

## Technical Memorandum

Date: January 29, 2019  
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Subject: East Multnomah County Groundwater TSA Remedy (ECSI 1479)  
SVE Expansion and Rebound Testing Work Plan

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### INTRODUCTION

Geosyntec Consultants (Geosyntec) has prepared this technical memorandum on behalf of Cascade Corporation (Cascade) and The Boeing Company (Boeing) to describe proposed expansion and rebound testing of the soil vapor extraction (SVE) system, which is a part of the East Multnomah County Troutdale Sandstone Aquifer (TSA) remedy being conducted jointly by the Cascade and Boeing. The TSA remedy is being implemented under the Department of Environmental Quality's (DEQ's) Consent Order No. WMCSR-NWR-96-08 (DEQ, 1997).

Soil vapor extraction has been utilized since 2015 to assist with chlorinated solvent mass removal in the unsaturated zone of the TSA. The purpose of this memorandum is to provide a review of the progress of the SVE system and to recommend modifications to the SVE system. Currently the SVE consists of five vapor extraction wells VW-17d-95.5, VMW-A, -B, -C, and -D, located in the south-central portion of the TSA remedy area near groundwater remedy well CMW-17ds and the groundwater pump and treat system (Figure 1). Well CMW-17ds, along with wells CMW-18ds and D-17ds, are located within the portion of the TSA remedy area where persistent trichloroethene (TCE) concentrations are detected in groundwater.

In July 2018, DEQ approved expansion of the SVE system to the east towards groundwater monitoring well CMW-18ds (proposed SVE wells VMW-E, -F, and -G shown on Figure 1; DEQ 2018; Geosyntec, 2018). Installation of these wells is pending receipt of a right-of-way permit from the Oregon State Department of Transportation. TCE concentrations in groundwater also

persist to the west, and TCE concentrations in groundwater have increased in monitoring well D-17ds (from 18.9 to 51.4 micrograms per liter [ $\mu\text{g/L}$ ]) since February 2017 (Figure 2). Recent groundwater elevation data indicates that the current groundwater level has been at the top to one foot above the top of the screen at well D-17ds since May 2017. The proposed SVE expansion described herein includes installation of six additional SVE wells near D-17ds.

Ongoing operation of the existing SVE system has removed over 51 pounds of VOCs from the unsaturated zone. During the time period of the SVE system (since 2015), TCE concentrations in the groundwater at CMW-17ds have decreased from 52 to 7.1 micrograms per liter ( $\mu\text{g/L}$ ), as shown on Figure 3. In addition, SVE system chlorinated solvent mass removal rates have decreased significantly since system startup (from 3.5 to 0.75 pounds per month), and TCE vapor results have consistently been below detection limits at vapor extraction wells VMW-A, VMW-B, and VMW-D since the February 2018 sampling event (Table 1). The proposed rebound study of these three wells will allow the evaluation of the potential VOC mass remaining in the surrounding soil. This will then inform the decision of whether vapor extraction from VMW-A, VMW-B, and VMW-D should be concluded, or whether cycling vapor extraction at these wells would be appropriate.

## **SVE SYSTEM EXPANSION**

Installation of six additional SVE wells is proposed to increase TCE mass removal in the unsaturated zone above the TSA groundwater near groundwater monitoring well D-17ds. The SVE wells will be connected to the existing SVE system near the Central Treatment System (Figure 1).

### **Vapor Well Locations**

Proposed SVE well locations were selected based on historic flow paths in the area of D-17ds which were to the southwest/west (i.e. relative to the historic groundwater “mound” radial flow pattern); closer to the TGA and CU1 truncation area where VOC concentrations may be higher; current groundwater gradients towards the extraction wells (EW-1 and EW-14); increasing VOC concentration at D-17ds; and use of D-17ds as a performance monitoring well for the SVE in the TSA.

The locations are identified as VMW-H, -I, -J, -K, -L, and -M on Figure 1. Based on driller availability and to minimize field mobilization costs, the six proposed SVE wells could be installed during the same mobilization as the DEQ previously approved vapor extraction wells around CMW-18ds (VMW-E, -F, and -G), which is planned for the first or second quarter of 2019.

