INTERIM CLEANUP ACTION CONSTRUCTION COMPLETION REPORT

Morrell's Dry Cleaners

Prepared for: David Shaw, Successor to Walker Chevrolet

Project No. 080190-004-13 • December 23, 2014

Aspect CONSULTING

earth + water

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Acronyms

Aspect	Aspect Consulting, LLC
ACFM	actual cubic feet per minute
bgs	below ground surface
cDCE	cis-1,2-dichloroethylene
COC	chemical of concern
COPC	chemical of potential concern
dBA	decibel, A-weighted
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FFS	Focused Feasibility Study
GAC	granular activated carbon
gpm	gallons per minute
HDPE	high density polyethylene
HP	horsepower
IWC	inches of water column
KW	kilowatt
KWH	kilowatt hour
lbs	pounds
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
MTCA	Model Toxics Control Act
MNA	monitored natural attenuation
ORP	oxidation-reduction potential
PCE	tetrachloroethylene
PID	photoionization detector

Property	Morrell's Dry Cleaners Property
PSCAA	Puget Sound Clean Air Agency
PVC	polyvinyl chloride
RI	Remedial Investigation
SCFM	standard cubic feet per minute
Site	Morrell's Dry Cleaners Site
SVE	soil vapor extraction
TCE	trichloroethylene
TOC	total organic carbon
TPN	tax parcel number
VCP	Voluntary Cleanup Program
VI	vapor intrusion
VOC	volatile organic compound

1 Introduction

This Interim Cleanup Action Construction Completion Report describes the biostimulation well network and biostimulation action completed to date and the specifications and construction completion details of the soil vapor extraction (SVE) system at the Morrell's Dry Cleaners Site (Site) in Tacoma, Washington. This report updates construction details in the Interim Cleanup Action Construction and Design Report (Aspect, 2014).

1.1 Site Description

The Morrell's Dry Cleaners Property (Property) is located at 608 North First Street in Tacoma, Washington. As shown in Figure 1, the Property is located on a triangular city block, consisting of multiple tax parcels, which is bound by North First Street on the northwest, Tacoma Avenue on the northeast, and Division Avenue on the southeast. The Morrell's Dry Cleaners Site is registered with the Washington State Department of Ecology (Ecology) Voluntary Cleanup Program (VCP) as VCP No. SW1039. The Site includes the Property and off-Property soil or groundwater confirmed or suspected of being impacted by contaminant releases at the Property. Under this definition, the Site extends to four private parcels and the City of Tacoma rights-of-way in Tacoma Avenue and North First Street that contain detectable concentrations of chlorinated volatile organic compounds (VOCs) in soil and/or groundwater associated with historical releases from the dry cleaning operations. These parcels (Figure 1) include the following:

- Tax Parcel No. (TPN) 2030120031 (7,930 square feet, Thriftway Properties, LLC): Contains a 3,600 square foot building that is leased to Morrell's Dry Cleaners and a non-occupied storage space for Stadium Thriftway. The northernmost 7.5 feet of the building containing Morrell's Dry Cleaners extends onto the adjoining parcel to the north (TPN 2030120012).
- TPN 2030120033 (13,450 square feet, Thriftway Properties, LLC): Contains a paved parking lot used by Stadium Thriftway.
- TPN 2030120012 (8,364 square feet, 4 the Boys Company, LLC): Contains Franco the Tailor, Tully's Coffee, office space, and the northernmost 7.5 feet of the building containing Morrell's Dry Cleaners.
- TPN 2030120013 (11,160 square feet, Stadium LLC): Contains retail space.

Low concentrations of chlorinated VOCs were detected in groundwater in the City of Tacoma rights-of-way north and west of these parcels. Tetrachloroethylene (PCE), associated with releases from historical dry cleaning operations, was detected in groundwater at concentrations slightly above applicable groundwater cleanup levels, while other VOCs were detected in one or more locations at concentrations below applicable cleanup levels. Based on this marginal exceedance, the street rights-of-way mark the approximate northern and western boundaries of the Site.

The remediation area is shown in Figure 2. The Morrell's Dry Cleaners building extends to the edge of a 7.5-foot easement on the adjoining parcel (TPN 2030120012). The 5-foot-wide alley on the north side of the Morrell's Dry Cleaners building is located on the adjoining parcel. The soil vapor extraction (SVE) system includes a SVE trench in the alley, a sub-slab suction pit beneath the Morrell's Dry Cleaners building, and angled SVE wells that extend beneath the building. The biostimulation wells are located on all four parcels within the Site, including MW-15 and MW-21 on TPN 2030120012, MW-8 near the boundary of TPN 2030120013, MW-2 and MW-16 to MW-18 on TPN 2030120031, and MW-19 and MW-20 on TPN 2030120033.

1.2 Investigation Background

Morrell's Dry Cleaners has operated at 608 North First Street since 1972 and dry cleaners have operated at this location since 1929. Aspect submitted a Remedial Investigation (RI) Report (Aspect, 2011) to Ecology summarizing the history of the Site. The RI documents results of soil and groundwater quality investigations, and presents a preliminary site conceptual model describing the nature and extent of contaminants and identifying potential exposure pathways. In response to an opinion letter from Ecology dated September 26, 2011 (Ecology, 2011), Aspect completed additional investigations and prepared a Data Gaps Investigation memorandum (Aspect, 2012). These reports identified chlorinated VOCs in soil, groundwater, and soil vapor at concentrations above applicable cleanup levels.

The Site is underlain by Vashon Till (hereafter referred to as glacial till) to approximately 30 feet below ground surface (bgs), Vashon Advance Outwash (hereafter referred to as Advance Outwash) sands from approximately 30 to 60 feet bgs, and Olympia Bed Interglacial Deposits and Undifferentiated Glacial and Interglacial Deposits from approximately 60 feet bgs to the lowermost boring depth of 146 feet bgs.

The uppermost water-bearing unit is in the advance outwash sand, with depth to water of about 45 feet bgs. Groundwater in this unit is likely recharged from south of the Site, including from Wright Park, and from on-Site sources such as leaky storm or sanitary sewer lines. Groundwater in the outwash sand migrates generally northward, but also discharges downward through a semi-confining layer. Monitoring of wells constructed along Tacoma Avenue indicates the outwash sand is dry on the downgradient (north) side of the Site; groundwater is instead encountered in deeper glacial and interglacial sands at depths below about 110 feet bgs. Groundwater in the deeper units, which is recharged in part from downward migration from the outwash sands at the Site, likely migrates towards Commencement Bay, which is approximately 1,500 feet northeast of the Site and approximately 250 feet below the Site elevation.

PCE has been released from historical dry cleaning operations and PCE, trichloroethylene (TCE), cis-1,2-dichloroethylene (cDCE), and vinyl chloride have been identified in vadose zone and saturated soil, groundwater, and soil vapor beneath the dry cleaning building. The PCE plume is essentially a vertical plume that extends beneath the building to the Advance Outwash sands, with some lateral spreading of the plume in the Advance Outwash.

1.3 Selected Remediation Approach

Aspect prepared a Focused Feasibility Study (FFS; Aspect, 2013) to identify and evaluate cleanup alternatives for the Site. The preferred alternative includes the following:

- Engineering controls for soil vapor intrusion (VI);
- SVE beneath the building and adjoining pedestrian alley;
- Biostimulation to enhance degradation of contaminants in groundwater in the upper water-bearing zone;
- Monitored natural attenuation (MNA) of residual groundwater contamination; and
- Environmental covenant to maintain engineering controls, to restrict access to contaminated soil, and to restrict groundwater use.

1.4 Preliminary Construction and Pilot Testing

The Interim Cleanup Action Construction and Design Report (Aspect, 2014) describes the initial construction and pilot testing activities that were performed between October 2013 and January 2014. The SVE and biostimulation wells were constructed between October 11 and 22, 2013. The wells were constructed in limited access areas, including beneath the dry cleaning building, and are placed to provide the most practicable coverage to address accessible contamination. Similarly, an SVE trench was constructed in the 5-foot-wide alley on the north side of the dry cleaners between December 3 and 17, 2013, and is planned for source removal and soil VI control in the normally occupied building space that is potentially impacted by PCE contamination. SVE pilot tests were performed for the SVE trench and SVE wells from January 20 to 22, 2014. The Site monitoring and biostimulation wells were sampled between December 12, 2013 and January 9, 2014 and the samples were submitted for analysis of the chemicals of concern (COCs) and MNA parameters. The latest soil and groundwater sampling results for the Site are provided in the Interim Cleanup Action Construction and Design Report (Aspect, 2014) and are not included in this report.

1.5 Report Organization

The remaining sections of this Interim Cleanup Action Construction Completion Report include the following:

- **Section 2** describes the biostimulation objectives, biostimulation well network, regulatory authorization, completed actions, and monitoring plan.
- **Section 3** describes the SVE objectives, collection system, equipment and process and instrumentation detail, regulatory authorization, construction, start-up testing, operations schedule, and monitoring plan.
- **Section 4** describes the planned reporting.

2 Biostimulation Activity

This section describes the remediation objectives, the biostimulation cleanup action performed for the PCE-contaminated, groundwater-bearing unit on June 23 and 24, 2014, and the monitoring plan.

2.1 Remediation Objectives for Biostimulation

Biostimulation was performed to enhance the bioattenuation of chlorinated VOCs in the Advance Outwash and reduce the concentrations of PCE and TCE through reductive dechlorination reactions. The biostimulants provide a controlled release of available carbon for up to 3 years to enhance the growth of natural anaerobic bacteria and to maintain a viable microbial population for the *in situ* treatment of the COCs.

Biostimulants were pumped into all of the impacted wells in the Advance Outwash to optimize *in situ* treatment, including vertical wells MW-2 and MW-8, angled wells MW-15 to MW-18, and vertical wells MW-19 to MW-21. No monitoring wells were used to evaluate the distribution of amendments or zones of treatment. Although initial treatment may be localized, treatment will improve the groundwater conditions for bioattenuation through natural groundwater advection and dispersion though the treatment areas.

Several treatment wells will be sampled semi-annually for VOCs and natural attenuation parameters to evaluate the effect, persistence, and recovery of biostimulation. Additional rounds of biostimulation may be warranted to maintain conditions suitable for treatment of PCE and TCE in the Advance Outwash. Details of the monitoring plan are provided below.

2.2 Biostimulation Wells

The nine biostimulation wells include MW-2, MW-8, and MW-15 to MW-21. These wells were installed as monitoring wells and biostimulation wells, and they are placed in locations that allow biostimulants to be dispersed within the PCE-impacted area of the Advance Outwash water-bearing unit that exists between 45 and 60 feet bgs. The well locations are shown in Figure 2 and the boring and well construction logs are provided in Appendix A. The wells are screened in the Advance Outwash at depths between 41 and 65 feet bgs.

The rationale for selected injection wells and biostimulation objectives are described below:

- Biostimulants were injected into MW-19 and MW-20 on the south side of the Morrell's Dry Cleaners building to inhibit the upgradient migration of contamination and to optimize the reducing conditions in groundwater that naturally migrates beneath the building. PCE was detected at concentrations of 62 and 140 µg/L in MW-19 to MW-20, respectively, in December 2013 and January 2014 (Aspect, 2014).
- Biostimulants were injected into angled wells MW-16 to MW-18, which are staggered across the east-west centerline of the building, to provide areal coverage of the biostimulants beneath the building. MW-16 to MW-18 are

screened across the upgradient boundary of the highest source of contamination, as detected by the Gore Sorber survey in February 2010 (Aspect, 2011). PCE was detected at concentrations ranging from 170 to 490 µg/L in MW-16 to MW-18 in December 2013 (Aspect, 2014).

- Biostimulants were injected into angled well MW-15, which is screened beneath the middle of the alley and beneath the higher soil sources of PCE detected by the Gore Sorber survey (Aspect, 2011). Biostimulation in MW-15 will treat contamination that migrates from the dry cleaning building and extends beneath the adjoining commercial building. PCE was detected at a concentration of 480 µg/L in MW-15 in December 2013 (Aspect, 2014).
- Biostimulants were injected in well MW-2, which is located about 15 feet east of the front entrance of the Morrell's Dry Cleaners building. MW-2 is located east of wells MW-16 to MW-18 and encountered the highest concentrations of COCs on the Site. The concentration of PCE was 1,600 µg/L in December 2013 (Aspect, 2014).
- Biostimulants were injected in well MW-21 and existing well MW-8, which are located approximately 15 and 45 feet east of the alley, respectively, and adjacent to the commercial buildings on the north side of the Site. PCE was detected at concentrations of 500 and 940 µg/L in MW-21 and MW-8, respectively, in December 2013 (Aspect, 2014).

2.3 Underground Injection Authorization

The biostimulation wells were registered with the Underground Injection Control (UIC) Program with Ecology in accordance with WAC 173-218-070. Ecology assigned UIC Site No. 32555 on June 10, 2014 and stated that the biostimulation wells are rule authorized and do not need a permit to operate. The Ecology authorization letter is provided in Appendix B.

2.4 Biostimulation Action

Biostimulants were pumped into the biostimulation wells on June 23 and 24, 2014.

2.4.1 Reagents

The biostimulation reagents include 3-D Microemulsion® (3DMe®) and HRC Primer®, which are engineered products sold by Regenesis. 3DMe® is a blend of lactate, polylactate esters, and free fatty acids and fatty acid esters that were diluted at the Site and injected as a high-volume emulsion. 3DMe® provides variable release rates of electron donors to biostimulate the groundwater for periods of up to 3 years. 3DMe® is slightly viscous and forms colloidal suspensions at concentrations above 300 mg/L. 3DMe® has hydrophilic and lipophilic properties that allow it to bind organic contaminants and be mobile in groundwater. HRC Primer® is a mixture of lactic acid and glycerol, which is provides a short-term release, typically 2 to 3 weeks, of lactic acid to jump start bioactivity and reduce the iron and sulfate in groundwater. HRC Primer® was added to the 3DMe® emulsion to quickly improve the reducing conditions for the reductive dechlorination of chlorinated VOCs.

The nine injection wells were each dosed with 400 pounds of 3DMe® Factory Emulsified (one 50 gallon drum) and 30 pounds of HRC Primer® (one 3.7 gallon bucket). Two batches were prepared in a 275-gallon tote for each injection well by adding about 50 percent of the 3DMe® Factory Emulsified product from the drum and about 50 percent of the HRC Primer® product from the bucket, and then diluting with potable water and mixing.

2.4.2 Injection

Two batches of biostimulant emulsion were injected into each injection well. Table 2-1 summarizes the injection volume, rate, and pressure for each injection batch. The pressure was restricted to 12 pounds per square inch gauge (psig) at the surface to maintain an injection pressure below the estimated fracture pressure of 0.73 psi per foot. The injection rates ranged from 12 to 20 gallons per minute (gpm) and were not constrained by pressure in MW-15 to MW-21, which were constructed with 0.020-inch slotted screen and 10- to 20-mesh sand pack. The flow rates were less than 4 gpm and the injection pressures were higher in former monitoring wells MW-2 and MW-8, which were constructed with 0.010-inch slotted screen. After injection of the second biostimulant batch, 25 gallons of water were injected into MW-15 to MW-21 and 15 gallons of water were injected into MW-2 and MW-8 in order to flush residual biostimulant through the well screens.

2.5 Monitoring Plan

This section describes the monitoring plan in the Interim Cleanup Action Construction and Design Report (Aspect, 2014) and describes the next scheduled sampling events.

2.5.1 Monitoring Objectives

Sampling will be performed to verify the effectiveness of biostimulation, to evaluate the resilience of treatment and recovery of pre-treatment groundwater conditions, and to assess whether additional biostimulation is warranted to reduce the concentrations of PCE and TCE in the Advance Outwash at the Site.

2.5.2 Monitoring and Compliance Wells

Biostimulants were injected into all of the impacted wells in the Advance Outwash to optimize enhanced attenuation. No monitoring wells exist to evaluate the areal distribution of treatment. The following injection wells will be sampled to evaluate the effectiveness and resilience of treatment:

- MW-2 has the highest concentrations of PCE, TCE, cDCE, and vinyl chloride. MW-2 will be sampled to evaluate the degree of PCE and TCE reduction and cDCE and vinyl chloride accumulation.
- Upgradient wells MW-19 and MW-20 will be monitored to evaluate whether PCE and TCE concentrations are reduced to less than the Method A CULs and to assess the recovery of groundwater, which should recover relatively quickly because of migration of non-treated groundwater through the treatment zone.
- Downgradient perimeter wells MW-15, MW-21, and MW-8 will be monitored to assess reduction of PCE and TCE and to assess whether additional biostimulation is warranted.

Wells MW-8D and MW-12D to MW-14D are screened in the Olympia Bed Interglacial Deposits, below the Advance Outwash, and are not anticipated to be impacted by biostimulation. These wells will be monitored to confirm COC concentrations in the deeper water-bearing zone do not increase to above applicable cleanup levels.

2.5.3 Sampling Parameters

The effectiveness of treatment is most readily assessed by measuring the concentrations of chlorinated VOC parent and daughter products and the concentrations of competing electron acceptors. VOCs will be analyzed by Method 8260C, which will include the chlorinated VOC COCs. Competing electron acceptors include dissolved oxygen (DO), nitrate, sulfate, and ferric iron. DO, oxygen reduction potential (ORP), and pH will be measured in the field with a YSI meter and flow through cell. Nitrate, nitrite, and sulfate will be analyzed by Method 300.0 or equivalent. Total iron (Fe) will be analyzed by Method 200.8, and ferrous iron will be analyzed in the field using the Hach Method IR-18C colorimetric test kit. The interim cleanup action does not include the sampling of available carbon and or any biological sampling.

The sampling parameters for wells MW-8D and MW-12D to MW-14D include the proposed COCs and DO, ORP, and pH.

2.5.4 Sampling Frequency

The Advance Outwash wells will be sampled semi-annually for the first 2 years and annually for the third year. The next round of sampling is scheduled for January 2015. Wells MW-8D and MW-12D to MW-14D (completed in the deeper Olympia Bed deposits) will be sampled annually for the first 3 years, and the next round of sampling is scheduled for July 2015. The sampling schedule will be modified after 3 years based on the monitoring outcomes.

3 SVE System Completion

This section describes the remediation objectives, the SVE system, the construction and start-up testing, the operations performance, and the monitoring plan. Continuous SVE operations began on October 15, 2014.

3.1 Remediation Objectives for SVE

SVE is being performed to remove the readily accessible PCE contamination from beneath the sub-slab, glacial till, and Advance Outwash and to inhibit PCE contamination from migrating into the normally occupied buildings on the Site. Source removal is a short-term objective, whereas sub-slab depressurization is a long-term objective.

SVE is being performed continuously to remove the readily accessible contamination in the initial remediation phase. SVE will be performed continuously until diminishing returns are observed.

SVE operations are anticipated to be intermittent in the subsequent remediation phase. The concentrations of PCE in soil vapor would be anticipated to increase (rebound) beneath the building in the absence of active SVE operation as soil vapor diffuses from lower permeable soil and accumulates in more permeable soil. SVE may be performed intermittently to remove the soil vapor and accumulated contamination from beneath the buildings. The frequency and duration of SVE operation will be dependent on the diffusion rate of PCE into the more permeable soil. The SVE blower will likely be operated for short-term intervals several times a week during non-business hours during the subsequent remediation phase.

3.2 SVE Collection System

The SVE collection system consists of an SVE trench between the dry cleaning building and adjacent building, a sub-slab suction pit (VE-SS) within the dry cleaning building, two angled SVE wells in the glacial till (VE-1 and VE-2) beneath the dry cleaning building, and two angled SVE wells in the Advance Outwash (VE-3 and VE-4) beneath the dry cleaning building. These SVE segments provide areal coverage of source contamination and provide the most practicable SVE collection system for the Site. Figure 2 shows the locations of the SVE trench, sub-slab suction pit VE-SS, and SVE wells VE-1 to VE-4 and Appendix A contains the SVE well construction and boring logs.

3.2.1 SVE Trench

The SVE trench (VE-H) is a 48-foot long, 4-foot deep trench located in the 5-foot-wide alley between the Morrell's Dry Cleaners building and the Tully's Coffee building. The SVE trench contains a 4-inch-diameter Schedule 80 PVC pipe with a 0.020-inch slotted screen; the top of pipe is about 3 feet bgs. The 1.5-foot-wide trench is backfilled with pea gravel from 1.5 to 4 feet bgs and is capped with an impervious HDPE liner and hydrated bentonite seal. The HDPE liner is keyed into the pea gravel to a depth of 2.25 feet bgs. Figures 3 and 4 show the trench details.

The SVE trench intersects more-permeable soil near the middle of the trench, where PCE contamination appears to accumulate. The depressurization radius of influence of the

SVE trench extends beneath the Morrell's Dry Cleaners building; however, the operation of the SVE trench alone does not provide the recommended depressurization of 0.005 inches of water column (IWC) beneath the entire building for sub-slab depressurization.

3.2.2 Sub-Slab Suction Pit

Sub-slab suction pit VE-SS (VE-SS) was constructed on November 12 and 13, 2014 after the startup of the SVE system. VE-SS will provide a means of depressurizing beneath the entire concrete slab of the 3,600-square-foot dry cleaning building and expedite the removal of accessible contamination beneath the dry cleaning building. VE-SS is located in the corner of an access area near former and planned dry cleaning equipment.

VE-SS was constructed by coring a 4-inch-diameter hole through the concrete slab and vacuum extracting about 1.5 cubic feet of gravel soil beneath the slab. A temporary blower was used to perform a pilot test for suction pit. The pilot test measured the air flow rates and vacuum pressures beneath the building in VP-4 (Morrell's Dry Cleaners) and VP-7 (Stadium Thriftway storage space) and a temporary vapor probe in the southeast corner of the Stadium Thriftway storage space. This pilot test showed that a single radon mitigation fan could depressurize beneath the building and that the SVE blower did not have the capacity to extract soil vapor from more than one suction pit. Based on this conclusion, a 4-inch-diameter Schedule 40 PVC pipe was installed in the suction pit and sealed at the floor, and the pipe was extended about 10 feet above the slab and then extended laterally through the sidewall of the building where it was connected to the SVE manifold near the inlet of the vapor-liquid separator. The 4-inch-diameter PVC riser was equipped with a manometer and notification labels for the operation of the sub-slab depressurization system.

