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2228 Livingston Street
Oakland, CA 94606
Telephone (510) 261-5500

January 27, 2017

Mr. Mark Detterman
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502

SUBJECT: SUB-SLAB DEPRESSURIZATION FEASIBILITY TESTING WORK PLAN CERTIFICATION
County Case # RO 2468
Former James River Corporation Site
2101 Williams Street
San Leandro, CA

Dear Mr. Detterman:

You will find enclosed one copy of the following document prepared by Geosyntec Consultants for the subject site.

- Sub-Slab Depressurization Feasibility Testing Work Plan dated January 27, 2017.

I declare under penalty of perjury that the contents and conclusions in the document are true and correct to the best of my knowledge.

Please don't hesitate to call me if you have any questions.

Sincerely,

2101 Williams Associates, LLC

Carey Andre

Geosyntec consultants

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27 January 2017

Mr. Mark E. Detterman, P.G., C.E.G.
Senior Hazardous Material Specialist
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Subject: Sub-Slab Depressurization Feasibility Testing Work Plan
2101 Williams Street, San Leandro, California

Dear Mr. Detterman,

This letter comprises a work plan for a sub-slab depressurization (SSD) feasibility test (Work Plan) for 2101 Williams Street, San Leandro, California (site) (**Figure 1**). The feasibility test described in this Work Plan is designed to evaluate the feasibility of an SSD system and a soil vapor extraction (SVE) system for vapor intrusion mitigation, assess whether an SSD or SVE system would be more effective in mitigating the potential vapor intrusion pathway into the onsite building, and obtain design parameters for a full-scale SSD or SVE system. Geosyntec Consultants, Inc. (Geosyntec) has prepared this Work Plan on behalf of 2101 Williams Associates, LLC. The Work Plan is submitted to Alameda County Environmental Health (ACEH) for review in accordance with the request for a work plan and feasibility testing in the ACEH letter dated 15 November 2016.

1. SITE BACKGROUND

The site is located at the edge of an industrial area in San Leandro, approximately 3,000 feet from the San Francisco Bay. The depth to groundwater at the site is generally from 10 to 12 feet below ground surface (bgs).[1] The groundwater in the site area flows west-southwest, towards the Bay.

[1] P&D Environmental, Inc., 2015. Subsurface Investigation Report (M1 through M6), County Case #RO 2468, Former James River Corporation Site, 2101 Williams Street, San Leandro, California. October 30.

The building onsite has historically housed industrial processes.[2] Western Waxide, which produced wax-coated paper products, constructed the original building onsite in 1943. In 1988, the property was sold to James River Corporation. James River Corporation had a flexible coatings plant onsite until they sold the property to Printpak in 1996. In 1998, Printpak sold the property to 2101 Williams Associates, LLC, the current owner. The building is currently used by multiple tenants for warehousing, food processing, and related offices.

Tetrachloroethene (PCE) contamination was identified in groundwater samples in the 1980s and 1990s.[3] Several groundwater, soil, and soil vapor investigations followed. Current or previous on-site uses of PCE or other chlorinated solvents have not been identified.[3] Previous investigation reports indicate that PCE appears to have migrated onto the site from properties to the east.

In 2016, a sub-slab soil gas investigation conducted by P&D Environmental, Inc. (P&D) detected a maximum sub-slab PCE concentration of 520,000 micrograms per cubic meter ($\mu g/m^3$) (**Figure 2**). As a result, ACEH advised 2101 Williams Associates that corrective action is required at the site to address soil gas PCE concentrations. P&D recommended an SSD feasibility test to determine the effectiveness of an SSD system in meeting ACEH requirements.[4] In a letter dated 15 November 2016, ACEH requested a work plan for feasibility testing of an SSD system as a potential corrective action for the site. This Work Plan was prepared to fulfill that request.

2. CONCEPTUAL SYSTEM DESIGN

The general objective of vapor intrusion mitigation systems is to prevent chemicals in the soil vapor beneath the building from migrating into the building. SSD and SVE systems both lower the pressure by extracting soil vapor from beneath the building. SSD systems apply a low vacuum (and high flow rate) to the materials directly below the building slab to cause the sub-slab to have a lower pressure than the indoor air space, interrupting the path of contamination into the building. In contrast, SVE systems apply a high vacuum to the soil, creating a low pressure zone underneath the building and removing the contaminant in the process.

[2] State Water Resources Control Board (SWRCB), Geotracker, 2015. James River Corporation (T06019771096). http://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T06019771096

[3] Anton Geological, 2013. Soil and Groundwater Investigation, ACEH request for Data Gap Information, Former Printpack Facility, 2101 Williams Street, San Leandro, California 94577, RWQCB SLIC Case RO0002468, Geotracker Global ID T06019771096.

[4] P&D Environmental, Inc., 2016. Sub-Slab Soil Gas Investigation Report (VP13 through VP19), County Case #RO 2468, Former James River Corporation Site, 2101Williams Street, San Leandro, California. 15 September.

Extraction points for SSD systems and extraction wells for SVE systems would both go through the building slab into the material below. The subsurface materials at the site include the following, from the top of slab grade:

- 4.5-inch to 12-inch thick concrete slab;
- 3.0 to 5.5 feet of fill material, which consists of gravelly silty sand; then
- Native soil, which is composed of silty clay and clay.

The conceptual designs of each system for the feasibility testing are described below.