### **Well Installation and Construction**

The well borings will be drilled using sonic drilling methods. Telescoping drilling methods (i.e. a stepdown) will be used at the contact between the Troutdale Gravel Aquifer (TGA) and underlying confining unit 1 (CU1). The borings will be drilled using 8-inch casing and a 6-inch diameter core barrel, stepped down to 6-inch casing with a 4-inch core barrel. A bentonite seal will be placed from the base of the 8-inch drill casing depth (top of the CU1) to the surface and allowed to set prior to advancement of the 6-inch drilling casing. Soil will be cored continuously and will be field screened for VOCs during drilling using a photoionization detector meter (PID). Target depths for the borings will be first encountered groundwater in the TSA, which is estimated to occur at 110 to 115 feet bgs based on groundwater measurements from well D-17ds. The depth to groundwater during the November 2018 monitoring event was 110.9 feet bgs at D-17ds. The borings will be extended to a maximum depth of 120 feet bgs.

A monitoring well/vapor well will be installed in the boring. The well will be installed with a 20-foot screen from approximately 95 to 115 feet bgs and will span the water table so portions of the screen will be saturated and unsaturated to allow for groundwater sampling and vapor extraction. Existing SVE wells VMW-A through VMW-E are constructed in a similar manner. At this time, a packer system is not anticipated to be necessary to separate the vapor and groundwater well screens, since the proposed vacuum is not strong enough to pull water into the SVE system and has not been an issue at the other existing SVE wells. The applied vacuum will be monitored and adjusted to prevent groundwater rise above the top of the vapor screen. The wells will be constructed of 2-inch diameter, schedule 40 polyvinyl chloride (PVC), with a 0.01- inch (10-slot) screen and 10/20 (or equivalent) silica sand filter pack.

Investigation derived waste (IDW) will consist of soil cuttings and water generated during drilling. Soil cuttings will be stored on-site in roll-off boxes, dewatered as necessary, pending characterization and off-site permitted disposal. We anticipate submittal of a No Longer Contains request for disposal of the IDW as non-hazardous waste. Water will be stored on-site in totes or a larger water storage container and solids will be settled out. Water will be treated through the on-site water treatment system and ultimately discharged under the existing National Pollutant Discharge Elimination System permit. Remaining solids will be added to a soil roll off box prior to characterization and disposal.

### **Vapor Well Startup and Performance Monitoring**

The wells will be connected to the blower near the Central Treatment System via an underground 4-inch PVC header, using 2-inch PVC piping to connect the wellhead to the header. Each wellhead

will be equipped with a well isolation valve and an upstream sample port. Further detail regarding wellhead and piping specifications can be found in the SVE System process flow diagram (Figure 4).

Process data and PID SVE effluent concentrations will continue to be recorded in the field on a weekly basis. Monthly SVE effluent and quarterly well vapor samples will be collected in evacuated 1.0-liter Summa canisters for laboratory analysis. The Summa canister samples will be analyzed for cVOCs by EPA Method TO-15 SIM. Groundwater samples will be collected from the new wells and D-17ds to evaluate initial groundwater VOC concentrations and quarterly thereafter.

The modified SVE system is expected to be operated for approximately 12 to 24 months at a flow rate of up to 700 standard cubic feet per minute (scfm), approximately 60-70 scfm for each of the 11 wells<sup>1</sup>, and an applied vacuum of 2-3 inches of mercury (in Hg). Discharge rates are estimated to remain below DEQ's de minimis treatment threshold of one ton per year for total VOCs and, as a result, effluent treatment is not planned.

### **Data Evaluation and Reporting**

Field data collected from the new wells and SVE system will be evaluated on a weekly basis to track and optimize system performance and to estimate VOC mass removal. The extracted VOC concentration and mass removal levels over time will be used to assess system performance.

System performance data, along with recommendations for system modifications, continued operation of the system, and/or termination of system operation, will be included in the TSA annual reports.

### **SVE WELL REBOUND TESTING**

The following are the procedures that will be conducted as part of the rebound testing of the existing SVE configuration:

- The SVE system will remain in operation for extraction from wells not part of the rebound testing<sup>2</sup>.

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<sup>1</sup> The expanded SVE system will consist of 2 existing wells (VMW-17d-95.5 and VMW-C), three wells previously approved to be installed around CMW-18ds (VMW-E, VMW-F, and VMW-G), and the six new wells proposed in this workplan (VMW-H, VMW-I, VMW-J, VMW-K, VMW-L, and VMW-M).