The concrete slab was constructed on top of 6 to 12 inches of gravel bedding. The lateral depressurization radius of influence extends beneath the entire building, but likely does not extend beyond the footings of the building because of the low permeability glacial till beneath the gravel bedding. Previous soil vapor sampling with Gore Sorbers indicate that higher concentrations of chlorinated VOCs are present beneath the slab (Aspect, 2011). Although the static concentrations are higher than in the alley where the SVE trench was constructed, the extracted concentrations are roughly equivalent to the SVE trench because the SVE system has a relatively large radius of influence and presumptively pulls ambient air through the foundation leakage pathways, which dilutes the concentration of VOCs in the extracted air from VE-SS.

The regenerative blower for the SVE system can extract about 100 standard cubic feet per minute (SCFM) of soil vapor from both the SVE trench and VE-SS; however, the blower can only extract about 115 SCFM of air at the operating pressures for the trench and suction pit. This means that the SVE trench and VE-SS cannot be operated concurrently to their fullest potential, and sequencing of operations is recommended. VE-SS was temporarily connected to the SVE system to reduce the concentrations of VOCs so that a radon mitigation fan can subsequently be installed and operated without pollution control.

3.2.3 Glacial Till SVE Wells

Glacial till SVE wells VE-1 and VE-2 were advanced from the east side of the Morrell's Dry Cleaners building at 45-degree vertical angles oriented perpendicular to the building.

The SVE well screens are completed in the glacial till from 18 to 32 feet bgs, the well screens extend 3 to 17 feet laterally beneath the building, and the well screens are parallel and about 7 feet apart from each other along their entire length. The glacial till wells may partially penetrate the top of the Advance Outwash, which was encountered between 30 and 34 feet bgs in MW-14D, MW-19, and MW-21 near the corners of the building. The SVE depressurization radius of influence is limited in the glacial till. During the SVE pilot test (Aspect, 2014), higher vacuum pressures were observed in Advance Outwash SVE wells VE-3 and VE-4 than in glacial till SVE well VE-2, which may indicate that VE-1 and VE-2 may partially penetrate the Advance Outwash. SVE is inherently limited by the low permeability of the glacial till, and the application of relatively high vacuum rates compared with the other segments is not warranted.

3.2.4 Advance Outwash SVE Wells

Advance Outwash SVE wells VE-3 and VE-4 were advanced from the east side of the Morrell's Dry Cleaners building and angle drilled beneath the building at vertical angles of 45 and 40 degrees. Although the wells are perpendicular to the building and parallel to each other, the wells screens are staggered horizontally in the Advance Outwash and extend between 10 and 30 feet laterally beneath the building, at depths ranging from 30 to 45 feet bgs in the Advance Outwash. During the SVE pilot test, the pressure response in the Advance Outwash wells indicates that the depressurization radius of influence is significantly more than 10 feet from the well screen (Aspect, 2014).

3.2.5 Completion and Construction Details from SVE Trench to SVE Wells

The construction details for the SVE trench and the SVE wells are provided in the Interim Cleanup Action Construction and Design Report (Aspect, 2014). This section summarizes the completion and construction details for the SVE conveyance pipes from the SVE trench to the SVE wells.

Completion Details

The two conveyance pipes above the SVE trench were capped on the east side of the alley during construction in December 2013. The conveyance pipes extend 26 feet laterally over the SVE trench and are sloped towards the SVE wells with measured slopes of 0.9 percent with no sag points.

The conveyance pipes were extended to the SVE wells between June 9 and 16, 2014. The trench extends up to 17 feet east-northeast of the SVE trench and then about 20 feet south-southwest to the east side of the SVE wells. The inside conveyance pipe, which surfaces on the east side in the alley, is connected to glacial till wells VE-1 and VE-2, which are manifolded below grade with no control valves to isolate the two wells. The outside conveyance pipe, which surfaces on the west side of the alley (middle vertical pipe), is connected to Advance Outwash wells VE-3 and VE-4. VE-3 and VE-4 are manifolded below grade with no control valves to isolate the two wells. The minimum measured slope of the conveyance pipes from the SVE trench to the SVE wells is 2.1 percent.

Construction Details

Aspect requested a contained-out determination from Ecology on March 31, 2014 for the disposal of soils excavated from the trench. Borings DP-09, DP-13, and DP-14 were

previously sampled for the RI (Aspect, 2011) and Data Gaps Investigation (Aspect, 2012) on the northeast side of building and 4 soil samples were collected between 3 and 7 feet bgs. PCE was detected at a concentration of 0.13 milligrams/kilogram (mg/kg) in the 6-foot bgs interval of DP-09, but was not detected in the 3-foot bgs interval. No contamination was detected in the 7-foot bgs intervals of DP-13 and DP-14. Ecology provided the contained-out determination for the trench soil on April 17, 2014, which is provided in Appendix C.

The trench was hand-dug next to the natural gas lines. The top of the natural gas line that extends across the alley was encountered 20 inches below grade and the top of the main natural gas line that extends east-northeast along the easement was encountered 26 inches below grade. The trench was excavated to the top of the natural gas lines and was graded to the SVE wells to provide a minimum 2.1 percent slope for the SVE conveyance lines to the SVE wells. The soil was screened in the field with a photo-ionization detector (PID), and there were no indications of contamination, and no soil samples were collected for laboratory analysis. Additional soil was excavated to about 6 inches deep to replace the concrete sidewalk and to replace portions of the concrete with an asphalt parking surface. The additional clean soil was added to the roll-off container with the trench waste and a second roll-off container was used. A total of 26.75 tons of soil was transported to Waste Management's Columbia Ridge Subtitle D landfill in Arlington, Oregon for disposal as Subtitle D waste. The waste manifests are provided in Appendix C.

The monuments for MW-15 and MW-21 were reset during construction. MW-21 is a vertical well and is currently located on the sidewalk, whereas MW-15 is an angled well and is currently located in the asphalt parking lot. SVE wells VE-1 to VE-4 were covered by the asphalt parking lot without monuments; however, survey nails were placed in the asphalt surface to identify the locations of the wellheads.

3.2.6 Piping Detail between SVE Equipment and Collection System

SVE trench VE-H, sub-slab suction pit VE-SS, glacial tills wells VE-1/VE-2, and Advance Outwash wells VE-3/VE-4 are connected to a 4-inch-diameter manifold pipe. Ball valves are installed to control the vacuum pressure and air flow from each segment. Additionally, each segment has a vapor sampling valve and a threaded connection where an anemometer can be inserted to measure the air flow rate in the pipe. The piping was completed during system installation on September 2, 2014, and the VE-SS piping was subsequently completed on November 13, 2014.

3.3 SVE Equipment

The SVE system includes a blower, vapor-liquid separator, water transfer pump and wastewater drum, and two vapor-phase granular activated carbon (GAC) drums. The equipment was constructed on modular skids, which were placed in the alley west of the access door to the Morrell's Dry Cleaners building. The SVE equipment was ordered on May 30, 2014 and installed at the Site on September 2, 2014. Appendix D provides the process and instrumentation detail (P&ID), the process control narrative, the equipment list, and the blower performance curve and Appendix E provides photographic documentation for the SVE system.

3.3.1 Blower

The blower is a 2-horsepower (HP) Roton EN505, single-phase regenerative blower. This blower is rated to draw 80 SCFM at 47 IWC and 110 SCFM at 30 IWC. The maximum vacuum is about 65 IWC and the maximum flow rate is 150 SCFM. The 2-HP blower draws about 3 kilowatts (KW) and uses about 2,100 kilowatt-hours (KWH) per month when operating continuously.

The blower is installed on a 34-inch by 46-inch skid that is positioned on the west side of the alley. The blower has a noise rating of 78 decibels (dBA), and is placed in a sound enclosure with passive vent louvers and a high temperature activated ventilation fan. The blower is equipped with inlet and discharge silencers that reduce noise levels to less than 75 dBA at a 5-foot distance from the equipment.

3.3.2 Vapor-Liquid Separator and Transfer Pump

The vapor-liquid separator and transfer pump are installed on a separate 34-inch by 48-inch skid located east of the blower skid. Water is collected in a 55-gallon, vapor-liquid separator under vacuum pressure. The vapor-liquid separator is equipped with a 0.75-HP single-phase pump that automatically discharges water from the vacuum container into a second container at atmospheric pressure. The transfer pump discharges water from the high-level switch to the low-level switch, but does not operate when the high-level switch is engaged in the second container. The vapor-liquid separator has a high-shutoff switch that shuts down the blower and sends an email notification that indicates that the SVE system needs service.

Minimal wastewater is generated by SVE operations. Although the groundwater table is about 45 feet bgs, the blower can extract soil moisture and perched water and can desiccate the soil in the unsaturated zone. Continuous SVE operations generated less than 50 gallons of water during the first 2 months of operation. Water generation is minimized by drawing soil vapor from the SVE trench or VE-SS, which reduces the vacuum pressure to the SVE wells.

3.3.3 Vapor Emissions Control

The VOC emissions are treated with GAC prior to discharge to the atmosphere. Two 55-gallon, vapor-phase GAC drums are connected in series, and vapor-phase sampling ports are installed before the first drum and after both drums. The drums contain about 165 pounds of GAC. The emissions from the second GAC drum are discharged through a stack that is about 13 feet above ground level. A rain cap is installed at the top of the stack to prevent water from entering the stack. The GAC drums have a flow capacity of 150 SCFM.

3.3.4 Process and Instrumentation Detail

The SVE manufacturer's P&ID is provided in Appendix D.

3.4 Permits and Waste Management

3.4.1 Air Emissions

The Puget Sound Clean Air Agency (PSCAA) is the local air authority with primacy for regulation of air emissions at the Site. As described in Section of 6.03(94) of Regulation I of the PSCAA, soil and groundwater remediation systems are exempt from submitting a

Notice of Construction and needing an Order of Approval from the PSCAA when air emission releases less than 15 pounds per year (lbs/year) of benzene or vinyl chloride, less than 500 lbs/year of PCE, and less than 1,000 lbs/year of toxic air contaminants. The emission limits will not be exceeded after vapor treatment, and sampling and calculations will be performed and documented to verify that emission limits are not exceeded.

Once the SVE removes sufficient contamination from beneath the sub-slab, VE-SS may be disconnected from the SVE system and connected to a radon fan on the roof of the building to provide continuous depressurization beneath entire building. The total emissions from the SVE and sub-slab depressurization system should be less than 500 lbs/year of PCE.

3.4.2 Wastewater

Condensate from the SVE pilot test will be placed in a 55-gallon drum and full drums will be staged in the alley pending appropriate disposal. Appropriate disposal is anticipated to be either off-site disposal as F001-listed waste within 90 days of generation or discharge to the sanitary sewer under authorization from the City of Tacoma wastewater authority.

3.4.3 Spent Carbon

Air sampling will be performed to assess when contamination breaks through the first GAC vessel. When breakthrough is observed, the spent GAC will be removed from the vessel and placed in a 55-gallon drum for off-site disposal or off-site regeneration, as appropriate. The GAC will be replaced in the vessel, and the new GAC will be placed as the second GAC vessel in series.

3.5 SVE Construction, Testing, and Start Up

The SVE system was installed in the alley on September 2, 2014 and mechanical connections were completed. The electrical panel was installed on September 3, 2014 and the electrical connections were permitted on September 30, 2014 with a dedicated power meter and service account. The equipment manufacturer conducted start-up testing on October 9, 2014 to verify system operations and control.

Aspect collected baseline sub-slab vapor samples from VP-4 (Morrell's Dry Cleaners building) and VP-7 (Stadium Thriftway storage space) on October 15, 2014, prior to start-up of the system. Table 3-1 shows the sub-slab vapor sample results. The baseline vapor sample from VP-4 (Morrell's Dry Cleaners building) contained 680,000 $\mu g/m^3$ of PCE (above 96 $\mu g/m^3$ Method B screening level), 5,100 $\mu g/m^3$ of TCE (above 3.7 $\mu g/m^3$ Method B screening level), 1,300 $\mu g/m^3$ of benzene (above 3.21 $\mu g/m^3$ Method B screening level), and 4,600 $\mu g/m^3$ of xylenes (above 457 $\mu g/m^3$ Method B screening level). The baseline vapor sample from VP-7 (Stadium Thriftway storage space) contained 140 $\mu g/m^3$ of PCE (above 96 $\mu g/m^3$ Method B screening level) and 3,200 $\mu g/m^3$ of TCE (above 3.7 $\mu g/m^3$ Method B screening level).

Continuous SVE system began on October 15, 2014.

3.6 SVE Operations and Performance

The SVE system is operated pursuant to the SVE objectives described above. Periodic Site visits are performed to measure the mass emissions and system parameters, to adjust the valve positions as necessary to optimize mass recovery, to service the equipment, and to manage wastewater.

Aspect conducted Site visits on the day of and the day after system start-up, then conducted weekly Site visits through November 20, 2014, and then bi-weekly Site visits thereafter. Table 3-2 summarizes the vacuum pressure, air flow, and concentration measurements from October 15, 2014 to November 20, 2014. The SVE system removed an estimated 82.5 pounds of PCE during the first 36 days of operation, or 2.3 pounds per day (lbs/day), as described below.

The mass emissions are calculated from each segment of the SVE system and into and out of the GAC drums. The mass emission rates are expressed in pounds per day at ideal conditions. The mass emissions into the first GAC drum express the treatment rate for the SVE system because the flow and concentration measurements are the most accurate. Although emission rates are calculated for each SVE segment, the flow and concentration measurements for individual segments are subject to more error. The flow rates for the SVE segments are measured with an anemometer that measures flow in feet per minute, whereas the combined flow rate into the GAC drum is more accurately measured with a pitot tube. The concentrations are measured with a PID. Since the collection system is under vacuum pressure, the peristaltic pump is used to extract vapor and pump it to the PID meter. The moist air created erroneously high readings from the glacial till wells on October 29 and November 6, 2014. The mass emissions from the SVE segments are used to tune the system to maximum mass recovery, minimize water generation, and satisfy sub-slab depressurization requirements.

Table 3-3 summarizes the concentrations of VOC emitted into and out of the first carbon drum during start up on October 15, 2014. As described in the Construction and Design Report (Aspect, 2014), contamination exists primarily as PCE in the shallow soil near the SVE trench, and the relative concentrations of biodegradation daughter products increase with depth, where TCE and DCE were extracted from the glacial till and TCE, DCE, and vinyl chloride were extracted from the Advance Outwash. The SVE system pulls a disproportionate amount of soil vapor from the shallow soil, and greater than 99 percent of the chlorinated solvents in the extracted vapor existed as PCE on October 15, 2014. For this reason, the mass concentration of PCE is calculated from the PID measurements. Vapor extracted by the SVE system initially included tetrahydrofuran, an ingredient in PVC primer used during construction of the system. The PID is more responsive to tetrahydrofuran than to PCE, which means the initial mass removal of PCE was overestimated.

Table 3-4 shows the measured vacuum pressures during the SVE pilot test and during continuous SVE operations from October 15 to November 20, 2014. The sub-slab suction pit (VE-SS) provides better sub-slab depressurization, but the SVE trench (VE-H) provides better protection for the adjoining buildings. The glacial till and Advance Outwash wells provide higher mass recovery rates than the shallow VE-H and VE-SS,

but some dilution from VE-H or VE-SS is needed to reduce the vacuum pressure and to minimize the generation of water.

Aspect plans to cycle the SVE collection system segments during bi-weekly Site visits to meet dual mass removal and depressurization objectives.

3.7 SVE Monitoring Plan

Aspect will periodically assess the performance of the SVE system and confirm compliance with the emission limits. The frequency of Site visits and monitoring are subject to change after the cessation of continuous SVE operations.

3.7.1 Performance Monitoring

Monitoring will be performed to estimate the mass removal rate, to optimize the performance of SVE from the collection system, and to assess the diminishing effectiveness of removal with continued operations. The following measurements will be recorded from the monitoring events:

- Vacuum pressure and the concentrations of VOCs from the wellheads to the four segments (i.e., SVE trench, sub-slab suction pit, glacial till wells, and Advance Outwash wells);
- Vacuum pressure, temperature, flow rate, and concentration from the manifolded line between the vapor liquid separator and the blower;
- Pressure and temperature from the effluent line from the blower; and
- Influent and effluent concentrations from the two vapor phase GAC drums

The concentrations of VOCs will be measured with a PID. The PCE mass removal rate will be calculated from the flow rate, PID measurement, vacuum pressure, and temperature; and will assume that all contamination exists as PCE. Table 3-2 will be maintained to calculate the PCE mass removal rate, to estimate the mass of PCE removed since the previous Site visit, and to calculate the total mass of PCE removed to date. The frequency of Site visits and performance monitoring will be dependent on observations, system performance, and wastewater accumulation.

Sub-slab vapor pressure will be measured in VP-4 and VP-7 to assess the depressurization beneath the slab and measurements will be recorded in Table 3-4. Additionally, the concentrations of VOCs will be measured in sub-slab vapor probes on a quarterly basis to monitor the effectiveness of SVE. Two weeks prior to sub-slab sampling, the soil vapor will be allowed to equilibrate without the operation of VE-SS and with the flow from VE-H minimized.

Concurrent with the compliance monitoring, quarterly air samples will be collected in a Summa canister from the sample port on the influent line to the first GAC drum and submitted for analysis of VOCs by Method TO-15.

3.7.2 Compliance Monitoring

Concurrent with performance monitoring, effluent air samples will be collected from the effluent of the first and second vapor phase GAC drum and measured for VOCs using a

PID. The total mass of VOCs emitted will be calculated using a molecular weight for PCE. Quarterly effluent samples from the second GAC vessel will be collected in a Summa canister and submitted for analysis of VOCs by Method TO-15. The total mass of PCE, TCE, DCE, and vinyl chloride will be estimated to confirm compliance with the PSCAA air emission limits described in Section 3.4.1.

4 Planned Reports

SVE and MNA system status reports will be prepared semi-annually the first year and annually thereafter. The first status report will describe the initial effectiveness of SVE operations, and will provide estimates of mass removal, diminishing returns, and modified operation, as warranted, and will describe the effects of biostimulation six months after injection. The first status report will report the groundwater sampling scheduled for January 2015 and SVE operations through February or March 2015. The remaining system status reports will describe SVE operations, the attenuation of enhanced biostimulation, and the performance of VI controls and MNA. The system status reports will recommend subsequent active and passive cleanup actions, and an opinion from Ecology will be requested as warranted.

References

Aspect Consulting, LLC (Aspect), 2011, Remedial Investigation Report, Morrell's Dry Cleaners, Prepared for: David Shaw, Successor to Walker Chevrolet, February 18, 2011.

Aspect Consulting, LLC (Aspect), 2012, Data Gaps Investigation, Former Walker Chevrolet and Morrell's Dry Cleaners, VCP Site SW1039, May 1, 2012.

Aspect Consulting, LLC (Aspect), 2013, Focused Feasibility Study, Morrell's Dry Cleaners, Prepared for: David Shaw, Successor to Walker Chevrolet, March 26, 2013.

Aspect Consulting, LLC (Aspect), 2014, Interim Cleanup Action Construction and Design Report, Morrell's Dry Cleaners, Prepared for: David Shaw, Successor to Walker Chevrolet, May 16, 2014.

Washington State Department of Ecology (Ecology), 2011, Opinion Letter on Independent Cleanup of the Morrell's Dry Cleaning Facility (Site), VCP Project No. SW1039, September 26.

Limitations

Work for this project was performed for the David Shaw, Successor to Walker Chevrolet (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

TABLES

Table 2-1 - Biostimulation Injection Volumes, Flows, and Pressures

Project #080190 - Morrell's Dry Cleaners, Former Walker Chevrolet Property, Tacoma, Washington

Well	Batch	Start Time	Injection Volume (gallons)	Injection Rate (gpm)	Injection Pressure (psig at surface)
MW-21	1	6/23/14 9:00 AM	275	17	5
MW-21	2	6/23/14 9:35 AM	275	15.5	5
MW-15	1	6/23/14 10:12 AM	275	14.5	3
MW-15	2	6/23/14 10:53 AM	275	16	3
MW-16	1	6/23/14 12:03 PM	275	16	3
MW-16	2	6/23/14 1:24 PM	275	20	3.5
MW-8	1	6/23/14 3:23 PM	275	3	10
MW-19	1	6/24/14 7:21 AM	275	17	<2
MW-19	2	6/24/14 7:21 AM	275	14	6
MW-20	1	6/24/14 8:18 AM	275	19	<2
MW-20	2	6/24/14 8:45 AM	275	19	<2
MW-8	2	6/24/14 9:42 AM	250	1.2	12
MW-17	1	6/24/14 12:42 PM	275	18	<2
MW-17	2	6/24/14 1:07 PM	275	19	<2
MW-2	1	6/24/14 1:44 PM	250	4	12
MW-2	2	6/24/14 3:12 PM	250	2.5	12
MW-18	1	6/24/14 4:38 PM	275	12	3
MW-18	2	6/24/14 5:08 PM	275	16	5

Notes:

All batches contain 200 pounds of 3DMe® Factory Emulsified and 15 pounds of HRC Primer®

gpm = gallons per minute

psig = pounds per square inch, gauge

Table 3-1 - Sub-Slab Vapor Sample Results

Project #080190 - Morrell's Dry Cleaners, Former Walker Chevrolet Property, Tacoma, Washington

Parameter				VP-1	VP-2	VP-3	VP-4	VP-7
Sample Date				2/9/2012	2/9/2012	2/9/2012	10/15/2014	10/15/2014
Location	Air Method B Non-Cancer Screening Level ($\mu g/m^3$)	Air Method B Cancer Screening Level ($\mu g/m^3$)	Subslab Method B Screening Level ($\mu g/m^3$)	Alley (west side SVE trench on west side of Morrell's restrooms)	Alley (middle of SVE trench on east side of Morrell's access door to alley)	Alley (east side of SVE trench adjacent to gas meters)	Morrell's Dry Cleaners (middle of lease space near highest detected concentrations detected by Gore Sorber survey in February 2010)	Stadium Thriftway storage lease space (middle of lease space)
PCE ($\mu g/m^3$)	18.3	9.62	96.2	**270**	**150,000**	**380**	**680,000**	**140**
TCE ($\mu g/m^3$)	0.914	0.37	3.7	1.1	**<230**	1.9	**5,100**	**3,200**
cDCE ($\mu g/m^3$)	—	—	—	<0.72	<170	<1.2	<880	8.6
tDCE ($\mu g/m^3$)	27.4	—	274	<0.72	<170	<1.2	**<880**	<6.9
1,1-DCE ($\mu g/m^3$)	91.4	—	914	NR	NR	NR	<880	<6.9
Vinyl chloride ($\mu g/m^3$)	45.7	0.28	2.8	<0.47	**<110**	<0.78	**<560**	**<4.5**
Benzene ($\mu g/m^3$)	13.7	0.321	3.21	<0.58	**<140**	<0.97	**1,300**	**<5.6**
Toluene ($\mu g/m^3$)	2290	—	22,900	1.9	<160	6.0	2,600	<6.6
Ethylbenzene ($\mu g/m^3$)	457	—	4,570	<0.79	<180	1.8	1,700	<7.6
Xylenes, total ($\mu g/m^3$)	45.7	—	457	4.1	<360	9.3	**4,600**	<15.2

Notes:

Bold and shaded values indicate screening level exceedances.

