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By Alameda County Environmental Health 10:17 am, Oct 05, 2017

September 21, 2017

Mr. Mark Detterman
Alameda County Health Care Services Agency
Environmental Health Services
Environmental Protection
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

RE: Data Gap Investigation Work Plan

SITE: Redford Residence
170 Woodland Way, Piedmont, California
ACHCSA Fuel Leak Case No. RO0003256
Global ID #T10000010538

Dear Mr. Detterman:

Upon my authorization, Wheeler Group Environmental, LLC has prepared the attached *Data Gap Investigation Work Plan*, dated September 20, 2017, for the above-referenced residential property at 170 Woodland Way in Piedmont, California. Wheeler Group has uploaded an electronic copy of the document to the State Water Resources Control Board's GeoTracker Database System, as well as the Alameda County Health Care Services Agency FTP Site. Should you have any questions, please contact Mr. Brent Wheeler, Manager of Wheeler Group Environmental, LLC (acting consultant for project) at (415) 686-8846 at your convenience.

I have read and acknowledge the content, recommendations, and and/or conclusions contained in the attached document or report submitted on my behalf to ACDEH's FTP server and the State Water Resource Control Board's GeoTracker website.

Respectfully Submitted,

Marcia Redford

Ms. Marcia Redford

Distribution: 1. Addressee, mark.detterman@acgov.org
2. Brent A. Wheeler, Wheeler Group Environmental, LLC
bwheeler@wheelergroupenvironmental.com

DATA GAP INVESTIGATION WORK PLAN

Redford Residence
170 Woodland Way, Piedmont, California 94611

APN 51-4731-20
GeoTracker Global ID No. T10000010538
Alameda County LOP Case No. RO0003256
WGE Project No. 2017111

September 20, 2017

Prepared For:

Ms. Marcia Redford
170 Woodland Way, Piedmont, CA 94611

Prepared by:

Wheeler Group Environmental, LLC

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STATEMENT OF PROFESSIONAL CERTIFICATION

Document Title: Data Gap Investigation Work Plan

Location: Redford Residence
170 Woodland Way, Piedmont, California

California Business and Professions Code Section 7835 specifies that all geologic plans, specifications, reports, or documents shall be prepared by a professional geologist or registered specialty geologist, or by a subordinate employee under his or her direction. In addition, the document shall be signed by the professional geologist or registered specialty geologist or stamped with his or her seal, either of which shall indicate his or her responsibility for them.

This document is prepared in accordance with the California Business and Professions Code Section 7835 by a "professional geologist" as defined in the Geologist and Geophysicist Act (California Business and Professions Code commencing with Section 7800).

WHEELER GROUP
ENVIRONMENTAL LLC

PROFESSIONAL GEOLOGIST
MARK T. YOUNGKIN
NUMBER 3888
Expires
4-30-2019
STATE OF CALIFORNIA

Date: September 20, 2017

Brent A. Wheeler
Principal/Manager

Mark Youngkin
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DATA GAP INVESTIGATION WORK PLAN

170 Woodland Way, Piedmont, California

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Wheeler Group Environmental, LLC

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DATA GAP INVESTIGATION WORK PLAN

170 Woodland Way, Piedmont, California

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Wheeler Group Environmental, LLC

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DATA GAP INVESTIGATION WORK PLAN

Redford Residence

170 Woodland Way, Piedmont, California

APN 51-4731-20

GeoTracker Gobal ID No. T10000010538

Alameda County LOP Case No. RO0003256

WGE Project No. 2017111

INTRODUCTION

On behalf of Ms. Marcia Redford, Wheeler Group Environmental, LLC (Wheeler Group or WGE) submits this Data Gap Investigation Work Plan for the residential property located at 170 Woodland Way in Piedmont, California (Site or subject property). In January 2017, one 300-gallon heating oil underground storage tank (UST) was removed with evidence of a heating oil release to soil. The work plan was requested by the Alameda County Department of Environmental Health (ACDEH) in its letter dated July 19, 2017. The ACDEH indicated that further work is required to assess the extent of contamination around the area of the former UST and to characterize existing conditions at the Site. The ACDEH also requires a Soil and Groundwater Investigation Report be submitted presenting the results of additional subsurface investigation. The purpose of this work plan is to present the procedures for additional subsurface investigation activities to address data gaps identified in the attached tables with a focused site conceptual model and evaluation of Low Threat Closure Policy criteria. The goal of the subsurface investigation is to provide information pertinent to the consideration of the case for regulatory agency closure under the Low-Threat Underground Storage Tank Case Closure Policy administered by the State Water Resources Control Board.

SITE LOCATION

The Site is located at the north side of Woodland Way approximately 60 feet west of its intersection with Lafayette Avenue and La Salle Avenue, see Figure 1–Site Location Map. The Site occupies an approximately 100 by 75 foot hillside lot (7546 square foot) and is improved with a two-story single-family residence (2,713 sq ft) constructed in 1925. From the Site's position on a local ridge-top, the topography slopes westward towards Wildwood Creek located about 400 feet southwest. The Oakland Davie Tennis Stadium is located approximately 570 feet southwest of the Site. A tributary drainage ravine of Wildwood Creek is located about 350 feet south of the Site, see Figure 2–Site Vicinity Map. The Site is located within a residential suburban neighborhood and surrounded by similar single-family residential structures. As shown on Figure 5–Topographic Map, the topographic slope is generally westward. Adjoining the Site on the north, east and south are similar residences at 180 Woodland Way, 122 Woodland Way, 165 Woodland Way and 340 La Salle Avenue that appear similar in elevation to the subject property. To the west is a similar residence at 160 Woodland Way that appears relatively lower in elevation.

SITE INFORMATION & DESCRIPTION

Posted Site Address:	170 Woodland Way
Community:	Piedmont
County:	Alameda
Elevation:	Appropriately 340 feet above mean sea level
Assessor's Parcel No:	51-4731-20
General Setting:	Residential Neighborhood
Property Type:	Single-family residence
Building Type:	Two-story wood frame with basement
Building size:	Approx. 2713 square feet
Lot Size:	Approx. 7546 square feet
Date of Construction	1925
Basement:	Unfinished basement with utility room
Interior Layout:	4 bedrooms and 4 bathrooms
Exterior Layout:	Landscaping with unattached garage
HVAC:	Natural gas
Source of Water:	Municipal Water District
Sewage Disposal:	Municipal
Solid Waste Disposal:	Municipal
Utilities:	Municipal water, electricity, natural gas, storm water, and sanitary sewer infrastructure is provided to the area by municipal companies
Primary Access:	Woodland Way
Number of Occupants:	One family
Current operations:	Residential

Figure 3–Site Plan shows the current configuration of the Site' exterior, basement and location of the former heating oil storage tank. The residential structure contains an unattached garage accessed by a paver stone driveway leading from the north side of Woodland Way. The residence is elevated on the lot approximately 3 to 4 feet above the Woodland Way street grade. The house is situated on an unfinished basement with utility room under the residence. The residence was originally heated by a heating oil furnace (oil burner) formerly located in the basement at the existing location of the natural gas furnace. The capped product and return lines are visible protruding from the basement foundation wall adjacent to the existing furnace. Heating oil for the oil burner was stored in a steel, single-wall 300-gallon underground storage tank (UST) formerly located beneath the east side of the driveway in front of the unattached garage. The tank was 8 feet in length and 2½ feet in diameter with the fill port at the southeast end of the tank. The bottom of the tank was at 3½ feet below driveway grade. Product and return piping extended from the bottom of the UST to the oil burner in the basement. UST removal activities conducted in January 2017 are discussed in the focused site conceptual model presented in Table 2.

DATA GAP SUMMARY AND PROPOSED INVESTIGATION

The focused site conceptual model (SCM) is presented in Table 2 and the evaluation of Low-Threat Underground Storage Tank Case Closure Policy (LTCP) criteria for data gaps is presented in Table 3. The SCM and LTCP analyses identified the following data gaps:

1. The magnitude and extent of residual heating oil contamination of soil has not been delineated at the former UST location
2. The extent and location of free petroleum product has not been delineated along the basement foundation wall
3. The impact of the heating oil discharge to groundwater has not been evaluated
4. The direction of groundwater flow has not been determined by direct measurement
5. Sensitive receptors exist at private water wells that are located just outside the estimated potential TPH plume length
6. The subsurface product piping beneath the floor slab of the basement has not been investigated for vapor intrusion potential

The ACDEH suggested in its correspondence that additional subsurface investigation is required to advance the case to closure. If the results of the investigation are favorable, ACDEH would generally consider case closure in conjunction with a deed restriction to protect future land use from direct contact, volatilization to air and vapor intrusion risks posed by residual heating oil contamination.

To avoid a deed restriction or notification on the property title, it is necessary to delineate the degree and extent of residual heating oil contamination remaining at the margins of the 2017 excavation and along the foundation of the existing residence. Soil bores surrounding the former excavation limits and along the residence perimeter could prove that residual soil contamination does not pose a risk to current and future land use or indicate if additional soil removal is needed. Product piping beneath the residence needs to be screened for leaks and the potential for vapor intrusion into the overlying residence.

The potential for groundwater contamination poses a risk of vapor intrusion to the subject residence and surrounding residences. The nearby private water wells are threatened with direct contact and incidental ingestion risks from groundwater contamination. Groundwater sampling is needed surrounding the former UST location to discount potential risks. The direct measurement of the groundwater flow direction, if feasible, would aid in the evaluation of potential groundwater contamination.

To achieve regulatory case closure under the LTCP criteria, additional subsurface investigation is required at the Site to characterize the existing condition of residual petroleum soil contamination, soil vapor contamination and potential groundwater contamination. The information derived from the investigation will be compared to the LTCP criteria to evaluate the need for additional remedial action or a recommendation for case closure review. The following table presents the rationale for the proposed investigation work to address each data gap.

Data Gaps Summary and Proposed Investigation

Data Gap	*Data Gap Description*	*Proposed Investigation to Address Data Gap*	*Rationale*
1	The magnitude and extent of residual heating oil contamination of soil has not been delineated at the former UST location	Excavation limit borings with soil sampling at 0-5 and 5-10 to determine if residual heating oil contamination presents a significant risk to human health and the environment	Laboratory analysis of 0-5 and 5-10 foot soil samples for Benzene, Ethylbenzene and Naphthalene needed for comparison to LTCP Table 1
2	The magnitude and lateral extent of heating oil impact to groundwater has not been evaluated	Grab groundwater samples from exploratory borings in potential down-gradient directions west and southwest from former UST location	Residual groundwater contamination poses a potential risk of vapor intrusion to surrounding residence structures and future land use
3	The direction of groundwater flow has not been determined	Install temporary well casing in at least three borings to create piezometers and measure groundwater elevations to estimate direction of groundwater flow	Groundwater flow direction is uncertain and may range from south to west−estimation of flow direction would allow groundwater sample to verify plume has not migrated offsite
4	Site has not been evaluated for extent and magnitude of free petroleum product along foundation wall of existing residence	Exploratory borings with soil and water sampling to determine if residual heating oil contamination presents a significant risk to human health and the environment	To achieve case closure without land use restriction, the delineation and removal of all free petroleum product is required by the LTCP criteria
5	Sensitive receptors exist at private water wells located in close to the estimated potential TPH plume length	Groundwater sampling is needed in vicinity of former UST location for analysis of petroleum hydrocarbons	The potential threat of petroleum contamination to an existing water well is a serious impediment to case closure
6	The condition of subsurface product piping beneath the floor slab of the basement has not been evaluated for a heating oil release	A sub-slab vapor probe with vapor sample is a quick and effective method to screen the entire basement floor for a heating oil release from product piping or leak from former oil burner location	It is difficult to determine the location of subsurface piping making soil sampling unreliable−the vapor intrusion risk from a heating oil release beneath the floor slab can be quickly evaluated with a sub-slab vapor sample

Based on the outstanding data gaps identified in the site conceptual model and evaluation of LTCP criteria, Wheeler Group proposes the additional investigation scope of work as presented in the following sections.

Description of Proposed Data Gap Investigation

Boring Label	*Depth Feet*	*Proposed Subsurface Investigation to Address Data Gap*	*Sample Data Collected*	*Laboratory Analyses*
B1	10	Lateral and vertical definition of residual soil contamination providing excavation limit confirmation soil sample on south side of former UST excavation	Soil sample at 5 and 10 feet and other intervals as needed based on field observations of petroleum contamination	TPH as Diesel, BTEX, and naphthalene
B2	10	Lateral and vertical definition of soil contamination providing excavation limit confirmation soil sample on north side of former UST excavation	Soil sample at 5 and 10 feet and other intervals as needed based on field observations	TPH as Diesel, BTEX, and naphthalene
B3	15	Lateral and vertical definition of soil contamination on west side of UST excavation; determine groundwater impact and direction of flow	Soil sample at 5, 10 and 15 feet and other intervals as needed based on field observations, grab groundwater sample	TPH as Diesel, BTEX, and naphthalene
B4	10	Lateral and vertical definition of soil contamination providing excavation limit soil sample on east side of excavation	Soil sample at 5 and 10 feet and other intervals as needed based on field observations	TPH as Diesel, BTEX, and naphthalene
B5	15	Lateral definition of soil contamination as step-out boring on west side of UST and soil sample along product piping run, determine impact to groundwater	Soil sample at 5, 10 and 15 feet and other intervals as needed based on field observations, grab groundwater sample	TPH as Diesel, BTEX, and naphthalene
B6	15	Determine impact along product and return piping at residence, determine groundwater impact adjacent to residence and direction of flow	Soil sample at 5, 10 and 15 feet and other intervals as needed based on field observations, grab groundwater sample	TPH as Diesel, BTEX, and naphthalene
B7	15	Determine groundwater impact and direction of flow, lateral definition of soil contamination if needed	Soil sample at 5, 10 and 15 feet and other intervals as needed based on field observations, grab groundwater sample	TPH as Diesel, BTEX, and naphthalene
B8	15	Determine soil and groundwater impact at foundation wall where product entered basement foundation wall	Soil sample at 5, 10 and 15 feet and other intervals as needed based on field observations, grab groundwater sample	TPH as Diesel, BTEX, and naphthalene
B9	5	Determine soil and groundwater impact beneath foundation slab where product entered basement foundation wall	Soil sample at 1 and 5 feet and other intervals as needed based on field observations, grab groundwater sample	TPH as Diesel, BTEX, and naphthalene
SS1	1	Sub-slab vapor probe in basement floor in vicinity of former heating oil burner and underground product lines	Sub-slab vapor sample from beneath concrete floor slab	TPH as Diesel, BTEX, and naphthalene

DATA GAP INVESTIGATION WORK PLAN

Wheeler Group is proposing additional site investigation in the form of soil, vapor and groundwater sampling to address the data gaps identified in the focused SCM and evaluation of LTCP criteria. The proposed sampling locations are shown on Figure 3−Site Plan, as well as in Photograph Pages 1 & 2. The following sections describe the procedures for the proposed investigation work.