2.1 Sub-Slab Depressurization System

SSD systems mitigate the migration of volatile organic compounds (VOCs) into buildings by applying a vacuum to a select number of extraction points that apply a low vacuum to the sub-slab aggregate or fill, which propagates through the fill beneath the building. The California Department of Toxic Substances Control (DTSC) recommends maintaining a minimum pressure differential of 0.02 inch of water gauged (IWG) between indoor air and the sub-slab environment in order to prevent vapor intrusion.[5]

An SSD system at the site would involve an electric blower/fan pulling a vacuum on the extraction points via a common header pipe. The extracted vapor would be either discharged directly to the atmosphere, or treated by granular activated carbon prior to release to the atmosphere. Bay Area Air Quality Management District (BAAQMD) requirements will be followed for vapor discharge to the atmosphere. The SSD system will also include a network of pressure measuring points to monitor the area of influence of the extraction points.

2.2 Soil Vapor Extraction System

SVE systems mitigate the migration of VOCs into buildings by applying a higher vacuum to the soil, creating a negative pressure zone, and removing soil vapor from the subsurface, thereby reducing concentrations of VOCs in the soil vapor beneath the building.

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[5] California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), 2011. Vapor Intrusion Mitigation Advisory. Final advisory revised October.

An SVE system at the site would consist of soil vapor extraction wells and monitoring wells extending through the building slab into the fill and terminating at the native soil. Similar to the extraction points for an SSD system, extraction wells would be connected by a common header pipe by which vacuum from an electric blower would be applied to the wells. BAAQMD will likely require the extracted vapor to be treated by granular active carbon prior to release to the atmosphere. The SVE system will also include a network of vapor monitoring wells to monitor the area of influence of the extraction wells.

3. FEASIBILITY TEST OBJECTIVE

The overall objectives of this feasibility test are to evaluate the feasibility of and to obtain optimal operational parameters for a full-scale SSD system or SVE system that would mitigate vapor intrusion into the building. The feasibility test is designed to determine the following:

- The sub-slab area of influence for various flow and vacuum conditions;
- Blower/fan requirements;
- The effects of foundation walls, grade beams, and sub-grade utility penetrations; and
- Whether exhaust controls will be required for the full-scale system to meet Bay Area Air Quality Management District (BAAQMD) regulations.

This Work Plan assumes that Geosyntec will have access to the portions of Moore Newton Quality Hardwood located in the building where the feasibility test infrastructure will be constructed, as shown in **Figure 3**, and that a temporary staging area will be provided in the adjacent parking lot with the concurrence of the owner. This area for testing is selected considering the building access, VOCs concentration distribution, and minimizing disturbance to the existing businesses.

4. FEASIBILITY TEST COMPONENTS

The feasibility test will be conducted using a sub-slab extraction point (EP) for the SSD system test, a soil vapor extraction well (EW) for the SVE test, new and existing vapor points (VPs), new soil vapor monitoring wells (VMWs), and a mobile blower system to generate vacuum and treat extracted soil vapors, as described in the sections below. The proposed EP, EW, VP, and VMW locations are indicated in **Figure 3**.

If a planned extraction or monitoring location is inaccessible, Geosyntec may modify the locations, subject to the owner's prior consent, to provide data to accomplish the feasibility test objectives described above.

4.1 Extraction Points

During building construction, typically a layer of coarse aggregate is placed as a base for the concrete slab. The EP will be 3-inches in diameter and installed within the building through the concrete slab to access this aggregate layer beneath the slab. A 6-inch sump will be constructed beneath the slab to propagate the applied vacuum in the layer or gap directly beneath the slab. Refer to **Figure 4** for details. The EP will have provisions to collect soil vapor samples, control the flow rate, and collect vacuum measurements.

4.2 Vapor Points

The radius of influence of the EPs will be monitored using existing VPs and new VPs. New VPs will be installed inside the building at varying distances (between 10 and 90 feet) from extraction points to allow evaluation of the area of influence. Two existing and two new VPs will be used to monitor the influence of the extraction point. The new VPs will be installed by drilling through the slab and accessing the material below the slab. Refer to **Figure 4** for details. The VPs will have a cap to prevent becoming a conduit for vapors entering the building, and the VP will be covered by a protective metal lid placed flush with the concrete surface to prevent damage to the probe.

4.3 SVE Well

The SVE well, EW, will be installed to test feasibility of a SVE system. The EW will be installed inside the building, vertically through the concrete slab and into the fill layer. The EW will be 3-inches in diameter and screened in the fill layer from 2.5 feet below ground surface (bgs) to the native soil. The screen length will depend on the fill thickness in the area, based on available information, the screen interval will likely range from 1.5 to 3 feet. Above the screen, the well will be sealed with grout and bentonite to prevent short circuiting due to applied vacuums. The SVE well will be designed to collect soil vapor samples, control the flow rate, and collect vacuum measurements. The proposed SVE construction is shown in **Figure 5**.

4.4 Vapor Monitoring Wells

The radius of influence of the EW will be monitored using four VMWs located at distances of approximately 10, 20, 40, and 60 feet from EW. The VMWs will be constructed similar to the EW but with 1-inch diameter casing screened from 2.5 feet bgs to native soil. The VMWs will have provisions to collect vacuum measurements. Refer to **Figure 5** for details.

4.5 Blower and Carbon Treatment System

A mobile blower system will be used for this feasibility test. The system will consist of the following:

- A positive-displacement blower, rated for a vapor flow rate of up to 300 standard cubic feet per minute (SCFM), for application of 0 to 100 IWG vacuum;
- A vapor recirculation line for vacuum and vapor flow control;
- A 50-gallon knockout drum with high liquid level shutdown and a discharge pump; and
- Four drums of 200-lbs vapor-phase granular activated carbon (VGAC) will be used for abatement of extracted soil vapor prior to discharge to the atmosphere.