All values are in units of $\mu g/m^3$ unless stated otherwise.

— Indicates that no standard exists.

NR - Not reported

Subslab Method B Screening Level is calculated by dividing the more stringent Air Method B Screening Level by a vapor attenuation factor of 0.1, in accordance with "Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action" (Ecology, October 2009).

Significant dates:

1. SVE trench constructed in alley between December 3 and 17, 2013. SVE trench was constructed through VP-1 to VP-3.
2. Continuous SVE operations initiated on October 15, 2014. Pressure radius of influence reliably extends to VP-4, but has limited influence to VP-7.

Table 3-2 - Soil Vapor Extraction Measurements and Calculations

Project #080190 - Morrell's Dry Cleaners, Former Walker Chevrolet Property, Tacoma, Washington

SVE Component	Time	SVE Blower Clock (hours)	Elapsed Run Time (days)	Anemometer Velocity (ft/min)	Pitot Tube Differential Pressure (IWC)	Flow Rate (SCFM)	Vacuum Pressure at Blower (IWC)	Vacuum Pressure at Wellhead (IWC)	Positive Pressure at Sample Point (IWC)	VOC (ppmV, PID) (Measured)	VOC (ppmV, PID) (Standard)	PCE (ppm, TO-15)	TCE (ppm, TO-15)	cis-1,2-DCE (ppm, TO-15)	Vinyl chloride (ppm, TO-15)	Tetra-hydro-furan (ppm, TO-15)	Inlet Temp (F)	Outlet Temp (F)	PCE Mass Removal Rate (lbs/hr)	PCE Mass Removal Rate (lbs/day)	Cumulative Mass of PCE Removed (lbs)
SVE	10/15/14	4.5	0.0	0		0.0	0	0	0	0	0						60		0.000	0.00	
Trench	10/15/14	7	0.1	1,180		95.2	18.5	4	0	202	196						60		0.483	11.60	1.2
	10/16/14	26	0.9	1,250		100.9	19	4	0	124	120						60		0.314	7.55	7.2
	10/22/14	173	7.0	1,330		107.5	19	5	0	27	26						59		0.073	1.75	17.9
	10/29/14	345	14.2	1,530		123.7	19	5	0	51	49						59		0.158	3.80	45.1
	11/6/14	534	22.1	1,400		113.6	20	5	0	115	111						57		0.328	7.86	107.0
	11/13/14	699	28.9	1,190		98.3	20	5	0	21	20						48		0.052	1.24	115.5
	11/13/14	700	29.0	0		0.0			0		0						48		0.000	0.00	115.5
	11/20/14	868	36.0	0		0.0	20	0	0	0	0						58		0.000	0.00	115.5
VE-SS	11/13/14	700	29.0	1,160		95.9											48		0.000	0.00	
	11/20/14	868	36.0	1,130		102.0	1.5	5	0	22	21						58		0.056	1.35	9.5
VE-1/VE-2	10/15/14	4.5	0.0	0		0.0	0	0	0	0	0						60		0.000	0.00	
Glacial Till	10/15/14	7	0.1	270		21.8	18.5	4	0	280	271						60		0.153	3.68	0.4
	10/16/14	26	0.9	260		21.0	19	4	0	205	199						60		0.108	2.59	2.4
	10/22/14	173	7.0	260		21.0	19	4	0	193	187						59		0.102	2.45	17.4
	10/29/14	345	14.2	270		21.8	19	5	0	400	387	PID measured 1,162 ppmV, 400 ppmV recorded					59		0.219	5.25	55.1
	11/6/14	534	22.1	330		26.8	20	5	0	400	385	PID measured 11,420 ppmV, 400 ppmV recorded					57		0.269	6.45	105.8
	11/13/14	699	28.9	260		21.5	20	4.5	0	460	435						48		0.248	5.95	146.8
	11/13/14	700	29.0	40		3.3					0						48		0.000	0.00	146.8
	11/20/14	868	36.0	30		2.4	2	0		265	256						58		0.016	0.39	149.5
VE-3/VE-4	10/15/14	4.5	0.0	0		0.0	0	0	0	0	0						60		0.000	0.00	
Advance	10/15/14	7	0.1	300		24.2	18.5	4	0	191	185						60		0.116	2.79	0.3
Outwash	10/16/14	26	0.9	260		21.0	19	3	0	221	214						60		0.117	2.80	2.5
	10/22/14	173	7.0	280		22.6	19	4	0	98	95						59		0.056	1.34	10.7
	10/29/14	345	14.2	280		22.6	19	4	0	130	126						59		0.074	1.78	23.4
	11/6/14	534	22.1	290		23.5	20	5	0	394	379						57		0.232	5.58	67.4
	11/13/14	699	28.9	290		24.0	20	4	0	168	159						48		0.101	2.43	84.1
	11/13/14	700	29.0	40		3.3					0						48		0.000	0.00	84.1
	11/20/14	868	36.0	60		4.9	1.5	0		167	161						58		0.021	0.49	87.5
Total Inlet	10/15/14	4.5	0.0			0.0														0.00	0.0
(Summed)	10/15/14	7	0.1			141.2														18.07	1.9
	10/16/14	26	0.9			142.8														12.94	12.1
	10/22/14	173	7.0			151.1														5.53	46.0
	10/29/14	345	14.2			168.1														10.82	123.6
	11/6/14	534	22.1			163.9														19.89	280.2
	11/13/14	699	28.9			143.7														9.62	346.3
	11/13/14	700	29.0			102.5														0.00	346.3
	11/20/14	868	36.0			109.3														2.24	362.0

Table 3-2 - Soil Vapor Extraction Measurements and Calculations

Project #080190 - Morrell's Dry Cleaners, Former Walker Chevrolet Property, Tacoma, Washington

SVE Component	Time	SVE Blower Clock (hours)	Elapsed Run Time (days)	Anemometer Velocity (ft/min)	Pitot Tube Differential Pressure (IWC)	Flow Rate (SCFM)	Vacuum Pressure at Blower (IWC)	Vacuum Pressure at Wellhead (IWC)	Positive Pressure at Sample Point (IWC)	VOC (ppmV, PID) (Measured)	VOC (ppmV, PID) (Standard)	PCE (ppm, TO-15)	TCE (ppm, TO-15)	cis-1,2-DCE (ppm, TO-15)	Vinyl chloride (ppm, TO-15)	Tetra-hydro-furan (ppm, TO-15)	Inlet Temp (F)	Outlet Temp (F)	PCE Mass Removal Rate (lbs/hr)	PCE Mass Removal Rate (lbs/day)	Cumulative Mass of PCE Removed (lbs)
GAC	10/15/14	4.5	0.0														60				
Inlet	10/15/14	7	0.1		2.1	115.7		6	16	267	281	120	0.36	0.36	<0.32	0.56	60	103	0.755	18.13	1.9
	10/16/14	26	0.9		2.1	115.7		6	16	139	145						60	98	0.393	9.44	9.4
	10/22/14	173	7.0		2.1	115.6		6	15	34	35						59	99	0.096	2.31	23.5
	10/29/14	345	14.2		2.1	115.6		6	15	32	33						59	98	0.091	2.18	39.1
	11/6/14	534	22.1		2.1	115.4		6	15	40	42						57	98	0.113	2.71	60.5
	11/13/14	699	28.9		2.1	114.4		6	15	23	24						48	94	0.064	1.55	71.1
	11/13/14	700	29.0		2.1	113.9		3			0						48	94	0.000	0.00	71.1
	11/20/14	868	36.0		2.1	115.0		3	16	24	25						58	98	0.068	1.62	82.5
GAC	10/15/14	4.5	0.0														60				
Mid Point	10/15/14	7	0.1		2.1	115.7		6	7	1	1	<1.2	<1.2	<1.2	<1.2	<1.2	60	103	0.003	0.07	0.0
	10/16/14	26	0.9		2.1	115.7		6	6	0	0						60	98	0.000	0.00	0.0
	10/22/14	173	7.0		2.1	115.6		6	5	0	0						59	99	0.000	0.00	0.0
	10/29/14	345	14.2		2.1	115.6		6	15	0	0						59	98	0.000	0.00	0.0
	11/6/14	534	22.1		2.1	115.4		6	5	2	2						57	98	0.006	0.14	1.1
	11/13/14	699	28.9		2.1	114.4		6	5	0	0						48	94	0.000	0.00	1.1
	11/13/14	700	29.0		2.1	113.9		3	4		0						48	94	0.000	0.00	1.1
	11/20/14	868	36.0		2.1	115.0		3	4	3	3						58	98	0.009	0.21	2.6
GAC	10/15/14	4.5	0.0														60				
Discharge	10/15/14	7	0.1		2.1	115.7		6	0	0	0						60	103	0.000	0.00	0.0
	10/16/14	26	0.9		2.1	115.7		6	0	0	0						60	98	0.000	0.00	0.0
	10/22/14	173	7.0		2.1	115.6		6	0	0	0						59	99	0.000	0.00	0.0
	10/29/14	345	14.2		2.1	115.6		6	0	0	0						59	98	0.000	0.00	0.0
	11/6/14	534	22.1		2.1	115.4		6	0	2	2						57	98	0.006	0.14	1.1
	11/13/14	699	28.9		2.1	114.4		6	0	0	0						48	94	0.000	0.00	1.1
	11/13/14	700	29.0		2.1	113.9		3	0		0						48	94	0.000	0.00	1.1
	11/20/14	868	36.0		2.1	115.0		3	0	0	0						58	98	0.000	0.00	1.1

Notes:
Flow rates are measured with an anemometer for the SVE trench, VE-1/VE-2, VE-3/VE-4, and VE-Subslab segments, whereas flow rate for the blower is measured using a pitot tube.

F = Fahrenheit
ft = feet
hr = hour
lbs = pounds
min = minute
DCE = dichloroethylene
PCE = tetrachloroethylene
TCE - trichloroethylene
VOC = volatile organic compound
ACFM = actual cubic feet per minute
SCFM = standard cubic feet per minute
SVE = soil vapor extraction
GAC = granular activated carbon
IWC = inches of water column
PID = photoionization detector
ppmV = parts per million by volume

Table 3-3 - Soil Vapor Extraction Remediation Air Emission Sample Results

Project #080190 - Morrell's Dry Cleaners, Former Walker Chevrolet Property, Tacoma, Washington

Pilot Test Segment	Inlet to First GAC Vessel		Outlet to First GAC Vessel	
Sample ID	INF-101514		EFF-101514	
Time	10/15/14 3:40 PM		10/15/14 3:45 PM	
Elapsed Time (days)	0.10		0.11	
Sample vacuum, field (in-Hg)	-7		-6	
Sample vacuum, lab (in-Hg)	-6.7		-5.1	
	ppmV	µg/m^3	ppmV	µg/m^3
PCE	120	800,000	<0.0012	<8.2
TCE	0.36	2,000	<0.0012	<6.5
cis-1,2-DCE	0.36	1,500	<0.0012	<4.8
trans-1,2-DCE	<0.32	<1,300	<0.0012	<4.8
1,1-DCE	<0.32	<1,300	<0.0012	<4.8
Vinyl chloride	<0.32	<820	<0.0012	<2.7
Acetone[1]	<1.3	<3,000	0.015	36
Tetrahydofuran[1]	0.56	1,600	<0.0012	<3.6

Notes:
in-Hg = inches of mercury
DCE = dichloroethylene
µg/m^3 = micrograms per cubic meter
PCE = tetrachloroethylene
ppmV = parts per million by volume
TCE = trichloroethylene

1. Acetone and tetrahydrofuran are ingredients in PVC primer, which was used to clean the PVC fittings prior to gluing the connections. The presence of acetone and tetrahydrofuran is a short-term artifact of construction. Since the photoionization detector (PID) detected tetrahydrofuran, the PID readings are disproportionately higher than the concentrations of PCE measured by Method TO-15.

Table 3-4 - Soil Vapor Extraction Sub-Slab Depressurization Measurements

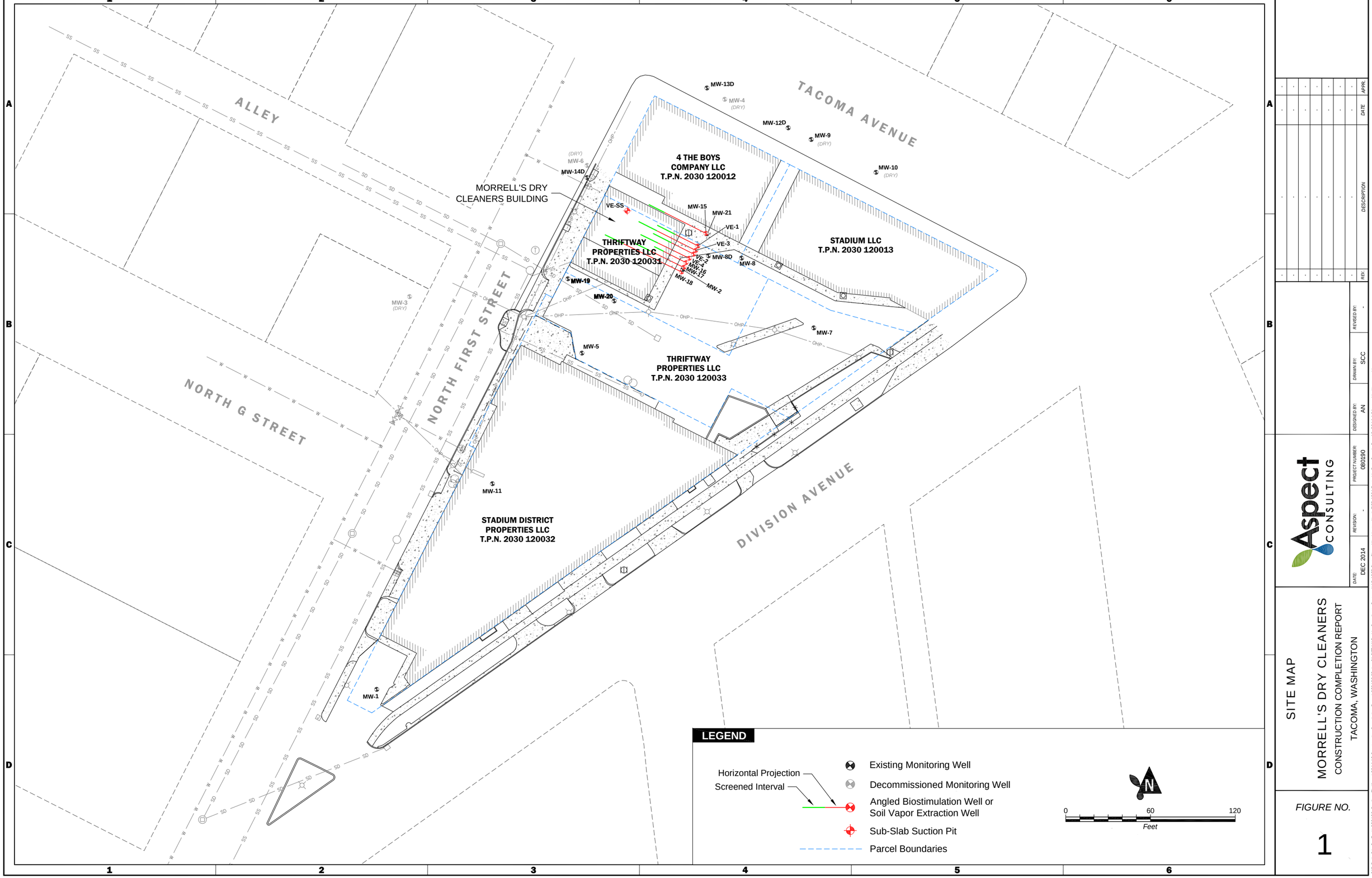
Project #080190 - Morrell's Dry Cleaners, Former Walker Chevrolet Property, Tacoma, Washington

Pilot Test Data (January 21, 2014) (1-hp regenerative blower)								
Elapsed Time (minutes)	**VP-1 (IWC)**	**VP-3 (IWC)**	**VP-4 (IWC)**	**VP-5 (IWC)**	**VP-7 (IWC)**	**VP-6 (IWC)**	**VP-2 (IWC)**	**VP-8 (IWC)**
Distance from Trench (ft)	1.75	9	22.5	35	57.4	57.4	12.5	57.9
Pilot Test (0 min)	0	0	0	0	0	0	0.002	0
Pilot Test (15 min)	-0.058	-0.024	-0.014	-0.01	-0.001	-0.003	-0.003	-0.003
Pilot Test (45 min)	-0.058	-0.025	-0.015	-0.011	0	0	-0.004	-0.001
Pilot Test (75 min)	-0.056	-0.024	-0.014	-0.01	0	0	-0.002	0.001
Pilot Test (105 min)	-0.05	-0.02	-0.011	-0.008	0	-0.002	-0.001	-0.003
Pilot Test (135 min)	-0.054	-0.023	-0.014	-0.01	0	0.002	-0.002	0.001
Pilot Test (165 min)	-0.056	-0.024	-0.014	-0.01	0	-0.001	-0.004	-0.001
Pilot Test (195 min)	-0.055	-0.024	-0.014	-0.01	0	-0.001	-0.003	-0.001
Pilot Test (225 min)	-0.053	-0.024	-0.013	-0.01	0	0	-0.004	-0.003

Continuous SVE Operations Data (2-hp regenerative blower)			
Date	**VP-4 (IWC)**	**VP-7 (IWC)**	**Comments**
Location	Morrell's Dry Cleaners	Stadium Thriftway Storage Room	
Distance from Trench (ft)	22.5	57.4	
10/15/2014	-0.03	-0.005	VE-H, VE-1/2, and VE-3/4 were fully open
10/16/2014	-0.024	0	VE-H, VE-1/2, and VE-3/4 were fully open
10/22/2014	-0.028	-0.001	VE-H, VE-1/2, and VE-3/4 were fully open
10/29/2014	-0.022	0	VE-H, VE-1/2, and VE-3/4 were fully open
11/5/2014	-0.015	0	VE-H, VE-1/2, and VE-3/4 were fully open
11/13/2014	-0.015	-0.001	VE-H, VE-1/2, and VE-3/4 were fully open
11/13/2014	-0.441	-0.021	VE-SS, VE-1/2, and VE-3/4 fully open, VE-H turned off
11/20/2014	-0.5	-0.025	VE-SS, VE-1/2, and VE-3/4 fully open, VE-H turned off

Notes:
Recommended minimum vacuum for sub-slab depressurization = 0.005 IWC
IWC = inches of water column
SVE = soil vapor extraction

FIGURES



DESCRIPTION	DATE	APPR.