Scope/Sequence of Work Activities

The general scope of work and sequence of activities described in this work plan include:

- Obtain boring permit as necessary from Alameda County Public Works Agency−Water Resources Section, and if necessary, from the City of Piedmont Public Works Department for drilling work conducted in the public right of way
- Outline the proposed work area and boring locations in white surface paint and notify Underground Service Alert to clear for subsurface public utilities extending through the designated work area(s)
- Prepare the Site Health & Safety Plan for all proposed field work and schedule and notify all parties of the confirmed field drilling/sampling date
- Using hydraulic push drilling and hand-auguring equipment, Wheeler Group and EnProbe Environmental Drilling Services (EnProbe) will drill up to 9 borings to a maximum depth of 15 fbg if bedrock conditions allow (hard bedrock was encountered at 5½ fbg during UST removal)
- Collect discrete soil samples from the borings at approximate depths of 0-5, 5-10 and 15 fbg as feasible, actual sample depths may vary based on the results of field screening and field evidence of soil contamination
- Appropriately seal, cap and label all soil samples for chilled storage
- Wheeler Group will log a continuous soil profile in each borehole beginning at grade surface and continuing to the total depth of each boring; field screen soil cuttings at all soil sample intervals for total Volatile Organic Compounds (VOCs) using a calibrated photoionization detector (PID)
- Wheeler Group will initially monitor the selected boreholes for water, if any, and free petroleum product and collect a water sample from three bores for the laboratory analysis of petroleum hydrocarbons
- In bores B3, B6, B7 and B8, Wheeler Group will instruct EnProbe to install capped 0.75-inch diameter well screen to provide three temporary piezometers, if feasible based on depth to bedrock
- Wheeler Group will perform a wellhead elevation survey using the temporary piezometers to estimate the local direction of groundwater flow, if feasible based on depth to bedrock

- Backfill all boreholes with Portland cement to within one foot of surface and finish borehole to match existing surface conditions
- Install one sub-slab vapor probe and recover one soil gas sample from beneath floor of residence basement, remove caps and drain product and return lines
- Deliver soil, vapor and water samples under chain-of-custody procedures to a State-certified analytical laboratory for the analysis of petroleum hydrocarbons
- Store all waste sample soil and equipment wash/rinse water in secured temporary storage containers pending off-site disposal at a State-licensed landfill/recycling facility
- Profile and transport all solid and liquid waste to respective State-licensed disposal facilities, remove and properly dispose of all used well casing
- Upload all investigative analytical data and required documentation to the State GeoTracker Database System
- Wheeler Group will interpret all data and prepare a technical report summarizing the activities, findings, and conclusions of the field investigation activities

Wheeler Group presents the following procedures for the additional investigation activities in the following sections.

Health And Safety Plan

All contractors will be responsible for operating in accordance with the most current requirements of State and Federal Standards for Hazardous Waste Operations and Emergency Response (Cal. Code Regs., tit. 8, section 5192; 29 CFR 1910.120). Onsite personnel are responsible for operating in accordance with all applicable regulations of the Occupational Safety and Health Administration (OSHA) outlined in the State General Industry and Construction Safety Orders (Cal. Code Regs., tit. 8) and Federal Construction Industry Standards (29 CFR 1910 and 29 CFR 1926), as well as other applicable federal, state and local laws and regulations. All personnel shall operate in compliance with all California OSHA requirements. In addition, California OSHA's Construction Safety Orders (especially Cal. Code Regs., tit. 8, sections 1539 and 1541) will be followed as appropriate. Specific requirements are identified below:

- At least 72 hours prior to initiating field work, Wheeler Group will surface mark all proposed work area(s) in white marking paint and notify Underground Service Alert (USA). All subsurface utility agencies must mark out all underground utility locations within public right of way extending through general work area(s), and if high priority subsurface utilities are present within 10 feet of proposed excavation(s), Wheeler Group will meet with specific utility agencies to identify exact locations (Title 8, Section 1541)
- Site work traffic controls and warning sign placement must conform to the requirements of the State Department of Transportation's California Manual on Uniform Traffic Control Devices for Streets and Highways, September 26, 2006 (Title 8, Sections 1598 & 1599).

Wheeler Group will prepare a site-specific Health & Safety Plan (HASP) for the Site in accordance with current health and safety standards as specified by the federal and California OSHA's. The HASP will be reviewed and updated if needed for future work. The provisions of the HASP are mandatory for all personnel of the proposed project and its contractors who are at the Site. The contractor and its subcontractors doing fieldwork in association with this work plan will either adopt and abide by the HASP or shall develop their own safety plans which, at a minimum, meet the requirements of this HASP. All onsite personnel shall read the HASP and sign the "Plan Acceptance Form" before starting daily Site activities.

Pre-Field Work Activities

Wheeler Group will submit a completed subsurface drilling permit application and associated permit fee to the Alameda County Public Works Agency (ACPWA)−Water Resources Section. If warranted, for any borings proposed in the public right of way, Wheeler group will also submit an encroachment permit application and fee to the City of Piedmont Public Works Department. Wheeler Group will arrange and schedule all drilling and laboratory subcontractor services. At least 72 hours before commencing field activities, Wheeler Group will notify the property owner and tenant(s) as well as the local agencies of all scheduled work activities, and will visit the site and outline the proposed work areas in white surface paint and subsequently notify Underground Service Alert (USA) to locate and mark any subsurface utilities extending through the designated work areas. Prior to commencing drilling activities, Wheeler Group will conduct a tailgate safety meeting with all site personnel addressing all information provided in the Site Health & Safety Plan (HASP), as presented above in the section on Health & Safety Plan.

Equipment Decontamination & Waste Storage

All drilling and sampling equipment will be cleaned between each sampling location using a non-phosphate Alconox® solution and double rinsed using clean, potable water. The equipment wash and rinse water generated from the decontamination of soil boring and sampling equipment or other derived liquid waste generated during the proposed sampling activities will be immediately transferred to 55-gallon, D.O.T.-approved liquid steel drum(s), properly labeled and stored onsite in a secure area. Drill cuttings, if generated, and excess sample soil (not submitted for laboratory analysis) will not be returned to the borehole, and will immediately be transferred to 5-gallon plastic pails for temporary storage during drilling operations. Periodically, the drill cuttings, if any, and waste sample soil will be transferred to a dedicated 55-gallon solid waste storage drum, to be properly labeled and stored onsite.

Drilling and Soil Sampling

As required per agency drilling permit conditions, each proposed soil boring will be drilled by a California-licensed Water Well Drilling Contractor (C-57). At each location, the driller will hand auger a 2.5-inch diameter borehole to the designated depth of 4.5–5 feet

below grade while simultaneously transferring soil cuttings to a 5-gallon plastic bucket. The purpose of the hand-auger drilling is to clear the boring locations for unmarked underground utilities and the underground sanitary sewer lateral reportedly extending in the northwest-southeast direction along the east side of the residence, see Figure 3–Site Plan.

The driller will advance each boring to a maximum depth of 15 fbg using a limited access, hydraulic Geo Probe drilling rig (or similar equipment) equipped with 2.25-inch diameter steel, concentrically-cased steel drill tubes. Discrete soil samples will be collected in each borehole between 4.5 and 15 fbg by advancing a butyrate plastic, tube-lined core sampler (1.5-inch-diameter) approximately 4 feet into relatively undisturbed soil. Soil samples will be collected continuously. Discrete soil samples will be collected at 0-5, 5-10 and 15 fbg for laboratory analysis, as feasible. Additional discrete soil samples will be recovered at changes of lithology, at the soil/groundwater interface, and at areas showing obvious contamination (i.e., petroleum staining and/or hydrocarbon odor).

Wheeler Group will classify and log all soil extracted from each borehole using the Unified Soil Classification System and Munsell Soil Color Chart, and monitor and record the organic vapor concentrations of selected soil samples using a calibrated MiniRae photo ionization detector (PID). All borings will be logged under the supervision of a California-registered Civil Engineer/Geologist. Soil samples retained for laboratory analysis of petroleum hydrocarbons will be immediately sealed with Teflon tape and plastic caps, appropriately labeled, and placed in a cooler chilled to approximately 4° C. Drill cuttings will not be returned to the boreholes and boreholes will be sealed with neat cement. Drill cuttings, if any, will be stored in a properly labeled 55-gallon solid waste drum for off-site disposal and/or recycling.

Grab Groundwater Sampling

Following drilling and soil sample collection in each borehole, Wheeler Group will instruct the drilling contractor to place factory-sealed, 0.75-inch diameter, screened PVC well casing (threaded with bottom cap) to the total depth of boreholes B3, B6, B7 and B8 to expedite water sampling and pre-filter the groundwater of coarse-grained sediments. Wheeler Group will periodically measure and record the depth to groundwater in the temporary casing using an electronic water level indicator and/or oil/water phase indicator and determine when the groundwater level recovers to a level allowing water sampling. Wheeler Group will obtain all measurements relative to the approximate north side of the top of casing (TOC), with an accuracy of 0.01 foot. When a sufficient groundwater volume is present in the borehole, Wheeler Group will immediately collect a grab groundwater sample within the PVC casing using a dedicated disposable polyethylene or Teflon bailer.

The volatile water samples will be collected and poured directly into laboratory cleaned 40-milliliter volatile organic analysis (VOA) vials (pre-preserved with hydrochloric acid) to prevent loss of any volatile constituents. The vials will be filled slowly and in such a manner that the meniscus extends above the top of the VOA vial. After the vials are filled and sealed with a laboratory provided Teflon cap, they will be inverted to insure there is no

head space or entrapped air bubbles. The non-volatile water samples for TPH as Diesel analysis will be collected in laboratory-provided, 1-liter amber bottles using a low-flow peristaltic pump and dedicated Teflon tubing.

All samples will be labeled and placed in a cooler chilled to approximately 4°C. Wheeler Group will submit the samples under a chain of custody to the analytical laboratory for chemical analysis.

Temporary Piezometer Elevation Survey

After drilling activities are completed, Wheeler Group will monitor the depth to groundwater in each temporary piezometer and perform a preliminary elevation survey at Borings B3, B6, B7 and B8, as designated on Figure 3─*Site Plan*. Wheeler Group will initially monitor and record the depth to groundwater and presence of free product in each temporary well using an electronic oil/water phase indicator. Wheeler Group will then survey the top of casing and associated grade elevation of each temporary piezometer to the nearest 0.01 foot. Elevations will be measured relative to a local benchmark with known elevation (Mean Sea Level) or arbitrary datum point using an assumed elevation. Wheeler Group will then calculate the approximate groundwater gradient and flow direction across the Site.

Backfilling of Exploratory Borings

All boreholes are required to be backfilled within 24 hours following drilling/sampling activities, per Alameda County Public Works Agency (ACPWA)−Water Resources Section drilling permit specifications. Immediately following the conclusion of soil and water sampling activities and groundwater elevation surveying, Wheeler Group will extract the temporary well casing, if present, and backfill each borehole with neat Portland cement up to approximately 1 fbg. In boreholes with standing water, a tremie pipe will be used to place Portland cement starting at the bottom of the borehole. The used PVC well casing will be rinsed and disposed of appropriately at an offsite facility as non-hazardous waste. The balance of the borehole will be backfilled with appropriate cover material to restore original Site conditions.

Sub-slab Vapor Sampling

Wheeler Group will collect a sub-slab vapor sample from one field point SS1 to evaluate the potential for vapor intrusion from existing abandoned subsurface product and return piping. The sampling field point is located in the basement of the residential structure as shown on Figure 3−Site Plan. A soil gas vapor probe will be installed utilizing commercially available Vapor Pin sub-slab soil gas sampling device provided by Cox-Colvin. The Vapor Pin is designed for use in sub-slab soil gas sampling. The Vapor Pin device is a single piece installation eliminating potential leak points and uses a silicone sleeve to form an air-tight seal with the side of the drill hole. The area of the vapor point will first be cleared of surface covering and hand washed with an Alconox solution. Wheeler Group and the drilling

contractor will use a hammer drill to drill a 5/8" hole, clean the drill cuttings from the hole with a brush and drill a 1½" surface hole to flush mount a pin cover. The Vapor Pin device is installed as described in the attached documentation titled Standard Operating Procedure Installation and Extraction of the Vapor Pin in the Appendix. Following the soil gas sampling, Wheeler Group will leave the temporary vapor probe installed for future additional vapor sampling, if needed.

Soil Gas Sampling Train

A soil gas sample will be collected following the procedures provided in DTSC's July 2015 Advisory–Active Soil Gas Investigations. Wheeler Group will wait at least 48 hours following the completion of borehole drilling before conducting the soil gas sampling. The appropriate purge volume will be 3 in accordance with the current advisory for soil gas investigations, to allow the soil vapor conditions to approach representative, ambient conditions after probe emplacement. The associated shut-in tests, leak testing, purging volume testing, and soil gas sampling will not be conducted until equilibration has occurred, at least 48 hours following completion of probe installation. A brief description of each soil gas assembly test is provided below. Figure 7–Schematic of Sub-slab Vapor Sampling, shows the equipment setup and sampling train utilized for sub-slab vapor sampling.

For collection and analysis of VOCs and Fixed Gases, a laboratory-supplied 6-liter purge canister and a 1-liter sample canister will be connected into a manifold using an inline 2-micron filter, a flow controller preset at a 150 milliliters/minute flow rate, and a dual valve assembly (V1 and V2). The sample canister, manifold, valves and the superior portion of the sub-slab vapor probe (at grade surface) will be connected using laboratory supplied Teflon tubing and Swagelok compression fittings. The sample canister and manifold assembly will be connected directly to the above-grade tubing of the newly-installed vapor probe. Clean laboratory-supplied canisters, manifold assemblies, and new Teflon tubing will be used at each sampling location. The laboratory will connect the vacuum gauges directly to each Summa canister prior to shipment. Per soil gas advisory specifications, flow rates between 100 and 200 milliliters per minute and an applied vacuum less than 100 inches of water should be maintained throughout purging and sampling to minimize both ambient air infiltration from dilution of samples and partitioning of vapors from pore water to soil gas, to help ensure collection of a representative soil gas sample.

Shut-In and Leak Testing

A shut-in test will be conducted to check for leaks in the above-grade sampling system. After assembly of the soil vapor sampling train as shown in Figure 7, Wheeler Group will close Valve V1 and apply a vacuum at the 6-liter purge canister and continually observe the vacuum gauge(s) for at least 1 minute (standard time at 10 minutes) to confirm that there is no observable loss in vacuum. Should a loss in vacuum occur, Wheeler Group will immediately close the valve at the purge canister and adjust all inline fittings between V1 and the purge and sample canisters. After validation of the shut-in test is completed, the soil gas sampling train will not be disconnected or altered, and the subsequent leak test can

be performed. A leak test is conducted during sample collection to check if ambient air is introduced into the soil gas sample and evaluate overall integrity of the sample.

Atmospheric leakage generally occurs through faulty valves/gauges and loose fittings in the soil gas sampling train, and by advection through voids in the vapor probe construction material, borehole wall and directly through the soil column itself. The leak check compound, isopropyl alcohol (IPA; CAS #67-63-0), is applied at the vapor probe inlet at grade surface, throughout the duration of the sampling event. Wheeler Group recommends using a shroud enclosure with minimal volume during the sampling of each vapor probe to ensure that a relatively high concentration of the leak check compound is maintained throughout the sampling event, and that the volatile tracer concentrations within the shroud be monitored and recorded periodically at 3-minute intervals using a calibrated PID.