A conceptual process diagram of the feasibility test system is shown in **Figure 6**. The system will be powered by a propane-fired generator or by existing onsite power (if available). The blower extraction flow rate and vacuum will be controlled by valves on the blower system, and the system will include instrumentation to record flow rate and vacuum.

5. FEASIBILITY TEST SYSTEM INSTALLATION

This section describes the activities associated with the installation of the feasibility test system.

5.1 Pre-Field Activities

The following pre-field activities will be performed:

- Coordinate site building access and field logistics with the building owner;
- Prepare a site health and safety plan (HASP);

- Mark the installation locations with paint and notify Underground Service Alert (USA North) at least 48 hours prior to the onset of subsurface activities;
- Clear below-grade locations for underground utilities by a private underground utility locating service;
- Meet with the tenants and the owner to confirm locations of sub-grade improvements;
- Obtain a drilling permit from ACPWA;
- Notify ACEH of any changes to the feasibility test schedule from the schedule discussed below; and
- Notify BAAQMD in advance of the feasibility test field activities.

5.2 Extraction Points

One EP will be installed inside the building. The EP will be installed through the concrete slab to the material directly beneath. A 5-inch diameter hole will be drilled through the slab. Approximately 6 inches of material beneath the slab will be removed and replaced with clean, 3/4-inch diameter, rounded river rock. The extraction point will be constructed using 3-inch diameter Schedule 40 PVC outfitted with a 3.5-inch diameter stretch-fit rotary shaft O-ring seal and wire mesh. The purpose of the O-ring will be to seal the bottom of the concrete slab and prevent annular grout from flowing below the slab. The pipe will be placed and centered inside the core hole with the ring seal and wire mesh situated on the surface of the rock layer. The annular space will be grouted from the ring seal to the slab surface using non-shrinking, cement-bentonite grout, to ensure a good seal to isolate the sub-slab layer from the indoor air.

The EP will be constructed so that soil vapor samples and vacuum measurements can be collected and it will have provisions to connect to a mobile blower and treatment system. Construction details are provided in **Figure 4**.

5.3 Vapor Points

Two new flush-mounted VPs will be installed near the EPs to monitor vacuum propagation. A 1-inch hole will be drilled 1.5 inches into the concrete building slab. Through the center of that hole, a 1/2-inch diameter hole will be drilled to the sub-slab material and extend a few inches into sub-slab material. The hole will be cleared of drilling debris using a bottle brush and a shop vacuum. A 1/4-inch brass pipe, which has an outer diameter of approximately 1/2 inch, will be connected to a threaded fitting with threaded cap and will be placed inside the 1/2 inch borehole. The annular void around the brass pipe in 1-inch core area will be sealed to the concrete slab utilizing non-shrinking, cement grout. A threaded cap will be placed on the brass pipe such that it is recessed slightly in the slab. Each VP will be covered with a protective metal lid placed flush with the concrete surface.

5.4 SVE Well and Vapor Monitoring Wells

One EW and four VMWs will be installed inside the building. Both the EW and the VMWs will be constructed the same way except for the borehole and casing diameters, and attachments at the top of the wells. Construction details are provided in **Figure 5**.

Eight-inch and four-inch holes will be cored through the concrete slab for EW and VMWs, respectively. The fill beneath the slab will be drilled to the native soil, which is encountered at approximately 3 to 5.5 feet bgs. The EW will be 3-inch diameter and the VMWs will be 1-inch diameter, both constructed of flush-threaded, Schedule 40 PVC casing. The well screens will be placed below 2.5 feet bgs and constructed of 0.020-inch factory-slotted PVC with solid PVC bottom caps. The annular space will be backfilled as follows: #3 sand from the bottom of the borehole to two inches above the top of the screen, hydrated bentonite chips for four inches above that, Portland cement for the next 1.5 feet, and the top four inches of the PVC casing will be free standing to facilitate connection to the extraction system. A waterproof locking cap will be installed over each well casing within an appropriately-sized, H20 traffic-rated, and flush-mounted well box set in concrete.

The temporary piping outside of the SVE well will be constructed to connect it to a mobile blower and treatment system. The VMWs will be constructed so that vacuum measurements can be collected.

5.5 Piping

The above-grade completion for each EP and SVE well will consist of 3-inch diameter Schedule 40 PVC piping, a Labcock sample port, and a PVC ball valve. The vapor extraction piping leaving the EP and SVE well will transition to hose via a banded rubber coupling. These individual hoses will manifold to a single 4-inch header hose. The common header hose will extend outside of the building to the mobile blower and treatment skid located in the parking area on the north side of the building. The above-grade connections will be temporary installations for the feasibility test.

6. FEASIBILITY TEST PROCEDURES

The feasibility test will be conducted following the installation of the extraction wells, monitoring points, piping system, and connection to the mobile blower and treatment skid. The following sections describe collection of baseline data, feasibility test system operation, and feasibility test termination. Feasibility test data and measurement will be recorded on field documentation forms.

6.1 Collection of Baseline Data

Atmospheric conditions will be documented using weather reports for a nearby weather station. Documented parameters will include wind speed and direction, temperature barometric pressure, cloud cover, and precipitation.

Measurements will be taken prior to vapor extraction to establish a baseline against which the vacuum influence measurements will be compared. The vacuum will be measured by connecting a digital micro-manometer to the active extraction point and the monitoring points in turn. Geosyntec will also measure the building interior air pressure relative to outdoor air. Observed pressure and vacuum measurements will be recorded to the nearest 0.01 IWG.