<sup>2</sup> It is anticipated that existing wells VMW-17d-95.5, VMW-C, and new wells VMW-E, VMW-F, VMW-G, VMW-H, VMW-I, VMW-J, VMW-K, VMW-L, and VMW-M will be operated during the rebound testing.

- Prior to modifying the SVE system for the rebound test, vapor samples will be collected from vapor extraction wells VMW-A, VMW-B, and VMW-D. These samples will be collected in Summa canisters and analyzed for VOCs using USEPA Method TO-15 SIM. System and SVE well vacuums and flow rates will also be collected at this time.
- The well isolation valves at VMW-A, VMW-B, and VMW-D will be closed in order to isolate the wells for the rebound study. These valves will remain closed for the duration of the rebound study, with the exception of brief purging (i.e., 60 seconds of purging) for rebound VOC sampling.
- During the rebound test period, VOC concentrations at VMW-A, VMW-B, and VMW-D will be monitored on a weekly basis. In order to sample the SVE wells, the isolation valve at each well will be opened for 60 seconds prior to sampling in order to allow the purge of approximately three well volumes. The vapor samples will be collected in Tedlar® bags using a vacuum pump and vacuum chamber to isolate the sample from the pump. Each sample will be analyzed using a MiniRAE® 3000 PID calibrated with isobutylene, and the results will be converted to TCE equivalents. When TCE field results show that TCE concentrations at each well have reached equilibrium, the rebound/shutdown period will be concluded. The estimated duration of the rebound/shutdown period is 2-3 months.
- Following the rebound test period, the well isolation valves at VMW-A, VMW-B, and VMW-D will be opened. After one hour of operation, the vapor extraction well flow rates and vacuums will be recorded, and vapor confirmation samples will be collected. Each sample will be collected in a Summa canister and analyzed for VOCs using USEPA Method TO-15 SIM.

### **SVE Rebound Testing Evaluation**

Following the conclusion of the SVE rebound test, the data will be evaluated to assess if significant rebound is observed in individual SVE wells. The commonly used criterion for defining a successful rebound test is an increase in pre-shutdown VOC concentrations of not more than 50 percent. However, this may not be an appropriate method to evaluate rebound given the lower pre-shutdown concentration levels. Although laboratory data will be available for pre- and post-rebound comparison, recent PID field measurements indicate that VOC concentrations at VMW-A, VMW-B, and VMW-D have been non-detect (i.e., 0 parts per million [ppm] as measured with the PID) for the past few sampling events. Therefore, even if laboratory data indicate detectable or trace concentrations of VOCs, the concentrations are expected to be so low that a 50 percent increase may be statistically insignificant and not a reliable measure of success of the rebound test. As a result, the rebound concentration data will be reviewed on a qualitative basis by the project team to evaluate the significance of the rebound.

SVE rebound data will be utilized to develop a path forward on the operation of the SVE and the expansion throughout the TCE persistent areas of the remedy. Results and recommendations will be provided to DEQ for consideration.

\* \* \* \* \*

**References:**

Geosyntec Consultants, 2018. Work Plan for Soil Vapor Extraction System Expansion East Multnomah County Troutdale Sandstone Aquifer Remedy, February 19, 2018.

Oregon Department of Environmental Quality (DEQ), 2018. Email from Ken Thiessen, DEQ, RE: Work Plan for Soil Vapor Extraction System Expansion, East Multnomah County Troutdale Sandstone Aquifer Remedy, Fairview, Oregon (ECSI #1479), July 2, 2018.

Oregon Department of Environmental Quality (DEQ), 1997. TSA Remedy Order on Consent, WMCSR-NWR-96-08, 14 February 1997.