The enclosure will be placed over the inlet of the soil vapor probe and contain at least the vapor tight valve V1 and associated sections of Teflon tubing. IPA would be applied directly to a gauze or cloth and placed on the floor surface near the vapor probe inlet, whereas a gaseous tracer compound would be infused directly surrounding the vapor sampling train assembly within the shroud enclosure. The selected leak check compound should not be a suspected site contaminant, and should be included in the laboratory analyte list. If warranted, a leak check sample canister (or associated tubing inlet) can be placed within the shroud enclosure and sampled concurrently with the soil gas sample.

Vapor Sample Collection

After a sufficient volume of vapor has been evacuated from the sampling assembly, Wheeler Group will perform vapor sample collection. If a leak check canister is utilized, it will be connected to a separate manifold system "J-Tube" consisting of a 2-micron filter, flow controller, and a single valve assembly, and connected directly to Teflon tubing that extends within the shroud enclosure. Wheeler Group will place clean gauze saturated with IPA within the interior of the shroud enclosure throughout the duration of each sampling period, and continuously monitor the interior atmospheric concentration of the shroud with a MiniRae® PID. Wheeler Group will record the interior shroud VOC concentrations every three minutes.

Wheeler Group will initially close the purge canister and open the valves for the 1-liter sample and leak detection canisters, and begin sample collection. Sampling will be terminated at each location when the sample canister vacuum gauge shows approximately 5 inches of mercury (adequate sample volume and suggested vacuum for sample extraction according to laboratory). Each sample canister will be disconnected from the sample train assembly, appropriately labeled and placed in a box or cooler (non-chilled) for return transport to the laboratory. The results of the soil vapor analysis will be confirmed with duplicate vapor samples (at a rate of 10% of the soil vapor samples) collected simultaneously in additional Summa canisters utilizing a duplicate manifold assembly.

Wheeler Group will utilize Thermal Desorption (TD) Tubes for collection and analysis of TPH as Diesel and Naphthalene using EPA method TO-17. Laboratory-provided stainless tubes are factory packed with specialized adsorbent and sealed at each end with threaded

Swagelok caps, then wrapped in tin foil, and shipped from the laboratory on blue ice. At each sample location, the TD tubes (2) are connected in series with Tygon or Teflon tubing to the soil gas wellhead point. The effluent end of the TD tubes are then connected with additional tubing to a low flow sampling pump, also provided by the laboratory. The pump is activated and the sample is collected by drawing approximately 2 liters of air through the TD tubes, absorbing the contaminant onto the interior media of each tube (sample duration @ 20 minutes). The sample/pump assembly is disconnected and the TD tubes are immediately re-capped with the Swagelock fittings, labeled, appropriately wrapped/sealed, and placed in blue ice for lab delivery.

Laboratory Analysis Plan

A copy of the certified laboratory analytical reports associated with the sampling events will be presented in technical report. Tables in the technical report will present a summary of the analytical results for the sampling events as well as data generated during previous sampling events at the Site. The laboratory will complete all volatile organic analyses within the 14-day required time limit for analysis.

Laboratory Analysis of Soil Samples

Wheeler Group will submit all collected soil samples under formal chain of custody command to Torrent Laboratories Inc. of Milpitas, California, a State-certified stationary laboratory (ELAP No. 1991) to perform the laboratory analyses of the following constituents:

- Total Petroleum Hydrocarbons (TPH) as Diesel (C10-C28) by EPA Method SW8015B(M)
- Benzene, Toluene, Ethyl Benzene, Total Xylenes (BTEX), and Naphthalene by EPA Method SW8260B

Laboratory Analysis of Groundwater Samples

Wheeler Group will submit all collected water samples under formal chain of custody command to Torrent Laboratories Inc. of Milpitas, California, a State-certified stationary laboratory (ELAP No. 1991) to perform the laboratory analyses of the following constituents:

- Total Petroleum Hydrocarbons (TPH) as Diesel (C10-C28) by EPA Method SW8015B with & without Silica Gel Cleanup
- Benzene, Toluene, Ethyl Benzene, Total Xylenes (BTEX), and Naphthalene by EPA Method SW8260B

Laboratory Analysis of Soil Gas Samples

Wheeler Group will submit the soil gas samples collected under chain of custody command to Torrent for chemical air analysis. The samples will be analyzed using the following California Department of Health Services approved methods:

- Fixed Gases of Methane, Carbon Dioxide and Oxygen by ASTM Method D-1946

- TPH as Diesel range organics by Method TO-17
- Volatile Organic Compounds (VOCs; Full List) by Method TO-15
- Naphthalene by Method TO-17

The leak check canister sample will be analyzed only for 2-Propanol (Isopropyl Alcohol – IPA) by Method TO-15.

WASTE MANAGEMENT

All petroleum hydrocarbon-impacted soil generated during the soil boring and sampling activities will be transferred directly to 55-gallon drums and temporarily stored onsite in a secure area. Pending receipt of the composite stockpile soil sample analysis, Wheeler Group and subcontractors will subsequently profile and transport the containerized waste to an appropriate State-licensed disposal facility under uniform waste manifest. A copy of the solid waste manifest and associated weight ticket will be included in the technical report.

All drilling and sampling equipment wash and rinse water generated during the additional investigation activities will be transferred to separate 55-gallon D.O.T. approved steel drums and stored onsite in a secure area. All waste liquid containers will be sealed and appropriately labeled and securely stored onsite pending future disposal at a State-licensed disposal or recycling facility. The liquid waste will be profiled for disposal/recycling under uniform waste manifest following receipt of the laboratory results of groundwater sample analysis.

SCHEDULE AND APPROVAL

The following deliverables will be submitted to ACDEH to the attention of Mark Detterman, according to the following schedule:

- October 20, 2017—Data Gap Investigation Work Plan

Wheeler Group anticipates beginning the pre-field activities within two weeks of receiving authorization to proceed from ACDEH and the client. Excavation, drilling and soil sampling should occur during October-November 2017, depending on work plan approval, client approval, permitting from both Alameda County Public Works Agency and City of Piedmont, and subcontractor driller availability.

- 60 days after work plan approval—Soil and Groundwater Investigation Report

Wheeler Group anticipates submitting a Soil and Groundwater Investigation Report within 60 days after work plan approval.

GEOTRACKER UPLOAD

Wheeler Group will upload all analytical data (EDF) as well as the Fluid-Level Monitoring Data (GEO_WELL) to the State Water Resources Control Board's GeoTracker Database System. Wheeler Group also will upload a copy of all boring logs (GEO_BORE), a revised Site Plan (GEO_MAP) and a copy of the report of findings (GEO_REPORT) in Portable Data Format (PDF) to the GeoTracker Database. A copy of each associated GeoTracker Upload Confirmation Form will be included in the appendices of the resulting report.

REPORT DISTRIBUTION

This document was distributed to the following parties:

Ms. Marcia Redford 170 Woodland Way Piedmont, California 94611 redfordfamily@earthlink.net	1 PDF Work Plan via Email 1 Hard Copy of Work Plan via USPS
Mark Detterman, PG, CEG Alameda County Department of Environment Health 1131 Harbor Bay Parkway, Suite 250 Alameda, California 94502-6577 mark.detterman@acgov.org	1 PDF Work Plan via GeoTracker Website 1 PDF Work Plan via ACDEH's FTP Server

REFERENCES

Alameda County Department of Environmental Health, 2017, Request for Site Investigation Work Plan; Fuel Leak Case No. RO0003256 and GeoTracker Global ID T1000010538, Redford Residence, 170 Woodland Way, Piedmont, CA 94611, Mark Detterman, Senior Hazardous Materials Specialist, PG, CEG, July 19, 2017.

Alameda County Department of Environmental Health, 2010, Notice of Responsibility; Redford Residence, 170 Woodland Way, Piedmont, CA 94611, Local ID RO0003256 and Global ID T1000010538, Ronald Browder, Contract Project Director, July 19, 2017.

Alameda County CUPA Program, 2017, Contaminated Site Case Transfer Form, Barbara Jakub, Hazardous Materials Specialist, February 7, 2017.

Alameda County Department of Environmental Health, 2017, Official Inspection Report, 170 Woodland Way, Piedmont, Barbara Jakub, Hazardous Materials Specialist, February 14, 2017 and amended with photographs on February 22, 2017.

Golden Gate Tank Removal, Inc., 2017, Underground Storage Tank Closure Report, 170 Woodland Way, Piedmont, CA 94611, Job No. 9609, prepared for Marcia Redford, February 14, 2017.

Norfleet Consultants, 1998, Groundwater Study and Water Supply History of The East Bay Plain, Alameda and Contra Costa Counties, CA, prepared for The Friends of the San Francisco Estuary, June 15, 1998.

San Francisco Bay Region 2. 2016, Regional Water Quality Control Board, Environmental Screening Levels−February 2016.

U.S. Geological Survey, 2000, Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California: Miscellaneous Field Studies MF-2342.

LIMITATIONS

It should be understood that all environmental assessments are inherently limited in that conclusions are drawn and recommendations developed from information obtained from limited research and visual observations. Subsurface conditions change significantly with distance and time and therefore may differ from the conditions implied by subsurface investigation. Existing hazardous materials and contaminants can escape detection using existing methods. The work performed in conjunction with this assessment and the data developed are intended as a description of available information at the dates and location given. Wheeler Group's professional services have been performed, with findings obtained and recommendations prepared in accordance with customary principles and practices in the field of environmental science, at the time of the assessment. This warranty is in lieu of all other warranties either expressed or implied.

Wheeler Group is not responsible for the accuracy of information reported by others or the independent conclusions, opinions or recommendations made by others based on the field exploration presented in this report. The findings contained in this report are based upon information contained in previous reports of corrective action activities performed at the subject property and based upon site conditions as they existed at the time of the investigation, and are subject to change. The scope of services conducted in execution of this phase of investigation may not be appropriate to satisfy the needs of other users and any use or reuse of this document and any of its information presented herein is at the sole risk of said user. The figures, drawings and plates presented in this report are only for the purposes of environmental assessment and no other use is recommended. No other third party may rely on this report, figures or plates for any other purpose.

DATA GAP INVESTIGATION WORK PLAN

Redford Residence

170 Woodland Way, Piedmont, California 94611

APN 51-4731-20

GeoTracker Global ID No. T10000010538

Alameda County LOP Case No. RO0003256

WGE Project No. 2017111

FIGURES, TABLES & PHOTOGRAPHS

Wheeler Group Environmental, LLC

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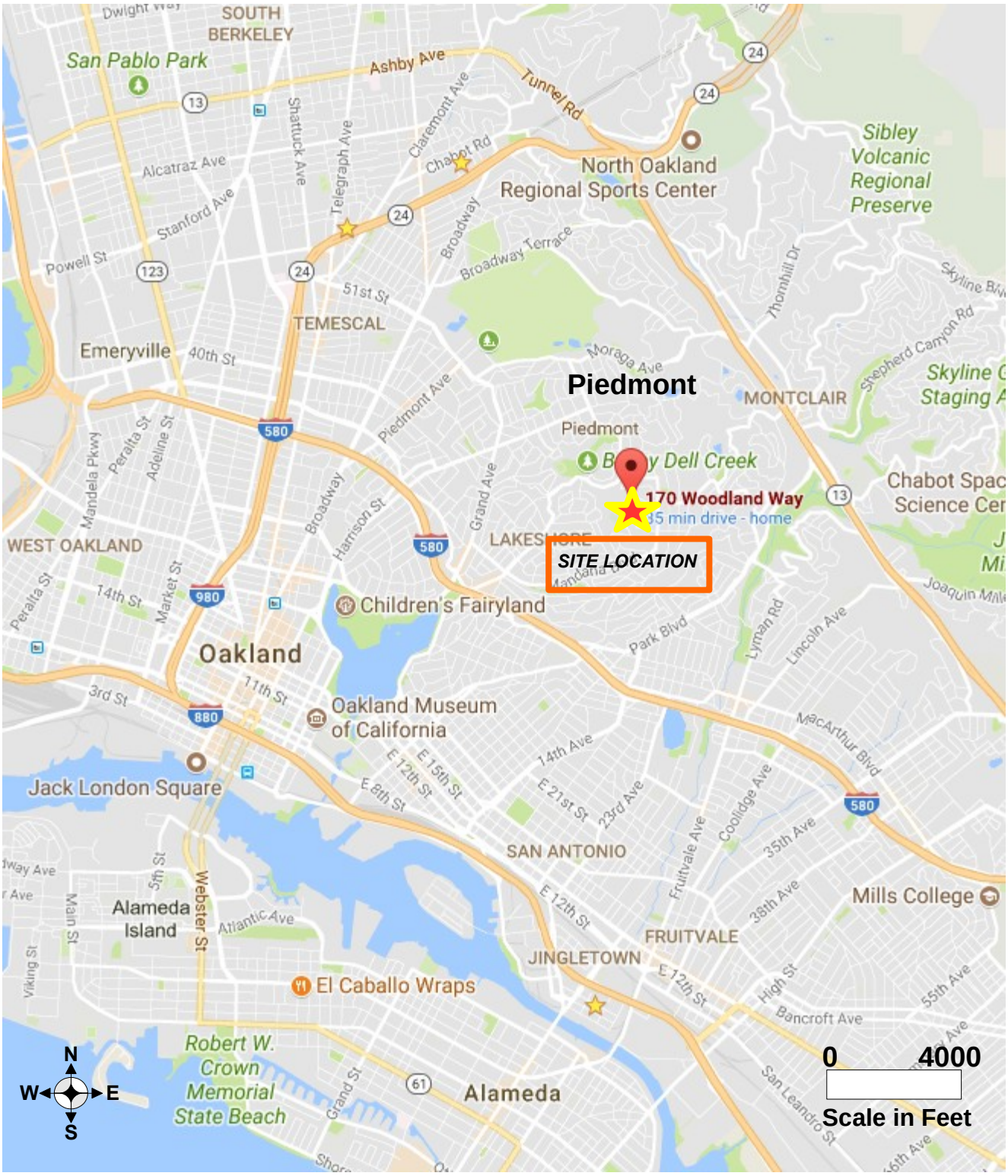
Project no. 2016105