For the duration of the feasibility testing, an 8-hour indoor air sample will be collected each day using a SUMMA™ canister with a regulator set to collect the sample over eight hours. The sample will be analyzed for selected VOCs using EPA Method TO-15.

6.2 Feasibility Test System Operation

The feasibility test will be performed using the following procedures:

1. On the first day of the feasibility test, known vacuums will be applied at the EP, and vacuum, flow rate, and vapor concentrations will be monitored at the EP (via a photoionization detector [PID]). In addition, vacuums will be monitored at the VPs, VMWs and the EW. At least four blower set-points will be tested for duration of one hour each to collect system parameters and to observe vacuum response at the monitoring points. Planned vacuum set points are 3, 6, 10, and 25 IWG, although these set-points may change based on field conditions. The EP and VP measurement frequency will be 10 minutes, and may be adjusted based on the field condition. One soil vapor sample will be

collected from the EP for the selected VOCs laboratory analysis (EPA Method 8260) at the start of each step test.

2. An extended SSD test will follow Step 1, in this step, a constant known vacuum will be applied at the EP for four hours. The vacuum will be selected based on the results of the Step 1. The flow rate, vacuum, and vapor concentrations will be monitored at the EP (via a PID), and vacuum will be monitored at the VPs, VMWs, and EW. The measurement frequency will be every 10 minutes and may be adjusted based on the field conditions. In addition, four soil vapor samples will be collected for laboratory analysis of selected VOCs by EPA Method 8260: one sample will be collected immediately after the start; after 45 minutes; after 2 hours; and after 4 hours or termination of the test.
3. On the second day SVE feasibility will be tested in a manner similar to Steps 1 and 2 above. The planned vacuum set points of 25, 50, 75, and 100 IWG will be applied at the EW and appropriate data will be collected. The extended 4-hour constant vacuum SVE test will follow the procedure described in Step 2.

6.3 Feasibility Test Termination

The feasibility test will be completed when sufficient data have been collected to identify the operational parameters of SSD and SVE system components. This is estimated to require two days of testing; however, testing may be extended to a third day if sufficient data is not collected in two days.

When the feasibility test is complete, the PVC pipes will be disconnected from the flexible hose and each sub-slab point will be closed to prevent vapor discharge. The blower system and all above-grade hoses will be removed. The carbon treatment system will be left onsite pending the spent carbon profile results. Once those results are received, the carbon will be disposed of at an offsite facility by a certified waste hauler under subcontract to Geosyntec. The SVE well, VPs, and VMWs will be left in place for incorporation in the full-scale system, but the EP will be abandoned.

7. FEASIBILITY TEST DATA ANALYSIS AND SYSTEM DESIGN

Geosyntec will review data obtained from the feasibility test and perform the following tasks:

- Evaluate the results of the SSD and SVE components and recommend one or both systems for full-scale use;

- Based on the area of influence observed, determine the quantities and locations of extraction points required for the selected system to maintain a minimum pressure differential of 0.02 IWG between the respective building indoor space and sub-slab environment in order to prevent vapor intrusion (as per the DTSC Vapor Mitigation Advisory guidelines);
- Determine the specifications for and select the appropriate blower/fan; and
- Assess whether treatment of the extracted vapors would be required by BAAQMD based on analytical results from the feasibility test. If required, design a vapor treatment system for the extracted vapors.

8. REPORT

Upon completion of the feasibility test, Geosyntec will prepare a report documenting the feasibility test results and providing a basis of design for the selected system. This report will include a summary of field operation procedures, operational parameter measurements, an evaluation of the results of the feasibility test, and the analytical results of the vapor sampling. The report will specify design criteria and parameters for a full-scale vapor intrusion mitigation system.

9. SCHEDULE

The feasibility test will be performed within six weeks of receiving approval of this Work Plan and approval from the client. The report described above will be completed and submitted to ACEH within four weeks of receipt of feasibility test laboratory analytical results (a two-week turnaround time will be used for laboratory processing). Total estimated duration is approximately three months after receiving ACEH and client approvals.

10. CONCLUSION

If you have any questions or comments on this Work Plan, please contact the undersigned at (510) 836-3034.

Sincerely,

Karina Navarro, P.E.
Engineer

REGISTERED PROFESSIONAL ENGINEER
SYED A. REHAN
No. C67805
Exp. 6/30/17
CIVIL
STATE OF CALIFORNIA

S. A. Rehan

Syed Rehan, P.E., B.C.E.E.
Principal Engineer

Enclosures:	Figure 1:	Site Map
	Figure 2:	PCE Soil Vapor Concentrations
	Figure 3:	Feasibility Test Layout
	Figure 4:	SSD Construction Details
	Figure 5:	SVE Construction Details
	Figure 6:	Feasibility Test Process Diagram

Electronic Copy to: Ms. Carey Andre, 2101 Williams Associates, LLC
Mr. Tom Graf, GrafCon

Legend

Subject Site Property Boundary

N

Source: P&D Environmental, 2016. Sub-Slab Soil Gas Investigation Report. September.