**Attachments:**

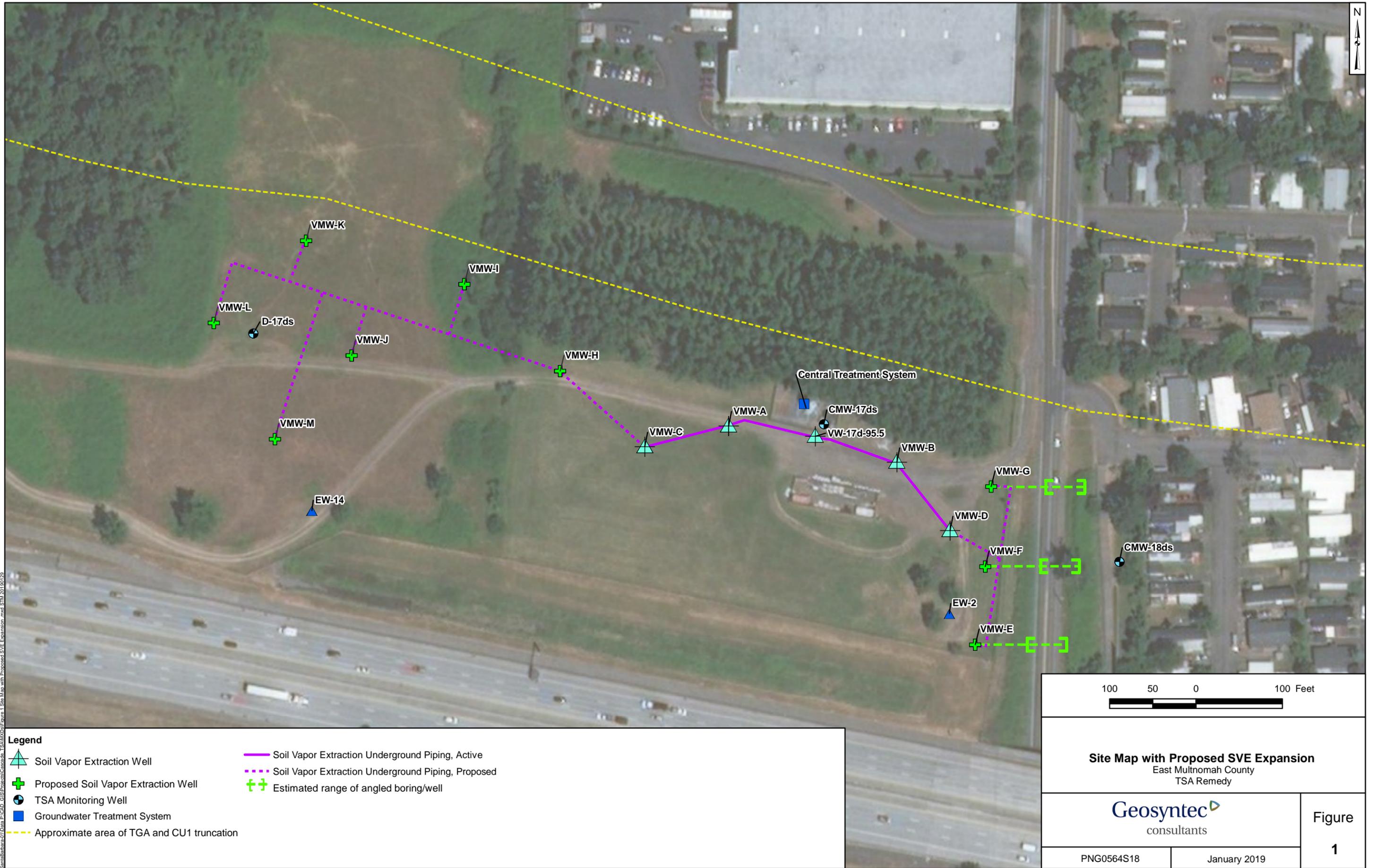
Figure 1: Site Map with Proposed SVE Expansion