Base map is a low resolution screen capture from Google Map data 2017

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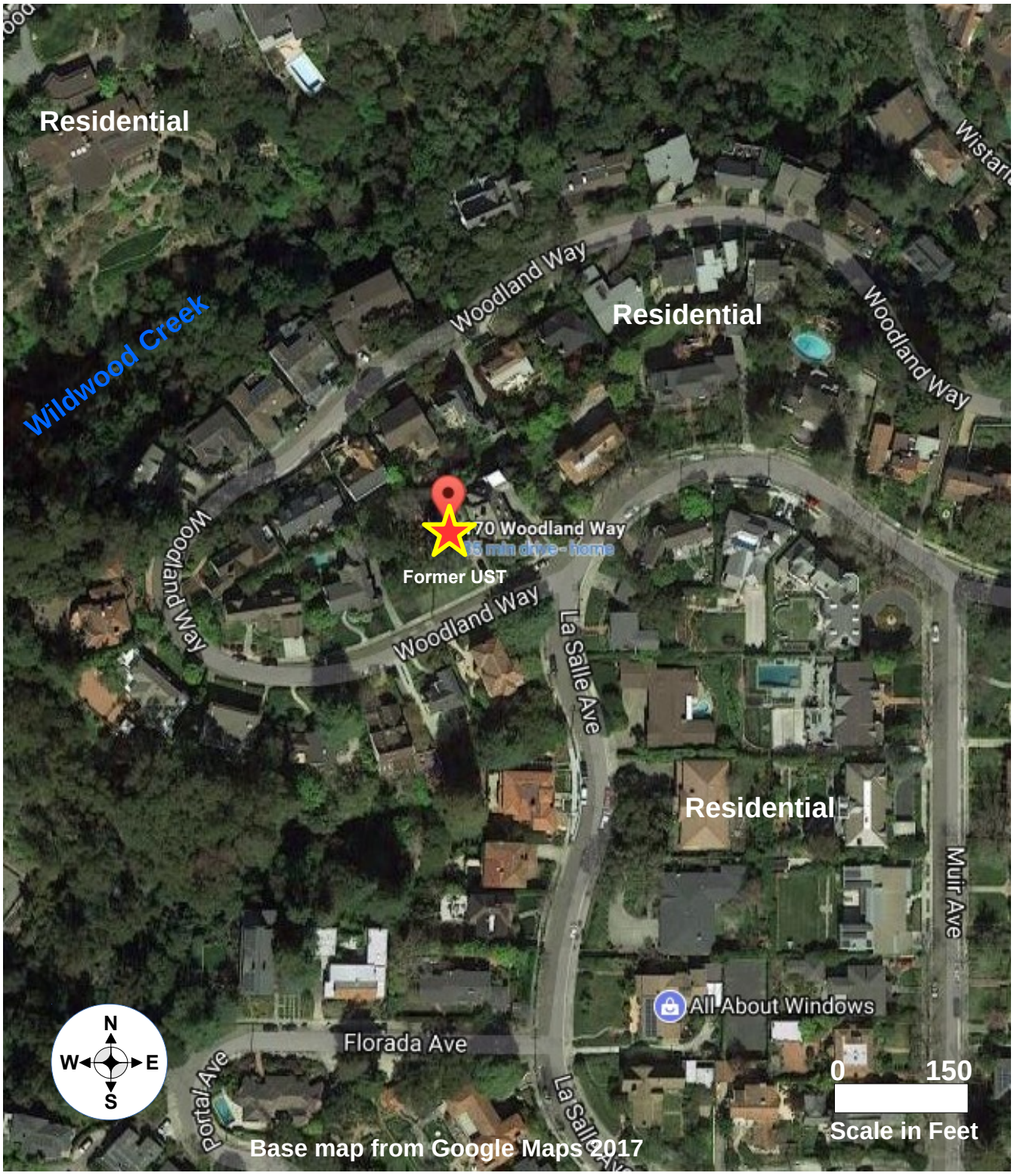
SITE LOCATION MAP
Data Gap Investigation Work Plan
170 Woodland Way, Piedmont, California

Project No. 2017111	FN: 2017111_Fig1_SiteLocationMap.odg	Drawing: MY Sept. 2017	***Figure 1***



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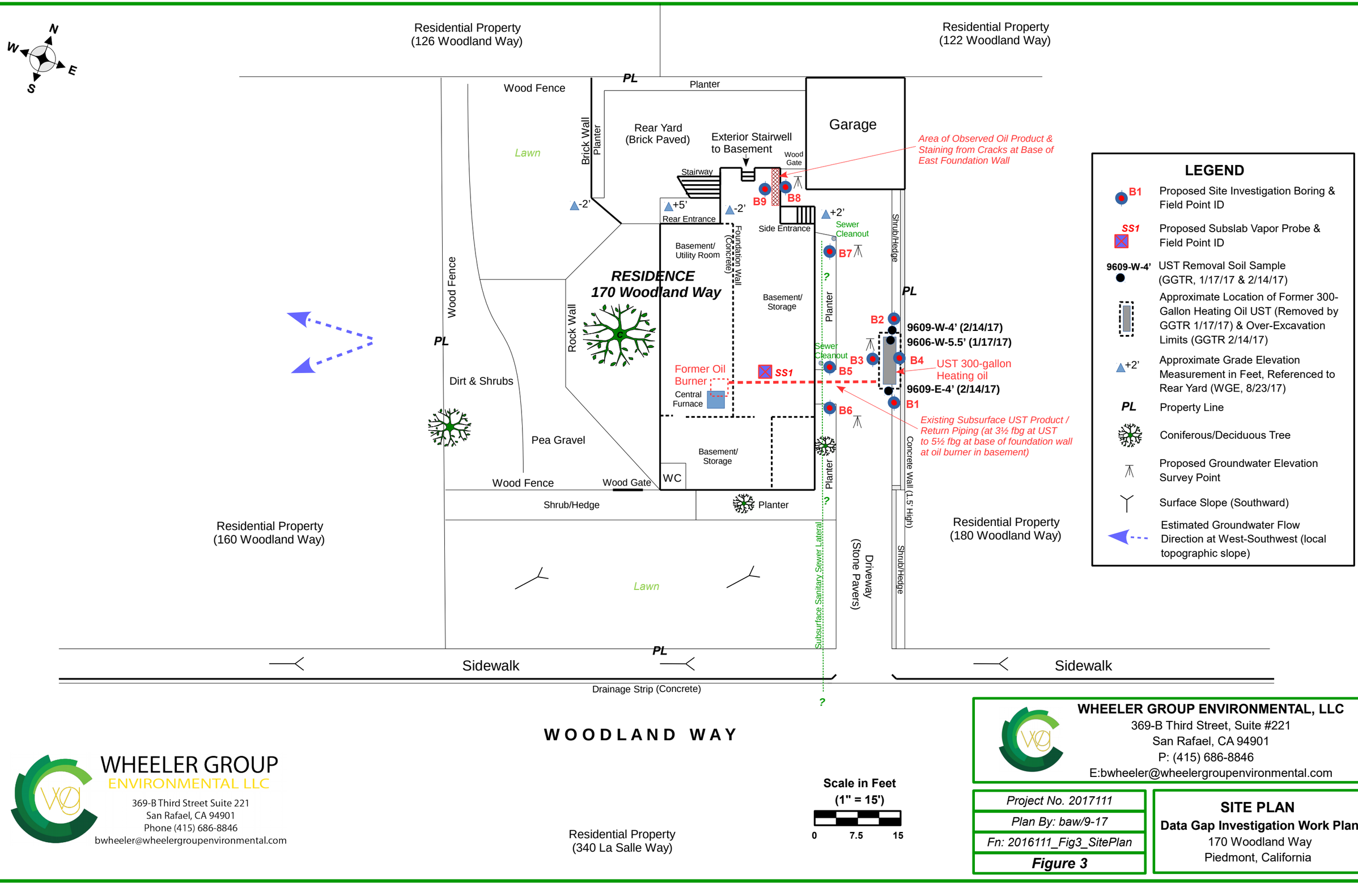
SITE VICINITY MAP

Data Gap Investigation Work Plan

170 Woodland Way, Piedmont, California

Project No. 2017111	*FN: 2017111_Fig2_SiteVicinityMap.odg*	*Drawing: MY Sept. 2017*	***Figure 2***



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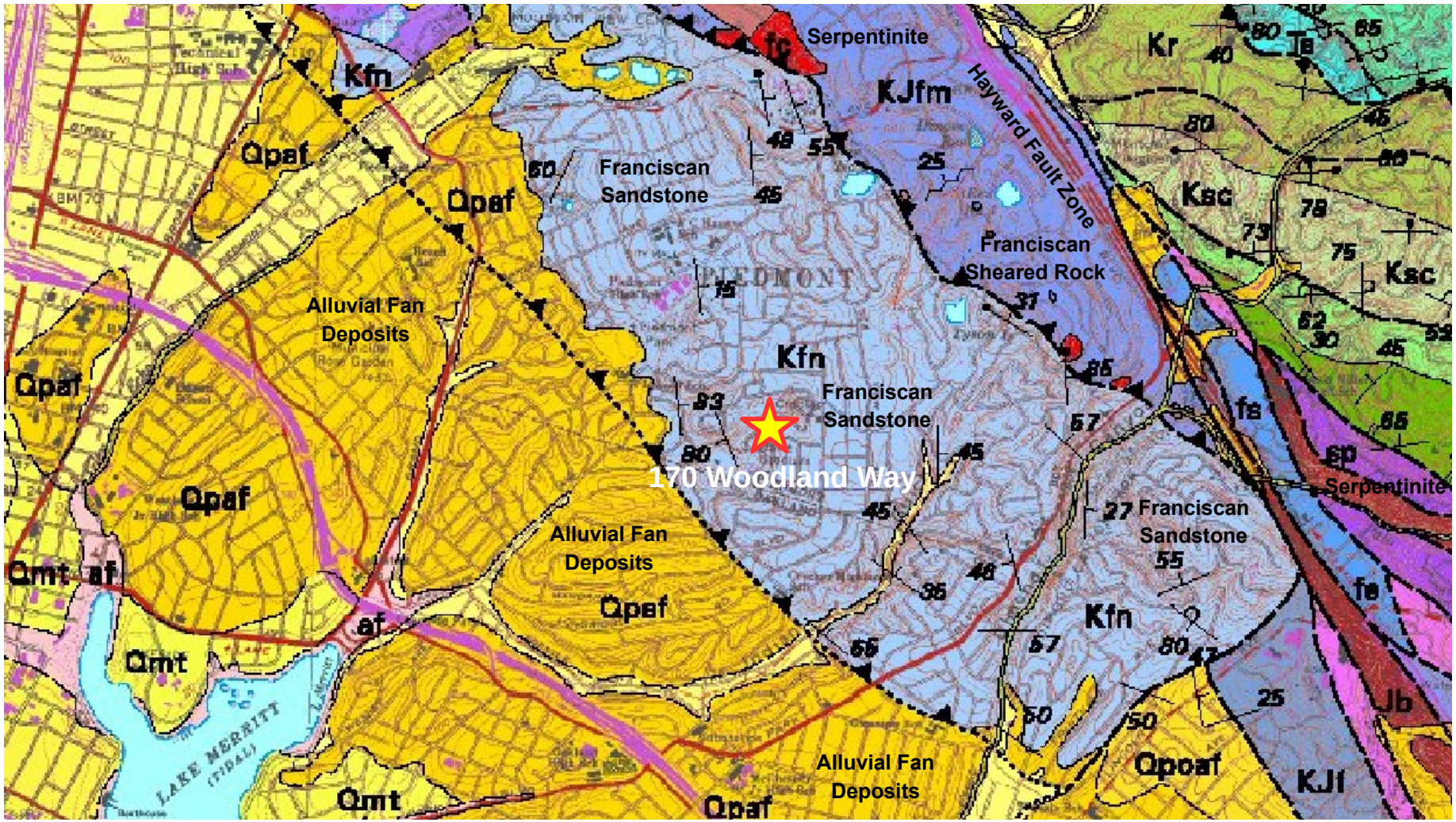
Project No. 2017111
Plan By: baw/9-17
Fn: 2016111_Fig3_SitePlan
Figure 3

SITE PLAN
Data Gap Investigation Work Plan
170 Woodland Way
Piedmont, California



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A portion of Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California: Miscellaneous Field Studies MF-2342 by U.S. Geological Survey 2000; see pamphlet text for explanation of geologic units shown on map

0 2000

Scale in Feet

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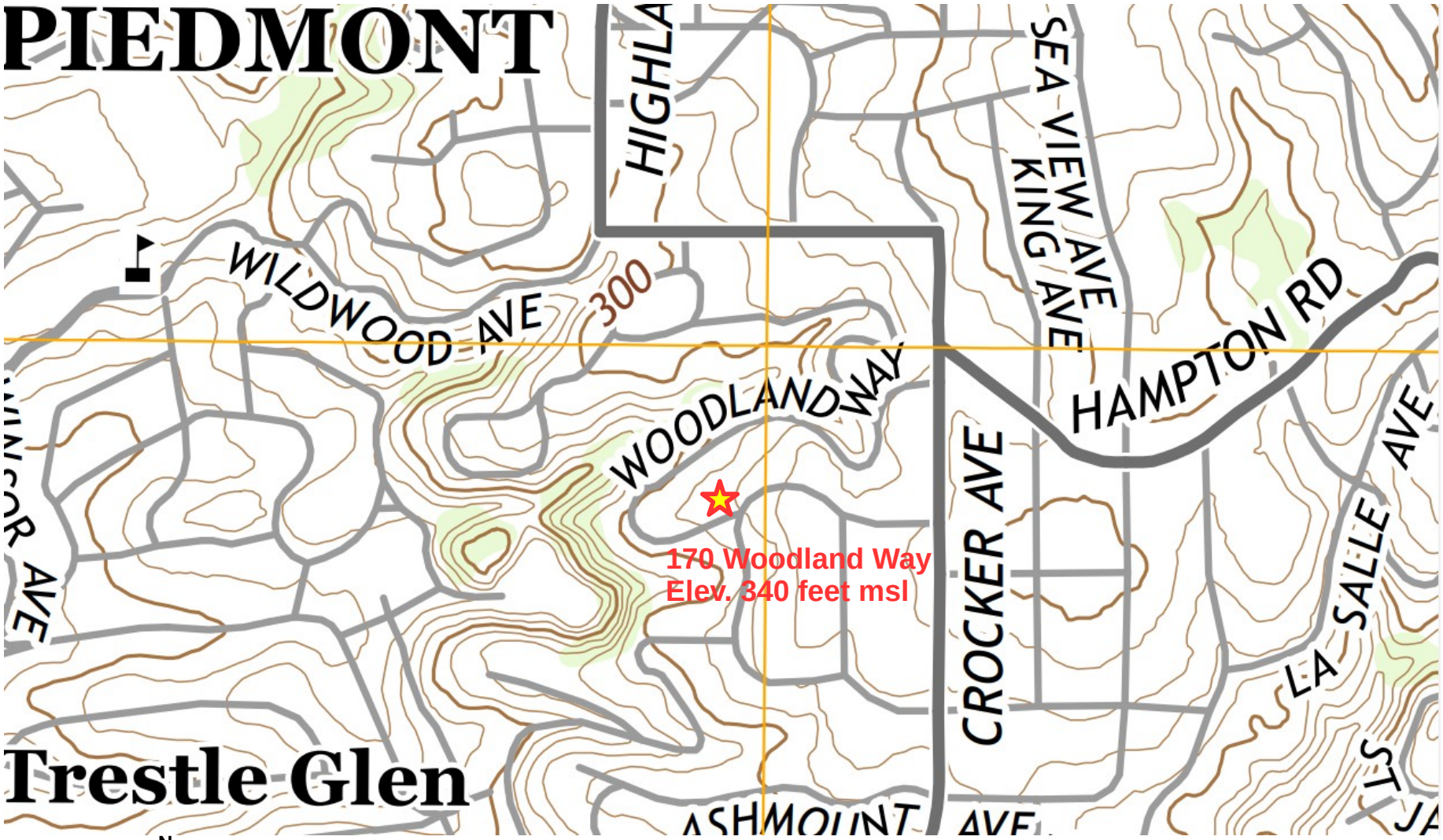
GEOLOGIC MAP

