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Mr. Bob Williams
Oregon Department of Environmental Quality
Northwest Region Portland Office
2010 SE 4th Avenue, Suite 400
Portland, OR 97201

Subject: Work Plan for Soil Vapor Extraction System Installation and Operation
East Multnomah County Troutdale Sandstone Aquifer Remediation
Fairview, Oregon

Dear Bob:

Geosyntec Consultants (Geosyntec) has prepared this Work Plan on behalf of Cascade Corporation (Cascade) to describe the installation and operation of a soil vapor extraction (SVE) system as part of the East Multnomah County Troutdale Sandstone Aquifer (TSA) remedy being conducted jointly by the Cascade Corporation (Cascade) and The Boeing Company (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). An SVE Pilot Study conducted at the site in July 2014 found that SVE can be effective in removing chlorinated solvents from the TSA (Geosyntec Consultants, 2014). This work plan outlines the installation of the SVE system and provides details on the operation, field data collection, and reporting.

EXTRACTION EQUIPMENT

An SVE system will be installed near the Central Treatment System (CTS) and powered with a temporary electrical connection from the CTS building. The SVE system will be equipped with a positive displacement blower capable of extracting 150 standard cubic feet per minute (scfm) of vapor at a vacuum of 9 inches of mercury (in Hg). The extraction air flow rate was selected based on the pilot test data to minimize groundwater mounding as well as to achieve a target air flow rate of 3 scfm per foot of screen length which is within the typical SVE range of 2 to 5 scfm per foot of screen length. The SVE system will be connected to three existing vapor monitoring wells (VW-17d-42.4, -75, and -95.5) that are screened in the upper TSA. To connect to the wells, a manifold on the SVE System will be connected to surface piping, and valving and gauging will be installed to allow for vapor transfer and process data collection. A conceptual schematic is shown on Figure 1. The nearby monitoring well (MW-17ds) will be capped to prevent short-circuiting. Quarterly water level data and VOC groundwater samples will continue be collected at this well. Although significant water production is not expected, any entrained

water will be separated from the vapor through the use of an in-line moisture separator, and the collected liquids will be transferred to the CTS for treatment and disposal.

Chlorinated volatile organic (cVOC) mass extraction rates are estimated to be on the order of 10-20 pounds per year, based on removal rates measured during the SVE Pilot Study. These discharge rates are below the DEQ treatment de minimis threshold [OAR 340-200-0020] of one ton per year for total VOCs or hazardous air pollutants. As a result, treatment of vapor is not required and the vapors will be discharged to the atmosphere via a steel stack terminating approximately 10 feet aboveground surface.

SVE SYSTEM INSTALLATION AND STARTUP

The SVE system will be enclosed within a chain-link fence to prevent unauthorized access. The target operating conditions for the wells are outlined in Table 1. These operating conditions were determined based on the results of the pilot study.

Extracted vapor concentrations will be recorded in the field with a photoionization detector (PID) and collected in evacuated 1.0-liter summa canisters for laboratory analysis. The summa canister samples will be analyzed for VOCs by EPA Method TO-15. The frequency of sampling is described below.

FIELD OPERATION AND DATA COLLECTION

The SVE system is expected to be operated for six to twelve months, depending on cVOC mass removal rates. During this time period, weekly, monthly, and quarterly data collection and testing will be performed as outlined below and summarized in Table 2:

- Weekly Sampling:
  - SVE system temperature, pressures, and flows;
  - Extraction well temperature, pressures, and flows; and
  - System outlet vapor sampling for VOCs (via PID).
- Monthly Sampling:
  - System outlet sampling for VOCs (via summa canisters).
- Quarterly Sampling:
  - Extraction well sampling for VOCs (via summa canisters).

Additionally, VOC samples (via summa canisters) will be collected from each of the three wells and the SVE system outlet after the first week of operation to provide baseline data.

DATA EVALUATION AND REPORTING

Data collected from the SVE system will be evaluated on a weekly basis to track and optimize the performance of the system and the amount of cVOC mass removed from the site. The extracted concentration and mass removal levels over time will be used to assess the duration of system operation. It is expected that operation of the system will be discontinued once mass removal rates reach asymptotic levels.

Quarterly memorandums will be prepared summarizing the performance of the system during that period and provide recommendations for system modifications, continued operation of the system, and/or termination of system operation.

REFERENCES

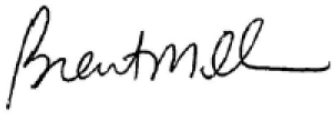
Geosyntec Consultants, 2014. TSA Soil Vapor Extraction Pilot Test Results. October 2014.

CLOSURE

We look forward to your review and approval of this Work Plan. Please contact us at (503) 222-9518 with any questions regarding this Work Plan or if you need additional information

Sincerely,

Geosyntec Consultants, Inc.



