the testing for all new canisters.
- If the initial vacuum pressure is more than minimum canister pressure necessary to collect a sample that will meet the required practical quantitation limit/method detection limit, continue to monitor the gauge to check for leaks in the manifold and connections to the Summa canister. Observe the gauge for 5 minutes. If the needle on



the gauge drops, indicating a loss of pressure, the sampling train is not air-tight. In this situation, refit and/or tighten the connections until the needle holds steady. If leakage is still indicated, use an alternate manifold/flow controller to confirm that the initial manifold/flow controller requires replacement. Obtain replacement equipment and repeat the testing.

- Once the sample canisters and the laboratory-supplied equipment have been tested and approved for use, proceed with field-testing for potential leaks in the sampling train associated with tubing connections and the seal at the concrete slab.

Shut-in Testing, Purging, and Real-Time Leak Detection

Use the following protocol to test for leaks during the sample collection. Follow the instructions below followed for shut-in testing, purging, and real-time leak detection:

- Remove the brass cap from the manifold/flow controller inlet and connect the tubing from the sample port using a laboratory-supplied manifold with a T-fitting. Connect the other outlet from the manifold will be connected via Teflon tubing to the helium sampling port on the side of the sampling shroud. Record the length of each piece of tubing used during sample train assembly. The tubing lengths will be used to estimate purge volumes of ambient air to be removed prior to sampling.
- Connect the tubing from the helium sampling port to the inlet for the lung box. Connect a Tedlar bag to the helium sampling port connection inside the lung box. Connect the low-volume purge pump inlet or syringe to the other port for the lung box. Open the valve on the Tedlar bag for sampling and seal the lung box.
- Ensure that the sampling shroud base has a seal that will retain the helium and minimize introduction of ambient indoor air.
- Perform additional shut-in testing on the fully assembled sampling train once it is set up in the field by evacuating the sampling train to a minimum measured vacuum of approximately 100 inches of water using the purge pump or syringe. Observe the vacuum gauge connected to the system with a T-fitting for at least 1 minute. If there is any observable loss of vacuum, adjust the fittings until the vacuum in the sample train does not noticeably dissipate. After a successful shut-in test, do not alter the sampling train. Calibrate the vacuum gauge so that it is sensitive enough to indicate a water pressure change of 0.5 inch.
- Attach the tubing from the flow controller for the helium canister to the port on the sampling shroud and begin filling the shroud with helium, maintaining a minimum concentration of at least 20 percent as measured with the helium detector.
DO NOT OPEN THE SAMPLE CANISTER.
- Purge an estimated three volumes of air from the tubing/borehole. Use the following equation to calculate the volume of air to be removed:
- Volume (in cubic inches) = $3.1417 X r^2$



- Where:
- X = the length of tubing (inches) and
- r = the inner radius (inches) of all tubing lengths being used.
- Use the same equation to estimate the volume of the cored boring in the concrete slab, where “ X ” is the depth of the boring, and “ r ” is the radius of the boring.
- Add the two volumes as well as the estimated volume of air within the manifold to determine one “internal” volume of air to be purged. Multiply this volume by three for three purge volumes; the result will be in cubic inches. Divide by the flow rate (200 milliliters per minute = 12.2 cubic inches per minute) to determine how many minutes (or convert to seconds by multiplying by 60) to purge the tubing. Record the calculations in the field notes.
- Use the low-flow purge pump or syringe to evacuate the lung box, drawing the calculated purge volumes into the Tedlar bag. The calculated purge volume should produce a sample volume sufficient to evaluate whether helium is present in the sample using the helium detector. If an additional sample is required, record the additional volume of soil gas removed.
- Once the calculated purge volume has been reached, close the valve on the shroud, and turn off the pump. Open the lung box and close the valve on the Tedlar bag. Remove the Tedlar bag and use the helium detector to measure the helium concentration in the Tedlar bag. If helium concentrations in the Tedlar bag exceed 5 percent of the helium concentration in the shroud (i.e., 1 percent helium in the Tedlar bag at a 20 percent shroud concentration), there is sufficient leakage to compromise the soil gas analytical results.
- Check all fittings/seals and repeat the shut-in test and leak test until helium concentrations are less than 5 percent of the concentration measured in the shroud.

Sampling Methodology

Soil gas sampling will be will not be performed during a significant rainfall event (i.e., more than 0.5 inch of rainfall during a 24-hour period). Sampling will only be conducted after 5 days without a significant rainfall event. Infiltration of rainwater adjacent to a building slab may have a temporary effect on soil gas conditions and yield biased, non-representative sampling results.

Initiate sampling procedures immediately upon confirmation that leakage of ambient air has been eliminated, or reduced to an acceptable level (i.e., less than 5 percent helium in the sample). Follow the instructions below for soil gas sample collection:

- Open the sample canister valve and record the pressure on the gauge as “initial pressure” in the field notes and on the sample tag attached to the canister. Ensure that the sample shroud is undisturbed and protects the sample canister throughout the sampling period. The sampling period will be based on the flow controller setting



- established by the laboratory. Maintain the flow rate between 100 and 200 milliliters per minute, as recommended in the DTSC Advisory.
- Check the canister to confirm that it is filling at the rate specified for the flow controller. Because the accuracy of the flow regulators can vary slightly, causing a canister to fill faster or more slowly than expected, check canister pressure before the end of the sampling period. The volume of air sampled is a linear function of the canister vacuum. Therefore, halfway through the sampling, the canister should be half-filled and the gauge should read approximately 17 inches of mercury. Ensure the final pressure at the end of sampling is 5 inches of mercury to ensure that ambient air does not accidentally enter the canister during shipping.
 - Upon completion of the sampling, record the time and the exact pressure of the canister on the sample tag for that canister, on the Chain of Custody form, and in the field notes. Record any other condition that could affect the results (e.g., site activities, weather, holes and/or cracks in the concrete slab).
 - Close the sample canister valve, disconnect it from the manifold, and replace and tighten the brass caps on the canister inlet.
 - If sampling from a temporary location, extract the Vapor Pin using the *Standard Operating Procedure Installation and Extraction of the Vapor Pin* prepared by Cox-Colvin & Associates, Inc. If sampling from a permanent location, install the flush-mounted cover to protect the Vapor Pin according to the *Standard Operating Procedure Installation and Extraction of the Vapor Pin* prepared by Cox-Colvin & Associates, Inc. (2016)

Post-Sampling Procedures

Ensure that all sample containers are labeled with the following information: sample identification, date and time the sample was collected, initial and ending canister pressure, site name, and company name. Record this information and the time sample collection was completed in the field notes and transfer pertinent information to the Chain of Custody form. Pack each Summa canister in its original shipping container, seal with a custody seal, and send to the laboratory for analysis as soon as possible.

Analysis

Subslab soil gas samples will be analyzed using U.S. Environmental Protection Agency Method TO-15. The hold time for analysis of most VOCs using U.S. Environmental Protection Agency Method TO-15 is 30 days. Check the Project Sampling Plan for any project-specific hold times.

DOCUMENTATION

Provide documentation regarding field activities, environmental and building conditions, and other sampling documentation such as photos and video recordings. Include the documentation on standard Farallon forms and in the field notes and, if electronically recorded, label the documents and transfer them to the proper project folder.



BIBLIOGRAPHY

- California Environmental Protection Agency. 2015. *Advisory – Active Soil Gas Investigations*. Department of Toxic Substances Control. July.
- Commonwealth of Massachusetts Department of Environmental Protection. 2002. *Indoor Air Sampling and Evaluation Guide*. WSC Policy #02-430. Boston, Massachusetts. April.
- Cox-Colvin & Associates, Inc. 2016. *Standard Operating Procedure Installation and Extraction of the Vapor Pin*. September.
- New York State Department of Health. 2006. *New York State Department of Health Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. October.
- U.S. Environmental Protection Agency. 1999. *Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method To-14A, Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters with Subsequent Analysis by Gas Chromatography*. Center for Environmental Research Information, Office of Research and Development. January.
- . 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils*. EPA530-02-052. November.
- . 2004. *Standard Operating Procedure (SOP) for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations*. U.S. Office of Research and Development, National Risk Management Research Laboratory, Groundwater and Ecosystem Restoration Division. Ada, Oklahoma.
- Washington State Department of Ecology. 2009. *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*. Review Draft. October.

STANDARD OPERATING PROCEDURE (SOP) CA-SL-02

SOIL GAS WELL INSTALLATION AND SAMPLING

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the information needed to document soil gas well installation and collect soil gas samples to ensure representative sampling and accurate documentation of the data collection process.

The step-by-step guidelines provided in this SOP are to be followed by the field crew installing soil gas wells and collecting soil gas samples. This SOP was prepared in accordance with the *Advisory–Active Soil Gas Investigations* dated July 2015, prepared by the California Department of Toxic Substances Control (California Environmental Protection Agency 2015) (DTSC Advisory) and additional guidance documents provided in the bibliography.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly conduct soil gas sampling:

- A laboratory- or subcontractor-provided shroud. The shroud will enclose the 1-liter Summa canister used to collect the sample while allowing leak testing to be performed using analytical-grade helium.
- An analytical-grade helium MGD 2002 dielectric helium detector (or equivalent helium detection device).
- New 0.25-inch-outside-diameter Teflon tubing and Swagelok 0.25-inch-outside-diameter compression fittings for dedicated sampling at each sampling location.
- A subcontracted concrete corer to penetrate the slab and remove a core with a minimum diameter of 4 inches.
- A subcontracted driller to hand-auger the first 5 feet of the borehole and drill the boring to depth.
- A sufficient number of 1-liter Summa canisters supplied by the analytical laboratory, as specified by the Project Sampling Plan. Each canister must be equipped with a dedicated manifold with a T-fitting that includes appropriate filters, pressure gauges, valves, and flow controllers set for a sample collection rate of 200 milliliters per minute or less (depending on the desired sampling-time interval), and/or accessories to collect samples required by the Project Sampling Plan.
- Equipment required to collect samples using 1-liter Summa canisters, including appropriate wrenches and other tools and/or fittings.
- A lung box, Tedlar bags, and a low-volume purge pump or syringe for evaluating leaks in the sampling train using helium tracer gas.
- The laboratory-provided shipping containers for the Summa canisters.



- Patch material to restore the area of the drilled hole to its original condition.
- Field notes to record sampling procedures and data.

DECONTAMINATION

Use dedicated soil gas sampling supplies and equipment at each location. Decontaminate reusable equipment that will come into contact with soil before arrival at the site, upon relocation at the site, and upon demobilization from the site, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

The following procedures are to be implemented to collect soil gas samples representative of conditions. Procedures include preparation for sampling, leak-detection protocols, leak-detection testing for manifolds, purging and real-time leak detection, sampling methodology, post-sampling procedures, and analysis.

Preparation for Installation

Perform the following steps to prepare and stage the sampling equipment prior to performing leak-detection testing and sample collection at each sampling location:

- Ensure that access agreements are in place and the building owner and/or operator is aware that sampling will be performed.
- Clear the sampling locations for utilities. Building slabs may contain conduits for electrical wires, structural cables, and/or other utilities that could be encountered when the slab is cored for sampling. Retain a private utility location service for each sampling location at sites where utility locations have not been documented.
- Install a borehole by advancing hand-driven augers to a depth of 5 feet below ground surface. If installing deeper soil gas wells, retain a drilling contractor to use a drilling rig to drill a borehole to the depth specified in the Project Sampling Plan.
- Upon reaching total depth, lower new 0.25-inch Teflon tubing equipped with an air-stone to approximately 0.5 foot above the bottom of the total depth. Backfill the borehole with approximately 1 foot of clean #3 sand. Place approximately 6 inches of dry granular bentonite on top of the sand as a transition seal. Backfill the remainder of the borehole with hydrated bentonite to the surface. If installing a nested soil gas well, ensure that the hydrated bentonite seal extends to approximately 1 foot below the depth of the next soil vapor sampling probe, and install the probe using the procedures described above. In the event groundwater or hand-auger refusal is encountered at a depth shallower than the desired total depth, construct the soil gas well using the procedures described above from a depth of 1 foot above the water table or refusal depth.



- Seal the Teflon tubing at the surface and install a traffic-rated flush mounted well box, if installing a permanent sampling point.
- Containerize any soil cuttings generated during the soil gas well installation pending characterization for off-site disposal.
- Place the sample canister assembly near the sampling point inside of the shroud. Use the laboratory-supplied manifold with T-fitting to connect the tubing and the fittings so there is a feed from the subslab sample collection tubing into the sampling canister and also to the connection exiting the shroud for leak detection.
- Configure the helium supply, helium detector, and sampling shroud for monitoring using a sampling train similar to that illustrated on Figure C-1 of the DTSC Advisory.