0 150 Feet

Site Map

2101 Williams Street
San Leandro, California

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Figure

1

WR2292

January 2017

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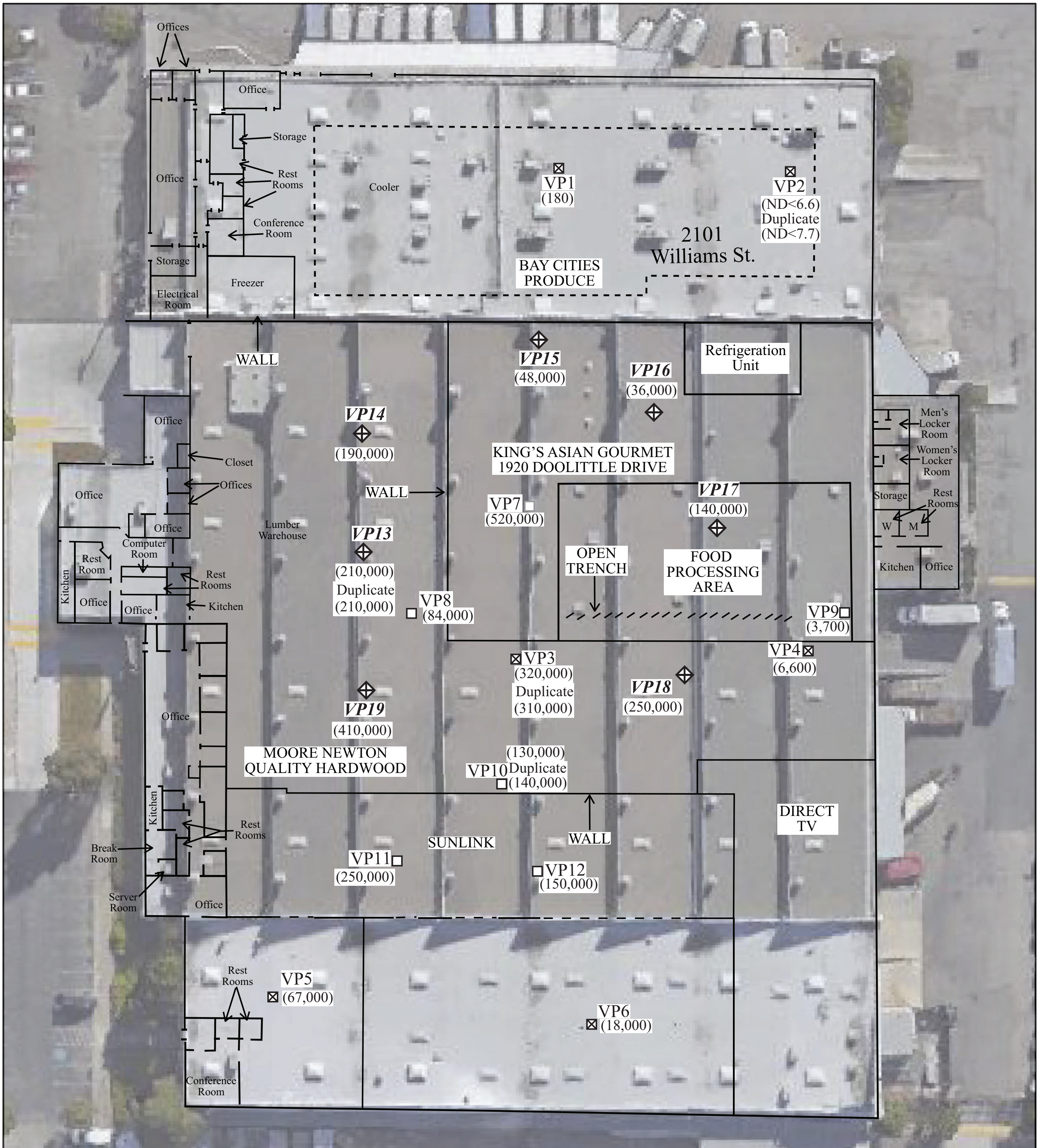

Legend

- ⊠ Vapor Pin Location (Installed 11/4/2014)
- □ Vapor Pin Location (Installed 2/3/2015)
- ⌖ Vapor Pin Location (Installed 4/29/2016)
- (520,000) PCE Concentration in Sub-Slab Soil Gas ($\mu g/m^3$)
- (ND<7.7) Not Detected

Note: Environmental Screening Level (ESL) for PCE = 2,100 $\mu g/m^3$
Source: P&D Environmental, 2016. Sub-Slab Soil Gas Investigation Report. September.