Figure 2: D-17ds Trichloroethene Groundwater Results

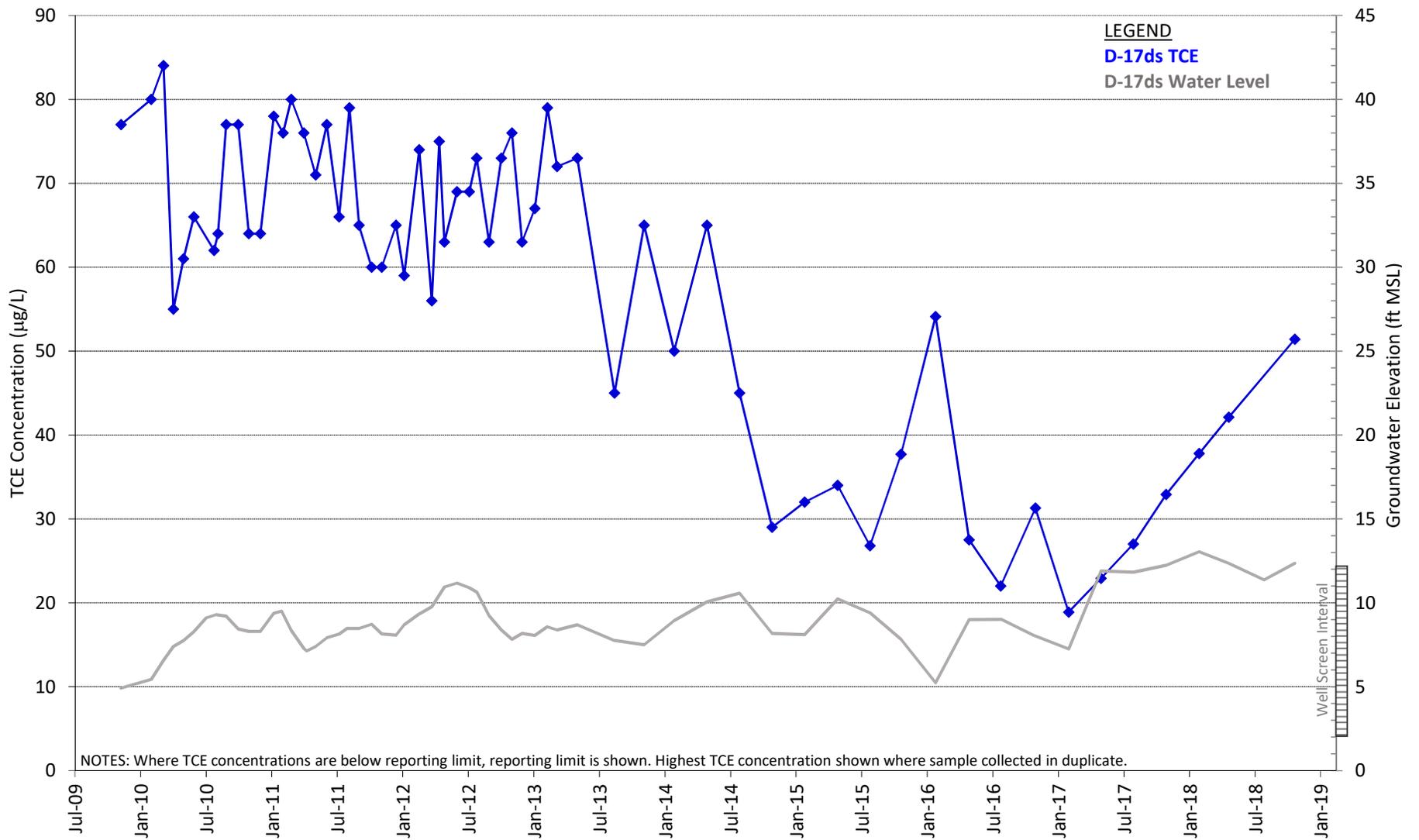
Figure 3: CMW-17ds Trichloroethene Groundwater Results