Equilibration Time

Subsurface conditions are disturbed during drilling and probe placement. Follow recommended equilibration times to allow the subsurface conditions to equilibrate back to representative pre-disturbance conditions detailed in Section 4.0, Soil Gas Sample Collection of the DTSC Advisory. Allow soil gas wells to equilibrate for at least 48 hours prior to sampling.

Leak-Detection Protocols

Make provisions to eliminate or minimize leakage of ambient air into the subslab soil gas sample. Helium concentrations measured in the sample must not exceed 5 percent of the helium concentration in the shroud (e.g., 1 percent helium in the sample at a 20 percent shroud concentration). Introduction of ambient indoor air into the soil gas sample may dilute the sample results or may bias the soil gas sample high if ambient air contains concentrations of the target hazardous substance(s). Use of a tracer gas enables detection of ambient air incursion from above the slab if the soil gas probe and/or the sampling canister manifold assembly is not completely sealed. Farallon uses analytical-grade helium as the tracer gas. Collect a preliminary soil gas in a Tedlar bag and screen using the helium detector before opening the 1-liter Summa canister. If helium is detected during real-time Tedlar bag sample collection, indicating potential ambient air leakage, make modifications and/or adjustments to the sampling equipment prior to soil gas sampling.

Leak-Detection Testing for Manifolds

Several days before sampling commences, test for leaks in the laboratory-supplied manifolds and/or flow controllers to allow time to obtain new canisters, manifolds, and/or flow controllers if the equipment fails the testing. Follow the instructions below for the leak-detection testing:

- Verify that the number engraved on each Summa canister matches the number listed on the certified-clean tag attached to the canister to ensure that the canister was properly decontaminated. Ensure that documentation of the laboratory certification for the canister(s) is included on a tag attached to the canister and in the paperwork that accompanies the canister shipment from the laboratory.



- Confirm that the Summa canister valves are closed (i.e., the knob is tightened clockwise).
- Attach the manifold—including the filter, flow controller, and pressure gauge—to the canister.
- Confirm that a brass cap is secured at the inlet of the manifold/flow controller, creating an air-tight sampling train.
- Quickly open and close the sample canister valve and observe the gauge reading. If the initial gauge reading is less than the minimum canister pressure necessary to collect a sample that will meet the required practical quantitation limit/method detection limit, discontinue leak testing and obtain additional canisters. Repeat the testing for all new canisters.
- If the initial vacuum pressure is more than minimum canister pressure necessary to collect a sample that will meet the required practical quantitation limit/method detection limit, continue to monitor the gauge to check for leaks in the manifold and connections to the Summa canister. Observe the gauge for 5 minutes. If the needle on the gauge drops, indicating a loss of pressure, the sampling train is not air-tight. In this situation, refit and/or tighten the connections until the needle holds steady. If leakage is still indicated, use an alternate manifold/flow controller to confirm that the initial manifold/flow controller requires replacement. Obtain replacement equipment and repeat the testing.
- Once the sample canisters and the laboratory-supplied equipment have been tested and approved for use, proceed with field-testing for potential leaks in the sampling train associated with tubing connections and the seal at the concrete slab.

Shut-in Testing, Purging, and Real-Time Leak Detection

Use the following protocol to test for leaks during the sample collection. Follow the instructions below followed for shut-in testing, purging, and real-time leak detection:

- Remove the brass cap from the manifold/flow controller inlet and connect the tubing from the sample port using a laboratory-supplied manifold with a T-fitting. Connect the other outlet from the manifold via Teflon tubing to the helium sampling port on the side of the sampling shroud. Record the length of each piece of tubing used during sample train assembly. The tubing lengths will be used to estimate purge volumes of ambient air to be removed prior to sampling.
- Connect the tubing from the helium sampling port to the inlet for the lung box. Connect a Tedlar bag to the helium sampling port connection inside the lung box. Connect the low-volume purge pump inlet or syringe to the other port for the lung box. Open the valve on the Tedlar bag for sampling and seal the lung box.
- Ensure that the sampling shroud base has a tight seal that will retain the helium and minimize introduction of ambient indoor air.



- Perform additional shut-in testing on the fully assembled sampling train once it is set up in the field by evacuating the sampling train to a minimum measured vacuum of approximately 100 inches of water using the purge pump or syringe. Observe the vacuum gauge connected to the system with a T-fitting for at least 1 minute. If there is any observable loss of vacuum, adjust the fittings until the vacuum in the sample train does not noticeably dissipate. After a successful shut-in test, do not alter the sampling train. Calibrate the vacuum gauge so that it is sensitive enough to indicate a water pressure change of 0.5 inch.
- Attach the tubing from the flow controller for the helium canister to the port on the sampling shroud and begin filling the shroud with helium, maintaining a minimum concentration of at least 20 percent as measured with the helium detector. **DO NOT OPEN THE SAMPLE CANISTER.**
- Purge an estimated three volumes of air from the tubing/borehole. Use the following equation to calculate the volume of air to be removed:

$$\text{Volume (in cubic inches)} = 3.1417 Xr^2$$

Where:

X = the length of tubing (inches) and

r = the inner radius (inches) of all tubing lengths being used.

- Use the same equation to estimate the volume of the cored boring, where “X” is the depth of the boring and “r” is the radius of the boring.
- Add the two volumes and well as the estimated volume of air within the manifold to determine one “internal” volume of air to be purged. Multiply this volume by three for three purge volumes; the result will be in cubic inches. Divide by the flow rate (200 milliliters per minute = 12.2 cubic inches per minute) to determine how many minutes (or convert to seconds by multiplying by 60) to purge the tubing. Record the calculations in the field notes.
- Use the low-flow purge pump or syringe to evacuate the lung box, drawing the calculated purge volumes into the Tedlar bag. The calculated purge volume should produce a sample volume sufficient to evaluate whether helium is present in the sample using the helium detector. If an additional sample is required, record the additional volume of soil gas removed.
- Once the calculated purge volume has been reached, close the valve on the shroud and turn off the pump. Open the lung box and close the valve on the Tedlar bag. Remove the Tedlar bag and use the helium detector to measure the helium concentration in the Tedlar bag. If helium concentrations in the Tedlar bag exceed 5 percent of the helium concentration in the shroud (i.e., 1 percent helium in the Tedlar bag at a 20 percent shroud concentration), there is sufficient leakage to compromise the soil gas analytical results.



- Check all fittings and repeat the shut-in test and leak test until helium concentrations are less than 5 percent of the concentration measured in the shroud.

Sampling Methodology

Soil gas sampling will not be performed during a significant rainfall event (i.e., more than 0.5 inch of rainfall during a 24-hour period). Sampling will only be conducted after 5 days without a significant rainfall event. Infiltration of rainwater adjacent to a building slab may have a temporary effect on soil gas conditions and yield biased, non-representative sampling results.

Initiate sampling procedures immediately upon confirmation that leakage of ambient air has been eliminated, or reduced to an acceptable level (i.e., less than 5 percent helium in the sample). Follow the instructions below for soil gas sample collection:

- Open the sample canister valve and record the pressure on the gauge as “initial pressure” in the field notes and on the sample tag attached to the canister. Ensure that the sample shroud is undisturbed and protects the sample canister throughout the sampling period. The sampling period will be based on the flow controller setting established by the laboratory. Maintain the flow rate between 100 and 200 milliliters per minute, as recommended in the DTSC Advisory.
- Check the canister to confirm that it is filling at the rate specified for the flow controller. Because the accuracy of the flow regulators can vary slightly, causing a canister to fill faster or more slowly than expected, check canister pressure before the end of the sampling period. The volume of air sampled is a linear function of the canister vacuum. Therefore, halfway through the sampling, the canister should be half-filled and the gauge should read approximately 17 inches of mercury. Ensure the final pressure at the end of sampling is 5 inches of mercury to ensure that ambient air does not accidentally enter the canister during shipping.
- Upon completion of the sampling, record the time and the exact pressure of the canister on the sample tag for that canister, on the Chain of Custody form, and in the field notes. Record any other condition that could affect the results (e.g., site activities, weather, holes and/or cracks in the concrete slab).
- Close the sample canister valve, disconnect it from the manifold, and replace and tighten the brass caps on the canister inlet.
- If sampling from a temporary location, extract the Teflon tubing and remove the bentonite using a hand-auger, as needed, according to the requirements of the permitting agency. If sampling from a permanent location, seal the Teflon tubing at the surface and close the traffic-rated well box.

Post-Sampling Procedures

Ensure that all sample containers are labeled with the following information: sample identification, date and time the sample was collected, initial and ending canister pressure, site name, and



company name. Record this information and the time sample collection was completed in the field notes and transfer pertinent information to the Chain of Custody form. Pack each Summa canister in its original shipping container, seal with a custody seal, and send to the laboratory for analysis as soon as possible.

Analysis

Subslab soil gas samples will be analyzed using U.S. Environmental Protection Agency Method TO-15. The hold time for analysis of most VOCs using U.S. Environmental Protection Agency Method TO-15 is 30 days. Check the Project Sampling Plan for any project-specific hold times.

DOCUMENTATION

Provide documentation regarding field activities, environmental and building conditions, and other sampling documentation such as photos and video recordings. Include the documentation on standard Farallon forms and in the field notes and, if electronically recorded, label the documents and transfer them to the proper project folder.

BIBLIOGRAPHY

California Environmental Protection Agency. 2015. *Advisory – Active Soil Gas Investigations*. Department of Toxic Substances Control. July.

Commonwealth of Massachusetts Department of Environmental Protection. 2002. *Indoor Air Sampling and Evaluation Guide*. WSC Policy #02-430. Boston, Massachusetts. April.

New York State Department of Health. 2006. *New York State Department of Health Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. October.

U.S. Environmental Protection Agency. 1999. *Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method To-14A, Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters with Subsequent Analysis by Gas Chromatography*. Center for Environmental Research Information, Office of Research and Development. January.

———. 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils*. EPA530-02-052. November.

———. 2004. *Standard Operating Procedure (SOP) for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations*. U.S. Office of Research and Development, National Risk Management Research Laboratory, Groundwater and Ecosystem Restoration Division. Ada, Oklahoma.

Washington State Department of Ecology. 2009. *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action*. Review Draft. October.

STANDARD OPERATING PROCEDURE EQ-01

EQUIPMENT DECONTAMINATION PROCEDURES

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for decontaminating sampling equipment during various field activities. The step-by-step guidelines provided in this SOP are to be followed by the field crew during all site visits, as applicable.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly decontaminate field equipment during various field tasks:

- Rinse water or distilled water.
- Deionized water.
- Liquinox or other phosphate-free detergent.
- Paper towels.
- Labeled squirt bottles.
- Long-handled hard-bristle brushes (for sediment and soil).
- Cotton swabs.
- Plastic sheeting, garbage bags, and aluminum foil (for sediment and soil).
- Core liner caps or plastic wrap and rubber bands (for sediment and soil).
- Extension arm for cleaning core liners (for sediment and soil).
- Plastic 5-gallon bucket.
- U.S. Department of Transportation-approved drum(s) for decontamination water unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (see Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.

Dilute Liquinox with distilled water in a squirt bottle in accordance with the instructions on the Liquinox package, and label the bottle. Fill another squirt bottle with distilled water, and label the bottle.



FIELD EQUIPMENT TO BE DECONTAMINATED AFTER USE

Decontaminate the following field equipment at the conclusion of field work each day, in accordance with the procedures outlined in this SOP:

- Water-level meter.
- Horiba/YSI multiparameter probe.
- Bladder pump.
- Submersible pump.
- Sediment and soil collection and processing equipment.

WATER-LEVEL METER DECONTAMINATION

Decontaminate the water-level meter after measuring the water level at a monitoring well before moving to a new monitoring well, using the following procedures:

- Spray the bottom half of a paper towel with the diluted Liquinox solution, and the upper half with deionized water.
- Grip the measuring tape of the water-level meter with the paper towel in one hand with the Liquinox side down toward the monitoring well casing.
- Begin slowly reeling up the water-level meter while maintaining firm contact between the measuring tape and the paper towel.
- Ensure that no debris or contamination remains on the measuring tape of the water-level meter once it has been reeled up.
- Use a clean new paper towel for each successive decontamination of the measuring tape of the water-level meter.