DRAWN BY: SCC
REVISED BY: -
DESIGNED BY: AN
PROJECT NUMBER: 080190
REVISION: -
DATE: DEC 2014

Aspect CONSULTING

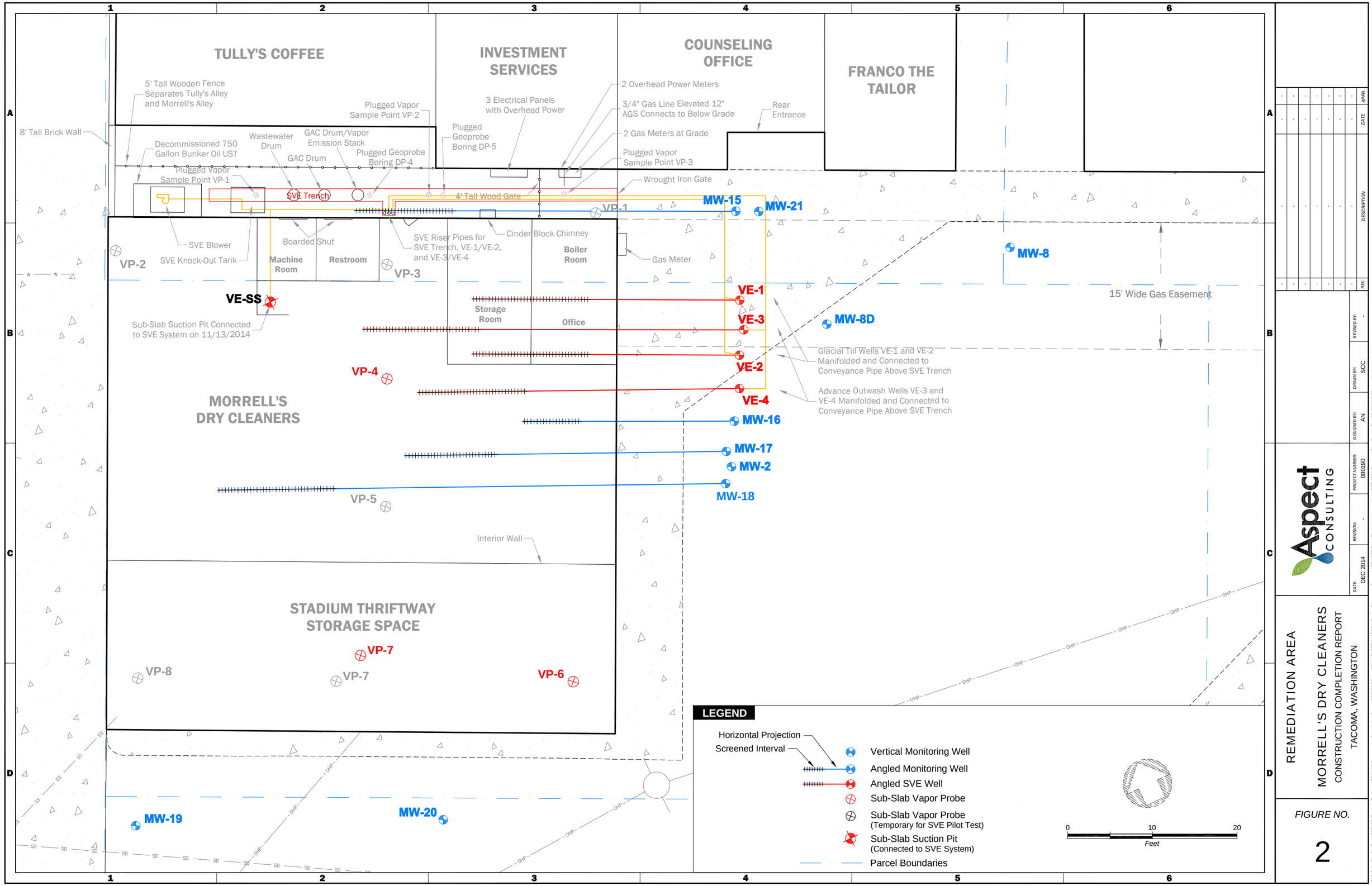
SITE MAP

MORRELL'S DRY CLEANERS
CONSTRUCTION COMPLETION REPORT
TACOMA, WASHINGTON

FIGURE NO.

1

CAD Path: G:_GeoTech\080190 Stadium Thriftway\2014-12 Construction Completion Report\080190-02.dwg 01-SITE MAP || Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet || Date Saved: Dec 10, 2014 1:21pm || User: scudd



Aspect CONSULTING

REMEDIATION AREA

MORRELL'S DRY CLEANERS

CONSTRUCTION COMPLETION REPORT

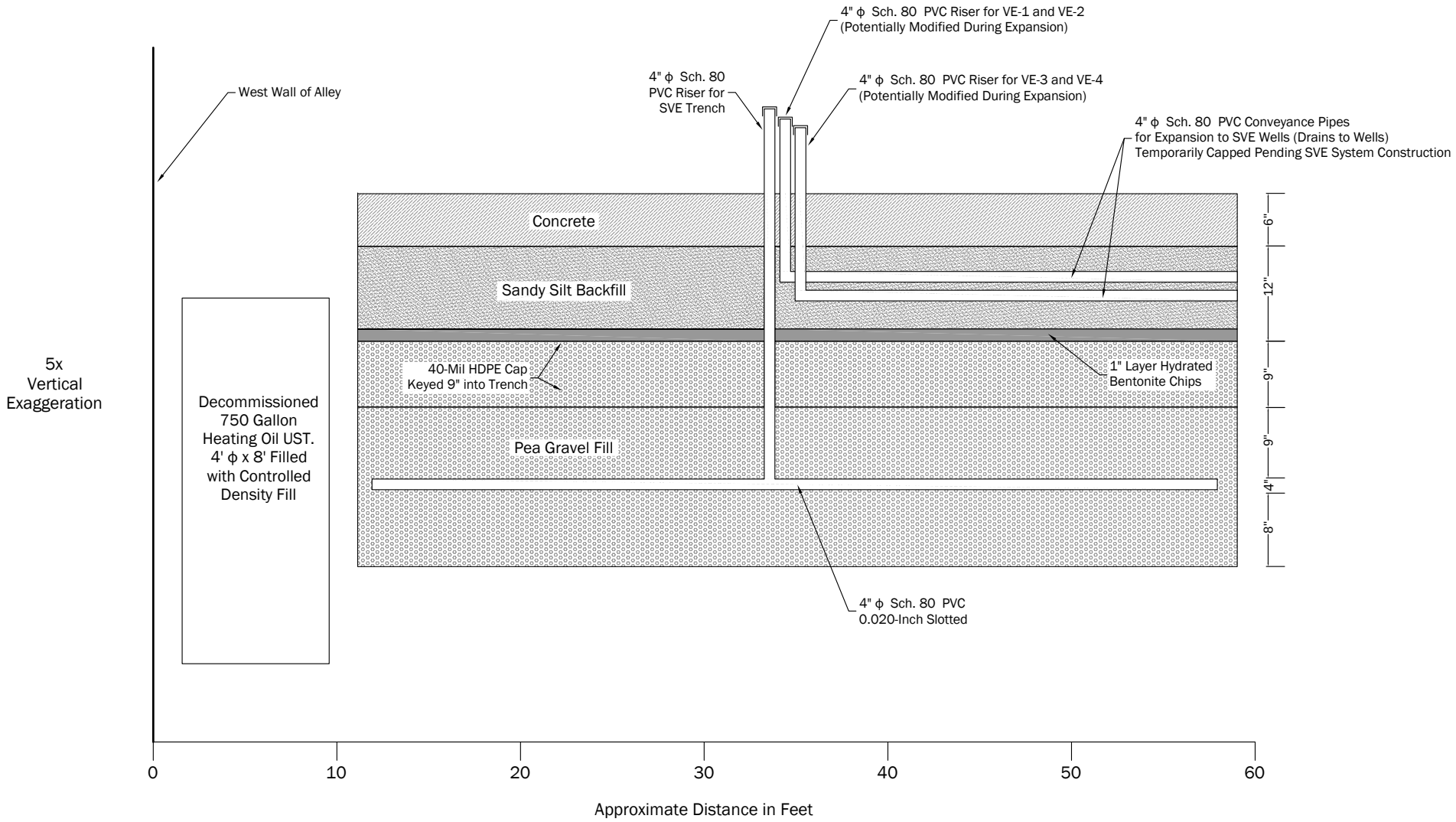
TACOMA, WASHINGTON

FIGURE NO.

2

DESIGNED BY: AN | DRAWN BY: SCC | REVISED BY: - | DATE: DEC 2014 | REVISION: - | PROJECT NUMBER: 080190

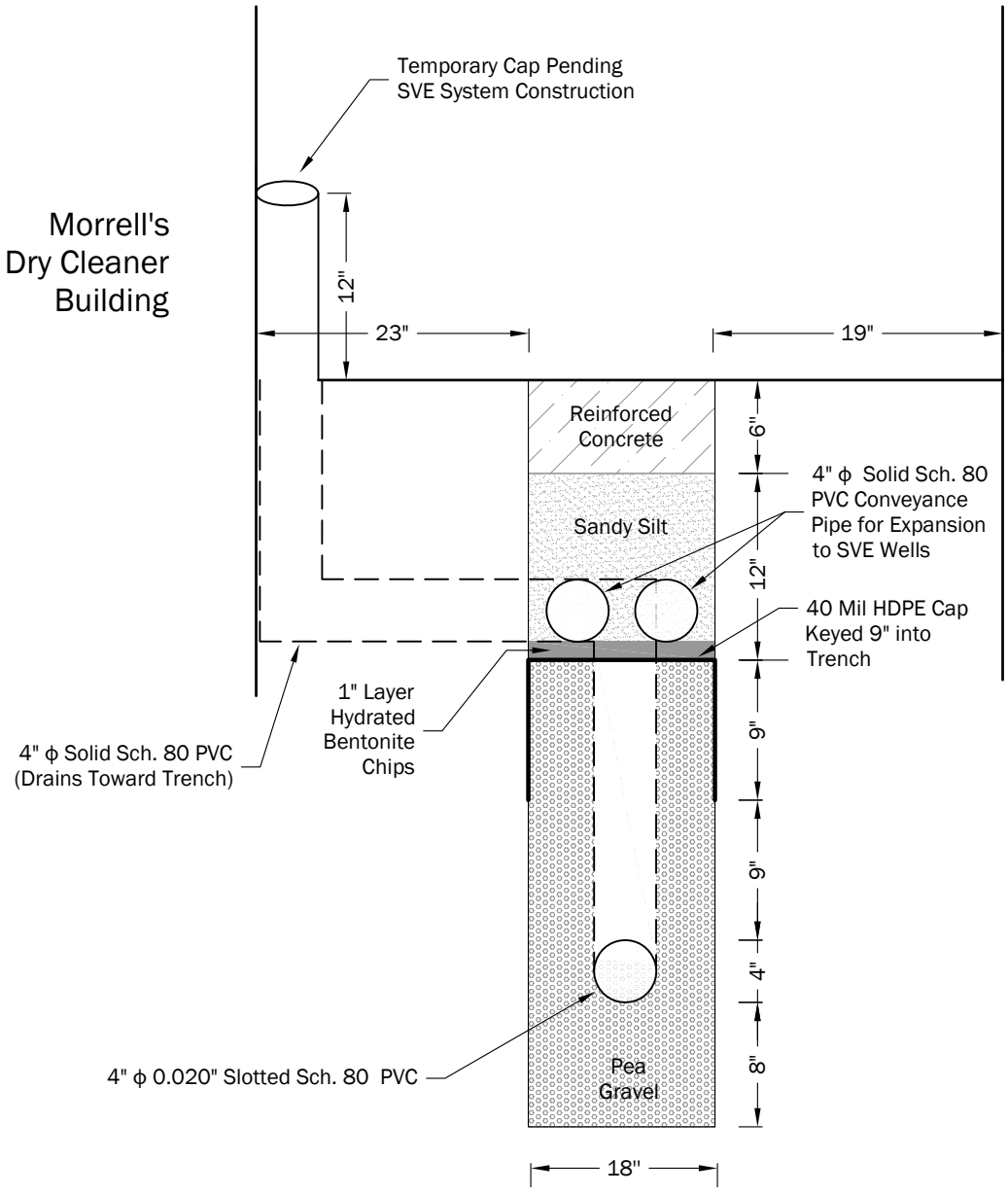
CAD Path: Q:_GeoTech\080190 Stadium Thriftway\2014-12 Construction Completion Report\080190-003.dwg 02 ALLEY DETAIL 10' SCALE | | Coordinate System: NAD 1983 State Plane Washington North FIPS 4601 Feet | | Date Saved: Dec 17, 2014 9:38am | | User: scudd



SVE Trench Detail in Alley North of Morrell's Dry Cleaners-View to North

Morell's Dry Cleaners Construction Completion Report
Tacoma, Washington

Aspect Consulting	DEC-2014	BY: AN/SCC	FIGURE NO. 3
	PROJECT NO. 080190	REV BY: SCC	



SVE Trench Detail in Alley North of Morrell's Dry Cleaners-View to West

Morell's Dry Cleaners Construction Completion Report
Tacoma, Washington

Aspect Consulting	DEC-2014	BY: AN/SCC	FIGURE NO. 4
	PROJECT NO. 080190	REV BY: SCC	

APPENDIX A

SVE and Monitoring Well Construction and Boring Logs

Holt Drilling A Division of Boart Longyear Company

MW-1

Resource Protection Well Report

Project Name BRUCE TITUS CHEV

Well Identification # ALM-064

Drilling Method SONIC 6"

Driller Ken Phillips

License # 2652

Date 1-22-07

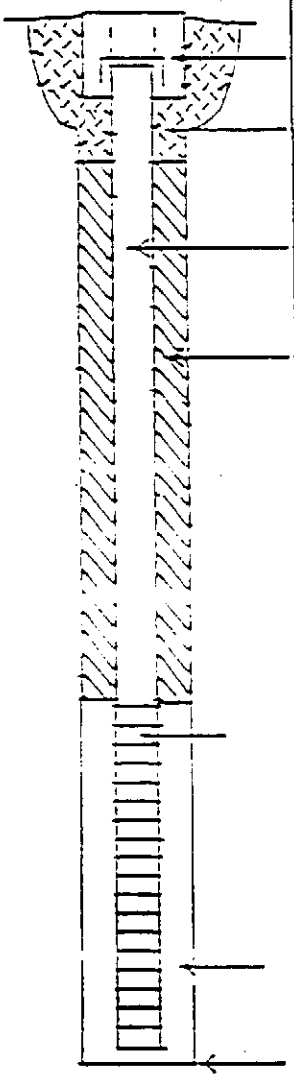
County PIERCE SE 1/4 SE 1/4

Section 32 T 21N R 3E

Street Address 630 STADIUM WY

Start Card R-70639

Consulting Firm STEMEN ENV.



AS-BUILT

WELL DATA

ALM-

MONUMENT: 8" FLUSH

CONCRETE SURFACE SEAL: 2 FT

RISER: 2 "x 60'

BACKFILL: FT

TYPE: 3/8 CHIPS

SCREEN: 2 "x 15'

TYPE: PVC

SLOT SIZE: .020

SAND PACK: 17'

MATERIAL: 10x20 SILICA

WELL DEPTH: 65'

FORMATION DESCRPITION

0-15' FT
BROWN SILTY SAND + GRAVEL FILL 20-30% ~~SAND~~ FINES
FT

15-50' FT
GREY SILTY SAND TO SANDY SILT WITH OCCASSIONAL LARGE GRAVELS VERY DENSE DRY (TILL)
FT

50-65 FT
ORANGE/BROWN SAND MEDIUM DENSE TO DENSE WET @ 54' TURNING GREY IN COLOR @ 60' FT

REMARKS

Signature K L Phillips

Holt Drilling A Division of Boart Longyear Company

MW-2

Resource Protection Well Report

Project Name BRUCE TITUS CHEV

Well Identification # ALM-#69

Drilling Method SONIC 6"

Driller Ken Phillips

License # 2652

Date 1-22-07

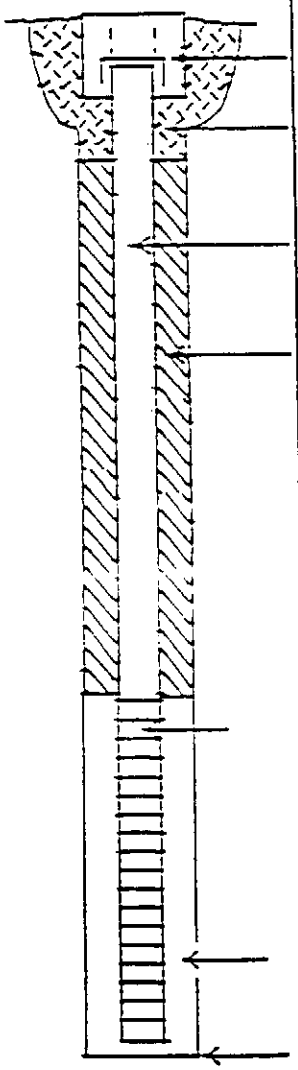
County PIERCE SE 1/4 SE 1/4

Section 32 T 21N R 3E

Street Address 630 STADIUM WY

Start Card R-70639

Consulting Firm STEMEN ENV.



AS-BUILT

WELL DATA

ALM-169

MONUMENT: 8" FLUSH

CONCRETE SURFACE SEAL: 2 FT

RISER: 2 "x 50'

BACKFILL: FT

TYPE: 3/8 CHIPS

SCREEN: 2 "x 15'

TYPE: PVC

SLOT SIZE: .020

SAND PACK: 17'

MATERIAL: 10x20 SILICA

WELL DEPTH: 65'

FORMATION DESCRPITION

0-15' FT
BROWN SILTY SAND + GRAVEL FILL 20-30% ~~SAND~~ FINES
FT

15-50' FT
GREY SILTY SAND TO SANDY SILT WITH OCCASSIONAL LARGE GRAVELS VERY DENSE DRY (TILL)
FT

50-65 FT
ORANGE/BROWN SAND MEDIUM DENSE TO DENSE WET @ 54' TURNING GREY IN COLOR @ 60' FT

REMARKS

Signature K K Phillips

Holt Drilling A Division of Boart Longyear Company

Resource Protection Well Report

MW-3

Project Name BRUCE TITUS CHEV

Well Identification # ALM-068

Drilling Method SONIC 6"

Driller Ken Phillips

License # 2652

Date 2-1-07

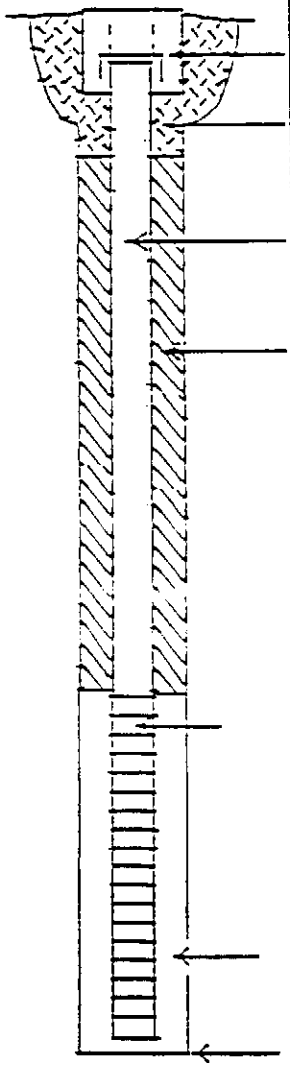
County PIERCE SE 1/4 SE 1/4

Section 32 T 21N R 3E

Street Address 633 DIVISION

Start Card R70639

Consulting Firm STEMEN ENVIORMENTAL

AS-BUILT	WELL DATA	FORMATION DESCRPITION
	MONUMENT: 8" FLUSH CONCRETE SURFACE SEAL: 2 FT RISER: 2 "x 52' BACKFILL: 48 FT TYPE: 3/8" CHIPS SCREEN: 2 "x 15' TYPE: FACTORY FLUSH SLOT SIZE: .020 SAND PACK: 17' MATERIAL: 10x20 SILICA WELL DEPTH: 67'	0-3 FT 2" ASPHALT BROWN COARSE SAND TGRAVEL 20-30% FINES (FILL) FT 3-54 FT GREY TO BROWN SILTY FINE SAND VERY DENSE DRY OCCASIONAL 20-30% FINES (TILL) 54-65 FT MOIST BROWN SAND MEDIUM DENSE 10-15% FINES 65-67' FT GREY VERY DENSE GREY SILTY FINE SAND WITH GRAVELS (TILL) FT REMARKS

Signature

BOART LONGYEAR E & I

MW-4

Resource Protection Well Report

Project Name Stadium Thriftway

Well Identification # BAM 164'

Drilling Method Sonic

Driller Thomas W. Croney

License # 2409

Date 1/9/08

County Pierce, NW¼ SE ¼

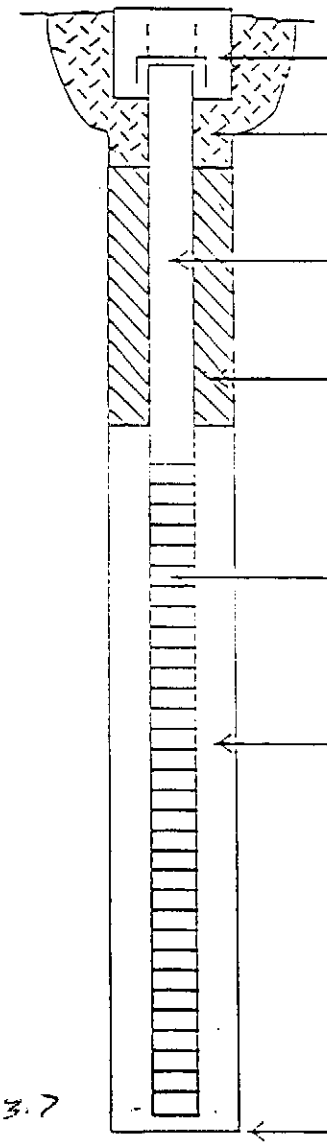
Section 32 T. 21N R. 3E

Street Address N 1st N Tacoma Ave

Start Card R 70843

Consulting Firm Stemen ENV

AS-BUILT | WELL DATA | FORMATION DESCRIPTION



MONUMENT TYPE: flush

CONCRETE SURFACE SEAL: 1-5 ±

PVC BLANK: 2 "48'

39 - neat cement

BACKFILL: 4 feet

TYPE: Bentonite

PVC SCREEN: 2 inch 15 feet

SLOT SIZE: 10

TYPE: flush thread

GRAVEL PACK: 18 ±

MATERIAL: 10 20 silica

WELL DEPTH: 63.7 ft

0 - 52 ±
Med Brn till
V- Dense

52-61 ±
Compact Sand. Lt Brn gravel

61 - 65 ±
compact gray till

REMARKS

Signature Thomas W. Croney

BOART LONGYEAR E & I

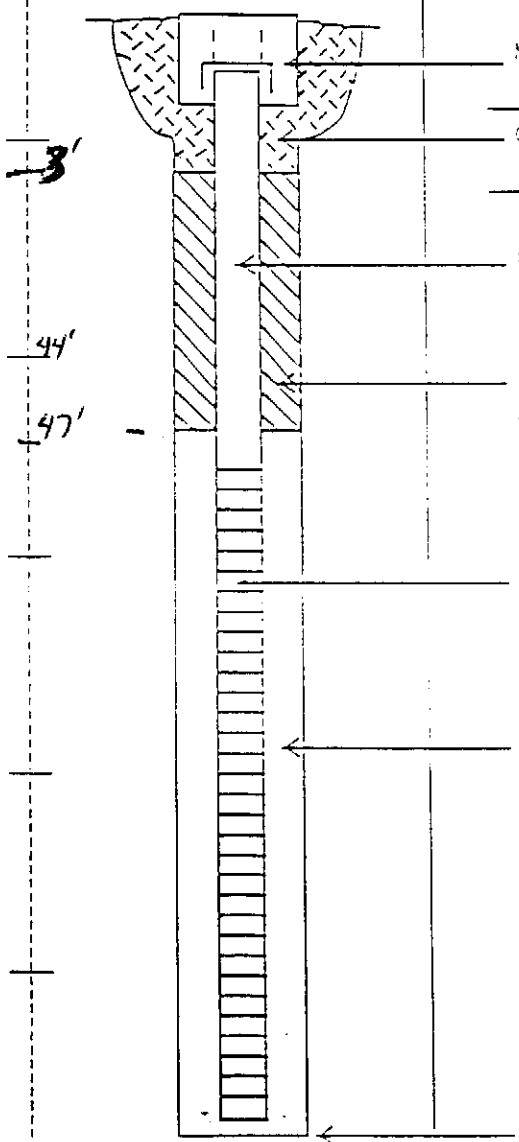
MW-5

Resource Protection Well Report

Project Name Stadium Thriftway
Well Identification # BAM 168'
Drilling Method Sonic
Driller Thomas Craney
License # 2409

Date 1-11-08
County Pierce NW ¼ SE ¼
Section 32 T. 21 N R. 3E
Street Address N. 1st ST & N. Tacoma AVE
Start Card R 70822
Consulting Firm Stemen Env.