Data Gap Investigation Work Plan

170 Woodland Way, Piedmont, CA

Project No. 2017111	*FN: 2017111_Fig4_GeologicMap.odg*	*Drawing By: MY Sept. 2017*	***Figure 4***



A portion of Oakland East Quadrangle, California: topographic quadrangle map by United States Geological Survey dated 2015; Scale 1:24,000; contour interval is 20 feet

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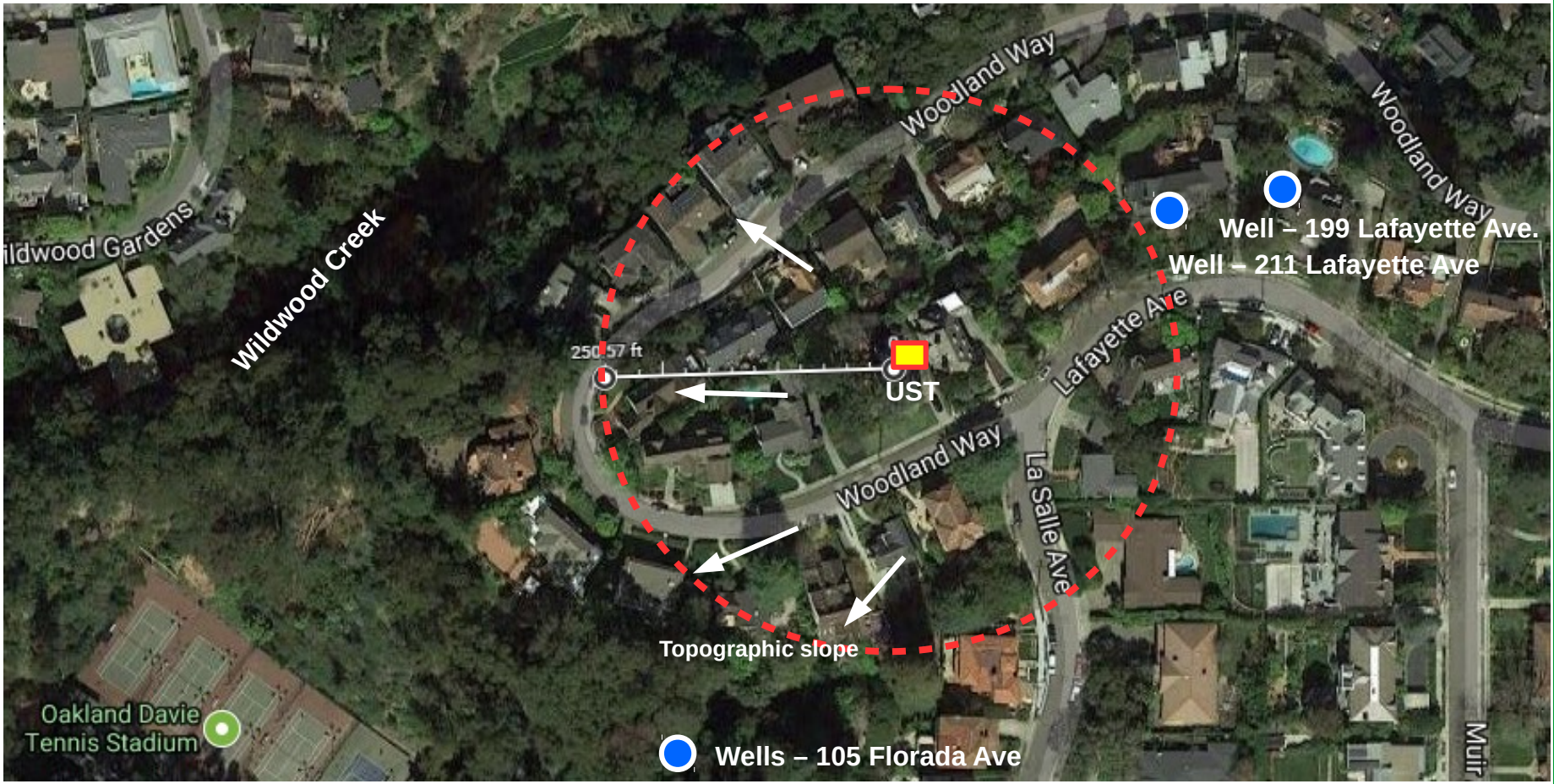
TOPOGRAPHIC MAP
Data Gap Investigation Work Plan
170 Woodland Way, Piedmont, CA

Project No. 2017111	*FN: 2017111_Fig5_TopoMap.odg*	*Drawing By: MY Sept. 2017*	***Figure 5***



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Potential TPH plume from heating oil UST at 170 Woodland Way based on <250 foot diameter potential plume diameter. Water wells are listed at 199 and 211 Lafayette Avenue and 105 Florada Avenue. Direction of topographic slope shown by white arrows towards drainage courses of Wildwood Creek. Base map from Google Maps 2017 with annotations by Wheeler Group Environmental, LLC, September 2017

0 150

Scale in Feet

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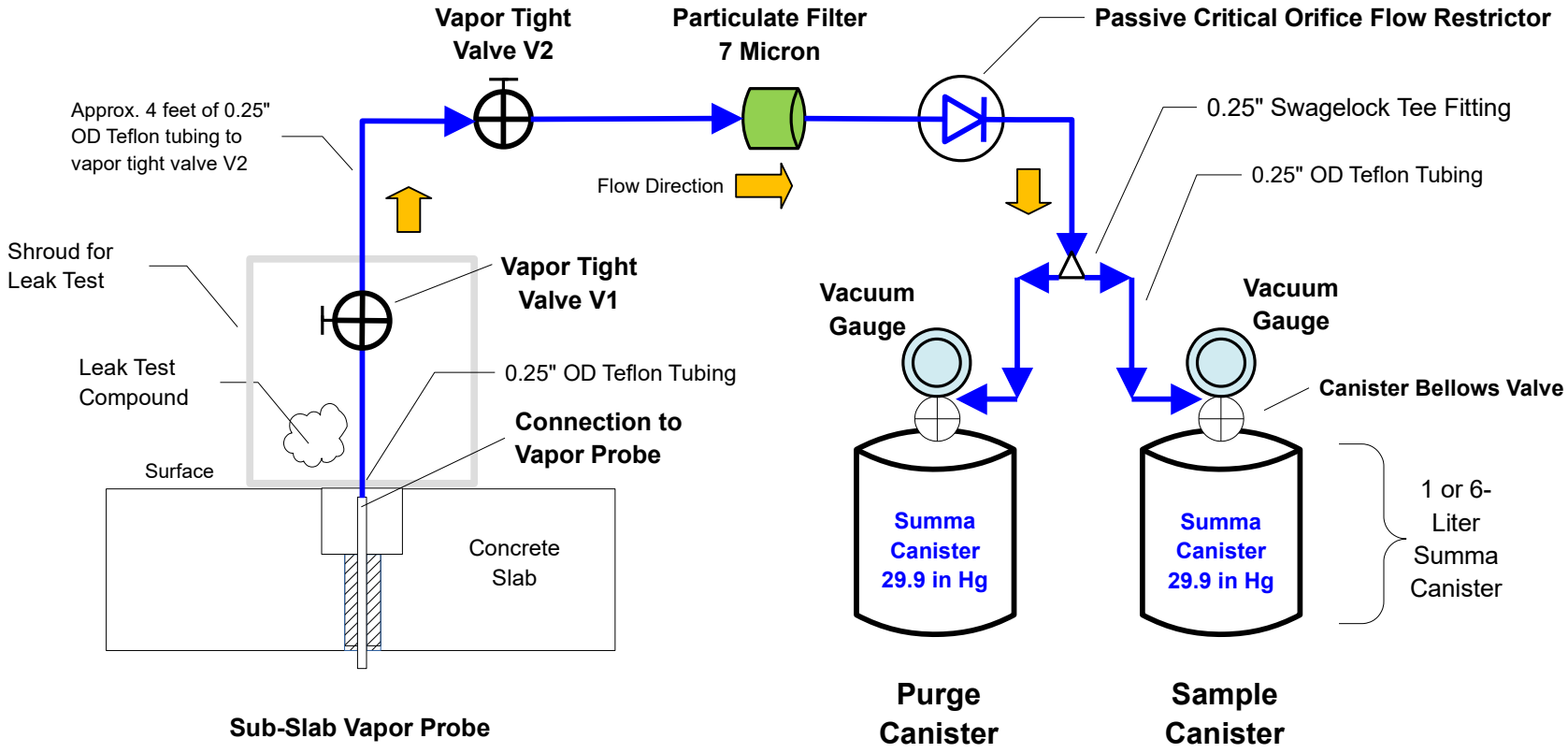
POTENTIAL TPH PLUME MAP
Data Gap Investigation Work Plan
170 Woodland Way, Piedmont, CA

Project No. 2017111	*FN: 2017111_Fig6_PlumeMap.odg*	*Drawing By: MY Sept. 2017*	***Figure 6***

NOT TO SCALE - SKETCH ONLY



All tubing is nominal 0.25" OD (0.17" ID) Teflon (lab or food grade)
All fittings are 0.25" Swagelock type

Laboratory Analysis, Summa canisters, flow restrictor, particulate filter, bellows valves, and vacuum gauges provided by laboratory

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Schematic of Subslab Vapor Sampling

Project No. 2017111	September 2017	**Figure 7**

TABLE 1

Soil Sample Laboratory Analysis Results for Petroleum Hydrocarbons

170 Woodland Way, Piedmont, California

Field Point ID	*Sampling Date*	*Depth Feet*	*TPH as Diesel*	*Benzene*	*Toluene*	*Ethyl Benzene*	*Total Xylenes*	*Naphthalene*	*MTBE*
			mg/Kg	*mg/Kg*	*mg/Kg*	*mg/Kg*	*mg/Kg*	*mg/Kg*	*mg/Kg*
					UST Removal Soil Samples				
9606-W-5.5	01/17/2017	5.5	14000	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
9606-SP	01/17/2017	Stockpile	9800	ND<0.25	ND<0.25	ND<0.25	0.4	0.36	ND<0.25
					Over-Excavation Soil Samples				
9609-E-4’	02/14/2017	4	2200	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
9609-W-4	02/14/2017	4	1500	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<0.5
Tier 1 ESL Values	*Feb. 2016*		*230*	*0.044*	*2.9*	*1.4*	*2.3*	*0.033*	*0.023*

Table 1 updated on September 13, 2017

Notes:

NA–Not Analyzed

ND–reported as less than method detection limit shown in table

Stockpile–laboratory composited sample from 4 discrete soil samples of overburden soil stockpile

TABLE 2

FOCUSED SITE CONCEPTUAL MODEL FOR REDFORD RESIDENCE AT 170 WOODLAND WAY, PIEDMONT, CA

SCM Element	*SCM Element Description*	*Data Gap*
Site ID	Redford Residence, 170 Woodland Way, Piedmont, California, APN: 51-4731-20 Alameda County LOP Case No. RO0003256 and GeoTracker Global ID No. T10000010538	
Current Land Use and Description	The approximately 7546 square foot lot is occupied by a two-story single-family residence (2713 sq ft) in a residential neighborhood with similar residences. There are no current plans to redevelop the Site. The residence at the Site was constructed in 1925 with a heating oil furnace located in the basement beneath the central portion of the residence, see Figure 3–Site Plan. Municipal water, electricity, natural gas and sewer infrastructure is provided to the area. Access to the property is by driveway from Woodland Way. Figures 1, 2 and 3 titled Site Location Map, Site Vicinity Map and Site Plan, respectively, show the location of the subject residence and surrounding neighborhood.	None
Topography	The Site is located at an approximate elevation of 340 feet msl on top of a local east-west trending Franciscan bedrock ridge. The topographic slope is away from the former UST location towards the west-southwest. Drainage ravines related to Wildwood Creek are located to the west and southwest of the Site with elevation drops up to approximately 180 feet. Figure 5–Topographic Map shows the local topography surrounding the Site and the location of nearby drainage ravines.	None
Surface Water	No surface water is located on the Site or within approximately 400 feet of the former UST location. From the Site's position on a local ridge-top, the topography slopes to the west towards the surface exposure of Wildwood Creek about 400 feet southwest of the former UST location. Another seasonally dry drainage ravine of Wildwood Creek is located about 350 feet south of the Site.	None
Geology Regional	The U.S. Geological Survey map titled Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California, Miscellaneous Field Studies MF-2342, dated 2000, contains geologic information for the Site's vicinity. Figure 4 titled Geologic Map shows an excerpt from this geologic map. As shown on this map, the Site is directly underlain by the Mesozoic Franciscan basement complex, which is composed of weakly to strongly metamorphosed graywacke, argillite, basalt, serpentinite, chert, limestone, and other rocks. A large area of shallow Franciscan sandstone labeled as Kfn is shown on the map at the Site's location. The sandstone is massive with some thin shale partings and shale interbeds. The sandstone consists of coarse-grained, biotite- and shale-chip-bearing lithic wacke (a type of clay-rich sandstone). Large biotite grains and shale chips up to 2 mm diameter are prominent in hand samples. The sandstone is dark greenish-gray where fresh, weathers to yellowish-brown. During the 2017 UST removal, hard bedrock was encountered at 5.5 fbg in the UST excavation.	None