HORIBA/YSI MULTIPARAMETER PROBE DECONTAMINATION

Decontaminate the Horiba/YSI multiparameter probe at the end of each workday or after sampling a monitoring well with high concentrations of contamination, using the following procedures:

- Remove the multiparameter probe from the flow-through cell, and thoroughly spray each component with deionized water.
- Use a cotton swab to gently clean around each sensor probe, ensuring that all contaminated water and material has been washed away.
- Refill the protective dissolved oxygen and pH probe caps with deionized water, and replace prior to storage.
- Once the multiparameter probe has been adequately cleaned, replace the protective shield, and return the probe to the case. If the device appears to be overly wet, allow it to air-dry with the case open.



- Do not use Liquinox to clean any probes on the Horiba multiparameter probe, as it may damage the device.

BLADDER PUMP DECONTAMINATION

Decontaminate the bladder pump after sampling a well and at the end of each workday, using the following procedures:

- After extracting the bladder pump from the well, break down the pump, remove and dispose of the used bladder, and spray each component with the diluted Liquinox solution, followed by deionized water.
- Wipe away any visible contamination or debris with a paper towel.
- Capture cleaning water in a liquid waste drum for proper disposal in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.
- Ensure that all contamination and Liquinox solution is washed off all components before reassembling the device, installing a new bladder, and moving to sample a new well.

SUBMERSIBLE PUMP DECONTAMINATION

Decontaminate the submersible pump after purging water from any well, using the following procedures:

- After extracting the submersible pump from the well, thoroughly spray down the pump with the diluted Liquinox solution, followed by deionized water.
- Wipe away any visible contamination or debris with a paper towel.
- Purge clean water through the pump and tubing to ensure that contaminated water has been cleared from all lines.
- Capture cleaning water in a liquid waste drum for proper disposal in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.

SEDIMENT AND SOIL SAMPLING AND PROCESSING EQUIPMENT DECONTAMINATION

Decontaminate sampling equipment used to collect and process sediment and soil samples, using the following procedures:

- Place contaminated equipment and decontamination tools on plastic sheeting.
- Thoroughly rinse all used equipment with distilled water in a 5-gallon bucket to remove excess sediment or soil.
- Pour one capful of Liquinox solution into a 5-gallon bucket filled with tap water or distilled water.
- Using a long-handled hard-bristle brush, thoroughly scrub the equipment with the Liquinox solution until no sediment or soil particles remain.



- Holding the equipment over a 5-gallon bucket, double-rinse the equipment with distilled water until no Liquinox solution remains. Do not allow clean equipment to come into contact with a contaminated surface.
- Drain the equipment and place it in a clean, dry place to prevent recontamination.
- If decontaminated equipment will not be re-used immediately, wrap stainless steel equipment (e.g., bowls, spoons) in aluminum foil with the dull side facing the equipment. Seal polycarbonate core liners with core caps or cellophane plastic. Rubber-band ends to ensure a proper seal.
- After decontamination has been completed, place disposable items into a garbage bag, and store decontamination water in a drum in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.

STANDARD OPERATING PROCEDURE EQ-02

PHOTOIONIZATION DETECTOR CALIBRATION AND OPERATION

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the information needed to properly use, operate, and handle MiniRAE Photoionization Detector (PID) Models 2000 and 3000. The PID is used as a field-screening instrument for measurement of total volatile organic (TVO) concentrations in air. Typical uses include air monitoring of the breathing zone for health and safety purposes, screening of groundwater and soil for TVO emissions, and monitoring of the headspace of a monitoring well. The PID is a highly sensitive instrument. MiniRAE Models 2000 and 3000 have a potential operating range of 0.1 to 15,000 parts per million (ppm) isobutylene equivalents, depending on the lamp used. The detection limit is 0.1 ppm hexane or isobutylene, with a response time of less than 3 seconds.

Operation and maintenance manuals specific to this equipment should be referenced as necessary. Two user manuals are kept in Farallon's PID case: the *MiniRAE 3000 Pocket Reference*; and the *MiniRAE 3000 User's Guide*. These manuals should always be stored in the PID case so they are available for reference.

The step-by-step guidelines provided in this SOP are to be followed by the field crew when monitoring concentrations of TVO compounds in the breathing zone, a soil sample, a water sample, or the headspace of a monitoring well.

EQUIPMENT

The following equipment is necessary to calibrate and operate the PID:

- The PID instrument;
- A calibration gas regulator and silicon tubing;
- Calibration gas containing approximately 100 ppm isobutylene; and
- A 110-volt battery charger.

PID CALIBRATION CHECK

PID calibration should be checked at the beginning of the day, and as needed if drift occurs (see "PID Drift or Other Change" section below). The instructions below are to be followed to check PID calibration (refer to pages 17 and 18 of the *MiniRAE 3000 User's Guide* for information regarding the connection between buttons and control functions):

- Turn on the PID by pressing [MODE]. Wait for the PID to proceed to the default display, and allow the instrument to warm up for 10 minutes in accordance with the manufacturer's instruction. The initial reading should be 0 or 0.1 part per million volume (ppmv).
- Connect the regulator to the gas cylinder, and connect the tubing to the regulator.



- Start the gas flow by pushing in the regulator knob and turning 90 degrees. Some gas will begin to escape.
- Connect the tubing from the regulator to the PID sensor tip. The PID reading should climb to 99 to 101 ppmv.
- When the PID reading reaches the maximum level displayed, turn off the regulator and disconnect the sensor tip. The reading should return to zero.
- If any of the readings predicted above do not occur, re-calibrate the PID or arrange for repair.

PID CALIBRATION

The instructions below are to be followed to perform a zero (fresh air) calibration and a span calibration on the PID (refer to pages 35 through 46 of the MiniRAE 3000 User's Guide for information regarding calibrations):

Zero Calibration (a zero calibration always should be performed prior to a span calibration):

- Turn the unit on by pressing [MODE] for approximately 1 second.
- Press and hold [MODE] and [N/-] simultaneously until you see the Password Screen.
- Input the password:
 - The default password is 0000.
 - Use the [Y/+] to increase the number value from 0 through 9.
 - Use the [N/-] to move the cursor to a different number slot.
 - Press [MODE] once you have input the password.
- Select "Calibration" by using [Y/+].
- Select "Zero Calib" by using [Y/+].
- Apply a fresh air source to the unit. Clean ambient air without detectable contaminants may be used as a fresh air source.
- Press [Y/+] to start the zero calibration. The zero calibration will take approximately 30 seconds to complete.
- The display screen will return to the Calibration menu when the zero calibration is complete.
- Record the values read by the PID in a calibration book or in the Log Field Book.

Once the zero calibration is complete, the unit automatically returns to the Calibration menu.

If the PID does not read 0.0 ppmv following the zero calibration, repeat the zero calibration procedure. If the PID fails both attempts to zero calibrate, move on to span calibration.



SPAN CALIBRATION

- Press [N/-] to scroll down to “Span Calib.”
- Press [Y/+] to select “Span Calib.”
- Select the proper calibration gas. Ensure that the calibration gas and the span value on the unit’s display screen have the same TVO concentration.
- Connect the regulator to the gas cylinder, and connect the tubing to the regulator.
- Press [Y/+] to begin the span calibration.
- Immediately apply the correct calibration gas to the unit’s probe by turning the regulator knob 90° in either direction. The span calibration will take approximately 30 seconds.
- The calibrated value should be +/- 2 percent of the concentration indicated on the calibration gas canister. Once the span calibration is complete, the unit will automatically return to the calibration menu.
- If the calibrated value is 2 percent greater than the concentration indicated on the calibration gas canister, repeat the span calibration procedure.
- Press [MODE] twice to navigate back to the main display.
- When calibrating the PID with isobutylene, record values read by the PID in a calibration book or in the Log Field Book.
- If the PID did not initially calibrate using the zero calibration mode, re-attempt to calibrate the PID using fresh air.

If the PID does not calibrate using the span calibration gas, call and update the Project Manager on the status.

PID DRIFT OR OTHER CHANGE

PID drift commonly is a failure of the instrument to return to zero after TVO concentrations dissipate. A failure to return to zero usually reflects inaccuracy at the upper end of the instrument’s detection range. Several situations can cause drift, including soil or water in the tip of the probe, soil or water in the sensor filter, or a change such as tightening or loosening the probe tip assembly since the instrument was last calibrated. The degree of drift from the initial daily calibration can be checked by exposing the PID to the calibration gas (see the “PID Calibration” section above). Re-calibration serves little purpose until the cause of the drift is determined.

If you determine that PID drift is occurring, complete the following actions:

- Unscrew the probe from the PID unit;
- Inspect the probe and the top of the unit for soil or moisture;
- Carefully remove any soil or moisture from the probe and/or unit by air drying;



- Replace the sensor filter on the probe with a new, unused sensor filter;
- Screw the probe back on the unit; and
- Apply Span Calibration gas to test the accuracy of the PID unit.

PID OPERATION

The instructions below are to be followed for PID use to screen soil and groundwater for TVO concentrations, to monitor the breathing zone for health and safety purposes, and to monitor monitoring well headspace:

- Connect the PID sample probe with filter to the PID hand-held air monitor.
- Turn on the PID by pressing [MODE]. Wait for the PID to proceed to the default display, and allow the instrument to warm up for 10 minutes in accordance with the manufacturer's instructions.
- **CAUTION!** Do not seal the soil in a plastic bag for longer than 5 minutes when conducting soil screening to avoid false readings due to moisture build-up (in wet situations, use the filter on the end of the sensor tip). Pierce the plastic bag with a clean tool, and immediately insert the sensor tip, quickly establishing a tight seal. The meter should react rapidly. Record the maximum value displayed within 30 seconds.
- To monitor groundwater and soil for TVO emissions, place the probe inlet near the groundwater or soil surface, and read the meter display showing detected concentrations. Do not allow water or soil to be sucked into the instrument.
- To monitor the breathing zone for health and safety purposes, allow the PID to monitor air quality at the breathing zone, chest, or face level, and read the meter display showing detected concentrations.
- Monitor the headspace of a monitoring well directly after the well has been opened. Place the probe inlet directly above the polyvinyl chloride well casing or tubing that is associated with a dedicated pump in the well. Read the meter display showing detected concentrations.
- Ensure that the PID is kept dry while in use. Humidity or moisture from rain can cause large fluctuations in PID readings, and can damage the instrument.
- If the PID displays erratic readings, it is possible that either moisture or dirt is in the probe, or dirt has collected in the filter. If this occurs, clean and dry the sample probe (possibly by placing it near a running heater in a vehicle), and replace the filter if necessary.

DOCUMENTATION

Document the PID measurements for all monitoring events on field forms and in a detailed field notebook, and record observations of varying weather conditions such as temperature and humidity fluctuations.



REFERENCES

PE Photovac Air Monitor/Portable Photoionization Detector Model 2000/3000 Manuals.

RAE Systems. 2010. *MiniRAE 3000 Pocket Reference*. PN: 059-4030-000-D. August.

———. 2010. *MiniRAE 3000 User's Guide*. P/N 059-4020-000. August.

STANDARD OPERATING PROCEDURE GN-01

FIELD NOTE PROCEDURES

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the information needed to document site and sampling activities during field work. The step-by-step guidelines provided in this SOP are to be followed by the field personnel during field work.

GENERAL FIELD NOTE INSTRUCTIONS

- Use a blue or black pen.
- Always document time in military time.
- Record your full name and the names of other Farallon employees present. Initials of personnel can be used after the full names have been provided in the field notes.
- Don't leave line spaces between field note entries.
- Keep handwriting neat.
- Be concise.

ITEMS TO INCLUDE IN FIELD NOTES

At Start of Workday:

- Document when and where you started the field day and when you arrived at the site.
- Note any stops along the way to the site.

Upon Arrival at Site:

- Note the reason for the site visit/site work.
- Document the weather on page 1, and throughout the day if the weather changes.
- Document the time personnel arrive at the site and the name of the company/agency they are affiliated with.
- Document the time subcontractors arrive, the tasks they are conducting, and the time they leave the Site.
- Conduct the Health and Safety (H&S) meeting, ensure all participants sign the H&S form, and include the signed H&S form in the field notes.
- Calibrate equipment: document equipment model number/serial number, calibration method, and results. Be specific (e.g., "Calibrated Horiba for pH using 4.0 standard." "Calibrated PID using 100 ppm isobutylene span gas and ambient air as zero gas."). Note whether the instrument is Farallon's or a rental. If using a rental, include in the field notes the calibration sheet that should have come with the equipment. If using two sets of



equipment, note on the field forms which equipment was used for each location. For example, label “Horiba 1” and “Horiba 2” on the groundwater sampling sheets, and document the serial numbers of the instruments in the field notes. Make sure to document the calibration results for Farallon equipment in the Rite-in-the-Rain notebook kept in each field equipment case.