N

0 60 Feet

PCE Soil Vapor Concentrations

2101 Williams Street
San Leandro, California

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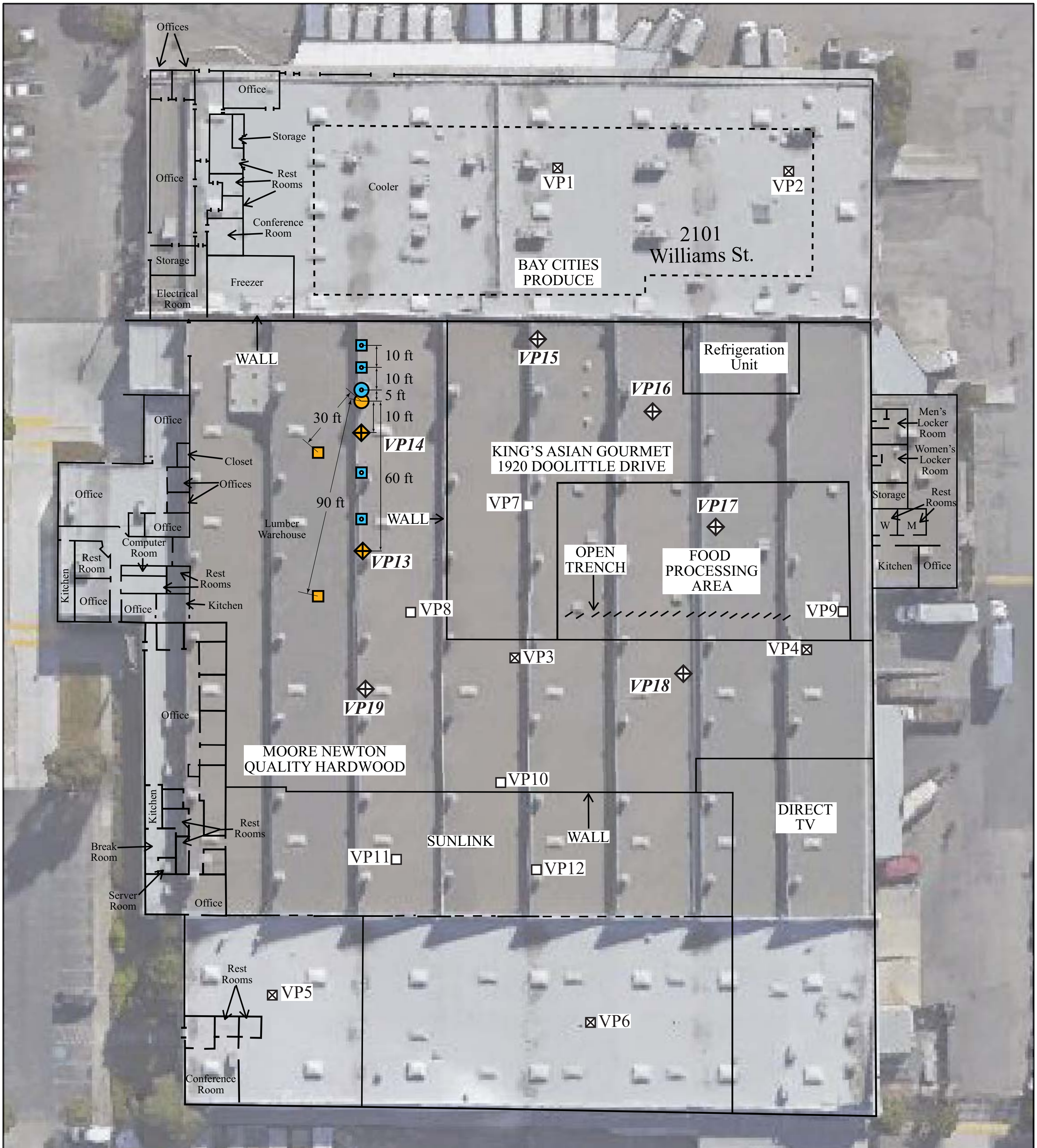
WR2292	January 2017

Figure 2



Legend

- Extraction Point (EP)
- Soil Vapor Extraction (SVE) Well
- Vapor Points (VPs)
- Vapor Monitoring Well (VMWs)
- Existing Vapor Pin to be Used in Feasibility Test (Installed 4/29/2016)
- Vapor Pin Location (Installed 11/4/2014)
- Vapor Pin Location (Installed 2/3/2015)
- Vapor Pin Location (Installed 4/29/2016)

Source: P&D Environmental, 2016. Sub-Slab Soil Gas Investigation Report. September.

N

0 60 Feet

Feasibility Test Layout

2101 Williams Street
San Leandro, California

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Figure 3

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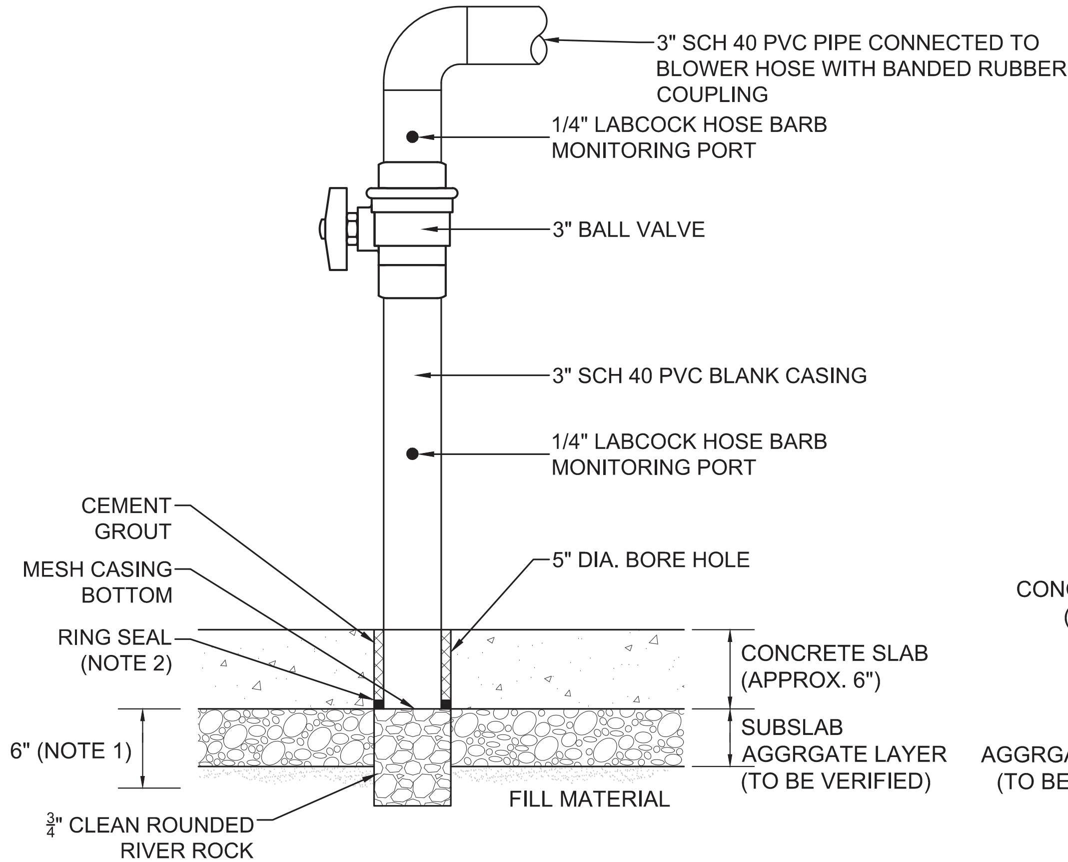
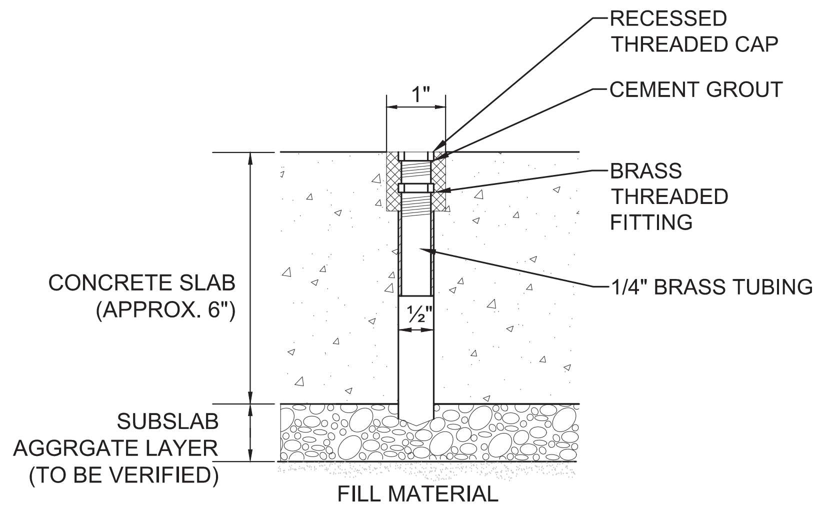