AS-BUILT | WELL DATA | FORMATION DESCRIPTION



MONUMENT TYPE: Flush

CONCRETE SURFACE SEAL: 3 ±

PVC BLANK: 2 x 50'

BACKFILL: 44 ±
TYPE: Bentonite

PVC SCREEN: 2 x 15'

SLOT SIZE: 10
TYPE: Flush Thread

GRAVEL PACK: 18 ±
MATERIAL: 10x20 Silica

WELL DEPTH: 65'

0 - 30 ±
med Brn consolidated sand med. gravel

30 - 42 ±
med - dk Brn course sand wet

42 - 57 ±
med Brn Till

57 - 63 ±
med Brn course sand - wet

63 - 65 ±
med Brn Till

REMARKS

Signature Thomas W. Craney

BOART LONGYEAR E & I

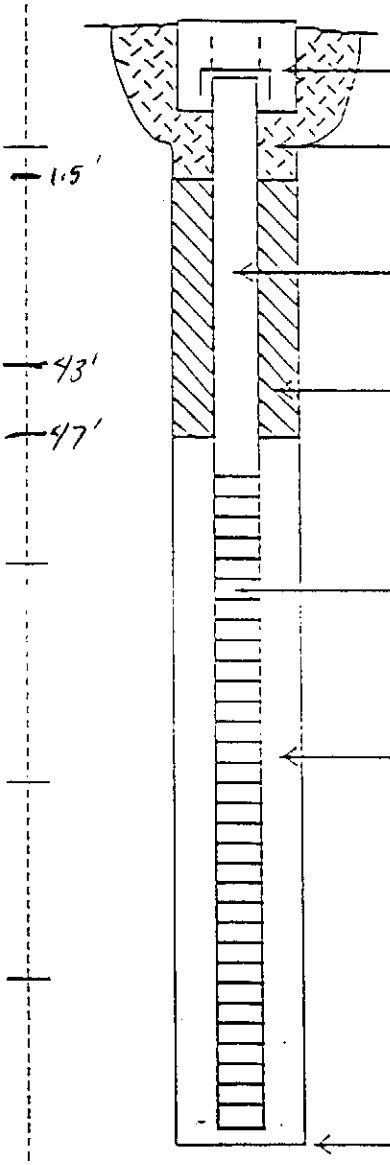
Resource Protection Well Report

MW-6

Project Name Stadium Thriftway
Well Identification # BAM 167
Drilling Method Sonic
Driller Thomas Cooney
License # 2409

Date 1-16-08
County Pierce NW ¼ SE ¼
Section 32 T. 21 N R. 3E
Street Address N 12th & N Tacoma Ave
Start Card R70822
Consulting Firm Stemen Env.

AS-BUILT | WELL DATA | FORMATION DESCRIPTION



MONUMENT TYPE: flush

CONCRETE SURFACE SEAL: 1 ft.

PVC BLANK 2 " x 49'
neat cement 41'

BACKFILL 4 ft.
TYPE: Bentonite

PVC SCREEN: 2 " x 15'
SLOT SIZE: 20
TYPE: Flush Thread

GRAVEL PACK 17 ft.
MATERIAL: 10x20 Silica

WELL DEPTH 64.2 ft.

1.5'
43'
47'

0 - 1 ft.
Asphalt - Road Base

1 - 60 ft.
Compact sand grvl med Brn
V. Dense

60 - 65 ft.
Med - DK Brn sand

REMARKS

Signature Thomas W. Cooney

Holt Drilling A Division of Boart Longyear Company

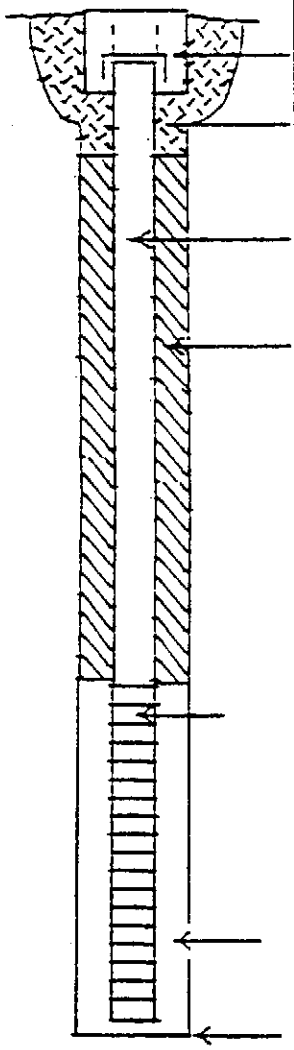
Resource Protection Well Report

MW-7

Project Name STADIUM THRIFTWAY
Well Identification # BAM-111
Drilling Method SONIC 4x6"
Driller Ken Phillips
License # 2652

Date 1.18.08
County PIERCE NW 1/4 SE 1/4
Section 32 T 21N R 3E
Street Address N. 1st St & Tacoma Ave
Start Card R70822
Consulting Firm STEMEN ENVIRONMENTAL

AS-BUILT



WELL DATA

BAM-111

MONUMENT: 8" FLUSH
CONCRETE SURFACE SEAL: 2 FT
RISER: 2 "x 50'
BACKFILL: FT
TYPE: 3/4 CHIPS
SCREEN: 2 "x 15'
TYPE: FACTORY FLUSH
SLOT SIZE: .020
SAND PACK: 18'
MATERIAL: 10x20 SILICA
WELL DEPTH: 65'

FORMATION DESCRPITION

0-1' FT
ASPHALT + BROWN SAND AND GRAVEL ROAD BASE

1-50' FT
BROWN SILTY SAND WITH LARGE GRAVELS VERY DENSE ~~WET~~ MOIST SAND @ 25'
(TILL) FT

50-65 FT
BROWN OXIDIZED SAND MEDIUM WET @ 55'

FT

FT

REMARKS

Signature

MW-8

BOART LONGYEAR

Resource Protection Well Report

Project Name Titus

Well Identification # BA5078

Drilling Method Sonic

Driller Brian Owens

License # 2997

Date 4/17/08

County Pierce NW ¼ SE ¼

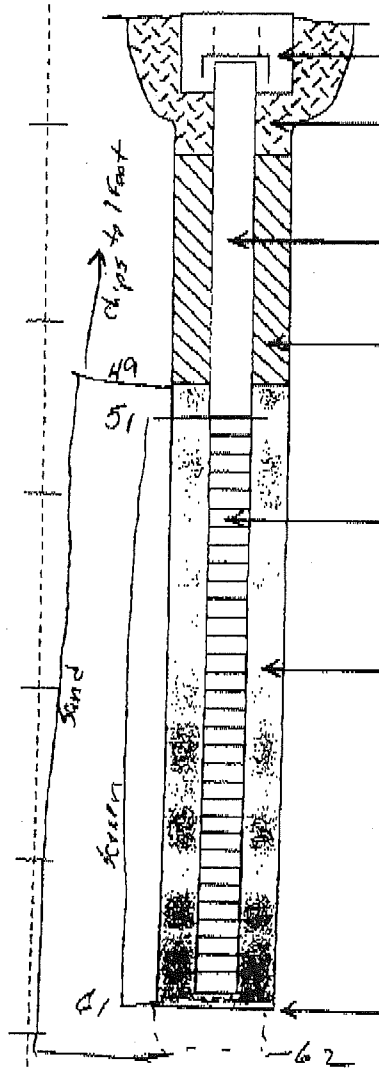
Section 32 T. 21N R. 3E

Street Address N 1st N Tacoma Ave

Start Card R70843

Consulting Firm Stemen

AS-BUILT



WELL DATA

MONUMENT TYPE: flush

CONCRETE SURFACE SEAL: 1 ft.

PVC BLANK 55 "x 2"

BACKFILL 49 ft.

TYPE: 3/4 bentonite chips

PVC SCREEN 10 "x 2"

SLOT SIZE: .10

TYPE: PVC

GRAVEL PACK 49 ft.

MATERIAL: Silica Sand

WELL DEPTH 61'

FORMATION DESCRIPTION

0 - 15 ft.
BROWN SILTY SAND & GRAVELLY FILL

15 - 50 ft.
GREY SILTY SANDS INTERMIXED WITH MEDIUM/LARGE GRAVELS

50 - 60 ft.
RUST/BROWN COLORED SAND MEDIUM DENSE/DENSE, WET AT 54 FT.

60 - 65 ft.
GREY COLORED SANDS MEDIUM DENSE.

REMARKS

Signature Brian Owens

VAV03a.CDR

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-8D	1 of 3

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	273.5
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	273.11
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/11/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/4/2009 - 5/6/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1 – 273	Flushmount monument, lockable thermos cap, concrete seal 0'-1'						Blacktop and concrete.	1
2 – 272							Vacuumed to 3'.	2
3 – 271							Very hard, slightly moist, light brown, slightly sandy, gravelly SILT (ML); fine sand; coarse to fine gravel, subrounded.	3
4 – 270								4
5 – 269								5
6 – 268								6
7 – 267								7
8 – 266								8
9 – 265							Grades to sandy.	9
10 – 264								10
11 – 263	2" diameter, schedule 40 PVC, threaded connections, 0'-96'							11
12 – 262							Very hard, brown, slightly gravelly, silty SAND (SM); fine gravel, rounded.	12
13 – 261								13
14 – 260								14
15 – 259								15
16 – 258								16
17 – 257								17
18 – 256								18
19 – 255								19
20 – 254								20
21 – 253	Hydrated bentonite chips, 1'-92'							21
22 – 252							Gravelly.	22
23 – 251								23
24 – 250								24
25 – 249							Slightly gravelly.	25
26 – 248								26
27 – 247								27
28 – 246								28
29 – 245								29
30 – 244							Hard, brown, slightly gravelly, very sandy SILT (ML); fine gravel, rounded.	30
31 – 243								31
32 – 242								32
33 – 241								33
34 – 240							Hard, brown, slightly gravelly, very silty SAND (SM); fine gravel, rounded.	34
35 – 239								35
36 – 238								36
37 – 237								37
38 – 236							Moist, red-brown, slightly silty SAND (SP); medium sand.	38
39 – 235								39
40 – 234							Trace gravel.	40
41 – 233								41
42 – 232								42
43 – 231								43
44 – 230								44
45 – 229								45
46 – 228								46
47 – 227								47
48 – 226								48
49 – 225								49
224								

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: DFR

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	MW-8D	2 of 3

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	273.5
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	273.11
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/11/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/4/2009 - 5/6/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51 – 223								51
52 – 222								52
53 – 221								53
54 – 220								54
55 – 219	▽ 5/4/2009						Wet.	55
56 – 218								56
57 – 217								57
58 – 216								58
59 – 215								59
60 – 214								60
61 – 213								61
62 – 212								62
63 – 211								63
64 – 210								64
65 – 209							Brown.	65
66 – 208	10/20 sand filter pack, 92'-120'						Very hard, moist, brown, sandy, silty GRAVEL (GM); non-plastic.	66
67 – 207								67
68 – 206								68
69 – 205								69
70 – 204								70
71 – 203								71
72 – 202								72
73 – 201								73
74 – 200							Brown, slightly gravelly, very silty SAND (SM); non-plastic.	74
75 – 199								75
76 – 198								76
77 – 197								77
78 – 196							Dark blue, slightly sandy SILT (ML); trace gravel.	78
79 – 195								79
80 – 194								80
81 – 193								81
82 – 192								82
83 – 191							Dry, gray, silty, very gravelly SAND (SM); fine sand.	83
84 – 190								84
85 – 189								85
86 – 188								86
87 – 187							Trace cobbles, subrounded.	87
88 – 186								88
89 – 185								89
90 – 184								90
91 – 183								91
92 – 182								92
93 – 181	2" diameter, 10-slot, schedule 40 PVC screen, 96'-106'						Very hard, dry, blue gray, sandy, very silty GRAVEL (GM).	93
94 – 180								94
95 – 179								95
96 – 178								96
97 – 177								97
98 – 176							Loose, slightly moist, brown, gravelly, very silty SAND (SM).	98
99 – 175								99
174								

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: DFR

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-8D	3 of 3

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	273.5
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	273.11
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/11/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/4/2009 - 5/6/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
101 (173)								101
102 (172)							Hard, dry, dark blue gray, gravelly, sandy SILT (ML).	102
103 (171)								103
104 (170)								104
105 (169)								105
106 (168)							Hard, dry, light gray, silty, very gravelly SAND (SM); fine sand; fine to coarse gravel.	106
107 (167)								107
108 (166)								108
109 (165)								109
110 (164)	▽							110
111 (163)								111
112 (162)	▼ 5/11/2009						Loose, wet, brown, slightly silty SAND (SP); fine sand.	112
113 (161)								113
114 (160)								114
115 (159)								115
116 (158)	Threaded PVC endcap						Hard, dry, light gray, silty, very gravelly SAND (SM); fine sand.	116
117 (157)								117
118 (156)								118
119 (155)								119
120 (154)								120
121 (153)							Boring terminated 120 ft BGS. Depth to perched water was 55 ft BGS ATD. Depth to water table at 112.56 ft BGS on 5/11/2009.	121
122 (152)								122
123 (151)								123
124 (150)								124
125 (149)								125
126 (148)								126
127 (147)								127
128 (146)								128
129 (145)								129
130 (144)								130
131 (143)								131
132 (142)								132
133 (141)								133
134 (140)								134
135 (139)								135
136 (138)								136
137 (137)								137
138 (136)								138
139 (135)								139
140 (134)								140
141 (133)								141
142 (132)								142
143 (131)								143
144 (130)								144
145 (129)								145
146 (128)								146
147 (127)								147
148 (126)								148
149 (125)								149
	(124)							

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: DFR

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	MW-9	1 of 2

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	274.5
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	273.78
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/11/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/5/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
0 – 274	Flushmount monument, lockable thermos cap						Blacktop and concrete.	0
1 – 273							Vacuumed to 5'.	1
2 – 272								2
3 – 271								3
4 – 270								4
5 – 269							Slightly moist, gray blue, gravelly, sandy SILT (ML).	5
6 – 268								6
7 – 267								7
8 – 266								8
9 – 265							Dry, lightly brown, very gravelly.	9
10 – 264	Quickrite portland cement, 0'-30'							10
11 – 263							Brown, slightly moist, gravelly, silty SAND (SM).	11
12 – 262								12
13 – 261								13
14 – 260								14
15 – 259								15
16 – 258							Dry, light gray.	16
17 – 257								17
18 – 256								18
19 – 255								19
20 – 254	2" diameter, schedule 40 PVC, threaded connections, 0'-60'							20
21 – 253								21
22 – 252							Very dense, slightly moist, gray blue.	22
23 – 251								23
24 – 250								24
25 – 249								25
26 – 248							Dry, dark gray blue, sandy SILT (ML), trace gravel.	26
27 – 247								27
28 – 246							Slightly moist, brown, gravelly, very silty SAND (SM); fine to medium sand, predominantly fine.	28
29 – 245								29
30 – 244								30
31 – 243								31
32 – 242							Grades to trace gravel.	32
33 – 241								33
34 – 240							Moist.	34
35 – 239	Hydrated bentonite chips, 30'-57'							35
36 – 238								36
37 – 237								37
38 – 236							Very gravelly.	38
39 – 235								39
40 – 234							Trace gravel.	40
41 – 233								41
42 – 232							Loose, moist, dark brown-red SAND (SP), trace gravel; fine to medium sand, predominantly fine; fine gravel, subrounded.	42
43 – 231								43
44 – 230								44
45 – 229								45
46 – 228								46
47 – 227							Grades to slightly silty.	47
48 – 226								48
49 – 225								49

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: DFR

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	MW-9	2 of 2

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	274.5
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	273.78
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/11/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/5/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51 – 224	Hydrated bentonite chips, 30'-57'						Grades to gravelly.	51
52 – 223								52
53 – 222								53
54 – 221	▽ 5/5/2009						Wet.	54
55 – 220								55
56 – 219								56
57 – 218							No gravel.	57
58 – 217	10/20 sand filter pack, 57'-70'							58
59 – 216								59
60 – 215								60
61 – 214								61
62 – 213								62
63 – 212								63
64 – 211	2" diameter, 10-slot, schedule 40 PVC screen, 60'-70'							64
65 – 210								65
66 – 209								66
67 – 208								67
68 – 207								68
69 – 206								69
70 – 205	Threaded PVC endcap							70
71 – 204							Boring terminted 70' BGS. Depth to water was 54 ft BGS ATD. Well was dry on 5/11/2009.	71
72 – 203								72
73 – 202								73
74 – 201								74
75 – 200								75
76 – 199								76
77 – 198								77
78 – 197								78
79 – 196								79
80 – 195								80
81 – 194								81
82 – 193								82
83 – 192								83
84 – 191								84
85 – 190								85
86 – 189								86
87 – 188								87
88 – 187								88
89 – 186								89
90 – 185								90
91 – 184								91
92 – 183								92
93 – 182								93
94 – 181								94
95 – 180								95
96 – 179								96
97 – 178								97
98 – 177								98
99 – 176								99
175								

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: DFR

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-10	1 of 2

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	275
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	274.45
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/11/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/7/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1 – 274	Flushmount monument, lockable thermos cap						Blacktop and concrete.	1
2 – 273							Medium dense, wet, dark brown, slightly silty, very gravelly SAND (SP); fine to coarse sand; fine to coarse gravel, rounded.	2
3 – 272								3
4 – 271							Medium dense, mosit, gray purple, silty, very gravelly SAND (SM); fine to coarse sand; fine to coarse gravel, subrounded.	4
5 – 270								5
6 – 269							Dry to slightly moist, brown to dark brown.	6
7 – 268							Loose, moist, dark brown, slightly silty, gravelly SAND (SP); predominantly medium to coarse sand; fine gravel, subrounded.	7
8 – 267								8
9 – 266								9
10 – 265							Medium dense, dry to slightly moist, fine to coarse gravel.	10
11 – 264							Very dense, dry, gray purple boulder.	11
12 – 263							Medium dense, slightlymoist, yellow-red to dark brown, gravelly, very silty SAND (SM); fine to coarse sand; fine to coarse gravel, subrounded.	12
13 – 262								13
14 – 261							Very stiff, dry to slightly moist, brown, gravelly, very sandy SILT (ML); fine to coarse sand; fine to coarse gravel, subrounded.	14
15 – 260	Quickrite portland cement, 0'-41'							15
16 – 259								16
17 – 258							Medium dense, slightlymoist, dark brown, silty, very gravelly SAND (SP); fine to coarse sand; fine to coarse gravel, subrounded.	17
18 – 257								18
19 – 256							Medium dense, slightly moist, dark brown, slightly silty, very gravelly SAND (SP); predominantly medium to coarse sand; fine to coarse gravel, subrounded.	19
20 – 255								20
21 – 254							Dense, dry to slightly moist, yellow-red to dark brown, silty, sandy GRAVEL (GM); fine to coarse sand; fine to coarse gravel, subrounded.	21
22 – 253								22
23 – 252							Medium dense, dry to slightly moist, yellow-red to dark brown, slightly silty, gravelly to very gravelly SAND (SP); predominantly medium to coarse sand; fine to coarse gravel, subrounded, increasing gravel with depth.	23
24 – 251								24
25 – 250	2" diameter, schedule 40 PVC, threaded connections, 0'-60'							25
26 – 249								26
27 – 248								27
28 – 247							Medium dense, dry to slightly moist, yellow-red to dark brown, silty, very gravelly SAND (SM); fine to coarse sand; fine gravel, subangular to subrounded.	28
29 – 246								29
30 – 245							Gradational decrease in silt. Becomes slightly silty, very gravelly SAND (SP).	30
31 – 244							Loose to medium dense, gravelly.	31
32 – 243								32
33 – 242							Medium dense, slightly moist, yellow-red, silty, very gravelly SAND (SM); fine to coarse sand; fine to coarse gravel, subrounded.	33
34 – 241								34
35 – 240							Loose, very silty, no gravel.	35
36 – 239							Medium dense, red-brown, gravelly.	36
37 – 238								37
38 – 237							Loose, slightly moist, yellow-red, slightly silty SAND (SP), trace gravel; perdominantly medium sand.	38
39 – 236								39
40 – 235							Medium dense to dense, gravelly; fine to coarse gravel, subrounded.	40
41 – 234								41
42 – 233								42
43 – 232								43
44 – 231								44
45 – 230	Hydrated bentonite chips, 41'-56'11"						Slightly gravelly; fine gravel.	45
46 – 229								46
47 – 228							Gravelly lense.	47
48 – 227								48
49 – 226							Gravelly lense.	49