- Document when work starts at a specific task location (e.g., well or boring), and document what equipment Farallon or the subcontractors are using at that location.
- Measure out and record the sample locations (using a rolling wheel, or GPS if available), and mark utilities on a field map if applicable.
- If media samples will be collected, complete the appropriate documentation form, or record the information in the field notes. For example, record field sampling methods (e.g., grab, composite), the type of media (e.g., soil, groundwater, stormwater), the time the sample was collected, sample location and ID, analytical method(s), the laboratory conducting the analysis, the size of the sample container, the number of containers used, and the preservative included in the sample container. If a composite sample is collected, record how many composite points make up the sample, and document where the composite samples were collected.
- If multiple samples are collected using the same methods and the same type of sample containers, simply document that a sample was collected the same as previous samples.
- Document when work is complete at each location.
- If conducting groundwater monitoring, note the condition of monitoring well monuments (e.g., bolts missing, gasket needed).
- Throughout the workday, note any relevant information (e.g., QC-sampling discrepancies, unexpected conditions, abnormal sampling events).

At End of Workday:

- Decontaminate equipment and note the decontamination method (e.g., Alconox and towels).
- Review the field notes, and complete sketches of any relevant features and sample locations if necessary.
- Record whether wastes were generated. If so, record how much was generated, whether the waste was sampled, and where the waste is stored.
- Place an “Analysis Pending” label on drums of waste, and fill out the label completely.
- Complete a drum inventory sheet and note the drum/container sizes and how much waste was accumulated.
- Document when you left the site;



- Document when you returned to the office or when the field day ended.
- Note any additional work performed after returning to the office (e.g., finished field notes, downloaded field photos).

Make sure to include any of the following forms relevant for the type of field work conducted:

- Daily Field Notes
- Health and Safety Meeting form
- Water Level Summary form
- Low Flow Well Purging and Sampling Data form
- Boring and/or test pit logs
- Monitoring Well Construction Data form
- Soil Sample Data form
- SVE Monitoring form
- Any site-specific operation and maintenance or pilot test forms
- Elevation Survey Data form
- Utility Clearance Log
- Waste Inventory Tracking Sheet
- Copy of the laboratory Chain of Custody form for any samples collected
- Copies of subcontractor daily log sheets (e.g., utility locate, drilling)
- Copies of rental equipment calibration sheets
- Near Miss form (if applicable)
- Incident Report form (if applicable)

Assemble all field forms used each day, scan, save to the electronic project Field Notes folder, and give the hard copy of the forms to the Project Manager.

Refer to the [Farallon Field Documentation Checklist](#) and the [Doc Reqs by Field Task](#) list.

STANDARD OPERATING PROCEDURE (SOP) GENERAL-02 UTILITY LOCATE

PURPOSE AND APPLICATION

The purpose of this SOP is to provide Farallon Consulting, L.L.C. (Farallon) personnel with the specific information needed to identify and locate utilities on sites where drilling or excavation activities will occur. Excavation is defined by Section 20 of Chapter 19.122 of the Revised Code of Washington (RCW 19.122.020) as “any operation, including the installation of signs, in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means.” For the purposes of this SOP, the excavation area refers to the area of an excavation or a perimeter around all proposed borings, test pits, soil gas sampling locations, and subslab soil gas sampling locations. Identifying utilities within the boundaries of a proposed excavation area prior to any digging is required by law and is necessary for the safety of Farallon personnel and contractors.

The guidelines provided in this SOP are to be followed by Farallon personnel who coordinate utility locating, mark locate boundaries, and/or observe field work that involves any type of excavation.

EQUIPMENT AND SUPPLIES

The following equipment and supplies are necessary to arrange and conduct utility locating:

- A map of the site with the proposed excavation area(s);
- Readable side sewer card figures, if applicable;
- Geographic information system (GIS) utility figures, if applicable;
- Readable American Land Title Association (ALTA) survey figures, if applicable;
- Any previous utility figures associated with the site;
- White marking products (e.g., paint, flags, stakes, grease marking pen, tape, chalk);
- Materials necessary to provide required documentation (e.g., Field Report form, camera, measuring wheel, global positioning system); and
- Personal protective equipment (PPE) as described in the site-specific Health and Safety Plan, or Level D PPE at a minimum.

PROCEDURES

The following utility locating procedures have been developed for use before excavation occurs on a site. The procedures are divided into the following four parts:

- Call Before You Dig System;



- Private Utility Locating Services;
- Hand-Clearing Proposed Excavation Areas; and
- Maintaining Public Utility Locate Marks.

The Project Manager should discuss the scope of work, details of the project location, and any essential information with the project field team before any of the procedures described below commence. When practicable, an on-site kickoff meeting involving a member of the field team and the Project Manager should be conducted to discuss the work to be performed, mark the boundaries of the excavation area, and mark potential boring locations, if applicable.

Call Before You Dig System

According to RCW 19.122.030, excavators are required to mark the boundary of a proposed excavation area using white marking products. Marking products include paint, flags, and stakes. Boundary marks should conform to the following guidelines:

- A continuous line, hashed line, dots, or corner marks with arrows are acceptable ways to mark the boundary.
- Flags and stakes can be used if paint is not adequate.

The location(s) of the proposed excavation area(s) must be reviewed to verify that no visible utilities that would interfere with the proposed excavation area(s) are present. If utilities are present, the Project Manager and field personnel should communicate the changes to the excavation that are area necessary before the boundaries are marked with white paint.

After marking the boundaries of the proposed excavation area, Farallon personnel must provide notice of the scheduled excavation to the owner/operators of buried utilities at least 2 but no more than 10 business days in advance by calling 811 or 1-800-424-5555, or using the online tool at www.callbeforeyoudig.org. Use of the online tool is preferred.

A map with the excavation area boundaries depicted and/or photos of the white paint marks is helpful in conveying the scope of work to the Call Before You Dig service.

The following information should be available to provide the Call Before You Dig service at the time of initial contact:

- Scope of work, including the start date and time.
- Contact information for the Project Manager and a field person able to answer questions from public utility locators regarding project details.
- Site address, township/range/section quarter, and name of property owner.



Once the Call Before You Dig system has been notified of the upcoming work, the system provides a ticket number, which

- Should be referenced whenever the Call Before You Dig service is contacted about the job.
- Provides proof that the Call Before You Dig system was notified prior to excavation. Public utility locators, inspectors, and law enforcement personnel may ask for the ticket number.
- Should be supplied to any subcontractors doing work on the site for reference when contacting the system for their own ticket number.

Call Before You Dig personnel will provide a list of public utilities present on the site, and will notify public utility operators of the planned work.

Public utility operators have 2 full business days after the day notification was received to locate and mark their lines, or to provide reasonable information on lines that they are not able to locate. The day notice is given is not included as 1 of these 2 days. Therefore, if excavation work is planned to start on a Monday, for example, the Call Before You Dig system must be notified by Wednesday the week before.

Two full business days must elapse between Call Before You Dig notification and the start of excavation. No excavation is to take place until all known utilities are marked or otherwise accounted for with information provided by the facility operator.

Locators mark their lines with colored hash marks. The American Public Works Association determines the colors to be used to denote different kinds of lines:

Red: Power Lines and Cable	Yellow: Gas, Oil, Petroleum
Orange: Telephone and Cable	Blue: Drinking Water
Green: Sewer (Storm and Sanitary)	Purple: Non-Potable Water
Pink: Survey Marks	White: Excavator Marks

Public utility operators are required to mark their lines only to the meter. Utility lines located beyond the meter are the responsibility of the property owner. Public utility operators should indicate by marking if no public utilities are present.

Public utility locators are required to mark their lines with reasonable accuracy. According to RCW 19.122.020, “reasonable accuracy means location within twenty-four inches of the outside dimensions of both sides of an underground facility.”

At this time, public utility companies are not required to mark abandoned or deactivated lines in Washington.



An individual not following the protocols established by the Call Before You Dig system can be held liable for up to three times the cost to repair a utility line damaged during excavation.

Records of ticket numbers and communications with the Call Before You Dig service should be stored in the project folder and supplied to on-site project personnel.

Before any excavation work is started, Farallon personnel should verify that all public utility marks are present on the site. The public utility company (companies) listed on the Call Before You Dig system ticket should be contacted if marks for that utility (utilities) are not present.

Private Utility Locating Services

After the public utility companies have marked their lines and before excavation begins, it is standard practice to have a private utility locating service clear areas that will be excavated.

Private locates generally are scheduled for the day before or the morning of the start of excavation.

Areas where excavation will occur must be cleared for conductible utilities by a private locator. Depending on the nature of the site and the proximity of utility lines, the private locator may also mark non-conductible utilities.

If possible, the excavation contractor should be on the site during the private utility locating to verify with the private locator that all proposed excavation areas are accessible.

When working with private utility locators, Farallon personnel should:

- Study existing figures of the site, noting the locations of known utilities.
- Use available side sewer cards or geographic information system utility figures to verify utility locations at the site.
- Verify that all public utilities have been marked by physically verifying that colored paint marks are present for all of the public utility companies listed on the One Call Before You Dig ticket. If any public utilities have not been marked, the utility company must be contacted and requested to mark the area, or to provide confirmation that the area is clear of their utility.
- Discuss the scope of work/excavation areas with the private locator.
- Document the name of the locating company and the name of the locator.
- Observe the locator clear the excavation area(s).
- Document the locate marks with photos, and note any uncertainties in the Field Report form.
- Identify the locations of shut-off valves for utilities such as water and natural gas.



- Contact the Project Manager or Principal to discuss relocating the excavation area if a proposed excavation area is in conflict with a utility identified by the private locator.
- Sign the locator's paperwork, if necessary, and depart the site if no additional field work is to be performed that day.

Private location of conductible utilities should sweep the excavation area in two perpendicular directions.

Private location of non-conductible utilities (typically storm and sanitary sewer) can use either a probe or a camera for accessible lines. Appropriately colored paint marks are applied by the private locator based on a signal sent from the probe or camera. For inaccessible lines, a ground-penetrating radar or magnetometer can be used to approximate the line locations. Marks based on this method should be considered approximate.

Hand-Clearing Excavation Areas

Prior to conducting certain excavation activities, excavators will clear the proposed excavation area to verify that no utilities are present. This can be accomplished through use of an air knife/vacuum truck, post-hole digging, hand-augering, or use of other hand tools that allow the excavation location to be explored sufficiently to verify that no utilities are present. Farallon Project Managers will confirm the method of clearing and depths with the field team before the excavation work is performed. Farallon Project Managers also need to discuss shallow soil sampling needs with the field team if clearing activities are being performed. Clearing activities should be conducted according to the following guidelines:

- Hollow-Stem Auger Drilling: Hand-clear to a minimum depth of 5 feet below ground surface (bgs) using an air knife/vacuum truck whenever possible. Alternative methods such as post-hole digging or hand-augering also may be used.
- Sonic Drilling: Hand-clear to a minimum depth of 5 feet bgs using an air knife/vacuum truck whenever possible. Alternative methods such as post-hole digging or hand-augering also may be used.
- Geoprobe Drilling: Clearing activity requirements are dependent on known utilities and results of the public and private utility location procedures completed above. Hand-clear using a post-hole digger or hand-auger to a maximum depth of 5 feet bgs is necessary. An air knife/vacuum truck may be used to hand clear each boring location to a maximum depth of 5 feet bgs, if available.
- Test Pit Excavation: No hand-clearing is necessary. Excavation contractors should be directed to dig cautiously in the upper 5 feet bgs in the event an unknown utility is present. A test pit excavation or regular excavation using machinery (e.g., track hoe, backhoe) should include using a spotter to watch for unidentified utility lines. Ideally, the spotter should be provided by the excavation contractor.
- Rotary Hammer for Soil Gas Sampling: No hand-clearing is necessary.



- Rotary Hammer for Subslab Soil Gas Sampling: No-hand clearing is necessary.