TABLE 2

FOCUSED SITE CONCEPTUAL MODEL FOR REDFORD RESIDENCE AT 170 WOODLAND WAY, PIEDMONT, CA

SCM Element	*SCM Element Description*	*Data Gap*
Geology Local	Piedmont City Hall is located approximately 2800 feet northwest of the Site and approximately the same elevation. The GeoTracker website contains a 2012 site investigation document by Aqua Science Engineers, Inc. (ASE) dated June 18, 2012, for the Piedmont City Hall LUST case. During their leaking fuel tank investigation, ASE drilled three exploratory borings to a total depth of 30 feet below grade (fbg). ASE drilled boring BH-A with a mud rotary drill rig encountering loose silty clay and silty sand to a depth of 4 fbg where free water was observed. From 4-8 fbg, hard shale and chert of the Franciscan bedrock was found. Hard greywacke sandstone occurred from 8 to 23 fbg followed by black shale from 23 to 29 fbg, and hard greywacke sandstone to drilling refusal at a total depth of 30.1 fbg. The second boring BH-B drilled through loose sand to a depth of 5 fbg where free water was observed on top of hard bedrock at a depth of 4.5 fbg. Hard grey Franciscan siltstone (likely a fine-grained sandstone) occurred to a depth of 21 fbg. Hard greywacke sandstone occurred from 21 to 29.5 fbg. Drilling refusal occurred at 30.1 fbg on hard black shale bedrock. Boring BH-C drilled through loose gravelly sand to a depth of 5 fbg with free water observed at 1 fbg. Hard Franciscan siltstone occurred from 5 to 27 fbg. Drilling refusal occurred at 30.1 fbg on hard black shale bedrock.	None
Geology Site Conditions	Golden Gate Tank Removal, Inc. (GGTR) summarizes the removal of the subject's underground storage tank (UST) in its Underground Storage Tank Closure Report dated February 14, 2017. The only existing site-specific data on subsurface conditions is found in the tank removal report and this information is sparse as follows: "Overburden soil observed during the UST removal was predominantly sandy clay." The report also indicates that the over-excavation of petroleum contaminated soil from beneath the former UST location encountered hard bedrock at a depth of 5½ fbg as indicated in the following sentence: "Beneath the tank was solid rock."	Site conditions are based on the sparse descriptions recorded during the 2017 tank removal activities
Hydrogeology Regional	Norfleet Consultants discussed the regional groundwater basins in its 1998 study titled *Groundwater Study and Water Supply History of The East Bay Plain, Alameda and Contra Costa Counties, CA.* The Piedmont region is located within the San Francisco Basin and the Oakland sub-area. Piedmont is located within the upland Highlands bedrock region of Cretaceous Franciscan units. The bedrock highland is a source of sediment for the alluvial fan deposits below in the San Francisco Basin. No historical well fields are located within the Highlands area of Piedmont. Traditionally, the Hayward Fault has been used as the eastern boundary of the San Francisco Basin. However, the outcrop area of Franciscan bedrock is believed to be the primary boundary and the Hayward Fault has little effect on the groundwater in the San Franciscan Basin. Therefore, the Site's location would not be included within a formal groundwater basin. However, local domestic water wells are known in the upland Franciscan sandstone related to local fracture zones in the bedrock.	None

TABLE 2

FOCUSED SITE CONCEPTUAL MODEL FOR REDFORD RESIDENCE AT 170 WOODLAND WAY, PIEDMONT, CA

SCM Element	*SCM Element Description*	*Data Gap*
Hydrogeology Local	While no significant regional groundwater resource is known within the Franciscan bedrock, domestic water wells occur locally within the Franciscan sandstone terrain accessing potable water at 50-250 feet below surface. The water resource appears to occur within fracture zones recharged by rainwater infiltration in the bedrock sandstone terrain. The fracture zones are not evident from the surface and appear localized and may not be laterally continuous.	No information on local groundwater conditions.
Hydrogeology Site Conditions	No groundwater was encountered during the UST removal and over-excavation activities. No water wells are known on the subject property or adjoining properties. Wildwood Creek is located about 400 feet southwest of the former UST location. No municipal water supply wells are reported within the Piedmont area. The Golden Gate Tank Removal, Inc. report and Official Inspection Report indicates that rain water occurred in the tank pit during over excavation activities. The water was removed to a 55-gallon drum prior to confirmation soil sampling.	Groundwater quality has not been determined at the Site.
Groundwater Flow Direction	There are no groundwater monitor wells at the Site or adjoining properties. The Site occurs on a bedrock ridge at an elevation of 340 feet above msl. Nearby ravines drop in elevation by up to 180 feet to the west and southwest. Franciscan bedrock is encountered at a shallow depth in this area with bedrock at 5½ fbg at the Site.	Groundwater flow direction at the Site has not been measured and the topographic slope indicates the direction of groundwater flow could vary from west to southwest
Nearby Wells	Figure 6 titled Potential TPH Plume Map shows the surrounding neighborhood and location of nearby private water supply wells and Wildwood Creek. Four known private water supply wells are located in the neighborhood of the subject property with the wells located just outside the 250-foot minimum plume length from the former UST location. 199 Lafayette Ave. / 6” dia. Domestic well / 200 feet deep / water at 120 feet / installed June 1977 211 Lafayette Ave. / 6” dia. Domestic well / 200 feet deep / water at 150 feet / installed June 1977 105 Florada Ave. / 2” dia. Monitoring well / 25 feet deep / water at 13 feet / installed May 1991 105 Florada Ave. / 6” dia. Domestic well / 199 feet deep / water at 67 feet / installed September 1992 A domestic water well is present at the 211 Lafayette Ave. residence approximately 260 feet east of the former UST location. Beyond the 211 Lafayette Ave. property is another domestic water well at 199 Lafayette Ave. Southwest is two water wells at the 105 Florada Ave. residence about 350 feet from the Site; one a domestic water well and the other described as a monitoring well.	Nearby private water supply wells may be sensitive receptors

TABLE 2

FOCUSED SITE CONCEPTUAL MODEL FOR REDFORD RESIDENCE AT 170 WOODLAND WAY, PIEDMONT, CA

SCM Element	*SCM Element Description*	*Data Gap*
UST Removal	After replacing the concrete driveway with paver stones, the property owner reported fuel oil product and rain water entering foundation cracks in the residence basement closest to garage on January 8, 2017. GGTR speculated that an abandoned tank must be present and located the UST on January 13th. On January 17, 2017, GGTR removed the single-wall steel UST from the sandy clay backfill in the tank pit. Golden Gate Tank Removal, Inc. (GGTR) summarizes the removal of the subject's underground storage tank (UST) in its revised Underground Storage Tank Closure Report dated February 14, 2017. Refer to the report for details and documentation. One 300-gallon UST formerly containing heating oil (analyzed as TPH as Diesel) was formerly located adjacent to the driveway near the unattached garage. The UST was 8 feet in length and 2½ feet in diameter and buried approximately 1 foot below grade with the bottom of the tank at 3½ fbg. The fill port was located on the south end of the tank. The Piedmont Fire Department provided oversight for the UST removal and the ACDEH CUPA did not require a permit. GGTR indicates that no exposed piping was present in the excavation. GGTR reported no holes in the UST. However, stained and odorous soil was present in overburden soil and soil beneath the former UST location. GGTR collected one soil sample following the UST removal. Soil sample 9606-W-5.5 was recovered from 5½ feet below the west end of the tank from loose soil on top of hard bedrock. The laboratory reported the sample had a TPH as diesel concentration of 14,000 mg/Kg. The composite stockpile soil sample had a TPH as diesel concentration of 9,800 mg/kg. On February 3, 2017, GGTR filed an Underground Storage Tank Unauthorized Release (Leak) Contamination Site Report citing a petroleum discharge to soil. On February 7, 2017, the Alameda County CUPA program requested transfer of the Leaking Underground Storage Tank (LUST) case to the ACDEH Local Oversight Program (LOP).	None
Source Removal and Over-excavation of Petroleum Contaminated Soil	On February 2, 2017, GGTR contacted the ACDEH to acquire a permit and obtain oversight for the over-excavation of contaminated soil beneath the former UST location. GGTR performed limited over-excavation of the UST cavity on February 14, 2017, under oversight of CUPA inspector Barbara Jakub. The Official Inspection Report dated February 14, 2017 (amended 2/22/17), reports two soil samples were recovered from the sidewalls at 4 feet adjacent to the southeast and northwest ends of the UST. The laboratory reported that soil samples 9609-E-4' and 9609-W-4' contained 2200 and 1500 mg/Kg TPH as diesel, respectively. The ACDEH in its letter dated July 19, 2017, states that the elevated concentrations of petroleum hydrocarbons reported by the laboratory in the excavation and stockpile soil samples confirms that an unauthorized release had occurred. GGTR transported a total of 1.43 tons of overburden soil and over-excavation soil from beneath the former UST location to an offsite recycling facility. On August 9, 2017, Wheeler Group inspected the residence basement observing the capped product and return heating oil pipes in the basement utility room wall adjacent to the existing natural gas furnace. Figure 3–Site Plan shows the location of the former heating oil burner and underground product and return lines leading to the former 300-gallon UST.	The lateral extent of the heating oil release has not been determined by complete confirmation soil sampling and the condition of subsurface product and return piping is unknown

TABLE 2

FOCUSED SITE CONCEPTUAL MODEL FOR REDFORD RESIDENCE AT 170 WOODLAND WAY, PIEDMONT, CA

SCM Element	*SCM Element Description*	*Data Gap*
Release Source and Volume	The heating oil UST is believed to be the main source of petroleum hydrocarbons detected in soil at the Site. The main source of petroleum contaminated soil was removed from beneath the former UST location to the top of hard sandstone bedrock at 5½ fbg. Underground product and return lines exist beneath the basement floor extending to the former oil burner location.	The magnitude and lateral extent of the heating oil release has not been determined
Petroleum Hydrocarbons in Soil	The results of the laboratory analyses of soil samples is presented in Table 1. A total of four soil samples have been analyzed for petroleum hydrocarbons from the former heating oil UST location at the Site. The laboratory analysis indicates that heating oil (analyzed as TPH as Diesel) is the primary contaminant of concern. TPH as Diesel is the only known contaminant to significantly exceed Tier I ESL values in soil. Table 1 summarizes the laboratory analyses data of soil samples. The composite stockpile soil sample 9606-SP contained 0.4 and 0.36 mg/kg of 0-Xylenes and Naphthalene, respectively. The discrete soil samples did not contain naphthalene above 0.5 mg/kg.	Excavation sidewall soil samples were not collected during the 2017 over excavation and the magnitude and lateral extent of the heating oil release has not been confirmed
Petroleum Hydrocarbons in Water	GGTR indicates that no groundwater was encountered during the UST removal activities. However, free water described by GGTR as rain water accumulated in the excavation pit. Water accumulated in the excavation was removed by GGTR to a 55-gallon drum prior to soil sampling. No water sample was collected of the water in the tank pit.	The magnitude and lateral extent of groundwater impact, if any, has not been defined
LNAPL	There are currently no groundwater monitoring wells at the Site. Light non-aqueous phase liquids were not observed during the over excavation to a depth of 5½ fbg and the purging of “rain water” from the excavation pit. The laboratory analysis of one soil sample from the excavation bottom reported a TPH as Diesel concentrations of 14000 mg/kg, which may indicate LNAPL in soil beneath the former UST location. This contaminated soil was removed by over-excavation on February 14, 2017. LNAPL issued from cracks in the basement foundation wall on January 8, 2017, and the magnitude and extent of LNAPL has not been determined along basement wall.	Presence of free petroleum product has not been determined along foundation wall of existing residence
Contaminants of Concern	A total of four soil samples have been analyzed for petroleum hydrocarbons from the former heating oil UST location at the Site. The laboratory analysis indicates that TPH as Diesel (heating oil) is the primary contaminant of concern. TPH as Diesel is the only known contaminant to significantly exceed Tier I ESL values in soil and the ACDEH indicates that the elevated concentrations of TPH as diesel are evidence of a heating oil release from the former UST. Table 1 summarizes the laboratory analyses data.	None
Plume Length	There are currently no groundwater monitoring wells at the Site and the groundwater flow direction across the Site cannot be evaluated. LTCP guidance predicts a minimal plume length of less than 250 feet for a mature TPH plume of petroleum such as heating oil (diesel). Figure 6–Potential TPH Plume Map shows the location of nearby private water supply wells and Wildwood Creek in relation to the former	The plume length has not been determined by site-specific groundwater measurements

TABLE 2

FOCUSED SITE CONCEPTUAL MODEL FOR REDFORD RESIDENCE AT 170 WOODLAND WAY, PIEDMONT, CA

SCM Element	*SCM Element Description*	*Data Gap*
	UST location and estimated TPH plume diameter.	
Risk Evaluation	The Site is zoned for residential land use and occupied by a single-family residence since 1925. Current plans are for the Site to remain in residential land use. The SCM indicates significant data gaps exist in association with the magnitude and lateral extent of residual heating oil soil contamination, the magnitude and lateral extent of heating oil contamination of shallow water, and the impact to water supply wells at potentially down-gradient residences. Abandoned product and return lines extending beneath the basement floor may present a risk of vapor intrusion if discharge of heating oil occurred beneath the basement floor. As such, the residual contamination may pose a risk to potential residential receptors and construction workers by incidental ingestion, dermal contact, dust inhalation, and vapor inhalation.	Additional investigation needed
Project ID:	Site Conceptual Model (SCM) as of September 12, 2017 File name: 2017111_Table2_SiteConceptualModel_Sept_2017.odt Wheeler Group Environmental, LLC Project No. 2017111	

TABLE 3

EVALUATION OF LOW THREAT CLOSURE POLICY CRITERIA FOR DATA GAPS AT REDFORD RESIDENCE, 170 WOODLAND WAY, PIEDMONT, CA

Criteria	*Description of Low Threat Closure Policy Criteria and Explanation*	*Data Gap*	*How to Address*
Site ID	**Redford Residence**, 170 Woodland Way, Piedmont, California, APN: 51-4731-20 Alameda County LOP Case No. RO0003256 and GeoTracker Global ID No. T10000010538		
A.	**General Criteria:** **The unauthorized release is located within the service area of a public water system:** Domestic water supply is provided to the Site by the East Bay Municipal Utility District (EBMUD)	No data gap present	No action needed
B.	**The unauthorized release consists only of petroleum:** Soil sampling from the UST removal and over excavation indicate the only contaminant of concern is heating oil (analyzed as Total Petroleum Hydrocarbons as Diesel)	No data gap present	No action needed
C.	**The unauthorized ("primary") release from the UST system has been stopped:** The source of the heating oil release was a 300-gallon underground storage tank (UST) removed for offsite recycling on January 17, 2017, by Golden Gate Tank Removal, Inc.	No data gap present	No action needed
D.	**Free product has been removed to the maximum extent practicable:** In its July 19, 2017 letter, ACDEH determined that the Site fails to meet the LTCP General Criteria D concerning free product. Soil concentrations of heating oil beneath UST and petroleum free product in basement of residence indicates petroleum free product remains an issue at the Site. The residual petroleum contaminated soil with concentrations exceeding 10,000 mg/kg was removed from beneath the former UST by over-excavation on February 14, 2017. Extent of LNAPL along basement foundation wall has not been determined.	Petroleum free product may be present at Site	Additional investigation needed at Site
E.	**A conceptual site model that assesses the nature, extent, and mobility of the release has been developed:** In its July 19, 2017 letter, ACDEH determined that the Site fails to meet the LTCP General Criteria E for a conceptual site model. A site conceptual model is presented with the work plan as this Table 2	No data gap present	No action needed
F.	**Secondary Source has been removed to the extent practicable:** Golden Gate Tank Removal, Inc. performed limited over excavation activities on February 14, 2017. GGTR removed heating oil contaminated soil to a depth of 5½ fbg beneath the former UST location. Hard bedrock was encountered at a depth of 5½ fbg and two soil samples collected from beneath the west and east ends of the former UST at a depth of 4 fbg contained 1500 and 2200 mg/kg TPH as diesel. GGTR did not excavate UST pit sidewalls.	The lateral extent of petroleum contamination has not been defined surrounding the former UST location.	Soil sampling is needed to define the petroleum contamination of soil
G.	**Soil or groundwater has been tested for MTBE and results reported in accordance with Health and Safety Code Section 25296.15:** The three confirmation soil samples from depths of 4 and 5½ fbg did not contain MTBE above 0.5 mg/Kg. The stockpile composite soil sample did not contain MTBE above 0.25 mg/Kg. Heating oil is not known to contain significant concentrations of MTBE.	No data gap present	No action needed
H.	**A nuisance exists, as defined by Water Code section 13050:** Free petroleum heating oil discharged with rain water through cracks in the basement foundation wall creating a nuisance. The lateral extent of heating oil impact has not been defined and it is unknown if the nuisance exists at the Site has been abated or impacts down-gradient properties.	The lateral extent of heating oil LNAPL has not been defined in the vicinity of the existing residence	Soil and water sampling is needed to define the petroleum contamination at the Site