EXTRACTION POINT (TYP)

NOT TO SCALE



VAPOR MONITORING POINT (TYP)

NOT TO SCALE

NOTES:

1. THE MATERIAL BELOW THE SLAB BOREHOLE WILL BE REMOVED TO 6 INCHES BELOW THE SLAB AND REPLACED WITH CLEAN ROUNDED RIVER ROCK.

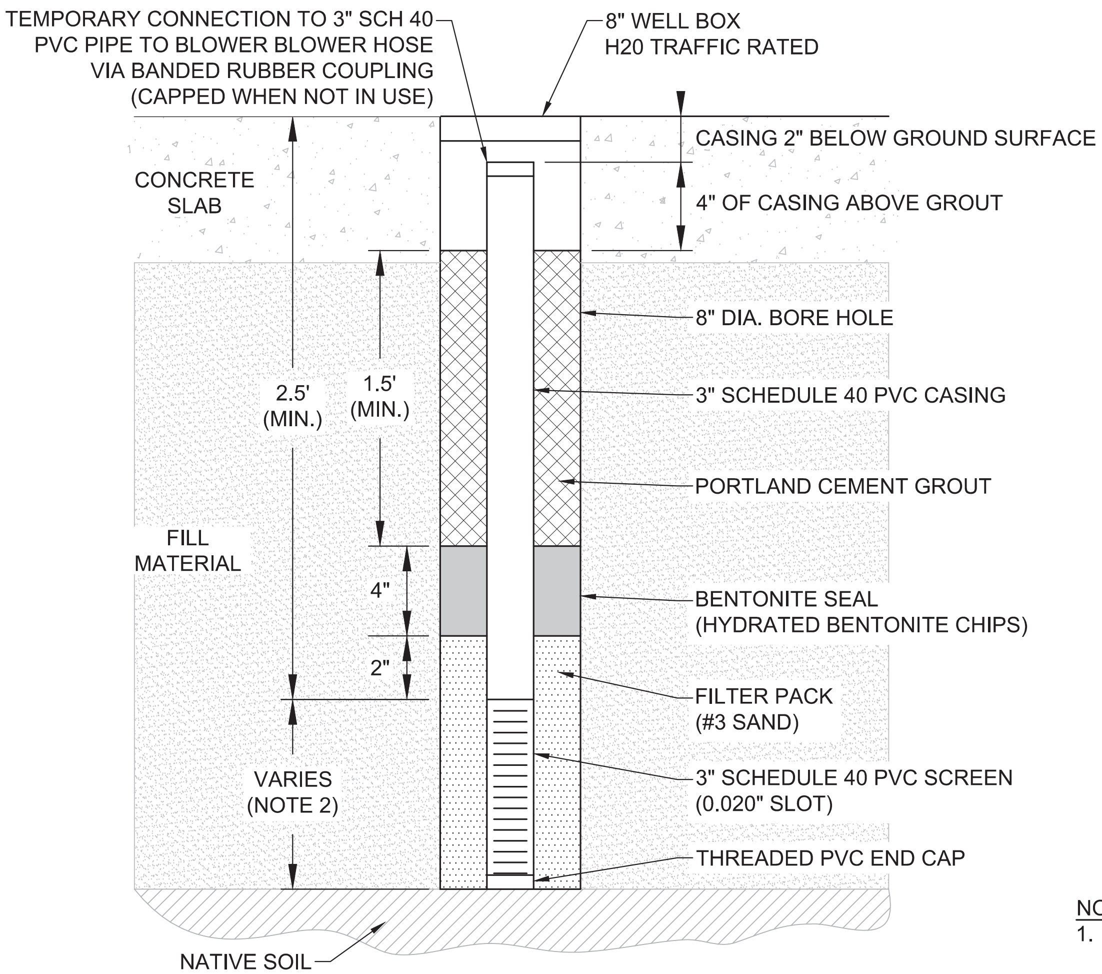
2. THE RING SEAL SHALL BE PLACED DIRECTLY ABOVE THE BOTTOM OF THE SLAB.