Some drilling contractors require that a utility line be exposed prior to drilling if the proposed drilling location is within a certain distance of the utility line. Farallon personnel should confirm drilling contractor requirements prior to conducting drilling activities.

If a utility line is encountered during clearing, excavators should verify that the utility has not been damaged, and Farallon personnel should document the encounter on the Field Report form with photos and details. RCW 19.122.020 states that “damage” includes the substantial weakening of structural or lateral support of an underground facility, penetration, impairment, or destruction of any underground protective coating, housing, or other protective device, or the severance, partial or complete, of any underground facility to the extent that the owner of the affected facility determines that repairs are required. The Project Manager or Principal should be notified immediately if a utility line is encountered during hand-clearing, and an alternate location will be proposed. A hand-cleared area having an exposed utility line should be backfilled with a bentonite seal and finished to match existing grade.

Maintaining Public Utility Locate Marks

According to RCW 19.122.030, “public utility locate marks expire 45 days from the date the excavator provides notice,” and “it is the responsibility of the excavator to maintain the public utility marks for 45 days, or for the length of the project—whichever is shortest. In any case, the public utility locate marks expire after 45 days.”

Locate marks can be maintained digitally through both photos and figures drawn to scale.

Locate marks can be maintained in the field using white paint. White paint can be applied between original hash marks, on either side of the hash marks, or on both ends. Offset paint or staking can be used if placed a uniform distance from the original marks with a clear indication of the direction and distance from the original marks. The original marks should not be painted over, and white paint should never be applied over colored paint. White marks should include a letter identifying the type of buried line.

UTILITY LINE DAMAGE

A utility line does not need to be ruptured or severed to be considered damaged. Scratching or denting a utility line or its protective tape also is considered damage, as the integrity of the line may have damaged even if the damage does not appear to be significant. Before excavation work begins, shut-off valve locations for applicable utilities should be documented. If a utility is believed to be damaged, the utility should be shut down if practicable and safe to do so. According to RCW 19.122.053, “all facility operators and excavators who observe or cause damage to an underground facility must report the damage event to the Washington State Utilities and Transportation Commission.”



If a utility line is hit and public safety is a concern, 911 should be the first call made after the immediate area has been evacuated. If a utility line is hit and the public is not at risk, the field team should notify the Project Manager, who will notify the Principal and the corporate Health and Safety Coordinator immediately. The Project Manager should then contact the utility that owns the damaged line, and report to the field team any instructions issued by the utility owner, and an expected timeframe for arrival of a utility owner representative at the site. Repairs to a utility line will not be attempted by Farallon personnel or contractors.

Damage must be reported through the Common Ground Alliance Damage Information Reporting Tool website, hosted by the Washington State Utilities and Transportation Commission: <http://www.utc.wa.gov/publicSafety/pipelineSafety/Pages/Damagereportingrequirements.aspx>

Access to damaged utility lines should be maintained to allow inspection by the utility company. An exposed utility should not be backfilled or patched until instruction to do so has been provided by the Project Manager or Principal.

DOCUMENTATION

Farallon personnel should document in the Field Report form the work performed and methods used by private utility locators, and photos from multiple angles with good reference points for each utility line in the excavation area(s).

REFERENCES

Washington Utilities Coordinating Council. 2014. *Guide to Safe Digging, Washington State Law and Industry Best Practices*.

STANDARD OPERATING PROCEDURE GN-03 SAMPLE SHIPPING

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology to ensure consistent and good quality sample shipment. This SOP is a supplement to site-specific work plans.

RESPONSIBILITIES AND QUALIFICATIONS

All personnel performing these actions are required to be familiar with the procedures described herein. Personnel performing or overseeing procedures described herein also must be familiar with health and safety requirements in the project-specific Health and Safety Plan (HASP).

EQUIPMENT AND SUPPLIES

Supplies needed to ship samples:

- Coolers – appropriate number and size;
- Custody seals;
- Bubble wrap;
- 1-gallon Ziploc bags for ice and samples;
- Ice;
- Samples and COC;
- Shipping labels; and
- Heavy-duty shipping tape.

PROCEDURES

It is critical to prepare samples for shipment at the end of the day to minimize the amount of time the samples will have to spend on ice in transport. Evaluate number of samples and coolers needed to ship the samples collected. If samples are in glass containers, consider shipping additional coolers to allow more room for bubble wrapping and padding sample containers.

Remember to provide enough ice to meet preservation requirements; the general ice to cooler rule is 20 pounds of ice per cooler. Line the cooler with a clean trash bag prior to packing, double-bag all ice using 1-gallon Ziploc bags, and close the trash bag last by “goose necking” and sealing with duct tape to prevent leakage.



The following procedures (representing the minimum shipping and handling requirements) will be used for sample packaging:

- A sample label will be affixed to the corresponding sample container at the time of sample collection.
- Bubble-wrap bags or an equivalent will be used to protect sample containers.
- Sample containers will be placed into a cooler and checked against the Chain of Custody form to ensure that all samples are listed and are placed into the correct cooler.
- One copy of the Chain of Custody form will be detached and retained by the Farallon field personnel.
- Remaining paperwork will be sealed in a resealable plastic bag and taped to the inside of the cooler lid.
- One to three resealable bags will be filled with ice and/or a chemical equivalent and included in the cooler. Ice will be double-bagged in heavy-duty bags.
- The cooler will be sealed with a chain-of-custody seal and taped shut using strapping tape.
- The laboratory address will be affixed to the cooler.
- Extraneous stickers will be removed from the cooler.
- The cooler will be examined to ensure that Farallon's return address is affixed.

Upon transfer of the samples to laboratory personnel or arrival of the samples at the laboratory facility, the laboratory will assume responsibility for custody of the samples.

Laboratory personnel will document the status of shipping and handling containers and will adhere to standard chain-of-custody procedures to track each sample through all of the stages of laboratory processing.

DOCUMENTATION

Retain a copy of the chain-of-custody to be scanned into the project files. List the project number and task number on the shipping label. Scan a copy of the receipt and send to the administrative staff.

STANDARD OPERATING PROCEDURE GW-01

MONITORING WELL CONSTRUCTION

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for monitoring well construction and installation. Monitoring well construction ultimately is at the discretion of the Project Manager, and is based on the geology at the site and the use of the monitoring well. Groundwater monitoring wells in the Puget Sound region, for example, typically are constructed using 2-inch-diameter Schedule 40 polyvinyl chloride well casing with 0.010-inch slotted screens because of the finer-grained materials prevalent in the region. Slot and sand sizes may be increased at the discretion of the Project Manager, depending on local geology. Monitoring wells must be installed and decommissioned by a licensed well driller, and constructed in general accordance with Chapter 173-360, Minimum Standards for Construction and Maintenance of Wells, of the Washington Administrative Code in Washington; with Rule 0410 of Division 240 of Chapter 690, Well Construction Standards – General, of the Oregon Administrative Rules in Oregon; with Bulletins 74-81 and 74-90, California Well Standards, from the California Department of Water Resources in California; and with the federal and/or state standards established for well construction specified in the project-specific field sampling plan in other states.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary for the construction and installation of monitoring wells:

- Monitoring well construction equipment (e.g., water-level meter, photoionization detector, tape measure, camera, plastic sheeting), as applicable.
- Monitoring well construction materials (e.g., well casing [screened and blank], filter pack sand, bentonite and/or Volclay Grout annular seal material, concrete, locking casing cap, well-head monument [flush-mounted or stove-pipe monument, as appropriate] complete with locking top, bollards for placement around well-head monument as applicable), provided by the driller.
- Materials necessary to provide required documentation, including Boring Log, Monitoring Well Construction Data form, and Field Report form.
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.
- U.S. Department of Transportation-approved drum(s) for decontamination wastewater and excess soil cuttings. Separate drums are needed for liquid and solid wastes (refer to Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.



DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with potentially contaminated soil and groundwater, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

Follow the instructions below for monitoring well construction and installation:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Before installing the casing, discuss the geology and groundwater conditions at the site with the Project Manager to confirm the depth the monitoring well screen should be placed at, and the length of screen to be used.
- Measure the depth to the bottom of the borehole to calculate the appropriate placement and length of the screened interval, filter pack, annular seal, and concrete surface seal. Calculate the approximate volumes of the filter pack and the seal material required for the specific monitoring well bore annulus and monitoring well casing diameter. Ensure that the filter pack extends from the bottom of the monitoring well intake to approximately 2 to 5 feet above the top of the monitoring well intake, and is approximately 2 to 4 inches thick. The monitoring well casing should be centered in the borehole. Ensure that the annular seal is a minimum of 2 feet thick above the top of the filter pack, and that the concrete seal is a minimum of 2 feet in depth from the surface.
- Prior to installation, measure and check the lengths of the monitoring well screen and the blank casing, and confirm the slot size and the sand filter pack size, the type of bentonite seal and/or Volclay Grout seal, and the monitoring well-head monument. For boreholes completed to depths deeper than the planned installation depth of the monitoring well casing, backfill the borehole with bentonite, sand, or pea gravel. Record the type and brand of the monitoring well construction materials used on a Monitoring Well Construction Data form.
- Record on a Field Report form the start and completion times for the various stages of monitoring well construction such as installation of the monitoring well casing into the borehole, filter pack and seal emplacement, and well-head monument placement.
- Record on a Monitoring Well Construction Data form the volumes of filter pack, the bentonite seal, and the concrete used to construct the monitoring well, and check against calculated volumes to confirm proper placement and amount. During the construction process, record any irregularities such as bridging of the filter pack or seal material that could indicate construction problems.
- Upon completion of monitoring well installation, measure the total monitoring well depth and the depth to groundwater, and record the measurements on the Monitoring Well Construction Data form.



- Place a mark or notch on the northern side of the top of the monitoring well casing to provide a monument for the measurement of water levels.

DOCUMENTATION

Document monitoring well construction activities on the Monitoring Well Construction Data form and the Field Report form.

REFERENCES

U.S. Environmental Protection Agency. 1991. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*. EPA160014-891034. March.

———. 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. April.

STANDARD OPERATING PROCEDURE GW-02

MONITORING WELL DEVELOPMENT

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for monitoring well development. All monitoring wells should be developed to create an effective filter pack around the monitoring well screen, rectify damage to the formation caused by drilling, remove fine particulates from the formation near the borehole, and assist in restoring the natural water quality of the aquifer in the vicinity of the monitoring well. The step-by-step guidelines provided in this SOP are to be followed by the field crew performing or overseeing monitoring well development.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly develop a groundwater monitoring well:

- Monitoring well key, socket wrench or speed wrench, socket set, padlock key, or other monitoring well-access equipment.
- Electric water-level meter long enough to reach the bottom of the monitoring well, calibrated to 0.01 foot.
- Two-inch-diameter (or appropriately sized) surge block.
- Monitoring well-purging equipment (e.g., silicone line, polyvinyl chloride pipe, plug, submersible or non-submersible pump, tubing, power supply, extension cord), as applicable.
- U.S. Department of Transportation-approved drum(s) for decontamination wastewater unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (see Farallon SOP WM-01, Field Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.
- Materials necessary to provide required documentation (e.g., Field Report form, Monitoring Well Construction Data form, and Waste Inventory Tracking Sheet).
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with groundwater, in accordance with SOP EQ-01, Equipment Decontamination Procedures.



PROCEDURES

Follow the instructions below for each monitoring well:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Brush away soil and vegetation, and pump standing water away from the monitoring well opening.
- Open the monitoring well cap.
- Measure the depth to water and the total depth of the monitoring well to the nearest 0.01 foot using a decontaminated water-level meter in accordance with Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells. Record the measurements on the Monitoring Well Construction Data form.
- Calculate the unit purge volume using the formula and the input values from the table below:

$$V = [X(\text{monitoring well depth} - \text{water level})] + [Y(\text{monitoring well depth} - \text{bottom of seal or water level, whichever is lowest in depth})]$$

Where:

V = monitoring well volume, including annular space

X = internal casing volume per unit length (gallons per linear foot)

Y = annular volume per unit length (gallons per linear foot)

Borehole Diameter (inches)	Casing Diameter (inches)	Volume _{casing} (X) (gallons per linear foot)	Volume _{annulus} (Y) (gallons per linear foot)
7	2	0.17	0.68
8	2	0.17	0.98
10	4	0.65	1.34
12	4	0.65	2.07
12	6	1.47	1.70
14	8	2.61	1.98

Development Procedures – Existing and New Monitoring Wells

Existing wells in a monitoring well network may require redevelopment if an excessive amount of fines are present in the monitoring well casing that could interfere with stabilization of water-quality parameters or collection of representative water-quality samples.