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: JMS

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-10	2 of 2

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	275
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	274.45
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/11/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/7/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–224	Hydrated bentonite chips, 41'-56'11"						Loose, moist. perdominantly medium to coarse sand.	51
52–223								52
53–222								53
54–221								54
55–220	▽ 5/7/2009						Medium dense, wet, trace gravel; predominantly medium sand; fine gravel.	55
56–219								56
57–218							Red-brown with black staining, slightly gravelly.	57
58–217	10/20 sand filter pack, 56'11"-70'							58
59–216								59
60–215							Black, fine to medium sand.	60
61–214							Loose to medium dense, very moist to wet, brown SAND (SP); no silt, no gravel.	61
62–213								62
63–212								63
64–211	2" diameter, 10-slot, schedule 40 PVC screen, 60'-70'							64
65–210								65
66–209								66
67–208								67
68–207								68
69–206							Medium dense, wet, red-brown, slightly clayey; fine to medium sand.	69
70–205	Threaded PVC endcap							70
71–204							Medium dense, wet, red-brown, slightly gravelly, clayey SAND (SC); predominantly fine to medium sand; fine gravel.	71
72–203	Natural backfill, 70'-75'							72
73–202							Medium dense, wet, dark brown, silty, gravelly SAND (SM); fine to coarse sand; fine gravel to cobbles, subrounded.	73
74–201								74
75–200							Medium dense, wet, dark brown to gray, slightly silty, very sandy GRAVEL (GP); fine to coarse sand; fine to coarse gravel, subrounded.	75
76–199								76
77–198								77
78–197							Boring terminated 75 ft BGS.	78
79–196							Depth to water was 55 ft BGS ATD. Well was dry on 5/11/2009.	79
80–195								80
81–194								81
82–193								82
83–192								83
84–191								84
85–190								85
86–189								86
87–188								87
88–187								88
89–186								89
90–185								90
91–184								91
92–183								92
93–182								93
94–181								94
95–180								95
96–179								96
97–178								97
98–177								98
99–176								99

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: JMS

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-11	1 of 2

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	274
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	273.52
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/12/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/8/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1 – 273	Flushmount monument, lockable thermos cap, concrete seal 0'-1'						Concrete.	1
2 – 272							Wet, light brown, silty, very gravelly SAND (SM); fine to coarse gravel, subround to subangular.	2
3 – 271								3
4 – 270								4
5 – 269							Slightly moist, very silty.	5
6 – 268							Wet, grades to gravelly, very silty SAND (SM); fine to coarse sand.	6
7 – 267								7
8 – 266							Very dense, very silty, very sandy GRAVEL (GM); cobbles.	8
9 – 265								9
10 – 264	2" diameter, schedule 40 PVC, threaded connections, 0'-53'							10
11 – 263							Slightly moist, brown, silty, sandy GRAVEL (GM); fine to coarse sand; fine to coarse gravel.	11
12 – 262								12
13 – 261							Grades to brown-gray.	13
14 – 260								14
15 – 259							Gray, very silty.	15
16 – 258							Very moist, brown, silty, very sandy GRAVEL (GM).	16
17 – 257							Very hard, very moist, dark gray, gravelly, very silty SAND (SM) with sandy silt interbeds	17
18 – 256								18
19 – 255								19
20 – 254	Hydrated bentonite chips, 1'-49'11"							20
21 – 253							Dry, gray, silty, very sandy GRAVELLY (GM); fine to coarse sand; fine to coarse gravel.	21
22 – 252								22
23 – 251							Brown.	23
24 – 250							Dry, brown, trace to slightly silty, very sandy GRAVEL (GP).	24
25 – 249							Gray, sandy.	25
26 – 248								26
27 – 247							Moist, gray, sandy, very silty GRAVEL (GM).	27
28 – 246							Brown, silty, very sandy.	28
29 – 245								29
30 – 244							Very moist, red-brown to dark brown, slightly gravelly, very silty SAND (SM).	30
31 – 243								31
32 – 242								32
33 – 241							Trace gravel.	33
34 – 240								34
35 – 239								35
36 – 238							Very moist, red-brown to dark brown, slightly gravelly, slightly silty SAND (SM).	36
37 – 237								37
38 – 236							Interbedded red-brown, very silty SAND and gray, very sandy SILT (SM/ML)	38
39 – 235								39
40 – 234							Very moist, red-brown, slightly silty to silty SAND (SM), trace gravel; fine to medium sand, fine gravel.	40
41 – 233								41
42 – 232								42
43 – 231							Very moist, redish brown, slightly silty, gravelly SAND with interbeds of silty to very silty SAND (SP-SM). Sand is fine to medium.	43
44 – 230								44
45 – 229								45
46 – 228								46
47 – 227							Brown gray, silty SAND interbedded with sandy SILT (SM-ML).	47
48 – 226								48
49 – 225	▽ 5/8/2009						Dark brown, predominately medium sand.	49

Sampler Type:
- ○ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: JTL

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-11	2 of 2

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	274
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	273.52
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water	- 5/12/2009
Sampling Method:	Continuous Core	Start/Finish Date	5/8/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–223	10/20 sand filter pack, 19'1.1"-63'						Wet.	51
52–222	▼ 5/12/2009							52
53–221							Gravelly.	53
54–220							Trace gravel to slightly gravelly.	54
55–219	2" diameter, 10-slot, schedule 40 PVC screen, 53'-63'						Wet, red-brown, interbedded silty SAND and slightly silty SAND (SM).	55
56–218								56
57–217								57
58–216								58
59–215								59
60–214							Wet, brown, silty SAND (SM); fine sand.	60
61–213								61
62–212							Wet, brown, slightly silty, gravelly SAND (SP); fine to coarse sand.	62
63–211	Threaded PVC endcap						Slightly moist, gray, very sandy, very silty GRAVEL (GM).	63
64–210								64
65–209							Moist, brown.	65
66–208							Slightly moist, light brown, sandy.	66
67–207								67
68–206								68
69–205	Natural backfill, 63'-70'						Grades to slightly moist, gray, slightly sandy, gravelly SILT (ML); with wood.	69
70–204							Boring terminated 70 ft BGS. Depth to water was 52.20 ft BGS on 5/12/2009.	70
71–203								71
72–202								72
73–201								73
74–200								74
75–199								75
76–198								76
77–197								77
78–196								78
79–195								79
80–194								80
81–193								81
82–192								82
83–191								83
84–190								84
85–189								85
86–188								86
87–187								87
88–186								88
89–185								89
90–184								90
91–183								91
92–182								92
93–181								93
94–180								94
95–179								95
96–178								96
97–177								97
98–176								98
99–175								99

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: JTL

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-12D	1 of 3

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	273
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water (ft BGS)	- 10/29/2010
Sampling Method:	Continuous Core	Start/Finish Date	10/25/2010 - 10/27/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1 272	Flushmount monument, thermos cap						Air Vacuum - No Recovery	1
2 271								2
3 270							Dry, gray-blue, slighlty gravelly, sandy SILT (ML); fine gravel; fine to medium sand	3
4 269	Concrete seal, 0'-5.5'							4
5 268							Dark brown, gravelly, very sandy SILT (ML); fine to coarse gravel (2")	5
6 267	Hydrated bentonite chips, 5.5'-110'						Gray-blue/dark brown, slightly gravelly, sandy SILT (ML)	6
7 266								7
8 265							Dry, brown, slightly silty, gravelly, SAND (SP-SM); fine to coarse gravel (2.5"), rounded to subrounded	8
9 264								9
10 263	2" diameter, Sch 40 PVC, 0.4'-113'						Dry, dark brown, gravelly, silty SAND (SM); fine to coarse gravel (2"), rounded to subrounded; fine to coarse sand	10
11 262								11
12 261							Dry, dark brown, very sandy GRAVEL (GW); fine to coarse gravel (2"), rounded to subrounded; fine to coarse sand	12
13 260								13
14 259								14
15 258							Dry, brown, slightly silty, gravelly SAND (SP-SM); fine to coarse gravel (2"), rounded to subrounded; fine to medium sand; with dark gray, slightly clayey, slightly gravelly, very sandy SILT (ML) lense (6")	15
16 257								16
17 256								17
18 255							Dry, brown/light gray, silty, very gravelly SAND (SM); fine to coarse gravel (2"); fine to coarse sand	18
19 254								19
20 253							Red-brown/light gray, slightly gravelly, very silty SAND (SM)	20
21 252							Light gray with red-brown mottling, slightly gravelly, silty SAND (SM); fine gravel; predominantly fine to medium sand	21
22 251								22
23 250								23
24 249								24
25 248							Dark brown, gravelly, very silty SAND (SM)	25
26 247								26
27 246								27
28 245								28
29 244								29
30 243							Slightly gravelly, very silty SAND (SM)	30
31 242							Dry, dark brown SAND (SP); trace gravel and silt; fine gravel, rounded, predominantly medium sand	31
32 241								32
33 240							Dry, dark brown, slightly silty SAND (SP-SM); medium sand	33
34 239								34
35 238							Dry, dark brown, slightly gravelly, silty SAND (SM); fine gravel, subrounded; fine to medium sand	35
36 237							Dry, dark brown, slightly gravelly SAND (SP); trace silt; fine gravel, subrounded; fine to medium sand	36
37 236								37
38 235							Dark brown/yellow-red, gravelly SAND (SP); fine to coarse gravel (1"); predominantly medium sand	38
39 234								39
40 233							Red-brown, slightly gravelly SAND (SP); trace silt; fine to medium sand	40
41 232							Fine to coarse gravel (3"); medium sand	41
42 231								42
43 230								43
44 229								44
45 228							Dark brown, gravelly SAND (SP)	45
46 227							Dark brown/yellow-red, slightly gravelly SAND (SP); trace silt; fine gravel; fine to medium sand	46
47 226								47
48 225							Slightly gravelly SAND (SP); medium sand	48
49 224								49

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: JMS

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-12D	2 of 3

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Boart Longyear / Spider Sonic
Sampling Method: Continuous Core

Ground Surface Elev. 273
Top of Casing Elev.
Depth to Water (ft BGS) - 10/29/2010
Start/Finish Date 10/25/2010 - 10/27/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51 222							Medium to coarse sand	51
52 221							Slightly gravelly SAND (SP); fine to coarse gravel (1.5"); predominantly medium sand	52
53 220								53
54 219								54
55 218							Trace silt; fine gravel	55
56 217								56
57 216								57
58 215							Dry, dark brown, silty SAND (SM); trace fine gravel; fine to medium sand	58
59 214								59
60 213							Dry, dark brown SAND (SP); medium sand	60
61 212								61
62 211								62
63 210								63
64 209								64
65 208								65
66 207								66
67 206							Gravelly SAND (SP); trace silt; fine to coarse gravel (3"), subrounded; medium to coarse sand	67
68 205								68
69 204								69
70 203								70
71 202							Slightly moist, dark brown, slightly silty, very sandy GRAVEL (GW-GM); fine to coarse gravel (2"); fine to coarse sand	71
72 201								72
73 200							Wet, dark brown/dark gray, slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (2"); medium to coarse sand	73
74 199								74
75 198							Wet, red-brown, silty, very sandy GRAVEL (GM); fine to coarse gravel (2"); fine to coarse sand	75
76 197								76
77 196							Wet, yellow-red, silty, gravelly SAND (SM); fine to coarse gravel (2"); fine to coarse sand	77
78 195	▽							78
79 194							Moist/very moist, dark brown, slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (1.5"); fine to coarse sand	79
80 193								80
81 192							Moist/very moist, yellow-red, silty, very gravelly SAND (SM); fine to coarse gravel (2"); fine to coarse sand	81
82 191								82
83 190							Moist/very moist, yellow-red, silty, very sandy GRAVEL (GM); fine to coarse gravel (3.5"); fine to coarse sand	83
84 189								84
85 188							Wet, red-brown/dark brown, slightly gravelly SAND (SP); fine gravel; predominantly medium sand	85
86 187							Wet, dark brown, slightly silty, gravelly SAND (SP-SM); fine to coarse gravel (2"); predominantly medium sand	86
87 186								87
88 185							Wet, brown, silty, very sandy GRAVEL (GM); fine to coarse gravel (2"); fine to coarse sand; with slightly silty, SAND (SP-SM) lense (6")	88
89 184								89
90 183							Wet, dark brown, silty, very gravelly SAND (SM); fine to coarse gravel (1"); predominantly coarse sand	90
91 182								91
92 181							Dry, gray SILT (ML)	92
93 180							Red-brown slightly gravelly, slightly sandy SILT (ML); fine gravel; fine to medium sand	93
94 179							Dry, brown, gravelly, very silty SAND (SM); fine gravel; fine to coarse sand	94
95 178								95
96 177							Dry, dark brown, gravelly, very sandy SILT (ML); fine to coarse gravel; fine to coarse sand	96
97 176								97
98 175							Yellow-red, slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (2.5"); fine to coarse sand	98
99 174							Slightly moist, dark brown, sandy, silty GRAVEL (GM);	99

Sampler Type:
○ No Recovery
▌▌ Continuous Core

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: JMS
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-12D	3 of 3

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Boart Longyear / Spider Sonic
Sampling Method: Continuous Core

Ground Surface Elev.: 273
Top of Casing Elev.:
Depth to Water (ft BGS): - 10/29/2010
Start/Finish Date: 10/25/2010 - 10/27/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
101–172							fine to coarse gravel (3"); fine to coarse sand	101
102–171								102
103–170							Slightly moist/moist, dark brown, silty, very gravelly SAND (SM); fine to coarse gravel (1.5"); fine to coarse sand	103
104–169								104
105–168								105
106–167							Moist, dark brown, silty, gravelly SAND (SM); fine to coarse gravel (3"); fine to coarse sand	106
107–166								107
108–165								108
109–164							Moist, dark brown, slightly silty, gravelly SAND (SP-SM); fine to coarse gravel (1.5"); fine to coarse sand	109
110–163	10/20 filter pack, 110'-134.5'							110
111–162							Moist, dark brown SAND (SP); trace fine gravel; medium sand	111
112–161								112
113–160	2" diameter, 10-slot, Sch 40 PVC screen, 113'-133'						Slightly moist, dark brown, silty, very sandy GRAVEL (GM); fine to coarse gravel (3"); fine to coarse sand	113
114–159								114
115–158								115
116–157							Slightly moist, gray, sandy, very silty GRAVEL (GM); fine to coarse gravel (3"); fine to coarse sand	116
117–156								117
118–155								118
119–154								119
120–153								120
121–152							Slightly moist, gray, gravelly, sandy SILT (ML); fine gravel; fine to coarse sand	121
122–151							Dry, dark brown/gray, sandy, silty GRAVEL (GM); fine gravel to cobbles, rounded to subrounded; fine to coarse sand	122
123–150								123
124–149							Moist, yellow-red/gray, slightly silty, sandy GRAVEL (GW-GM), fine to coarse gravel (3"); fine to coarse sand	124
125–148								125
126–147								126
127–146	▽ 10/26/2010							127
128–145								128
129–144	▼ 10/29/2010							129
130–143							Moist, gray, slightly sandy, gravelly SILT (ML); fine gravel; fine to coarse sand	130
131–142							Dry, dark brown/gray, sandy, gravelly SILT (ML); fine to coarse gravel (2"); fine to coarse sand	131
132–141								132
133–140	PVC endcap							133
134–139								134
135–138	Hydrated bentonite chips, 134.5'-140'						Very moist, gray, slightly sandy, gravelly SILT (ML); fine to coarse gravel (2"); fine to coarse sand	135
136–137							Very moist, brown, silty, sandy GRAVEL (GM); fine to coarse gravel (3"), rounded to subrounded; fine to coarse sand	136
137–136								137
138–135								138
139–134								139
140–133							Wet, brown, silty, sandy GRAVEL (GM); fine to coarse gravel (2"); fine to coarse sand	140
141–132								141
142–131								142
143–130								143
144–129								144
145–128								145
146–127								146
147–126								147
148–125								148
149–124								149

Sampler Type:
○ No Recovery
▌▌ Continuous Core

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: JMS
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-13D	1 of 3

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Boart Longyear / Spider Sonic
Sampling Method: Continuous Core

Ground Surface Elev.: 273
Top of Casing Elev.:
Depth to Water (ft BGS): - 10/29/2010
Start/Finish Date: 10/27/2010 - 10/29/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1 272	Flushmount monument, thermos cap						Air Vacuum - No Recovery	1
2 271		○						2
3 270								3
4 269	Concrete seal, 0'-6'							4
5 268							Dry, brown, gravelly SAND (SP); trace silt; fine to coarse gravel (1.5"); predominantly fine sand	5
6 267							Dry, brown, slightly gravelly, silty SAND (SM); fine gravel; fine sand	6
7 266	Hydrated bentonite chips, 6'-121'							7
8 265							Dry, dark brown, slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (1.5"); fine to coarse sand	8
9 264								9
10 263	2" diameter, Sch 40 PVC, 0.4'-125'						Gray, slightly silty, very gravelly SAND (SP-SM) lense (2")	10
11 262								11
12 261							Dry/slightly moist, gray, gravelly, silty SAND (SM); fine to coarse gravel (1.5"); fine to coarse sand	12
13 260								13
14 259								14
15 258							Dry, yellow-red/gray, sandy, very gravelly SILT (ML); fine to coarse gravel (1.5"); fine to coarse sand	15
16 257								16
17 256							Dry, gray, silty, very gravelly SAND (SM); fine to coarse gravel (1"), rounded to subrounded; fine to coarse sand	17
18 255							Yellow-red/gray mottling, slightly gravelly, silty SAND (SM)	18
19 254								19
20 253							Dry, yellow-red/brown, silty SAND (SM); trace gravel; fine gravel; predominantly fine sand	20
21 252								21
22 251							Gray, silty, very gravelly SAND (SM); fine to coarse gravel (2.5"); fine to coarse sand	22
23 250								23
24 249								24
25 248								25
26 247								26
27 246								27
28 245							Dry, yellow-red, slightly silty, gravelly SAND (SP-SM); fine to coarse gravel (3"); predominantly fine to medium sand	28
29 244		○						29
30 243								30
31 242							Slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (1.5"); fine to coarse sand	31
32 241								32
33 240							Dry, yellow-red, slightly gravelly SAND (SP); trace silt; fine gravel, rounded; predominantly medium-fine sand	33
34 239								34
35 238								35
36 237								36
37 236							Fine to coarse gravel (1.5"); predominantly medium sand	37
38 235								38
39 234								39
40 233								40
41 232							Slightly moist, dark brown, gravelly SAND (SP); fine to coarse gravel (2"); predominantly medium sand	41
42 231								42
43 230							SAND (SP); medium sand	43
44 229								44
45 228							Silty, gravelly SAND (SM) lense (6")	45
46 227							Yellow-red, slightly gravelly SAND (SP); fine gravel	46
47 226								47
48 225							Dark brown, slightly gravelly SAND (SP); trace silt; fine to coarse gravel (2"); predominantly fine to medium sand	48
49 224								49

Sampler Type:
○ No Recovery
▌▌ Continuous Core

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: JMS
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-13D	2 of 3

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Boart Longyear / Spider Sonic
Sampling Method: Continuous Core

Ground Surface Elev.: 273
Top of Casing Elev.:
Depth to Water (ft BGS): - 10/29/2010
Start/Finish Date: 10/27/2010 - 10/29/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51 – 222							Trace gravel	51
52 – 221								52
53 – 220								53
54 – 219								54
55 – 218							Fine gravel	55
56 – 217								56
57 – 216								57
58 – 215								58
59 – 214							Slightly moist, gray, silty SAND (SM); fine sand	59
60 – 213							Dry, dark brown/yellow-red SAND (SP); medium-fine sand	60
61 – 212								61
62 – 211								62
63 – 210							Slightly moist, dark brown, silty SAND (SM); fine to medium sand	63
64 – 209								64
65 – 208							Dry, yellow-red/dark brown SAND (SP); medium sand	65
66 – 207							Very gravelly SAND (SP) lense (6")	66
67 – 206								67
68 – 205								68
69 – 204								69
70 – 203							Dark brown silty SAND (SM) lense (6")	70
71 – 202							Slightly moist/moist, dark brown, gravelly SAND (SP); fine to coarse gravel (2"), rounded to subangular; medium-fine sand	71
72 – 201								72
73 – 200							Moist/very moist, dark brown SAND (SP); trace gravel	73
74 – 199							Wet, yellow-red/dark brown, silty, sandy GRAVEL (GM); fine to coarse gravel (2"); fine to coarse sand	74
75 – 198								75
76 – 197								76
77 – 196								77
78 – 195								78
79 – 194							Moist, gray, slightly gravelly, very silty SAND (SM); fine gravel; fine to coarse sand	79
80 – 193								80
81 – 192	▽						Wet, red-brown, silty, gravelly SAND (SM); fine to coarse gravel (1.5"); fine to coarse sand, predominantly coarse	81
82 – 191								82
83 – 190							Wet, red-brown, slightly silty, gravelly SAND (SP-SM); fine to coarse gravel (3"); predominantly medium sand	83
84 – 189								84
85 – 188							Moist, red-brown, sandy, silty GRAVEL (GM); fine to coarse gravel (3"), rounded to subrounded; fine to coarse sand	85
86 – 187								86
87 – 186							Wet, red-brown, slightly silty, gravelly SAND (SP-SM); fine gravel; fine to coarse sand, predominantly coarse	87
88 – 185								88
89 – 184							Moist/very moist, yellow-red/red-brown, slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (2"), rounded to subangular; fine to coarse sand	89
90 – 183		○						90
91 – 182							Dry, dark brown, sandy, very gravelly SILT (ML); fine to coarse gravel (2.5"), rounded to subangular; fine to coarse sand	91
92 – 181								92
93 – 180							Wet, dark brown, sandy, very silty GRAVEL (GM); fine to coarse gravel (2"), rounded to subrounded; fine to coarse sand	93
94 – 179								94
95 – 178							No recovery	95
96 – 177								96
97 – 176		○						97
98 – 175								98
99 – 174								99

Sampler Type:
○ No Recovery
▌▌ Continuous Core

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: JMS
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-13D	3 of 3