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Attachments:

Table 1	SVE System Target Operating Conditions
Table 2	SVE System Sampling Frequency
Figure 1	SVE System Equipment

Tables

Table 1
SVE System Target Operating Conditions
Cascade TSA - Fairview, Oregon

Well	Vacuum, in Hg	Flow Measurement, scfm
VW-17d-42.5	6-7	15-20
VW-17d-75	6-7	65-75
VW-17d-95.5	5-6	70-80

Abbreviations:
scfm = standard cubic feet per minute
in Hg = inches of mecury

Table 2

SVE System Sampling Frequency

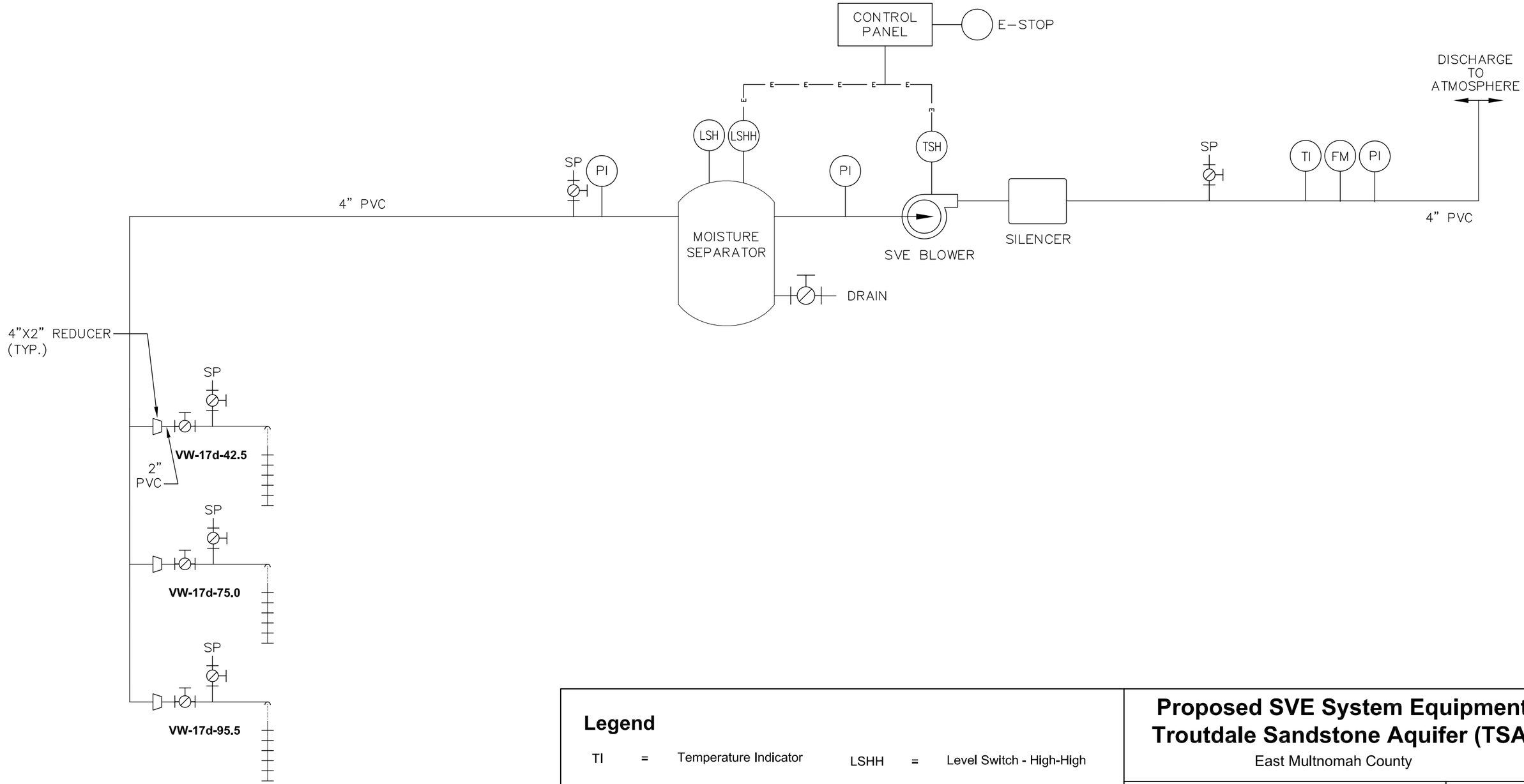
Cascade TSA - Fairview, Oregon

		Sampling Frequency		
SVE SYSTEM MONITORING	**Units**	**Weekly**	**Monthly**	**Quarterly**
VACUUMS	---			
SVE System Inlet	in H_g	X	X	X
VW-17d-42.5	in H_g	X	X	X
VW-17d-75	in H_g	X	X	X
VW-17d-95.5	in H_g	X	X	X
TEMPERATURE				
SVE System Inlet	deg C	X	X	X
VW-17d-42.5	deg C	X	X	X
VW-17d-75	deg C	X	X	X
VW-17d-95.5	deg C	X	X	X
FLOW RATES				
SVE System Inlet	ft/min	X	X	X
VW-17d-42.5	ft/min	X	X	X
VW-17d-75	ft/min	X	X	X
VW-17d-95.5	ft/min	X	X	X
VOC CONCENTRATIONS (PID)				
SVE System Outlet	ppm	X	X	X
CONCENTRATIONS (Summa)				
SVE System Outlet	---		X	X
VW-17d-42.5	---			X
VW-17d-75	---			X
VW-17d-95.5	---			X

Notes:

in Hg	=	inches of mecury
ft/min	=	feet per minute
ppm	=	parts per million
deg C	=	Degrees In Celcius
---	=	not applicable
X	=	Data collected

Figures



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 Troutdale Sandstone Aquifer (TSA)

East Multnomah County

Geosyntec consultants

PNG0564S | November 2014

FIGURE 1

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