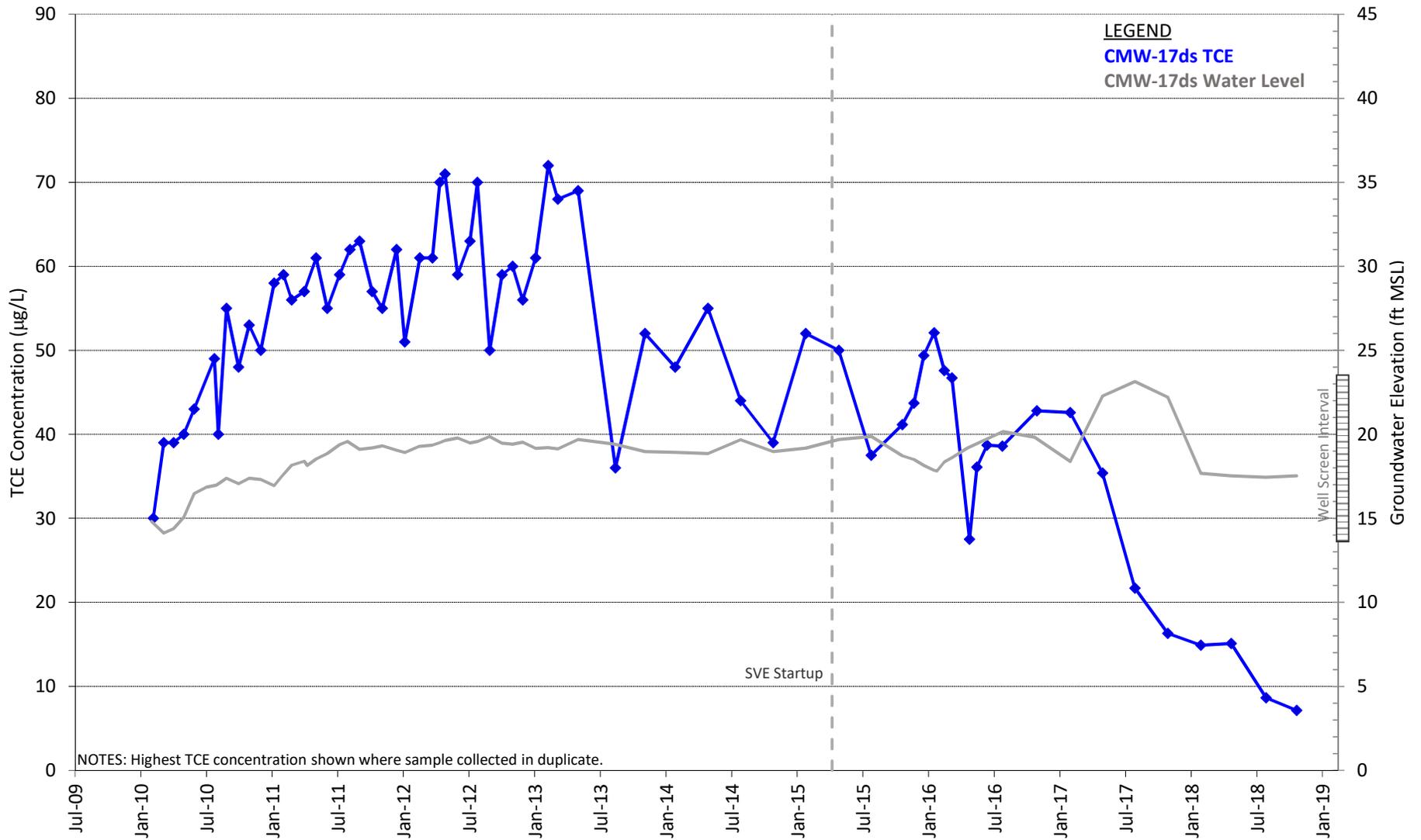
Figure 4: Proposed SVE System Process Flow Diagram