TABLE 3

EVALUATION OF LOW THREAT CLOSURE POLICY CRITERIA FOR DATA GAPS AT REDFORD RESIDENCE, 170 WOODLAND WAY, PIEDMONT, CA

Criteria	*Description of Low Threat Closure Policy Criteria and Explanation*	*Data Gap*	*How to Address*
1.	**Media Specific Criteria for Groundwater:** In its July 19, 2017 letter, ACDEH determined that the Site fails to meet the LTCP Media-Specific Criteria for Groundwater		
a.	**Groundwater Plume Length:** No groundwater monitor wells are present at the Site and the existence and extent of any groundwater plume has not been determined. The LTCP guidance predicts a minimal plume length of <250 feet for a mature plume of heating oil (diesel). The Site does not meet the Groundwater Criteria due to the lack of groundwater investigation and delineation of a potential groundwater plume. The presence of four privately owned water supply wells occurs within the neighborhood of the subject property. Using the LTCP guidance to predict a minimal plume length of <250 feet indicates that all wells are outside the estimated plume length. Figure 6–Potential TPH Plume Map shows the location of nearby private water supply wells in relation to the former UST location and estimated TPH plume diameter.	The groundwater has not been sampled at the Site	Groundwater sampling needed
b.	**Groundwater Plume is Not Stable:** The release would be considered mature and would be expected that any associated plume would have already migrated to its maximum extent, if a plume is present. A mature groundwater plume would be considered stable. No groundwater sampling has occurred at the Site.	The groundwater has not been sampled at the Site	Groundwater sampling needed
c.	**Nearest Water Supply Well:** LTCP guidance predicts a minimal plume length of <250 for a mature plume of heating oil (diesel). The Site does not meet the Groundwater Criteria due to the lack of delineation of a potential groundwater plume, and the presence of four privately owned water supply wells within the Site's immediate neighborhood. 199 Lafayette Ave. / 6" dia. Domestic well / 200 feet deep / water at 120 feet / installed June 1977 211 Lafayette Ave. / 6" dia. Domestic well / 200 feet deep / water at 150 feet / installed June 1977 105 Florada Ave. / 2" dia. Monitoring well / 25 feet deep / water at 13 feet / installed May 1991 105 Florada Ave. / 6" dia. Domestic well / 199 feet deep / water at 67 feet / installed September 1992 A domestic water well is present at the 211 Lafayette Ave. residence approximately 260 feet east of the former UST location. Beyond the 211 Lafayette Ave. property is another domestic water well at 199 Lafayette Ave. Southwest is two water wells at the 105 Florada Ave. residence about 350 feet from the Site; one a domestic water well and the other described as a monitoring well.	The groundwater has not been sampled at the Site	Groundwater sampling needed
d.	**Property Owner Willing to Accept a Land Use Restriction: T**he ACDEH generally indicates that a deed restriction may be appropriate if residual soil contamination is present within 10 feet of surface grade. Due to residual contamination remaining in the vicinity of the former UST, it appears appropriate to have a legal mechanism to protect and inform current and future property owners, and construction workers from direct contact with residual contamination in the former tank pit area.	Owner has not indicated if land use control is acceptable	Ask owner about land use control

TABLE 3

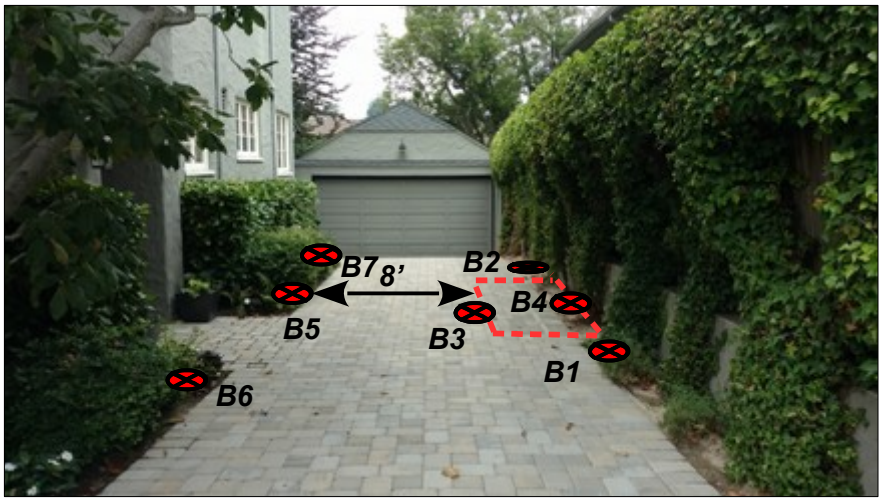
EVALUATION OF LOW THREAT CLOSURE POLICY CRITERIA FOR DATA GAPS AT REDFORD RESIDENCE, 170 WOODLAND WAY, PIEDMONT, CA

Criteria	*Description of Low Threat Closure Policy Criteria and Explanation*	*Data Gap*	*How to Address*
e.	**Sensitive Receptor Survey:** LTCP guidance predicts a minimal plume length of <250 for a mature plume of heating oil (diesel). The Site does not meet the Groundwater Criteria due to the lack of delineation of a potential groundwater plume, and the presence of four privately owned water supply wells within the Site's immediate neighborhood.	The groundwater has not been sampled at the Site	Groundwater sampling needed
f.	**Naphthalene Contamination:** Laboratory analysis for naphthalene is needed to meet LTCP guidelines. To date, three discrete UST removal confirmation soil samples have been analyzed for naphthalene with all results less than 0.5 mg/kg. The soil stockpile composite soil sample had a naphthalene concentration of 0.36 mg/kg, above the ESL value of 0.033, and this contaminated soil was removed for offsite disposal.	Naphthalene analyzed in existing soil samples and naphthalene contamination does not appear significant	Naphthalene will be included in laboratory analysis of future soil samples
2.	**Media Specific Criteria for Vapor Intrusion to Indoor Air:** In its July 17, 2017 letter, ACDEH determined that the Site fails to meet the LTCP Media-Specific Criteria for Vapor Intrusion to Indoor Air. The lack of lateral delineation of soil contamination makes evaluation of vapor intrusion risk uncertain. Product and return piping for former oil burner are capped in basement below residence and product piping extends beneath basement concrete floor slab. Condition of product piping buried beneath concrete floor slab of basement is not known. Release of heating oil from product piping beneath residence could result in vapor intrusion risk to occupants.	Lateral extent and magnitude of soil contamination has not been defined Condition of product piping beneath residence is unknown and heating oil release could be present beneath residence	Additional subsurface investigation is needed Subsurface investigation required to evaluate if a release from piping has occurred
3.	**LTCP Media Specific Criteria for Direct Contact and Outdoor Air Criteria:** In its July 17, 2017 letter, ACDEH determined that the Site fails to meet the LTCP Media-Specific Criteria for Direct Contact and Outdoor Air. Lack of lateral delineation of soil contamination at the Site makes if difficult to evaluate the risk of direct contact and outdoor air. To preclude the need for notifications to the property deed, a minimum of four soil bores is required at the former UST location. To meet LTCP guidelines, soil samples must be collected from both the 0 to 5 and 5 to 10 foot depth intervals or at intervals of staining, odor, PID readings that indicate petroleum soil contamination. The bores should extend to a minimum depth of 5.5 fbg (where rock bedrock was encountered) or deeper if feasible to define the vertical extent of soil contamination.	Lateral extent and magnitude of soil contamination has not been defined	Additional soil samples needed with laboratory analysis for TPH as diesel, BTEX and naphthalene
Project ID:	Evaluation of LTCP Criteria for Data Gaps as of Sept. 13, 2017, Wheeler Group Environmental, LLC Project No. 2017111 File name: 2017111_Table3_LTCPEvaluation_Sept_2017.odt		

Photograph No. 1 – Northwest view of subject residence at 170 Woodland Way showing general surface topography of front yard and driveway of property (WGE, 8/23/17).

Photograph No. 2 – Southeast view of driveway along east side of residence, showing approximate location and lateral limits of former 300-gallon Heating Oil UST excavation (shown as red dashed line) and proposed investigation soil borings and field point IDs (WGE, 8/23/17).

Photograph No. 3 – Northwest view of driveway along east side of residence, showing approximate lateral limits of former 300-gallon Heating Oil UST excavation (shown as red dashed line) and proposed investigation soil borings and field point IDs (WGE, 8/23/17).



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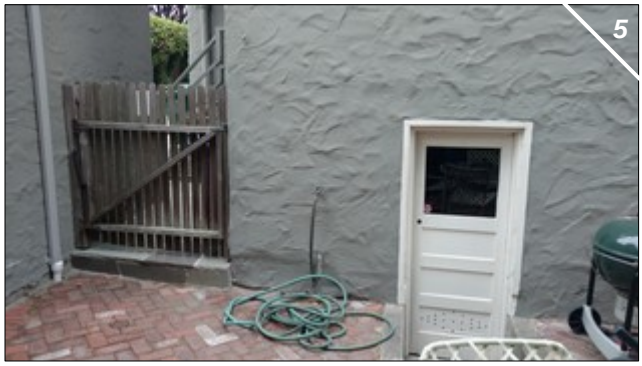
PHOTOGRAPH PAGE 1
Data Gap Investigation Work Plan
170 Woodland Way
Piedmont, California

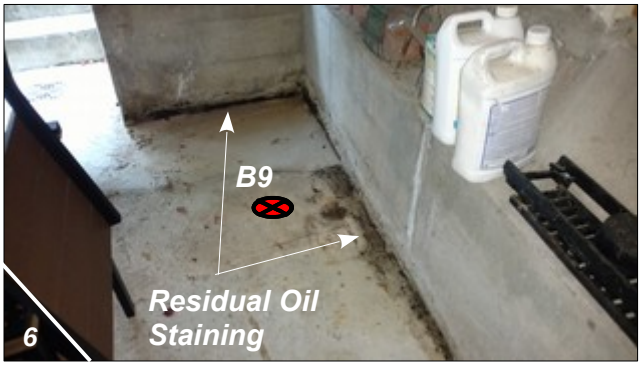
Project No. 2017111	*FN: 2017111_Photo P1*	*Drawing By:baw/09-17*	***Photographs 1-3***

Photograph No. 4 – Northwest view of driveway and side entrance to residence, showing proposed location of Investigation Soil Boring B7; wood gate shown between northeast corner of residence and garage for access to rear yard (WGE, 8/23/17).



Photograph No. 5 – Southeast view of exterior stairwell entrance to basement from rear yard of residence; rear yard (brick-paved portion) approximately 2 to 2.5 feet below elevation of driveway at location of former UST (WGE, 8/23/17).

Photograph No. 6 – North view of interior of basement (northeast corner) showing residual staining at base of foundation stem wall; oil product reportedly issued through cracks of stem wall during period of heavy rain in December 2016 and cleaned up by property owner thereafter; basement floor approximately 4 to 4.5 feet below elevation of driveway at location of former UST (WGE, 8/9/17).



Photograph No. 7 – Southeast view of interior of basement utility room showing location of existing central furnace system and product/return piping (at bottom of east foundation wall), as shown) associated with former UST oil burner system (WGE, 8/9/17).

Photograph No. 8 – South view of interior of basement storage room showing approximate location of existing subsurface UST product/return piping and proposed investigation soil boring and subslab vapor probe locations (WGE, 8/23/17).

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PHOTOGRAPH PAGE 2
Data Gap Investigation Work Plan
170 Woodland Way
Piedmont, California

Project No. 2017111	*FN: 2017111_Photo P2*	*Drawing By:baw/09-17*	***Photographs 4-8***

DATA GAP INVESTIGATION WORK PLAN

Redford Residence
170 Woodland Way, Piedmont, California 94611

APN 51-4731-20
GeoTracker Global ID No. T10000010538
Alameda County LOP Case No. RO0003256
WGE Project No. 2017111

APPENDIX A

Standard Operating Procedure Installation and Extraction of the Vapor Pin
Well Search Database Excerpt for Piedmont California

Wheeler Group Environmental, LLC

369-B Third Street, Suite #221, San Rafael, CA 94901
Phone: 415-686-8846

Standard Operating Procedure Installation and Extraction of the Vapor Pin™

May 20, 2011

Scope:

This standard operating procedure describes the installation and extraction of the Vapor Pin™[1] 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.

Equipment Needed:

- Assembled Vapor Pin™ [Vapor Pin™ and silicone sleeve (Figure 1)];
- Hammer drill;
- 5/8-inch diameter hammer bit (Hilti™ TE-YX 5/8" x 22" #00206514 or equivalent);
- 1½-inch diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch diameter bottle brush;
- Wet/dry vacuum with HEPA filter (optional);
- Vapor Pin™ installation/extraction tool;
- Dead blow hammer;
- Vapor Pin™ flush mount cover, as necessary;
- Vapor Pin™ protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel.

[1]Cox-Colvin & Associates, Inc., designed and developed the Vapor Pin™; a patent is pending.

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 diameter hole at least 1¾-inches into the slab.

4) Drill a 5/8-inch diameter hole through the slab and approximately 1-inch into the underlying soil to form a void.

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 extraction/installation tool over the Vapor Pin™ to protect the barb fitting and cap, and tap the Vapor Pin™ into place using a

dead blow hammer (Figure 2). Make sure the extraction/installation tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.

Figure 2. Installing the Vapor Pin™.

For flush mount installations, unscrew the threaded coupling from the installation/extraction handle and use the hole in the end of the tool to assist with the installation (Figure 3).

Figure 3. Flush-mount installation.

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 4).

Figure 4. Installed Vapor Pin™.

7) For flush mount installations, cover the Vapor Pin™ with a flush mount cover.

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the Vapor Pin™ (Figure 5).

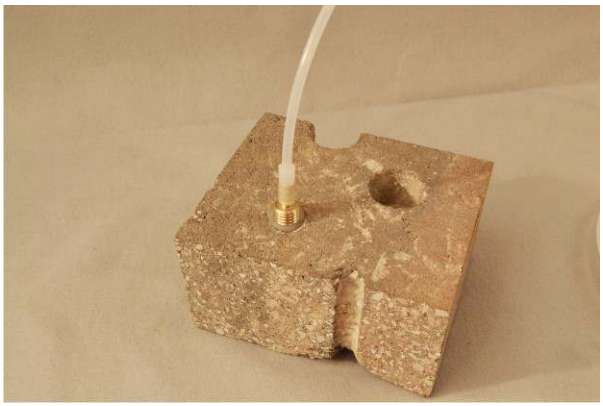

Figure 5. Vapor Pin™ sample connection.