Geosyntec consultants

SSD CONSTRUCTION DETAILS

2101 WILLIAMS STREET
SAN LEANDRO, CALIFORNIA

FIGURE NO.	4
PROJECT NO.	WR2292 / 01
DATE:	JANUARY 2017



SOIL VAPOR EXTRACTION WELL DETAIL

NOT TO SCALE (NOTE 1)

NOTES:

1. CONSTRUCTION OF THE VAPOR MONITORING WELLS WILL BE THE SAME AS THIS, EXCEPT THAT THOSE WILL USE A 1" PIPE IN A 4" BOREHOLE.

2. THE LENGTH OF THE SCREEN SHALL BE SELECTED SUCH THAT IT WILL TERMINATE AT THE TRANSITION FROM FILL MATERIAL TO NATIVE SOIL.

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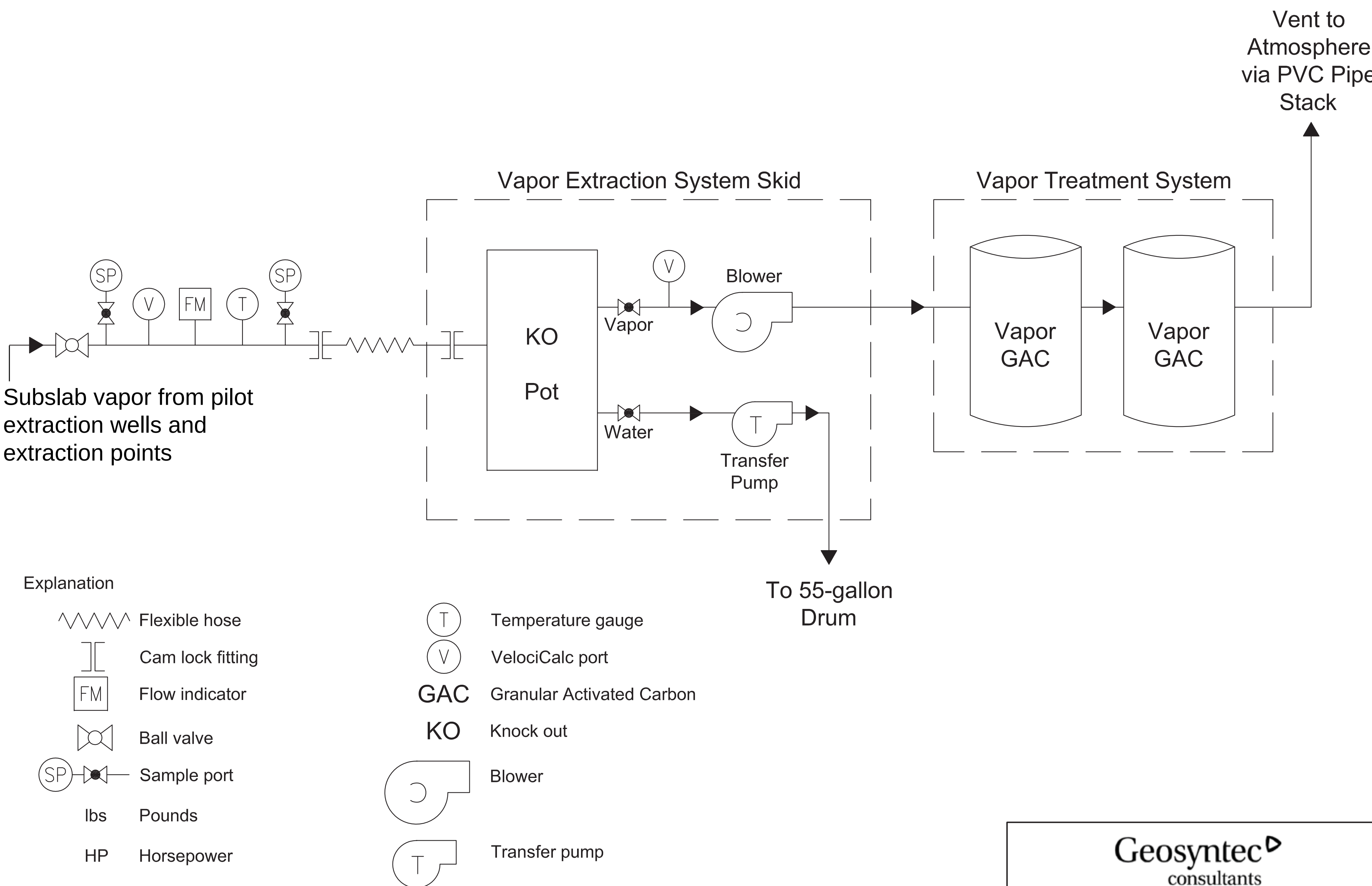
SVE CONSTRUCTION DETAILS

2101 WILLIAMS STREET
SAN LEANDRO, CALIFORNIA

FIGURE NO.	5
PROJECT NO.	WR2292 / 01
DATE:	JANUARY 2017



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FEASIBILITY TEST PROCESS DIAGRAM
2101 WILLIAMS STREET
SAN LEANDRO, CALIFORNIA

FIGURE NO.	6
PROJECT NO.	WR2292/01
DATE:	JANUARY 2017