The instructions below are to be followed for development of existing and new monitoring wells:

For existing monitoring wells only:

- Remove the pump and/or any dedicated tubing from the monitoring well.

For existing and new monitoring wells:

- Attach one length of twine to the decontaminated surge block (or use a drill rig or tripod) and lower the surge block to within 0.25 foot of the bottom of the monitoring well.
- Surge the monitoring well by vigorously moving the surge block up and down from 0.25 foot from the bottom of the monitoring well to 1 foot above the top of the screened interval for a minimum of 5 minutes to create a surging action across the screened interval, which will bring finer-grained material into suspension. Move the surge block up and down in 3-foot sections until the entire monitoring well screen length has been surged. Record on the Monitoring Well Construction Data form the number of times the surge block is raised and lowered, and total surge time.
- Remove the surge block.
- If a submersible pump is to be used for monitoring well development, gently lower the pump into the monitoring well to within 1 foot of the bottom of the screened interval. If a non-submersible pump is to be used, lower the tubing to within 1 foot of the bottom of the screened interval.
- Begin purging the monitoring well at a rate sufficient to remove fines without pumping the monitoring well dry. Record on the Monitoring Well Construction Data form the volume of water pumped from the monitoring well.
- Surge and pump the monitoring well, including saturated annular space, a minimum of three and a maximum of five monitoring well volumes. If the monitoring well runs dry, let the monitoring well recharge. Then commence purging until a minimum of three monitoring well volumes have been purged. If this event is the first time the monitoring well has been developed and water was added during the drilling process, remove the volume of water introduced during drilling and monitoring well construction. Purging has been completed when *one* of the following has occurred:
 - The minimum purge volume has been removed; OR
 - Five purge volumes and the drilling process water volume have been removed.
- Measure the total depth of the monitoring well after development, and record on the Monitoring Well Construction Data form the total volume of water pumped from the monitoring well.
- Record on the Monitoring Well Construction Data form a description of the suspended particle content, and additional information such as unique odor or water color.



- Containerize the purge water in a U.S. Department of Transportation-approved drum(s) unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (refer to Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.
- Upon completion of monitoring well development, properly seal, secure, and label the drums in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste. Record the number and contents of the drums on a Waste Inventory Tracking Sheet. At a minimum, the drum label(s) should include:
 - Boring/monitoring well ID.
 - Facility name.
 - Drum contents.
 - Date.
 - Drum number.
- Close the monitoring well and record any monitoring well-integrity concerns on the Field Report form and the Monitoring Well Construction Data form.
- Decontaminate all equipment in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

DOCUMENTATION

Document monitoring well development activities on the Monitoring Well Construction Data form. Record the number and contents of the drums on a Waste Inventory Tracking Sheet.

REFERENCE

U.S. Environmental Protection Agency. 1991. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*. Document No. 160014-891034. March.

STANDARD OPERATING PROCEDURE GW-03

GROUNDWATER LEVEL MEASUREMENT IN MONITORING WELLS

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for measuring and documenting the depth to groundwater in monitoring wells. The step-by-step guidelines provided in this SOP are to be followed by the field crew to ensure consistent and representative measurements of depth to groundwater in monitoring wells. When multiple wells are present at a site, all water-level measurements typically are taken as quickly as possible to aid in the creation of potentiometric surface maps that are representative of a “single” point in time.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly measure the depth to groundwater in monitoring wells:

- Monitoring well key, hand drill, socket set, Allen wrench, speed handle, padlock key, or other monitoring well-access equipment specific to the monitoring well monument cover plate.
- Electronic water-level meter (Solinst or equivalent) narrow enough to fit in the monitoring well, calibrated to 0.01 foot, with sufficient line to reach the bottom of the monitoring well.
- Oil-water interface probe, if light nonaqueous-phase liquid (LNAPL) is known or suspected to be present.
- Disposable bailer if LNAPL is known or suspected to be present, and the Project Manager requests that LNAPL be bailed from the well.
- Tape measure.
- Materials necessary to provide required documentation, including Groundwater Level Measurement Summary Forms and Field Report forms.
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with groundwater, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.



PROCEDURES

Follow the instructions below for measuring water levels at each monitoring well:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Check the operation of the water-level meter by turning on the indicator switch and pressing the test button.
- Remove soil or vegetation from the monitoring well site.
- Open the monitoring well-head enclosure, and use a bilge pump or cup to remove standing water inside the monitoring well monument before opening the monitoring well cap. Dispose of standing water to the ground surface.
- Open the monitoring well cap.
- Monitor air quality at the monitoring well-head if volatile contaminants are suspected to be present, or if it is unknown whether volatile contaminants are present.
- Repeat above procedure until all monitoring wells are open.
- Allow the water level to equilibrate with ambient atmospheric pressure for approximately 15 minutes before measuring.
- Before taking any measurements, carefully measure the length of the sonde to the nearest 0.01 foot. The additional 2 to 3 inches from the zero point of the sonde to the tip of the sonde **must be discounted** for **all** total depth measurements.
- Measure and record the depth to water using a water-level meter that has been decontaminated in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures. With the water-level meter turned on to a medium level of sensitivity, slowly lower the meter into the monitoring well casing until it reaches the groundwater table. The probe will beep when it reaches the interface of the groundwater table (when the electronic circuit is first completed). Stop lowering the probe, hold the graduated water-level cable to the notch or mark on the northern side of the top of the monitoring well casing, and note the length measurement. Repeat this process to collect a second water-level measurement. If the two readings differ by more than 0.01 foot, repeat the measurements until the readings stabilize. Repeat the process until three consecutive stabilized readings have been measured. Record the water-level measurement **only** in relation to the probe being lowered into the monitoring well, *not* as it is raised out of the monitoring well. If you cannot see the top of the monitoring well casing when the water level beeps, grasp the tape with your thumb and index finger exactly at the measuring point corresponding with the notch or mark at the top of the monitoring well casing. Slowly pull the cable out of the monitoring well and read the measurement. Repeat until readings stabilize.
- Remove the cable from the monitoring well, and record the stabilized depth-to-water measurement on the Groundwater Level Measurement Summary Form to the nearest 0.01 foot.



- Measure the total monitoring well depth. **NOTE:** If groundwater samples are to be collected, measure the total monitoring well depth **after** all groundwater samples have been collected, to avoid resuspension of settled solids in the monitoring well, impacting the samples. If the monitoring well does not have a dedicated pump, lower the water-level indicator probe to the bottom of the monitoring well to measure the total depth of the monitoring well. Gently bounce the probe on the monitoring well bottom, and pull the slack in the cord to read the total monitoring well depth. Repeat three times to ensure that the monitoring well depth measurement is reproducible, and is representative of the true depth. Note on the Groundwater Level Measurement Summary Form whether the bottom of the monitoring well is hard or soft.
- Remove the cable from the monitoring well, and record the monitoring well depth measurement on the Groundwater Level Measurement Summary Form to the nearest 0.01 foot.
- Decontaminate the water-level meter in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.
- If the presence of LNAPL is suspected or if site conditions are unknown, check for the presence of LNAPL by one of two methods:
 - Use of a bailer: Use a new 3-foot-long disposable bailer attached to a nylon rope. Slowly lower the bailer until the bottom of the bailer is approximately 2 feet below the water surface. Slowly retrieve the bailer, and measure the product thickness using a tape measure. Record the information on the Groundwater Level Measurement Summary Form. Dispose of the bailer and product or wastewater in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste.
 - Use of an oil-water interface probe: Decontaminate the oil-water interface probe in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures. With the oil-water interface probe meter turned on to a medium level of sensitivity, slowly lower the probe into the monitoring well casing until it reaches the top of the LNAPL. The probe will have a steady beep when it reaches the interface of the LNAPL (when the electronic circuit is first completed). Stop lowering the probe, hold the graduated oil-water interface cable to the notch or mark on the northern side of the top of the monitoring well casing, and note the length measurement. Repeat this process to collect a second LNAPL measurement. If the two readings differ by more than 0.01 foot, repeat the measurements until the readings stabilize. Repeat the process until three consecutive stabilized readings have been measured. Record the depth to LNAPL measurement **only** in relation to the probe being lowered into the monitoring well, *not* as it is raised out of the monitoring well. If you cannot see the top of the monitoring well casing when the oil-water interface probe beeps, grasp the tape with your thumb and index finger exactly at the measuring point corresponding with the notch or mark at the top of the monitoring well casing. Slowly pull the cable out of the monitoring well and read the



measurement. Repeat until readings stabilize. Once the depth to LNAPL has been recorded, collect the water-level measurement as described above using the oil-water interface probe. Once the depth to LNAPL and the depth to the groundwater table have been determined, subtract the depth to LNAPL from the depth to the groundwater table to determine LNAPL thickness.

- Close the monitoring well as appropriate based on monitoring well-head construction. Record any concerns about monitoring well integrity on the Groundwater Level Measurement Summary Form and on the Field Report form.

DOCUMENTATION

Document monitoring well water-level measurements on the Groundwater Level Measurement Summary Form. Document any additional information on the Field Report form.

REFERENCE

U.S. Environmental Protection Agency. 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance*. Office of Solid Waste. November.

STANDARD OPERATING PROCEDURE GW-04

LOW-FLOW GROUNDWATER SAMPLING PROCEDURES

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for collecting and documenting groundwater samples from monitoring wells using U.S. Environmental Protection Agency (EPA) low-flow groundwater sampling procedures (EPA 1996, 2017) for chemical analysis to ensure consistent and representative sampling. The step-by-step guidelines provided in this SOP are to be followed by the field crew conducting groundwater sampling.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly purge and sample a monitoring well:

- Monitoring well key, hand drill, socket set, padlock key, or other monitoring well-access equipment.
- Electronic water-level meter long enough to reach the bottom of the monitoring well, calibrated to 0.01 foot. Alternatively, to measure for light nonaqueous-phase liquid thickness in addition to groundwater, use an oil-water interface probe.
- Monitoring well purging and sampling equipment:
 - Submersible pump (bladder or Grundfos): the pump, control box, and power source (typically a portable generator or a 12-volt battery); or
 - Peristaltic pump: the pump with pump head, silicone tubing, tubing connectors (as needed), and power source (typically a 12-volt battery).
- Sample tubing of project- and site-specific type and length.
- Bailer, if a pump is not used, or if light nonaqueous-phase liquid requires removal.
- Sufficient number of 55-gallon drums, including lids, gaskets, and fasteners, to contain all purge water, unless other water-handling arrangements have been made.
- Flow-through water-quality meter(s) to measure temperature, pH, specific conductivity, dissolved oxygen, oxidation-reduction potential (ORP), and turbidity.
- Air-space monitoring equipment if required (photoionization detector or multi-gas meter).
- Decontamination equipment and supplies (e.g., buckets, scrub brushes, deionized or distilled water, potable water, Liquinox detergent).
- Materials necessary to provide required documentation, (e.g., sample labels, Field Report forms, Low-Flow Well Purging and Sampling Data form, Chain of Custody form, Waste Inventory Tracking Sheet).



- Sample containers with the chemical preservatives appropriate for the samples, as described in project-specific plans, or as required by the analytical laboratory at a minimum.
- Personal protective equipment as described in the site-specific Health and Safety Plan (HASP).
- Sampling-support equipment (e.g., sample coolers, ice, bubble wrap, clear tape, duct tape, resealable plastic bags, garbage bags, paper towels, distilled water, nitrile gloves, shipping supplies).
- U.S. Department of Transportation-approved drum(s) for purge water, unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (Refer to Farallon SOP WM-01, Field Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate reusable equipment that will come into contact with the monitoring well(s) and/or be used to acquire samples, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES FOR LOW-FLOW GROUNDWATER SAMPLING

Low-flow groundwater sampling procedures have been developed for monitoring wells with a dedicated pump (dedicated monitoring wells) and for monitoring wells without a dedicated pump (non-dedicated monitoring wells). Setup, purging, sample collection, and post-sampling procedures for dedicated and non-dedicated monitoring wells are presented below.