Project Name:	Morrell's Dry Cleaners	Ground Surface Elev.	273
Location:	608 North 1st Street, Tacoma, WA	Top of Casing Elev.	
Driller/Method:	Boart Longyear / Spider Sonic	Depth to Water (ft BGS)	- 10/29/2010
Sampling Method:	Continuous Core	Start/Finish Date	10/27/2010 - 10/29/2010

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
101–172							Moist, brown, silty, sandy GRAVEL (GM); fine gravel to cobbles (4"), rounded to angular; fine to coarse sand; with silty, gravelly SAND (SM) lense (6")	101
102–171								102
103–170							Moist, dark brown/gray, silty, gravelly SAND (SM); fine to coarse gravel (3"), rounded to subrounded; fine to coarse sand	103
104–169								104
105–168								105
106–167							Moist, brown/dark brown, sandy, silty GRAVEL (GM); fine to coarse gravel, rounded to subrounded; fine to coarse sand	106
107–166								107
108–165								108
109–164							Very moist, dark brown/yellow-red, silty, gravelly SAND (SM); fine to coarse gravel (1"); predominantly coarse sand	109
110–163								110
111–162							Very moist, brown/dark brown, sandy, very silty GRAVEL (GM); fine to coarse gravel (2.5"); fine to coarse sand	111
112–161								112
113–160							Slightly moist, red-brown/brown, slightly silty, gravelly SAND (SP-SM); fine to coarse gravel (2"); predominanlty fine sand	113
114–159								114
115–158								115
116–157							Dry, light brown, sandy, silty GRAVEL (GM); fine gravel to cobbles (3.5"), rounded to subrounded; fine to coarse sand	116
117–156								117
118–155							Moist, brown, silty, gravelly SAND (SM) lense (6")	118
119–154							Wet, dark brown, slightly silty, gravelly SAND (SP-SM) lense	119
120–153							Very moist, brown, sandy, very silty GRAVEL (GM); fine gravel to cobbles (4"); fine to coarse sand	120
121–152								121
122–151	10/20 filter pack, 121'-146'						Wet, yellow-red, slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (3"); predominantly medium sand	122
123–150								123
124–149							Moist, brown, silty, very sandy GRAVEL (GM); fine to coarse gravel (2"); predominantly medium sand	124
125–148	2" diameter, 10-slot, Sch 40 PVC screen, 125'-145'						Slightly moist, brown, sandy, silty GRAVEL (GM); fine to coarse gravel (2.5"); fine to coarse sand	125
126–147							Very moist/wet, brown, silty, sandy GRAVEL (GM); fine gravel to cobbles (4"); predominantly coarse sand	126
127–146								127
128–145							Moist, gray, sandy, very silty GRAVEL (GM); fine to coarse gravel (2"); fine to coarse sand	128
129–144								129
130–143							Dry, dark brown/gray, silty, sandy GRAVEL (GM); fine to coarse gravel (3"), rounded to subangular; fine to coarse sand	130
131–142								131
132–141								132
133–140								133
134–139								134
135–138							Wet, brown, slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (2"); predominantly medium to coarse sand	135
136–137	▽ 10/28/2010							136
137–136	▼ 10/29/2010							137
138–135							Moist, yellow-red, silty, very gravelly SAND (SM); fine to coarse gravel (3"); predominantly medium to coarse sand	138
139–134								139
140–133							Dry, gray-purple, slightly gravelly, sandy SILT (ML); fine gravel; fine to coarse sand	140
141–132								141
142–131							Wet, brown, slightly silty, very gravelly SAND (SP-SM); fine to coarse gravel (3"), predominantly coarse sand	142
143–130								143
144–129							Wet, brown, slightly silty, sandy GRAVEL (GW-GM); fine to coarse gravel (3"), rounded to angular; fine to coarse sand	144
145–128	PVC endcap							145
146–127								146
147–126								147
148–125								148
149–124								149

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: JMS

Approved by: ALN

Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-14D	1 of 3

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Major Drilling - Jeffrey / Sonic Geoprobe 8140LS - track mounted
Sampling Method: Continuous Core

Ground Surface Elev.:
Top of Casing Elev.: 272.46
Depth to Water (ft BGS): - 2/3/2012
Start/Finish Date: 1/30/2012 - 2/2/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1-7	Flush mounted steel well monument; thermos cap Cement surface seal from 0-2' bgs						Cleared for utilities using an air vacuum - No Recovery.	1-7
8-12	2" ID schedule 40 PVC casing, threaded connection, 0'-123'						Moist, brown, very gravelly, very silty SAND (SM); cobbles up to 5"; fine to medium sand, diamict fabric.	8-12
13-23	Bentonite chip seal (NSF/ANSI 60), 2'-121' bgs						Slightly moist, sandy, very gravelly, SILT (ML); fine to medium sand; cobbles up to 4". Diamict fabric.	13-23
24-27							Moist, brown, gravelly, very silty SAND (SM); fine to medium sand; subangular gravel; diamict fabric; cobbles up to 4". Orange-brown. Brown.	24-27
28-30							Moist, brown, slightly silty, gravelly SAND (SP-SM); fine to medium sand; subrounded gravel.	28-30
31-33							Moist, gray, gravelly, silty SAND (SM); fine to medium sand; subangular gravel. Brown.	31-33
34-41							Moist, brown, slightly gravelly SAND (SP); fine to medium sand. 1" pockets of pink, slightly silty SAND.	34-41
42-43							Moist, gray with iron stain mottling, gravelly, very sandy SILT (ML); fine to medium sand; subrounded gravel; diamict fabric.	42-43
44-45							Moist, gray, slightly silty, gravelly SAND (SP-SM); fine to medium sand.	44-45
46-47							Moist, orange-brown, slightly gravelly SAND (SP); trace silt.	46-47
48-49							Moist, brown with iron stain mottling, slightly gravelly, silty SAND (SM); 1" pockets of silt, fine to medium sand, subangular fine gravel with cobbles.	48-49

Sampler Type:
- ○ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-14D	2 of 3

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Major Drilling - Jeffrey / Sonic Geoprobe 8140LS - track mounted
Sampling Method: Continuous Core

Ground Surface Elev.:
Top of Casing Elev.: 272.46
Depth to Water (ft BGS): - 2/3/2012
Start/Finish Date: 1/30/2012 - 2/2/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51							Moist, dark gray brown, slightly gravelly SAND (SP); medium to coarse sand, fine subrounded gravel.	51
52							Moist, red-brown, slightly silty SAND (SP-SM); medium sand; trace gravel.	52
53								53
54							Gravelly.	54
55							Moist, yellow-brown SAND (SP); medium to coarse sand.	55
56								56
57								57
58								58
59							Moist, gray, slightly silty SAND (SP-SM); fine to medium sand, trace fine gravel; faint stratification	59
60								60
61							Moist, brown to dark brown SAND (SP); medium sand.	61
62							Red-orange, slightly gravelly.	62
63								63
64								64
65							Very moist to wet, brown, very silty SAND (SM); fine sand.	65
66								66
67							Grades to fine to medium sand.	67
68							Wet, dark red-brown, very gravelly SAND (SP); coarse sand; trace silt, with cobbles up to 3".	68
69								69
70								70
71							Wet, brown-gray SAND (SP); trace gravel; medium sand.	71
72								72
73							Wet, red-brown GRAVEL (GW); fine to coarse gravel; trace silt; trace coarse sand.	73
74								74
75							Moist, red-brown with iron staining, very gravelly SAND (SP); medium sand, fine to coarse rounded gravel with cobbles up to 3"; trace silt; diamict fabric.	75
76								76
77							Brown.	77
78								78
79							Dry, gray, gravelly, very sandy SILT (ML); fine to medium sand; subrounded to subangular gravel; cobbles up to 4".	79
80								80
81							Moist, brown-red, slightly gravelly SAND (SP); medium sand; subrounded gravel; trace silt.	81
82								82
83							Slightly moist, gray, gravelly, silty SAND (SM); fine to medium sand; fine to coarse subrounded to rounded gravel.	83
84								84
85								85
86							Wet, brown SAND (SP); fine to medium sand, trace gravel.	86
87							Wet, red-brown GRAVEL (GP); coarse gravel and cobbles.	87
88								88
89							Very moist to wet, brown, gravelly, sandy SILT (ML); diamict fabric, cobbles up to 4".	89
90							Gray.	90
91								91
92								92
93							Moist, gray-brown, slightly gravelly, silty SAND (SM); fine to medium sand.	93
94								94
95								95
96								96
97								97
98							Moist to wet, brown-gray SAND (SP); fine to medium sand.	98
99							Moist, gray-brown, slightly silty, gravelly SAND	99

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-14D	3 of 3

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Major Drilling - Jeffrey / Sonic Geoprobe 8140LS - track mounted
Sampling Method: Continuous Core

Ground Surface Elev.:
Top of Casing Elev.: 272.46
Depth to Water (ft BGS): - 2/3/2012
Start/Finish Date: 1/30/2012 - 2/2/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
101							(SP-SM).	101
102							Moist to wet, brown, very sandy GRAVEL (GP); tr. silt, fine to coarse sand; fine subrounded to subangular gravel.	102
103								103
104							Slightly moist, gray and brown mottled, gravelly, sandy SILT (ML); fine to medium sand; fine to coarse gravel; diamict fabric.	104
105								105
106								106
107								107
108								108
109								109
110								110
111							Moist, brown and gray mottled, gravelly, silty SAND (SM); fine to medium sand; subrounded gravel up to 2".	111
112								112
113								113
114							Dry to slightly moist, gray with iron stain mottling, gravelly, sandy SILT (ML); diamict fabric.	114
115								115
116								116
117							Moist, brown-gray, slightly silty, very gravelly SAND (SP-SM); medium to coarse sand.	117
118							Moist, brown-gray, gravelly, silty SAND (SM); cobbles up to 3".	118
119								119
120								120
121							Slightly moist, gray, gravelly, sandy SILT (ML); fine to medium sand; cobbles up to 3".	121
122								122
123							Moist, brown, very silty, sandy GRAVEL (GM); cobbles up to 4", angular gravel, fine to coarse sand.	123
124								124
125	10x20 colorado silica sand filter pack, 121'-143.5' bgs						Dry to slightly moist, gray, gravelly, sandy SILT (ML); fine to medium sand, cobbles up to 4".	125
126								126
127								127
128							Moist, brown-gray with orange mottling, silty, very gravelly SAND (SM); fine to coarse sand; fine to coarse angular gravel with cobbles up to 3".	128
129								129
130	▽ 2/1/2012							130
131								131
132								132
133								133
134	▼ 2/3/2012						Moist to wet, gray-brown, gravelly, sandy SILT (ML); fine to coarse sand, fine to coarse subangular gravel; diamict fabric.	134
135	2" ID schedule 40 PVC 20-slot screen, 123.5'-143.5' bgs							135
136							Very gravelly.	136
137								137
138							Moist.	138
139								139
140							Wet.	140
141								141
142								142
143								143
144	Threaded PVC end cap							144
145							Bottom of boring at 145' BGS.	145
146								146
147								147
148								148
149								149

Sampler Type:
○ No Recovery
▌▌ Continuous Core

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	MW-15	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 273.84 ft
Depth to Water
Start/Finish Date 10/14/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1	Flushmount monument, lockable thermos cap, concrete seal 0'-4'						Concrete.	1
2							No logging or sampling.	2
3								3
4								4
5							Boring drilled 37 degrees from vertical to intercept saturated soil under alley.	5
6								6
7								7
8								8
9								9
10	2" diameter, schedule 40 PVC, threaded connections, 0'-55'							10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20	Hydrated bentonite chips, 4'-52'							20
21								21
22								22
23								23
24							Strong solvent-like odor in cuttings. (24 ft bgs)	24
25								25
26								26
27								27
28								28
29								29
30				36.7				30
31								31
32								32
33								33
34								34
35								35
36								36
37								37
38								38
39								39
40								40
41								41
42								42
43								43
44								44
45								45
46								46
47								47
48								48
49								49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-15	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 273.84 ft
Depth to Water
Start/Finish Date 10/14/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–74	10/20 sand filter pack, 52'-75' 2" diameter, 0.020-inch, schedule 40 PVC screen, 55'-75'						Well screen is completed in advance outwash beneath alley, 33 to 45 ft west-northwest of monument, and 44 to 60 ft below ground surface	51–74
75	Threaded PVC endcap						Bottom of boring is 60 feet below ground surface.	75
76–99								76–99

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-16	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 272.88 ft
Depth to Water
Start/Finish Date 10/15/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1	Flushmount monument, lockable thermos cap, concrete seal 0'-4'						Asphalt over concrete.	1
2							No logging or sampling.	2
3								3
4								4
5							Boring drilled 23 degrees from vertical, perpendicular to the building.	5
6								6
7								7
8								8
9								9
10	2" diameter, schedule 40 PVC, threaded connections, 0'-45'							10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20	Hydrated bentonite chips, 4'-42'							20
21								21
22								22
23								23
24								24
25								25
26								26
27								27
28								28
29								29
30								30
31								31
32								32
33								33
34								34
35								35
36								36
37								37
38								38
39								39
40								40
41								41
42	10/20 sand filter pack, 42'-65'						Well screen is completed in advance outwash beneath Morrell's Dry Cleaners building, 18 to 25 feet west-northwest of monument, and 41 to 60 feet below ground surface	42
43								43
44								44
45								45
46								46
47								47
48								48
49								49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-16	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 272.88 ft
Depth to Water
Start/Finish Date 10/15/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–64	2" diameter, 0.020-inch, schedule 40 PVC screen, 45'-65'							51–64
65	Threaded PVC endcap						Bottom of boring is 60 feet below ground surface.	65
66–99								66–99

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-17	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 272.97 ft
Depth to Water
Start/Finish Date 10/15/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1	Flushmount monument, lockable thermos cap, concrete seal 0'-4'						Asphalt over concrete.	1
2							No logging or sampling.	2
3								3
4								4
5							Boring drilled 32 degrees from vertical, perpendicular to the building.	5
6								6
7								7
8								8
9								9
10	2" diameter, schedule 40 PVC, threaded connections, 0'-51'							10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20	Hydrated bentonite chips, 4'-48'							20
21								21
22								22
23								23
24								24
25								25
26								26
27								27
28								28
29								29
30								30
31								31
32								32
33								33
34								34
35								35
36								36
37								37
38								38
39								39
40								40
41								41
42								42
43							Well screen is completed in advance outwash beneath Morrell's Dry Cleaners, 27 to 38 feet west-northwest of monument, and 43 to 60 feet below ground surface.	43
44								44
45								45
46								46
47								47
48								48
49	10/20 sand filter pack, 48'-71'							49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	MW-17	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 272.97 ft
Depth to Water
Start/Finish Date 10/15/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–70	2" diameter, 0.020-inch, schedule 40 PVC screen, 51'-71'							51–70
71	Threaded PVC endcap						Bottom of boringis 60 feet below ground surface.	71
72–99								72–99

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-18	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 272.80 ft
Depth to Water
Start/Finish Date 10/16/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1–49	Flushmount monument, lockable thermos cap, concrete seal 0'-4' 2" diameter, schedule 40 PVC, threaded connections, 0'-65' Hydrated bentonite chips, 4'-62'						Asphalt over concrete. No logging or sampling, strong solvent-like odor in cuttings. Boring drilled 45 degrees from vertical, perpendicular to the building.	1–49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	MW-18	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 272.80 ft
Depth to Water
Start/Finish Date 10/16/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–99	10/20 sand filter pack, 62'-85' 2" diameter, 0.020-inch schedule 40 PVC screen, 65'-85' Threaded PVC endcap						Well screen is completed in advance outwash beneath Morrell's Dry Cleaners, 46 to 60 feet west-northwest of monument, and 46 to 60 feet below ground surface Bottom of boring is 60 feet below ground surface.	51–99

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-19	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: Dames & Moore

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 273.15 ft
Depth to Water
Start/Finish Date 10/17/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1–49	Flushmount monument, lockable thermos cap, concrete seal 0'-2'						Asphalt.	1
							Very dense, moist, brown, slightly silty, gravelly SAND (SP-SM); diamict fabric, fine to medium sand, solvent-like odor.	2–19
	2" diameter, schedule 40 PVC, threaded connections, 0'-45'				50/6			10–11
	Hydrated bentonite chips, 2'-42'				50/6		Very dense, moist, brown gray, silty, gravelly SAND (SM); diamict fabric, solvent-like odor, predominantly fine sand, fine to coarse gravel.	20–24
					50/6		Trace gravel.	25–29
					50/6		Very dense, moist, orange brown, slightly gravelly SAND (SP); fine to medium sand, solvent-like odor.	30–34
					21 21 30		Trace silt.	35–39
					36 50/6		Trace fine gravel, slight solvent-like odor.	40–42
	10/20 sand filter pack, 42'-60.5'							43–44
					50/6			45–49

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-19	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: Dames & Moore

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 273.15 ft
Depth to Water
Start/Finish Date 10/17/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51					50/6		Wet, red brown.	51
52								52
53								53
54								54
55	2" diameter, 0.020-inch, schedule 40 PVC screen, 45'-60'							55
56								56
57								57
58								58
59								59
60	Threaded PVC endcap				50/6		Very dense, wet, dark red brown SAND (SW); fine to coarse sand, trace fine gravel.	60
61								61
62							Bottom of boring is 60.5 feet below ground surface.	62
63								63
64								64
65								65
66								66
67								67
68								68
69								69
70								70
71								71
72								72
73								73
74								74
75								75
76								76
77								77
78								78
79								79
80								80
81								81
82								82
83								83
84								84
85								85
86								86
87								87
88								88
89								89
90								90
91								91
92								92
93								93
94								94
95								95
96								96
97								97
98								98
99								99

Sampler Type:
- ○ No Recovery
- ◧ 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	MW-20	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 273.03 ft
Depth to Water
Start/Finish Date 10/11/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1	Flushmount monument, lockable thermos cap, concrete seal 0'-2'						Asphalt.	1
2							No logging or sampling.	2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10	2" diameter, schedule 40 PVC, threaded connections, 0'-45'							10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20	Hydrated bentonite chips, 2'-42'							20
21								21
22								22
23								23
24								24
25								25
26								26
27								27
28								28
29								29
30								30
31								31
32								32
33								33
34								34
35								35
36								36
37								37
38								38
39								39
40								40
41								41
42								42
43	10/20 sand filter pack, 42'-60'							43
44								44
45								45
46								46
47								47
48								48
49								49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-20	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 273.03 ft
Depth to Water
Start/Finish Date 10/11/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–59	2" diameter, 0.020-inch, schedule 40 PVC screen, 45'-60'							51–59
60	Threaded PVC endcap						Bottom of boring is 60 feet below ground surface.	60
61–99								61–99

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-21	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: Dames & Moore

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 274.03 ft
Depth to Water
Start/Finish Date 10/17/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
0	Flushmount monument, lockable thermos cap, concrete seal 0'-2'						Asphalt.	0
1–4							Very dense, moist, brown, silty, gravelly SAND (SM); diamict fabric, fine to medium sand.	1–4
5				0.0	50/6			5
6–9								6–9
10	2" diameter, schedule 40 PVC, threaded connections, 0'-45'				26			10
11			VOC/FOC	10.5	50/6			11
12–14								12–14
15			VOC/FOC	165	50/6			15
16–19								16–19
20	Hydrated bentonite chips, 2'-42'			0.0	50/6			20
21–24								21–24
25			VOC/FOC	0.0	50/6			25
26–29								26–29
30				0.0	50/6			30
31–34								31–34
35				0.0	50/5		Very dense, moist, red brown, slightly gravelly SAND (SP); fine to medium sand.	35
36–39								36–39
40			VOC/FOC	0.0	50/6		Brown.	40
41–42								41–42
43	10/20 sand filter pack, 42'-60.5'							43
44								44
45				0.0	50/6		Red brown, trace fine gravel.	45
46–49								46–49

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	MW-21	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: Dames & Moore

Ground Surface Elev. (site datum)
Top of Casing Elev. (site datum) 274.03 ft
Depth to Water
Start/Finish Date 10/17/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51				0.0	50/6		Very dense, moist, brown, slightly silty SAND (SP-SM); fine sand.	51
52								52
53								53
54								54
55	2" diameter, 0.020-inch, schedule 40 PVC screen, 45'-60'		VOC/FOC	0.0	50/6		Very dense, wet, brown, SAND (SP); fine to medium sand.	55
56								56
57								57
58								58
59								59
60	Threaded PVC endcap			0.0	50/6		Bottom of boring is 60.5 feet below ground surface.	60
61								61
62								62
63								63
64								64
65								65
66								66
67								67
68								68
69								69
70								70
71								71
72								72
73								73
74								74
75								75
76								76
77								77
78								78
79								79
80								80
81								81
82								82
83								83
84								84
85								85
86								86
87								87
88								88
89								89
90								90
91								91
92								92
93								93
94								94
95								95
96								96
97								97
98								98
99								99

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	VE-1	1 of 1

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum) 273.99 ft
Top of Casing Elev. (site datum)
Depth to Water
Start/Finish Date 10/21/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
0							Concrete.	0
1	Sand well-head protection with concrete overtop.						No logging or sampling, strong solvent-like odor in cuttings.	1
2								2
3								3
4								4
5	4" diameter, schedule 40 PVC, threaded connections, 0'-25'						Boring drilled 45 degrees from vertical, perpendicular to the building.	5
6								6
7								7
8								8
9								9
10	Hydrated bentonite chips, 2'-22'							10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20								20
21								21
22								22
23	10/20 sand filter pack, 22'-45'							23
24								24
25							Well screen is completed in glacial till beneath Morrell's Dry Cleaners building, 18 to 32 feet west-northwest of near-surface manifold, and 18 to 32 feet below ground surface	25
26								26
27								27
28								28
29								29
30								30
31								31
32								32
33								33
34								34
35	4" diameter, 0.020-inch, schedule 40 PVC screen, 25'-45'							35
36								36
37								37
38								38
39								39
40								40
41								41
42								42
43								43
44								44
45	Threaded PVC endcap						Bottom of boring is 32 feet below ground surface.	45
46								46
47								47
48								48
49								49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	VE-2	1 of 1