10) Conduct leak tests [(e.g., real-time monitoring of oxygen levels on extracted sub-slab soil gas, or placement of a water

dam around the Vapor Pin™) Figure 6]. Consult your local guidance for possible tests.

Figure 6. Water dam used for leak detection.

11) Collect sub-slab soil gas sample. When finished sampling, replace the protective cap and flush mount cover until the next sampling 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). Continue turning the tool to assist in extraction, then pull the Vapor Pin™ from the hole (Figure 8).

Figure 7. Removing the Vapor Pin™.

Figure 8. Extracted Vapor Pin™.

2) Fill the void with hydraulic cement and smooth with the trowel or putty knife.

3) Prior to reuse, remove the silicone sleeve and discard. Decontaminate the Vapor Pin™ in a hot water and Alconox® wash, then heat in an oven to a temperature of 130° C.

The Vapor Pin™ to designed be used repeatedly; however, replacement parts and supplies will be required periodically. These parts are available on-line at www.CoxColvin.com.

Replacement Parts:

Vapor Pin™ Kit Case - VPC001
Vapor Pins™ - VPIN0522
Silicone Sleeves - VPTS077
Installation/Extraction Tool - VPIE023
Protective Caps - VPPC010
Flush Mount Covers - VPFM050
Water Dam - VPWD004
Brush - VPB026

Permit	Tr	Section	Address	Longcity	Owner	Update	Xcoord	Ycoord	Matchlevel	Tsrqq	Rec_code	Phone	City	Drilldate	Elevation	Totaldepth	Waterdepth	Diameter	Use												
	1S/3W	19F 1	7 HIGHLAND	Piedmont	MR. BOSTROM	7/23/1984	122233980	37830180	8	1S/3W 19F	2087	0	PIE	6/77	0	108	29	6	DOM	D	0	0	0	0	L		7	HIGHLAND			
W2009-0288	1S/3W	19K	555 Blair Ave	Piedmont	Art Shartsis	10/6/2009				1S/3W 19K			PIE	5/18/2009		300	115	10	IRR				35				555	Blair Ave		WCR #- 09	Well #1
W2014-0380	1S/3W	19K	340 HIGHLAND AVE	Piedmont	CHEVRON ENVIRONMENTAL MANAC	6/9/2016				1S/3W 19K			PIE			17			DES	WCR-e0214951							340	HIGHLAND AVE			
W2014-0381	1S/3W	19K	340 HIGHLAND AVE	Piedmont	CHEVRON ENVIRONMENTAL MANAC	6/9/2016				1S/3W 19K			PIE			17			DES	WCR-e0214963											
W2014-0382	1S/3W	19K	340 HIGHLAND AVE	Piedmont	CHEVRON ENVIRONMENTAL MANAC	6/9/2016				1S/3W 19K			PIE			13			DES	WCR-e0214965											
W2014-0383	1S/3W	19K	340 HIGHLAND AVE	Piedmont	CHEVRON ENVIRONMENTAL MANAC	6/9/2016				1S/3W 19K			PIE			18			DES	WCR-e0214966											
W2014-0384	1S/3W	19K	340 HIGHLAND AVE	Piedmont	CHEVRON ENVIRONMENTAL MANAC	6/9/2016				1S/3W 19K			PIE			17.5			DES	WCR-e0214967											
	1S/3W	19L 1	132 DRACENA ST	Piedmont	PG&E	7/23/1984	122236871	37827652	2	1S/3W 19L	2088	0	PIE	7/74	0	120	30	0	CAT	D	0	0	0	0	L		132	DRACENA ST			
	1S/3W	19M 1	GRAND AV & HOLLY PLACE	Piedmont	EBMUD	12/10/1984	122241700	37825600	8	1S/3W 19M	2089	0	PIE	2/76	0	65	0	0	CAT	D	0	0	0	0	L		GRAND	AV & HOLLY PLACE			
	1S/3W	19M 2	RICARDO & ARTUNA AV	Piedmont	CITY OF FREMONT	7/31/1984	122239400	37826300	0	1S/3W 19M	2090	0	PIE	8/77	0	300	35	0	IRR	D	0	0	10	0	L		RICARDO	& ARTUNA AV			
	1S/3W	19M 3	RICARDO & ARTUNA AV	Piedmont	CITY OF PIEDMONT	7/23/1984	122239400	37826300	0	1S/3W 19M	2091	0	PIE	Oct-77	0	300	0	0	IRR	D	0	0	15	0	L		RICARDO	& ARTUNA AV			
	1S/3W	19M 4	GRAND AV & HOLLY PLACE	Piedmont	EBMUD	7/23/1984	122241700	37825600	8	1S/3W 19M	2092	0	PIE	1/82	0	65	0	0	CAT	D	0	0	0	0	L		GRAND	AV & HOLLY PLACE			
	1S/3W	19M 5	125 HILLSIDE AV.	Piedmont	JOHN B. BATES	6/15/1989	122235849	37828464	0	1S/3W 19M	2093	0	PIE	Dec-88	0	100	20	4	IRR	D	0	0	50	0	L		125	HILLSIDE AV.			
	1S/3W	19P 1	377 HILLSIDE AV	Piedmont	GRAY	7/23/1984	122233717	37823455	0	1S/3W 19P	2094	0	PIE	/00	0	85	44	60	IRR	?	0	1	0	0	L		377	HILLSIDE AV			
	1S/3W	19P 2	326 EL CERRITO	Piedmont	TRAULSEN	7/23/1984	122236096	37824170	2	1S/3W 19P	2095	0	PIE	/77	0	300	100	6	DOM	D	0	0	40	0	L		326	EL CERRITO			
	1S/3W	19P 3	304 HILLSIDE	Piedmont	ABBOTT	7/23/1984	122234346	37825058	8	1S/3W 19P	2096	0	PIE	/77	0	220	160	6	DOM	D	0	0	50	0	L		304	HILLSIDE			
	1S/3W	19P 4	321 Hillside Ave	Piedmont	Paul Hertelendy	4/17/1991	122234278	37824537	0	1S/3W 19P	1619	0	PIE	2/91	0	82	80	6	IRR	D	0	0	25	0	D		321	Hillside Ave			
	1S/3W	19Q	Highland Way/Highland Ave	Piedmont	Chevron	3/12/1991	122229800	37824700	3	1S/3W 19Q	1207	0	PIE	Dec-90	0	24	12	2	MON	D	0	0	0	0	D		Highland	Way/Highland Ave			
	1S/3W	19Q	Bonita and Vista Avenues	Piedmont	Harris & Associates	6/26/1990	122232600	37824400	3	1S/3W 19Q	350	0	PIE	1/90	101	13	0	6	BOR*	G	0	0	0	0	D		Bonita	and Vista Avenues			
	1S/3W	19Q 1	781 HIGHLAND AV	Piedmont	FRANK ADAMA	7/23/1984	122228584	37822619	0	1S/3W 19Q	2097	0	PIE	5/77	0	200	100	6	DOM	D	0	0	125	0	L		781	HIGHLAND AV			
	1S/3W	19Q 2	HIGHLAND & VAL VISTA AV	Piedmont	CITY OF PIEDMONT	7/23/1984	122231200	37824800	8	1S/3W 19Q	2098	0	PIE	8/77	0	250	12	6	IRR	D	0	0	60	0	L		HIGHLAND	& VAL VISTA AV			
	1S/3W	19Q 3	141 HAZEL LANE	Piedmont	BILL BREASHEARS	8/8/1988	122230533	37822332	0	1S/3W 19Q	2099	0	PIE	May-88	0	100	30	4	DOM	D	0	0	0	0	L		141	HAZEL LANE			
	1S/3W	19Q 4	55 HAZEL LN.	Piedmont	THOMAS CROWLEY	6/15/1989	122229195	37820900	0	1S/3W 19Q	2100	0	PIE	Sep-88	0	160	50	4	IRR	D	0	0	20	0	L		55	HAZEL LN.			
	1S/3W	19Q 5	120 Hazel Lane	Oakland	Jon Evans	4/30/1993	122230388	37822571	1	1S/3W 19Q	0	0	OAK	Oct-92	0	275	51	5	IRR	D	0	0	0	0	D		120	Hazel Lane			
96421	1S/3W	19Q 6	340 Highland Av	Piedmont	Chevron Products Company	10/19/1997	122231042	37824758	1	1S/3W 19Q	0	0	PIE	Oct-96	0	18	2	2	MON	D	0	0	0	0	D		340	Highland Av			
96421	1S/3W	19Q 7	340 Highland Av	Piedmont	Chevron Products Company	10/19/1997	122231042	37824758	1	1S/3W 19Q	0	0	PIE	Oct-96	0	18	4	2	MON	D	0	0	0	0	D		340	Highland Av			
94292	1S/3W	19Q 8	340 Highland Av	Piedmont	Chevron	12/26/1997	122231042	37824758	1	1S/3W 19Q	0	0	PIE	5/94	0	20	15	2	MON	G	0	0	0	0	D		340	Highland Av			
W2008-0614	1S/3W	19Q 9	133 Caperton Ave	Piedmont	Jennifer Ranin	1/13/2009				1S/3W 19Q			PIE	9/16/2008		80	120		IRR								133	Caperton Ave		WR-C #092	IRR-1
W2015-0921	1S/3W	19Q 10	125 Guilford Rd	Piedmont	Roger Strauch, 125 Guilford Rd, Pie	3/2/2016				1S/3W 19Q			PIE			200	15		IRR	WCR-e0301784							125	Guilford Rd			
	1S/3W	19R 1	321 MOUNTAIN AVE	Piedmont	ALAN M DACHS	12/21/1988	122225215	37823200	0	1S/3W 19R	2101	0	PIE	Jun-88	0	220	65	5	IRR	D	0	0	75	0	L		321	MOUNTAIN AVE			
	1S/3W	30A 1	135 WILDWOOD AV	Piedmont	WILLIAM LAIDY	7/23/1984	122226957	37819042	8	1S/3W 30A	2158	0	PIE	?	0	275	15	0	IRR	D	0	0	30	0	L		135	WILDWOOD AV			
	1S/3W	30A 2	444 WILDWOOD AV	Piedmont	R.H. LOGAN	9/26/1984	122226582	37819837	0	1S/3W 30A	2159	0	PIE	8/77	0	120	15	0	IRR	D	0	0	0	0	L		444	WILDWOOD AV			
	1S/3W	30A 3	68 LINCOLN AVE	Piedmont	SHELDON C. RAMSEY	6/27/1988	122225076	37821066	0	1S/3W 30A	2160	0	PIE	Jun-88	0	140	20	5	IRR	D	0	0	0	0	L		68	LINCOLN AVE			
	1S/3W	30A 4	336 SHELDON	Piedmont	KENDALL FORD	12/21/1988	122226188	37819459	9	1S/3W 30A	2161	0	PIE	Jul-88	0	197	22	4	IND	D	0	0	12	0	L		336	SHELDON			
	1S/3W	30A 5	144 Wildwood Gardens	Piedmont	Arthur C. Oppenheimer	6/7/1991	122238650	37819037	3	1S/3W 30A	1645	0	PIE	3/91	13	15	6	2	MON	D	0	0	0	8	D		144	Wildwood Gardens			
	1S/3W	30A 6	25 Crocker Ave	Piedmont	Don Hucke	3/6/1992	122224724	37820550	1	1S/3W 30A	7334	0	PIE	5/91	0	170	37	6	IRR	D	0	0	40	0	D		25	Crocker Ave			
W2008-0693	1S/3W	30A 7 C	456 Wildwood Ave	Piedmont	James Feuille	11/8/2008				1S/3W 30A			PIE	Oct-08		260	63	10	IRR	WCR-e0945633							456	Wildwood Ave		WCR-e0945633	
99WR080	1S/3W	30A 8	1401 Wildwood Gardens	Piedmont	Norman Givant	7/20/2012				1S/3W 30A			PIE	11/1/1999		400	0	12	IRR (dry hole)										0010D9DA	703723	dry hole
W2014-0264	1S/3W	30A	109 Crocker Ave	Piedmont	Shahan & Anna Soghikian, 109 Crocl	8/16/2016				1S/3W 30A			PIE			300			IRR	WCR-e0226207											
	1S/3W	30B	120 REQUA RD.	Piedmont	JOHN REYNOLDS	2/23/1988	122231972	37820290	0	1S/3W 30B	6528	0	PIE	9/87	0	250	0	0	BOR	D	0	0	0	0	L		120	REQUA RD.			
	1S/3W	30B 1	30 PROSPECT RD	Piedmont	BLOOM	7/23/1984	122232774	37819186	0	1S/3W 30B	2162	0	PIE	/77	0	0	0	0	TES	D	0	0	0	0	L		30	PROSPECT RD			
	1S/3W	30B 2	147 REQUA ROAD	Piedmont	WALTER SCHEY	9/25/1989	122230814	37819736	0	1S/3W 30B	2163	0	PIE	Feb-89	0	231	30	4	IRR	D	0	0	0	0	L		147	REQUA ROAD			
	1S/3W	30B 4	444 Wildwood Avenue	Piedmont	James Fetherston	4/17/1991	122226582	37819837	0	1S/3W 30B	1620	0	PIE	3/91	0	258	27	5	DOM	D	0	0	1	0	D		444	Wildwood Avenue			
	1S/3W	30H 1	199 LAFAYETTE	Piedmont	MR. WARD	7/23/1984	122226186	37817200	2	1S/3W 30H	2164	0	PIE	6/77	0	200	120	6	DOM	D	0	0	35	0	L		199	LAFAYETTE			
	1S/3W	30H 2	211 LAFAYETTE	Piedmont	JEFF DENNIS	7/23/1984	122226242	37817200	2	1S/3W 30H	2165	0	PIE	6/77	0	200	150	6	DOM	D	0	0	40	0	L		211	LAFAYETTE			
	1S/3W	30H 3	203 LA SALLE AV	Piedmont	ED JURKANIN	7/23/1984	122224432	37815400	0	1S/3W 30H	2166	0	PIE	Oct-81	0	140	40	8	IRR	D	0	0	0	0	L		203	LA SALLE AV			
	1S/3W	30H 4	105 Florada Ave.	Piedmont	David & Marcia Vastine	11/15/1991	122227500	37815901	0	1S/3W 30H	2019	0	PIE	5/91	301	25	13	2	MON	D	0	0	0	288	D		105	Florada Ave.			
	1S/3W	30H 5	105 Florada Ave	Piedmont	David & Marcua Vastine	7/31/1992	122227398	37815774	1	1S/3W 30H	7530	0	PIE	9/92	0	199	67	6	DOM	D	0	0	0	0	D		105	Florada Ave			
W2009-0345	1S/3W	30H 6	200 Crocker Ave	Piedmont	Amnon Rodan	10/6/2009				1S/3W 30H			PIE	7/20/2009		146	50	10	IRR	WCR#-0945660			50				200	Crocker Ave		WCR#-094	Well #1
	1S/3W	30L 1	E/O PALOMA & CALMAR	Piedmont	PG&E	7/23/1984	122234493	37812736	8	1S/3W 30L	2167	0	PIE	1/75	0	120	0	0	CAT	D	0	0	0	0	L		E/O	PALOMA & CALMAR			