Setup

Setup procedures differ slightly for dedicated versus non-dedicated monitoring wells. Follow the instructions below for the monitoring wells as indicated:

- Calibrate the water-quality meter for the field parameters specified in the project-specific plans. At a minimum, collect temperature, pH, and specific conductivity during purging and prior to sampling. Record on the Field Report form the equipment calibration and maintenance performed. Decontaminate the water-quality meter between monitoring wells by rinsing with distilled or deionized water. Manage the rinsate water used in collecting these measurements in the same manner as for purge water, as defined in project-specific plans, and in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste.
- Don appropriate personal protective equipment as described in the site-specific HASP, including nitrile gloves for activities that might involve contact with groundwater or equipment. Change gloves between each monitoring well at a minimum, or when



contaminants could be introduced into a monitoring well or onto decontaminated equipment.

- Brush away soil and/or vegetation, and pump standing water away from the monitoring well opening. If necessary, place a plastic drop cloth around the monitoring well-head to prevent sampling equipment from contacting the ground surface.
- Inspect the condition of the monitoring well (e.g., locked monitoring well cap, tightness of monitoring well cap, well-marked measuring point on casing, disturbance of surface casing, straightness of monitoring well casing, condition of concrete pad). Indicate the monitoring well condition on the Low-Flow Well Purging and Sampling Data form.
- Open the monitoring well cap. If the site-specific HASP identifies organic compounds as potential contaminants of concern, screen the monitoring well headspace and the breathing zone headspace (if specified in the HASP) for organic vapors using the appropriate field monitoring instrument (e.g., photoionization detector, multi-gas meter).
- Measure and record the depth to water using a decontaminated water-level meter in accordance with Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells.
- If light nonaqueous-phase liquid may be present (see site-specific plans), obtain a sample from the monitoring well using a bailer (if a dedicated pump is not in use), as specified in Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells. Alternatively, measure free-floating product thickness using an oil-water interface probe.
- Calculate the monitoring well casing volume as follows:

Monitoring well casing volume in gallons = $(\pi * r^2) * h (7.48 \text{ gallons/cubic foot})$

Where:

r = radius of the inside of the monitoring well casing in feet

h = length of the water column in the monitoring well casing (i.e., the depth to the bottom of the monitoring well minus the depth to water, both measured from the mark at the top of the monitoring well casing), in feet

- **For monitoring wells with dedicated pumps and tubing:** Set up a flow-through cell in preparation for purging. Connect dedicated tubing from the monitoring well to the flow-through cell. Set tubing and/or pump to the correct water depth in accordance with the constituents being sampled for, as described in project-specific plans. **DO NOT IMMERSE water-quality probes or meters in purge water containing nonaqueous-phase liquids, which could damage the probes.** Turn the pump controller to its lowest setting, set the memory in the flow-through cell to record readings every 3 minutes, and turn on the pump. Begin purging slowly (i.e., less than 500 milliliters per minute [ml/min]) to prevent drawing down the water table.



- **For monitoring wells with non-dedicated pumps:** Connect dedicated silicon tubing to the peristaltic pump. Place the tubing intake at the midpoint of the screen, or at the depth pre-determined in the project-specific plans. If using a bladder pump, insert the bladder pump and attach the dedicated polyethylene tubing so the pump intake is at the approximate midpoint of the screened interval, or set the pump intake to the depth pre-determined in the project-specific plans.

Purging Procedures

The purging instructions below are to be followed for dedicated and non-dedicated monitoring wells:

- Begin purging, and initiate water-quality testing for temperature, pH, specific conductivity, dissolved oxygen, ORP, and turbidity. Purge monitoring wells using a peristaltic or bladder pump, and dedicated polyethylene and silicon tubing. Record water-quality parameters every 3 minutes.
- Record water levels every 3 minutes, as possible. It is imperative that the water level not drop by more than 0.33 foot during the low-flow purging process. If the water level drops more than 0.33 foot during purging, reduce the flow rate on the pump. Recommended purge rates generally are less than 500 ml/min. Actual purge rates will vary based on aquifer material and monitoring well construction. If the water level continues to drop by more than 0.33 foot during the low-flow purging at a rate less than 100 ml/min, notify and consult with the Project Manager on how to proceed.
- Record flow rates every 3 minutes. Ensure that the flow rate does not exceed 500 ml/min during the low-flow purging process.

Purging Requirements

Continue purging at a constant rate until the water-quality parameters have stabilized for three successive measurements according to the stability criteria provided in the table below. Before samples can be collected from each monitoring well, the groundwater must stabilize according to following criteria:

- Drawdown is no greater than 0.33 foot for low-flow sampling, and
- The water-quality parameters should stabilize according to the criteria specified below:



Water-Quality Parameter	Stability Criterion
Turbidity (if required)	10% for values greater than 5 NTU or three consecutive values < 5 NTU
Dissolved oxygen	10% for values greater than 0.5 mg/l, or three consecutive values <0.5 mg/l
Specific conductivity	3%
Oxidation-reduction potential	+/- 10 millivolts
pH	+/- 0.1 unit
Temperature	3%

Notes:

mg/l = milligrams per liter

NTU = nephelometric turbidity unit

Although under some circumstances, a monitoring well may not stabilize according to the above criteria, the monitoring well can still be sampled if the monitoring well does not meet stability criteria due to the instrument accuracy, or the water level drops below the minimum value using low-flow sampling procedures. For example, a fluctuation in ORP greater than 10 millivolts does not meet the stability criterion. However, because the accuracy range of the ORP instrument is ± 20 millivolt, the stability criterion would be considered satisfied and within the range of instrument accuracy. Consult the manual for the instrument to determine the accuracy range.

Also, if the water level drops below the minimum value using low-flow sampling procedures (i.e., the pump intake, or the top of the screen if the aquifer is confined) during purging and one monitoring well volume of groundwater has been removed from the monitoring well, or the monitoring well runs dry during the purging procedure, sample the monitoring well as soon as the water level has recovered sufficiently to allow collection of the volume of groundwater necessary for all samples. Use the following equation to determine the minimum volume of groundwater to remove before sampling:

Minimum purge volume = $2 \times [500 \text{ milliliters} + M \times (\text{length of tubing in feet})]$

Where: M = volume (in milliliters) contained in a 1-foot length of tubing

The value of M is provided below for the inner diameters of tubing listed:

Inner Diameter (inches)	M (milliliters)
0.125	2.4
0.25	9.7
0.5	39

Record on the Field Report form and the Low-Flow Well Purging and Sampling Data form if any monitoring well did not meet the drawdown and stability criteria and explain the rationale for sampling the monitoring well at the time it was sampled. If stability criteria have not been achieved following completion of all entries in the Low-Flow Well Purging and Sampling Data form, notify



and consult with the Project Manager whether to continue purging until stability criteria have been achieved or begin sample collection.

Sample Collection

During low-flow sampling, do not stop pumping once the purging requirements have been met. Turn down the flow rate on the pump so the water flow is minimal, but maintain sufficient pressure in the system to prevent water from the tubing or flow-through cell from flowing back into the monitoring well. Disconnect the pump discharge hose from the flow-through cell, or cut the tubing just before the connection to the flow-through cell. It is imperative not to lower the water table or disturb the water column. Fill pre-cleaned laboratory-supplied sample containers directly from the pump discharge tube into the proper sample container, and fill to capacity. Place a bucket beneath the sampling tube to catch any unsampled water between filling the sample jars. When collecting groundwater samples for multiple analyses, collect the samples in the order listed below per the EPA (1992) groundwater sampling technical guidance:

- Volatile organic compounds (VOCs);
- Dissolved gases and total organic carbon;
- Semivolatile organic compounds;
- Metals and cyanide;
- Major water quality cations and anions;
- Radionuclides; and
- Dissolved (filtered) inorganics (if required).

When collecting samples for VOCs, adjust the flow rate as low as possible without introducing air bubbles into the system. When filling the VOC containers, hold the cap in hand to minimize contamination, and direct the flow from the pump discharge tubing down the side of the sample container to minimize aeration. Fill all VOC sample containers to the top, ensuring a positive meniscus when the cap is screwed down on the container. Tap the filled VOC container, and invert several times to ensure no air bubbles are present in the sample container. If an air bubble is present, the VOC sample must be recollected using a fresh VOC sample container. If sampling for other analytes, the flow rate may be increased.

If dissolved inorganics are required, attach a new disposable 0.45-micrometer filter cartridge to the discharge line. Collect filtered samples last. Pre-rinse the disposable filter cartridges by running a minimum of 0.25 gallon of groundwater through them (collecting the groundwater into a waste bucket) prior to collecting the samples directly into the sample container. Alternate field filtration methods may be specified in the project-specific plans. Remove the pump and/or tubing from the monitoring well.



Post-Sampling

- Record the depth to water of well to determine whether the water level changed from the original reading.
- Close and lock the monitoring well or tap and record any monitoring well integrity concerns on the Field Report form and the Low-Flow Well Purging and Sampling Data form.
- Transfer purge, wash, and rinse water into a U.S. Department of Transportation-approved drum(s) and label. Separate drums are needed for liquid and solid wastes, in accordance with SOP WM-01, Field Handling of Investigation-Derived Waste. Do not add liquid wastes to drums containing solid wastes.

PROCEDURES FOR RECONNAISSANCE GROUNDWATER SAMPLING

Collect reconnaissance groundwater samples from borings using direct-push or hollow-stem auger drilling methods and 0.75- or 2-inch-inside-diameter temporary monitoring well casing and 0.010-inch slotted screen. In some cases, alternate well casing diameters or screen slot sizes may be appropriate based on the drilling equipment or project-specific requirements. Follow the instructions below for reconnaissance groundwater sample collection:

- Withdraw the drill casing when the desired sampling depth has been reached, so the temporary monitoring well screen is exposed to water-bearing material.
- Insert disposable polyethylene tubing to the approximate midpoint of the temporary monitoring well screen. Attach the appropriate length of pre-cleaned disposable silicon tubing from the polyethylene tubing to connect with the peristaltic or bladder pump.
- Set up the peristaltic or bladder pump in preparation for purging. Turn the pump to its lowest setting and turn on the pump. Begin purging slowly to prevent drawing down the water table.
- Purge each temporary monitoring well point using a peristaltic or bladder pump until visual turbidity is as low as possible, or until the temporary monitoring well is purged dry of water.
- Purge a minimum of 1 to 2 liters before sample collection, if possible. If the temporary monitoring well is completely dewatered during purging, collect samples when sufficient recharge has occurred to allow filling of the sample containers.
- Slow the pumping rate to less than 500 ml/min to reduce the potential for volatilization of chemicals during sample collection.
- Collect the sample as described above.
- If insufficient groundwater is available to collect a sample using a peristaltic or bladder pump (i.e., the boring pumps dry or cannot maintain a sufficient flow of less than 100 ml/min) or if the depth to groundwater exceeds the maximum practicable limit for sampling using a peristaltic or bladder pump, use a disposable polyethylene bailer lowered



into the monitoring well screen to collect a groundwater sample from the screened interval, if possible.

DOCUMENTATION

Document the monitoring well purging and sampling activities on the Low-Flow Well Purging and Sampling Data form and on the Field Report form. Track samples on a Chain of Custody form. Track waste generated during groundwater sampling on a Waste Inventory Tracking Sheet.

REFERENCES

- U.S. Environmental Protection Agency (EPA). 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance*. Office of Solid Waste. November.
- . 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. April.
- . 2017. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells*. EQASOP-GW4. September.

STANDARD OPERATING PROCEDURE SL-01

SOIL CORE SAMPLING

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for collecting and documenting soil core samples collected during environmental drilling. All drilling operations will be conducted by a licensed drilling subcontractor. This SOP presents the procedures that will be performed by Farallon field staff once the soil core or sampler has been collected by the drilling subcontractor. The step-by-step guidelines provided in this SOP are to be followed by the field crew conducting subsurface soil sampling.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly collect soil samples from borings:

- Personal protective equipment (PPE) as described in the site-specific Health and Safety Plan.
- Differential global positioning system, if required in project-specific plans. Discuss the methodology for recording the location of the sample point with the Project Manager before conducting the field work.
- Photoionization detector (PID) to monitor and record soil headspace readings.
- Appropriate soil sampling equipment, including:
 - Stainless steel hand-auger.
 - Wooden or steel stakes to stabilize cores on table while sampling.
 - Folding table.
 - Utility knife.
 - Stainless steel spoons or scoops.
 - Six-mil plastic sheeting.
 - Resealable plastic bags.
 - Duct tape.
 - Tape measure.
 - Laboratory-provided certified pre-cleaned sample containers.
 - Soil sample plunger and syringes for sampling volatile organic compounds (VOCs) using U.S. Environmental Protection Agency (EPA) Method 5035A.
- Materials necessary to provide required documentation including sample labels, field report forms, boring logs, and laboratory chain-of-custody forms.