Table 1: SVE Well Vapor Sampling Analytical Results

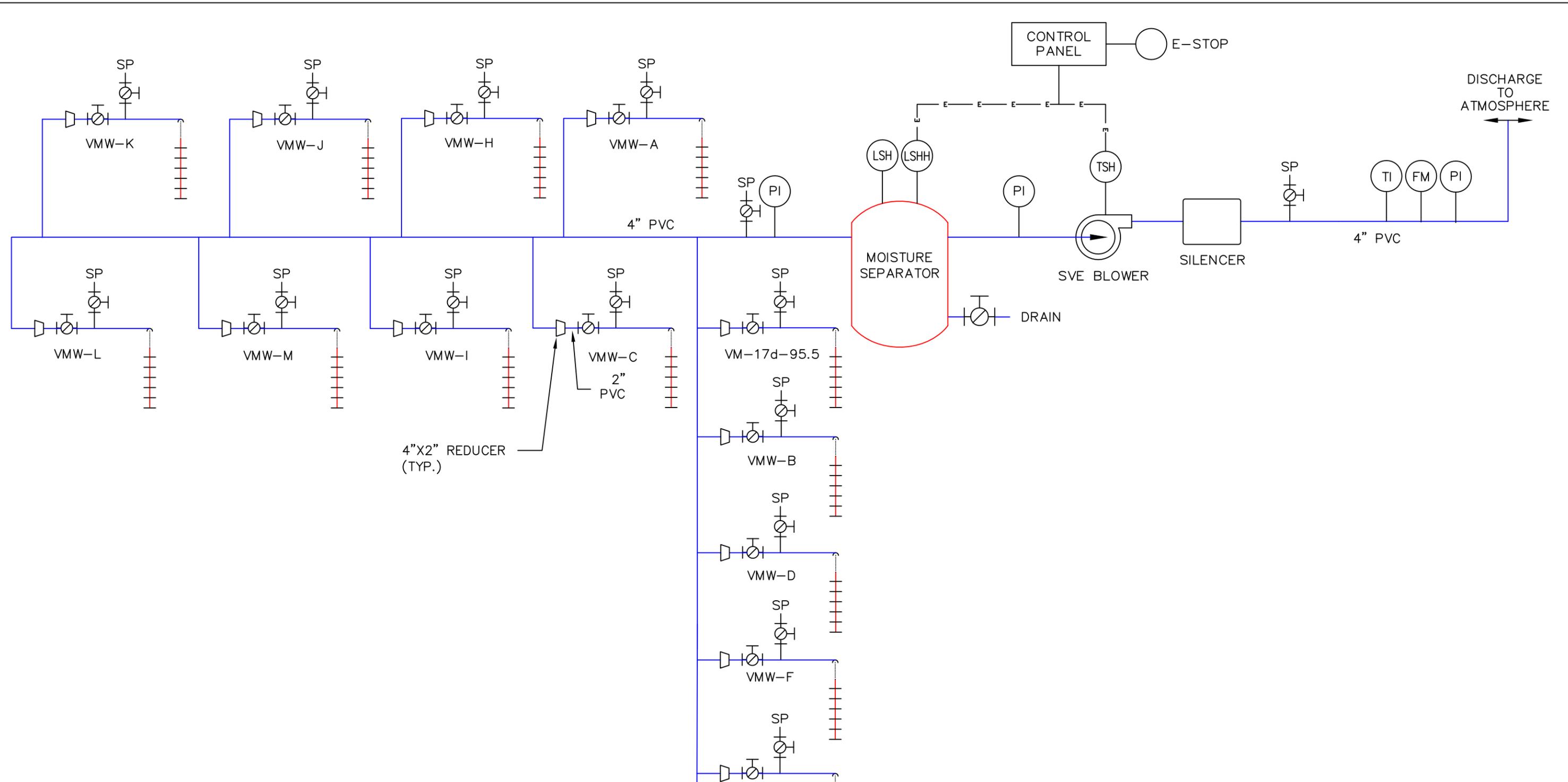


Santa Barbara CA | Data: P:\CAD - GIS\Projects\Caseade - TSA\MapDocs\Figure 1 Site Map with Proposed SVE Expansion.mxd | STM 20190729





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**Legend**

- |                            |                                 |
|----------------------------|---------------------------------|
| TI = Temperature Indicator | LSHH = Level Switch - High-High |
| FM = Flow Meter            | SP = Sample Point               |
| PI = Pressure Indicator    | TSH = Temperature Switch - High |
| LSH = Level Switch - High  | E-Stop = Emergency Stop         |

**Proposed SVE System Equipment  
Flow Diagram**  
 East Multnomah County

		<b>FIGURE</b>  <b>4</b>
PNG0564S18	January 2019	

**Table 1**  
**SVE Well Vapor Sampling Analytical Results - Trichloroethene**  
**East Multnomah County TSA Remedy**

Sample Date	VMW-17d-95.5	VMW-C	Proposed Rebound Wells		
			VMW-A	VMW-B	VMW-D
4/28/15	11,000	-	-	-	-
7/28/15	2,500	-	-	-	-
10/27/2015 <sup>1</sup>	530	-	-	-	-
11/30/2015 <sup>2</sup>	2,000	-	-	-	-
1/26/16	2,100	-	-	-	-
3/15/16	2,100	-	-	-	-
6/21/16	1,800	-	-	-	-
9/27/16	1,200	-	-	-	-
12/14/16	71	73	9,000	1,000	< 19
1/10/17	830	3,000	680	1,600	6,600
2/7/17	590	< 2.0	530	580	3,600
5/9/17	560	3,000	< 2.1	2.7	1,600
8/8/17	410	2,700	430	2.5	2,300
11/7/17	370	2,500	120	< 2.0	< 2.0
2/6/18	360	2,100	< 1.9	< 1.9	2.1
5/10/18	360	2,000	< 2.1	< 2.2	< 2.1
8/7/18	5.6	560	< 2.2	< 2.2	< 2.3
11/6/18	< 2.1	1,200	< 2.2	< 2.1	< 2.0

Notes:

All values are in micrograms per cubic meter (ug/m<sup>3</sup>)

< 2.1 = Trichloroethene was not detected above the method reporting limit shown

<sup>1</sup> 10/27/15: VMW-17d-95.5 sample may have canister issue

<sup>2</sup> 11/30/15: VMW-17d-95.5 resampling event due to potential issues with October 2015 sample.