- U.S. Department of Transportation-approved drum(s) for decontamination wastewater and excess soil cuttings. Wastewater and soil cuttings should be handled in accordance with Farallon SOP WM-01.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.
- Sampling support equipment (e.g., sample coolers, ice, bubble wrap, clear packing tape, heavy resealable plastic bags, garbage bags, paper towels, distilled water, nitrile gloves).

DECONTAMINATION

Reusable equipment that will come into contact with soil boring samples or will be used to acquire soil samples is to be decontaminated before arrival at the site, between soil samples collected, upon relocation at the site, and upon demobilization from the site, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

Prior to drilling, all underground utilities must be located, and cleared with an air-knife or other method approved by the Farallon Health and Safety Coordinator.

Collect soil samples from areas known or suspected to have the lowest concentrations of constituents of concern first, with areas of higher concentrations of constituents of concern sampled last, unless the Project Manager indicates a different project-specific sampling protocol. **At a minimum, soil samples should be collected and retained in laboratory-supplied glassware every 5 vertical feet. Additional samples should be collected at observed major changes in lithology, such as sand-silt contacts, or where odor, staining, or high PID readings are observed.**

The procedures listed below may be modified as appropriate with approval from the field team lead and/or the Project Manager. Any modifications must be identified in the project-specific sampling plans or, at a minimum, details must be noted on the Field Report form.

Soil core collection methods differ for hollow-stem-auger, direct-push, and sonic drilling techniques, each summarized below:

- Hollow-stem-auger: Collect soil core samples using a standard 18-inch-length (6-inch waste barrel) Dames & Moore split-spoon sampler with a 2.5-inch inner diameter that can be used with or without brass or stainless steel liners.
- Direct-push: Collect soil core samples using 5-foot macrocore samplers with acetate sample liners.
- Sonic: Collect soil core samples using a standard 6-inch-diameter stainless steel sampling rod. Use a 2.5-, 5.0-, or 10-foot polyethylene liner inside the sampling rod for soil sample collection.



Record the specific drilling and soil sampling equipment used on the Boring Log form and on the Field Report form.

Setup

The instructions below are to be followed at each boring site:

- Don appropriate PPE as described in the site-specific Health and Safety Plan.
- Ensure that each borehole has been cleared to a minimum depth of 5 feet below ground surface using an air knife, per the Farallon health and safety policy.
- Set up a temporary sampling table adjacent to the drill rig to log and collect soil samples from the soil cores as they are recovered during drilling. Lay plastic sheeting over the table to keep the surface clean and to prevent potential cross-contamination between borings and soil samples. Designate clean areas for decontaminated sampling equipment and laboratory-provided certified pre-cleaned soil sample containers.
- Set up a separate decontamination area if appropriate (Refer to Farallon SOP EQ-01, Equipment Decontamination Procedures.)
- Calibrate the PID to monitor headspace for selected soil core samples in accordance with the equipment manual.

Sample Collection and Processing

The instructions listed below are to be followed for collecting samples using lined and unlined split-spoon and tube samplers:

- Don a new pair of nitrile sampling gloves for each individual soil sample collected, and prior to decontaminating sampling equipment to avoid potential cross-contamination.
- Ensure that the drillers have properly decontaminated all drill shoes and caps prior to initiating drilling operations. At a minimum drill shoes and caps must be decontaminated between sampling locations in accordance with Farallon SOP EQ-01. If highly contaminated media is encountered, decontamination between sampling intervals may be required. Replace dirty or ineffective decontamination water as needed throughout the workday.
- Report subsurface and drilling conditions on Boring Logs. Include the number of blow counts (if applicable) or any resistance encountered during drilling operations.
- Place the core tube, core liner, or split spoon on a new piece of aluminum foil on the sample logging/processing table. If necessary, use wood or metal stakes as shims to stabilize the tube, liner, or split spoon on the sample logging/processing table.
- If a core liner is used, split the liner open with a decontaminated utility knife, taking care not to penetrate the soil in the liner with the blade or knife.



- Briefly examine the soil sample visually for obvious signs of contamination, and take PID readings.
- Take care to:
 - **Always** collect soil from the center of the sampler or liner; not from sidewalls.
 - **Always** use decontaminated stainless-steel spoons or scoops to handle the soil within a given sample interval.
 - **Always** don a new pair of nitrile gloves before processing each sample interval in each soil core to prevent cross-contamination in the soil core.
- When sampling for VOCs, collect them immediately after opening the core tube, split spoon, or core liner. Use a decontaminated stainless steel spoon to collect the VOC samples directly into the laboratory-provided VOC sample container with no headspace, and seal it tightly. Follow the sample collection guidelines provided by the manufacturer or the analytical laboratory when using a plunger-type sampling device in accordance with EPA Method 5035A.
- Perform a headspace test using a PID:
 - Retain approximately 100 grams of the soil sample in a heavy resealable plastic bag or glass sample container, shake the sealed bag to volatilize the contaminants in the soil;
 - Wait approximately 5 minutes before measuring for headspace analysis using the PID (Washington State Department of Ecology 2011);
 - Insert the PID probe tip into a small opening in the top of the bag and record the PID units on the Boring Log form. **Do not puncture the resealable plastic bag to obtain headspace readings.**
 - Reseal the bag after taking the headspace reading in case further assessment of the sample is needed.
- If specified in the project-specific plans, photograph each section of the boring, including in the photograph notations on a white board documenting sample location identifier, date, orientation, depth, and site markers.
- Describe the soil samples in accordance with ASTM International Standard D-2488-00, *Standard Practice for Description and Identification of Soils*.
- Record on the Field Report form any deviations from the project-specified sampling procedures or from this SOP, or any obstacle encountered.
- Record the observed lithology on the Boring Log form using the Unified Soil Classification System and reported depths below ground surface using a tape measure.



- Discard excess soil cuttings in a labeled waste drum or a soil bin in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste. Do not add soil to a liquid waste drum.
- Backfill the borehole, as appropriate.
- Record the boring location using a differential global positioning system or offset measurements from a permanent hard point on the Site.
- Decontaminate the soil sampling equipment, and don a new pair of sampling gloves before collecting each new soil sample.

DOCUMENTATION

Document the soil sampling activities on the Boring Log form, the Chain of Custody form, and the Field Report form.

REFERENCE

- American Society for Testing Materials. 1989. *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*. Method D-1586-11.
- U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operation Methods*. EPA Document No. 540-P-87-001. December 1.
- Washington State Department of Ecology. 2011. *Guidance for Remediation of Petroleum Contaminated Sites*. Ecology Publication No. 10-09-057. Toxics Cleanup Program. September.

STANDARD OPERATING PROCEDURE WM-01

FIELD HANDLING OF INVESTIGATION-DERIVED WASTE

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for containerizing, labeling, and tracking investigation-derived waste (IDW), and for exchanging information with the Project Manager. IDW may include soil cuttings, purge water, development water, and/or decontamination water.

This SOP has been developed in compliance with Washington State Dangerous Waste Regulations (Chapter 173-303 of the Washington Administrative Code), Oregon Hazardous Waste Management Rules (Division 100 of Chapter 340 of the Oregon Administrative Record), Environmental Health Standards for the Management of Hazardous Waste (Division 4.5 of Title 22 of the California Code of Regulations), and the U.S. Environmental Protection Agency Resource Conservation and Recovery Act (Parts 239 through 282 of Title 40 of the Code of Federal Regulations).

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly containerize, label, and track IDW:

- U.S. Department of Transportation-approved drum(s) constructed of a material that does not react with the contaminants of concern for the project. Farallon typically uses lined open-top steel drums. Use a polyethylene drum for a material suspected to be corrosive.
- Labels appropriate to the characteristics of the IDW as indicated by the Project Manager:
 - Non-Hazardous Waste Labels: For IDW known to be nonhazardous based on previous data and waste profiles.
 - Hazardous Waste or Washington State Dangerous Waste Labels: For IDW known to be hazardous/dangerous based on previous data and waste profiles.
 - On Hold Pending Analysis Labels: For waste not previously characterized, pending receipt of analytical results. On Hold Pending Analysis labels are temporary, and should be replaced with the applicable waste label once the waste has been characterized.
 - Major risk labels associated with the waste characteristics.
- Waste Inventory Tracking Sheet.
- Grease marking pencil or paint pen.
- Indelible ink pen.
- Crescent wrench, speed wrench, socket wrench, or other hand tool to seal the drum(s).



- Sampling supplies, if needed, including:
 - Stainless steel or plastic bowls and spoons for homogenizing soil and/or solids samples, depending on the analysis to be performed;
 - Glass or stainless steel container for homogenizing liquid samples, depending on the analysis to be performed; and
 - Stainless steel hand-auger or a glass tube, depending on the medium being sampled (i.e., soil/solids or liquid).

PROCEDURES

Follow the instructions below to inspect, label, and inventory IDW drums, and to containerize IDW:

- Inspect new drums brought to the site to ensure that they do not have dents or corrosion, and are in good condition. Lined or coated drums are preferred.
- Inspect drums remaining at the site from previous project work. Notify the Project Manager if a drum is leaking, damaged, or improperly labeled.
- Place soil and solids into separate drums from those containing liquids such as purge water, development water, and decontamination water. Do not add liquid IDW to drums containing soil or solids. Do not fill drums containing liquid IDW above 85 percent capacity, particularly in areas known to reach freezing temperatures.
- Discuss with the Project Manager whether chlorinated solvents or other contaminants of concern detected in areas of the site would cause IDW from that area to be characterized as hazardous/dangerous waste. Hazardous/dangerous waste should be drummed separate from nonhazardous/dangerous waste, where possible, to minimize the amount of hazardous/dangerous waste generated.
- Use a grease pencil or paint pen to clearly mark the lid and the label of each drum with a unique identifier such as a number or a letter. Verify that no two drums have the same identifier marked on the lid or label, including drums remaining from previous project work.
- Inventory each Farallon-generated drum and its contents on a Waste Inventory Tracking Sheet.
- Track any waste added to an existing drum on a Waste Inventory Tracking Sheet.
- Label each drum with a completed Non-Hazardous Waste, Hazardous Waste/Washington State Dangerous Waste, On Hold Pending Analysis, or other appropriate waste label. List the client's name as the Shipper or Generator, and the accumulation start date as the date when waste was first placed into the drum. If waste was added to an existing drum, add that date to the accumulation dates on the drum label. If the waste in the drum has been designated as hazardous/dangerous, add a major risk label(s) pertaining to the waste characteristics associated with that designation (e.g. flammable, reactive, corrosive,



toxic). Consult the Project Manager with questions about appropriate major risk labels. All labels should be placed with the top of the label toward the top of the drum. Do not place a drum label sideways or upside down.

Use care when drumming, labeling, and tracking IDW. Mistakes in the disposal of waste can result in serious legal and financial repercussions for Farallon and the client.

DRUM SAMPLING

Sampling and analysis of wastes for hazardous/dangerous waste characterization purposes is to be conducted in accordance with U.S. Environmental Protection Agency Publication No. SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. Samples collected in California for hazardous waste characterization are to adhere to the requirements specified in California Code of Regulations Sections 66261.21 to 66261.24 of Title 22, Characteristics of Hazardous Waste. Discuss with the Project Manager the specific analyses to be performed prior to sample collection. The instructions below are to be followed for drum sampling, using composite sampling techniques to sample soil, solids, and liquid wastes:

- Collect soil/solids samples from various locations and depths in the drum using a hand-auger or other decontaminated apparatus. Place all samples into a single decontaminated stainless steel bowl using decontaminated stainless steel tools, or into a plastic bowl using plastic spoons, depending on the analyses to be performed. Homogenize the samples in the bowl.
- Place samples of the homogenized soil/solids from the bowl into sample jars for analysis.
- Collect liquid samples from the drum using a glass sampling tube. Insert the tube to the base of the drum to fill the entire tube with liquid. Place the liquid into sample jars for analysis.

DRUM STORAGE

Follow the instructions below for drum storage:

- Label and store the drums in an area approved by the client.
- Store hazardous/dangerous waste drums in a secured area.

DOCUMENTATION

Document IDW drums on the Waste Inventory Tracking Sheet as described above. Provide the original Waste Inventory Tracking Sheet and the original field notes to the Project Manager.

REFERENCE

U.S. Environmental Protection Agency. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. Publication No. SW-846. Third Edition, Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), and V (2015).