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum) 273.81 ft
Top of Casing Elev. (site datum)
Depth to Water
Start/Finish Date 10/21/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1	Sand well-head protection with concrete overtop.						Concrete.	1
2							No logging or sampling, strong solvent-like odor in cuttings.	2
3								3
4								4
5	4" diameter, schedule 40 PVC, threaded connections, 0'-25'						Boring drilled 45 degrees from vertical, perpendicular to the building.	5
6								6
7								7
8								8
9								9
10	Hydrated bentonite chips, 2'-22'							10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20								20
21								21
22								22
23	10/20 sand filter pack, 22'-45'							23
24								24
25							Well screen is completed in glacial till beneath Morrell's Dry Cleaners building, 18 to 32 feet west-northwest of near-surface manifold, and 18 to 32 feet below ground surface.	25
26								26
27								27
28								28
29								29
30								30
31								31
32								32
33								33
34								34
35	4" diameter, 0.020-inch, schedule 40 PVC screen, 25'-45'							35
36								36
37								37
38								38
39								39
40								40
41								41
42								42
43								43
44								44
45	Threaded PVC endcap						Bottom of boring is 32 feet below ground surface.	45
46								46
47								47
48								48
49								49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	VE-3	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum) 273.92 ft
Top of Casing Elev. (site datum)
Depth to Water
Start/Finish Date 10/22/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1	Sand well-head protection with concrete overtop.						Concrete.	1
2							No logging or sampling, strong solvent-like odor in cuttings.	2
3								3
4								4
5	4" diameter, schedule 40 PVC, threaded connections, 0'-44'						Boring drilled 45 degrees from vertical, perpendicular to the building.	5
6								6
7								7
8								8
9								9
10	Hydrated bentonite chips, 2'-41'							10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20								20
21								21
22								22
23								23
24								24
25								25
26								26
27								27
28								28
29								29
30								30
31								31
32								32
33								33
34								34
35								35
36								36
37								37
38								38
39								39
40								40
41								41
42	10/20 sand filter pack, 41'-64'						Well screen is completed in advance outwash beneath Morrell's Dry Cleaners building, 31 to 45 feet west-northwest of near-surface manifold, and 31 to 45 feet below ground surface.	42
43								43
44								44
45								45
46								46
47								47
48								48
49								49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	VE-3	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum) 273.92 ft
Top of Casing Elev. (site datum)
Depth to Water
Start/Finish Date 10/22/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–63	4" diameter, 0.020-inch, schedule 40 PVC screen, 44'-64'							51–63
64	Threaded PVC endcap						Bottom of boring is 45 feet below ground surface.	64
65–99								65–99

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
080190	VE-4	1 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum) 273.53 ft
Top of Casing Elev. (site datum)
Depth to Water
Start/Finish Date 10/18/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
1	Sand well-head protection with concrete overtop.						Concrete.	1
2							No logging or sampling, strong solvent-like odor in cuttings.	2
3								3
4								4
5	4" diameter, schedule 40 PVC, threaded connections, 0'-39'						Boring drilled 40 degrees from vertical, perpendicular to the building.	5
6								6
7								7
8								8
9								9
10	Hydrated bentonite chips, 2'-37'							10
11								11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20								20
21								21
22								22
23								23
24								24
25								25
26								26
27								27
28								28
29								29
30								30
31								31
32								32
33								33
34								34
35								35
36								36
37							Well screen is completed in advance outwash beneath Morrell's Dry Cleaners building, 25 to 38 feet west-northwest of near-surface manifold, and 30 to 45 feet below ground surface.	37
38	10/20 sand filter pack, 37'-59'							38
39								39
40								40
41								41
42								42
43								43
44								44
45								45
46								46
47								47
48								48
49								49

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

Aspect CONSULTING

Monitoring Well Construction Log

Project Number	Well Number	Sheet
080190	VE-4	2 of 2

Project Name: Morrell's Dry Cleaners
Location: 608 North 1st Street, Tacoma, WA
Driller/Method: Cascade Drilling / Hollow Stem Auger - Angle
Sampling Method: No samples

Ground Surface Elev. (site datum) 273.53 ft
Top of Casing Elev. (site datum)
Depth to Water
Start/Finish Date 10/18/2013

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
51–58	4" diameter, 0.020-inch, schedule 40 PVC screen, 39'-59'							51–58
59	Threaded PVC endcap						Bottom of boring is 45 feet below ground surface.	59
60–99								60–99

Sampler Type:
○ No Recovery

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: ALN
Figure No.

MONITORING WELL STADIUM THRIFTWAY.GPJ February 7, 2014

APPENDIX B

Underground Injection Control Authorization Letter

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

June 10, 2014

D. E. Wickham
13013 Panorama Drive, Suite 125
Fountain Hills, AZ 85268

RE: Registration with the Underground Injection Control (UIC) Program, Morrells' Dry Cleaners, 608 N 1st St., Tacoma, WA 98403

Dear Mr. Wickham:

This letter is to acknowledge receipt of your registration form received June 2, 2014 to register the above-mentioned site with the UIC program. The UIC wells are rule authorized and do not need a permit to operate. The site is registered as UIC site number 32555.

The project includes:

- Injecting 400 pounds 3D Microemulsion Factory Emulsified and 30 pounds of Hydrogen Release Compound Primer mixed with 550 gallons of water into each of the following UIC wells, MW2, MW8, and MW15 through MW21.

The injected compounds are intended to improve groundwater quality and meet the water Quality Standards for Ground Water of the State of Washington, chapter 173-200 WAC. Inherent environmental risks are associated with injecting compounds into groundwater. Characterize, manage, and monitor the site to minimize risk and prevent unforeseen degradation of groundwater quality. Mobilized metals or other substances, injected chemicals or hazardous bi-products, are not allowed to migrate beyond the site property boundary or plume boundary.

The two UIC Program requirements for rule authorization are, the UIC wells must be registered and the discharge from the well must meet the nonendangerment standard, of WAC 173-218-080.

Please refer to the UIC site number in all correspondence concerning this site. Also, contact us when the wells are closed and describe the closure method.

Please call me at (360) 407-6143 if you have any questions. Additional information can also be found at our website http://www.ecy.wa.gov/programs/wq/grndwtr/uic/index.html.

Sincerely,

MSHansen

Mary Shaleen-Hansen
Water Quality Program

Cc: Alan Noell, Aspect Consulting

APPENDIX C

Waste Disposition Reports

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

April 17, 2014

D.E. Wickham
13013 Panorama Drive, No. 125
Fountain Hills, AZ 85268

RE: Contained-in determination for soils contaminated with listed dangerous waste constituents located at 608 North First Street, Tacoma, Washington. RCRA Site ID No. WAD027555184

References:

(a) Request for contained-in determination from Alan Noell (Aspect Consulting) dated March 31, 2014 to Ava Edmonson (Ecology).
(b) Request for contained-in determination from Alan Noell (Aspect Consulting) dated March 31, 2014 to Samuel Iwenofu (Ecology) received via electronic mail.

Dear Mr. Wickham:

The Washington State Department of Ecology (Ecology) received a Contained-in Determination request for approximately fifteen (15) tons of soil containing F001 listed dangerous waste constituents that would be generated from additional trenching at 608 North First Street (former Morrell's Dry Cleaner), Tacoma, Washington.

Analytical data for the contaminated soils and supplemental information were submitted to Ecology to determine if the soils contaminated with listed dangerous waste constituent should be managed as dangerous wastes according to the "Contained-In/Out Policy." Ecology understands that these specific soils do not designate under federal characteristics (WAC 173-303-090) or state-only criteria (WAC 173-303-100).

Based on the information received and reviewed, Ecology has determined that these soils are contaminated with listed dangerous waste constituent at concentrations that do not warrant management as dangerous wastes,[1] and Ecology will not require disposal of these soils as listed wastes at a RCRA permitted treatment, storage, and disposal (TSD) facility, provided all of the conditions below are implemented:

1. The contaminated soils should be kept completely covered and contained during transport and disposal. If the soil should be emptied directly into a truck or trailer, the delivery truck or railcar shall be plastic lined, and during transport, all loads must be covered to

[1] February 19, 1993 Ecology Contained-In Policy Memo

prevent wind dispersion. All other adequate measures shall be taken to prevent spills and dispersion due to wind or rain erosion. Measures shall also be taken to prevent unauthorized contact with these soils and groundwater at all times.

2. Directly deliver these soils to a permitted **RCRA Subtitle D** Waste Management Landfill in Arlington, Oregon, as proposed in your request. Please be aware that local solid waste agencies have the authority to impose additional requirements on solid waste streams.

3. The contaminated soils shall be placed directly in the landfill cell, and are not to be used for daily, intermediate, or final cover.

4. These contaminated soils shall not be sent to any incinerator, thermal desorption unit, or recycling facility unless that facility is a RCRA Subtitle C permitted hazardous waste TSD facility.

5. Copies of all bills of lading/weight (scale) tickets and signed solid waste landfill receipt records for these contaminated soils should be forwarded, **within 10 days of your receipt**, to Ecology's Southwest Regional Office, Attention: Samuel Iwenofu.

Ecology issued this determination based on the information provided and reviewed to date. This written decision does not apply to any other area or media. Additional contained-in determination requests would be required for on-going and future investigation and cleanup activities.

This letter is intended to only address the procedures for disposal of fifteen (15) tons of contaminated soil in accordance with Washington State's Dangerous Waste Regulations (Chapter 173-303 WAC). Regulatory decisions regarding the applicable soil and groundwater cleanup levels and appropriate exposure pathways will be addressed by project managers in Ecology's Toxics Cleanup Program.

Failure to comply with the terms of this letter may result in the issuance of an administrative order and/or penalty as provided by the Revised Code of Washington, Sections 70.105.080 and/or .095 (Hazardous Waste Management Act).

If you have questions regarding this letter, please feel free to contact Samuel Iwenofu of my staff at (360) 407-6346 or electronically at siwe461@ecy.wa.gov.

Sincerely,

Ava Edmonson, Section Manager
Hazardous Waste and Toxics Reduction Program
Southwest Regional Office

By Certified Mail:
91 7199 9991 7032 9243 8246

cc: Central Files
Samuel Iwenofu, Department of Ecology
Eugene Radcliff, Department of Ecology
Dean Yasuda, Department of Ecology
Alan Noell, anoell@aspectconsulting.com
Joe Morrice, jmorrice@aspectconsulting.com

Columbia Ridge
18177 Cedar Springs Lane
Arlington, OR, 97812
Ph: (541) 454-2030

Original 239732
Ticket# 209528

Customer Name CLEARCREEK CONTRACTORS INC CL
Ticket Date 06/16/2014
Payment Type Credit Account
Manual Ticket# 804812
Hauling Ticket#
Destination UP/R TRANSPORT
Profile 108209WA (CM^CONTAINED IN WASTE^CLEARCREEK CONTRACTORS^WALKER CHEVROLET^1082
Generator OR-WALKER CHEVROLET WALKER CHEVROLET 608 N FIRST ST

Carrier 8000
Vehicle# 8540
Container 8540
Billing # 0000146
Manifest
PO 213078

Volume

	Time	Scale	Operator	Inbound		
In	06/13/2014 11:39:01	Front Scale	SMastrio		Gross	39900 lb*
Out	06/16/2014 11:39:01		SMastrio		Tare	6500 lb*
			* Manual Weight		Net	33400 lb
					Tons	16.70

Comments Rental 6/10-6/11 = 1 day
Dropped 6/10/14

	Product	LD%	Qty	UOM	Rate	Tax	Amount	Origin
1	Cont Soil Sp. W.-T	100	16.70	Tons				WA-TACOMA
2	DEL U SPW-DELIVERY	100	1	Each				WA-TACOMA
3	FEA T SPW-FUEL,ENV	100	16.70	Tons				WA-TACOMA
4	RENT SPW DAILY-CAN	100	1	Each				WA-TACOMA
5	LINER SPW-LINER UN	100	1	Each				WA-TACOMA
6	LOC U SPW-LOCAL TR	100	1	Load				WA-TACOMA
7	RAIL U SPW-RAIL UN	100	1	Load				WA-TACOMA

Columbia Ridge
18177 Cedar Springs Lane
Arlington, OR, 97812
Ph: (541) 454-2030

Original 239733
Ticket# 209529

Customer Name CLEARCREEK CONTRACTORS INC CL
Ticket Date 06/16/2014
Payment Type Credit Account
Manual Ticket# 804855
Hauling Ticket#
Destination UP/R TRANSPORT
Profile 108209WA (CM^CONTAINED IN WASTE^CLEARCREEK CONTRACTORS^WALKER CHEVROLET^1082
Generator OR-WALKER CHEVROLET WALKER CHEVROLET 608 N FIRST ST

Carrier 8000
Vehicle# 8627
Container 8627
Billing # 0000146
Manifest
PO 213078

Volume

	Time	Scale	Operator	Inbound		
In	06/14/2014 11:40:21	Front Scale	SMastrio		Gross	26600 lb*
Out	06/16/2014 11:40:21		SMastrio		Tare	6500 lb*
			* Manual Weight		Net	20100 lb
					Tons	10.05

Comments Rental 6/11-6/12 = 1 day

	Product	LD%	Qty	UOM	Rate	Tax	Amount	Origin
1	Cont Soil Sp. W.-T	100	10.05	Tons				WA-TACOMA
2	FEA T SPW-FUEL,ENV	100	10.05	Tons				WA-TACOMA
3	RENT SPW DAILY-CAN	100	1	Each				WA-TACOMA
4	LINER SPW-LINER UN	100	1	Each				WA-TACOMA
5	LOC U SPW-LOCAL TR	100	1	Load				WA-TACOMA
6	RAIL U SPW-RAIL UN	100	1	Load				WA-TACOMA

APPENDIX D

SVE System Manufacturer's Process and Instrumentation Detail, Process Control Narrative, and Blower Specifications and Performance Curve

PROCESS TREATMENT SYSTEM

PROJECT # 202456

Site:

Tacoma, Washington

Prepared For:

Aspect Consulting, LLC
ATTN: Alan Noell

Design Submittal Package
Revision A1

Prepared by:

Amir Moradi
800.420.4056 ext. 1134
amoradi@newterra.com

Tim Coates
800.420.4056 ext. 1279
tcoates@newterra.com

Submittal Approval Form

17-Jun-14

202456 **Walker Chevrolet**

Customer: Alan Noell Aspect Consulting, LLC

****PLEASE REVIEW AND VERIFY ALL INFORMATION ON THIS FORM***

FOR TECHNICAL ASSISTANCE,PLEASE CONTACT:

Tim Coates 613-498-1876 Ext: 1279

EMail: tcoates@newterra.com Fax: 613-345-7633

SIte Specifications **Check** ☐

Elevation: 243 ft
Max Temp: 100 deg F
Min Temp: 0 deg F
Noise Target: 75dBA at 5ft
Gas Required: None
Water Required: None
Telephone Reqd: None
Building: Skids(3x4)(3x4)

System SVE(First Blower) **Check** ☐

80 scfm @ 47 in wc
Blower Disch Temp: 122 deg F
Inlet Legs: 3
Disch Press: 27 in wc
Water Flowrate: 5 gpm
Heat xchg Disch: deg F

Air Sparge **Check** ☐

@ psi
Sparge Disch Temp: deg F
Disch Legs:
Heat xchg Disch: deg F

Contaminants **Check** ☐

PCE, TCE, cDCE, tDCE, 1,1-DCE, vinyl chloride
carbon tetrachloride, chloroform, and naphthalene

System Electrical Specifications **Check** ☐

Voltage: 115V-1ph AutoRestart: Yes
Main Disconnect: 100A F@100A
Panel Approval: MET certified to the UL 508A standard (GP)
Classification: GP

System Approval: USMET(GP) Clas GP Skid
Panel Type: PLC-DL06 Display: C-MORE Micr
Offsite: newterra Ethernet/Cell/Sprint
Autodialer: newterra/Web
EMonitor: NotReq EServer: NotReq

System SVE (Second Blower) **Check** ☐

@ deg F
Blower Disch Temp:
Inlet Legs:
Disch Press: in wc
Water Flow: gpm Heat xchg Disch: deg F

Other Specifications **Check** ☐

Other Inlet Liquid Flow: 22 psi
Disch Flow: 5 gpm @
AirTreatment: Carbon
Water_Treatment: None
Stripper Airflow: cfm
Stripper Dsn Flow: gpm OWS_Flow: gpm

CUSTOMER APPROVAL

At a minimum, please thoroughly review the following:

Process and Instrumentation Diagram: ☐
System Layout Drawing: ☐
System Control Logic: ☐

I have reviewed and approve of the information on this form and in the design submittal provided.

NAME **SIGNATURE** **DATE**

Any changes made during the submittal process that alter the equipment ordered may require a change order from the customer and may res in additional costs and possible change in the shipping date.

Other Information

Alarm Emails and Connection Info

newterra inc.
2248 Meridian Blvd., Suite H, Minden, NV 89423
(800) 420-4056/www.newterra.com

March 10, 2014

Alan Noell
Aspect Consulting, LLC
401 Second Avenue South, Suite 201
Seattle, WA 98104
Tel (206) 838-6592 / anoell@aspectconsulting.com

Re: Quote # 202456R2 / Tacoma Dry Cleaner

Dear Mr. Noell:

Thank you for giving **newterra** an opportunity to provide a proposal for your project. The proposal we have provided in this document is based on our understanding of your requirements.

Based on our discussions, this is my understanding of what you value most on this project:

- PRICE: We understand that the capital cost of the system is a very important decision criterion; therefore we have done everything possible to provide you with a system with the lowest cost possible while maintaining the engineering/manufacturing standards and quality that has built our reputation in the industry. If you are interested we may be able to provide you with some ideas that could reduce your cost without compromising our standards or quality.
- SERVICE AND SUPPORT AFTER SHIPMENT: We understand the importance of achieving 90%+ uptime and that it is necessary to meet your commitments to your customer. Some of the infrastructure we have implemented to support you in this endeavor include: a field service team consisting of eight (8) field service technicians located throughout North America; an internal technical support staff ready to answer your calls; an inventory of replacement parts and consumables available for next day delivery; we have implemented a sophisticated web-based telemetry and controls system that facilitates troubleshooting remotely; and we have a team of people who are prepared to provide various levels of training depending on your needs.
- COMMITMENT: We understand that our performance will have a direct impact on your success with your client. We are extremely committed to ensuring that you are successful, this means that if we make a mistake we will do whatever it takes to resolve the problem immediately.

You are a very important customer to **newterra**. We have done work with many of your offices and would very much like to work with you on this project. If you would like references or have any questions or concerns while you review our proposal please don't hesitate to give me a call.

Sincerely,

Scott Jay – Western Regional Account Manager
newterra
Office: 800-420-4056 x1136 / Cell 714-404-1766 / bbaize@newterra.com

Cameron Wood - Applications Engineering
newterra
Office: 800-420-4056 x1266 / cwood@newterra.com

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GENERAL OVERVIEW OF EQUIPMENT:

The following proposal is based on our understanding of your requirements. It includes a MET Certified SVE system mounted on two (2) skids, one skid to be 2'10" x 3'10", the 2nd to be 2'10" x 4', with a relay based control panel.

DESIGN PARAMETERS:

120V single-phase power available
Non-hazardous location for equipment & control panel
Site noise constraints: 75 dBA @ 5 feet
Ambient up to 100 degrees F
Altitude 243 feet

EQUIPMENT DESCRIPTION:

Vacuum Extraction Manifold (Provided Lose):

3" Vacuum extraction manifold constructed with three 2" legs
Each Leg:

- Gate valve
- Vacuum gauge
- Sample port
- Terminated with a 4" NPT connection
- Manifold to be mounted on a stand to allow for placement on site as required. Interconnecting piping between manifold and vapor liquid separator is the responsibility of others.

Vapor Liquid Separator:

newterra model **VLD-400**, 55 G vapor liquid separator with:

- Exterior to be painted with urethane gloss enamel (**newterra** Blue)
- Interior to be epoxy coated
- 6" clean out
- Sight glass with column level switch assembly:
  - High level alarm switch
  - High level pump control switch
  - Low level pump control switch
- Manual drain plumbed to edge of skid

Goulds NPE model **1ST** centrifugal transfer pump with a ¾ HP 115/230V/1P motor:

- Performance: 5 GPM at 50' TDH
- Motor: TEFC

Water inlet piping to pump to contain the following components:

- Ball valve

Water discharge piping to contain the following components:

- Pressure gauge
- Sample port
- Gate valve
- Check valve
- Paddle wheel totalizing water flow meter

- Piping to be terminated at the edge of the skid

Please note:

a) Freezing protection has not been provided for the vapor liquid separator. Please note that should temperatures drop below freezing, the potential exists for water within the system to freeze which could cause damage to system components. Damage due to freezing is not covered under **newterra**'s warranty. If freezing protection is required, please contact **newterra** and a revised proposal can be provided.

Soil Vapor Extraction Blower:

Rotron model EN505AX58ML regenerative blower with a 2 HP 115/230V/1P motor:

- Motor: EXP (Suitable for CL 1 DIV 1)
- Performance at inlet of blower: Specific performance not requested
  - Maximum vacuum with single phase motor: 47"WC at the inlet to the blower
  - Flow rate at maximum vacuum: 80 SCFM
- Expected inlet pressure losses through **newterra** system: 15" WC
- Expected discharge pressure losses: Dependent on operating point
- Discharge temperature: Dependent on operating point
- Noise rating: 78 dBA

Inlet piping to blower to contain the following components:

- Vacuum gauge
- Solberg inlet filter/silencer
- Vacuum gauge
- newterra PFLOW pitot tube flow indicator
- Sample port
- Dilution line to contain:
  - Solberg filter/silencer
  - Ball valve
- Vacuum gauge
- Vacuum relief valve
- Piping

Discharge piping from blower to contain:

- Discharge silencer
- Sample port
- Pressure gauge
- Temperature gauge
- High temperature alarm switch
- Piping

Please note:

a) Depending on the operating point of the blower, the discharge temperature can vary from 86F at 10"WC vacuum to 122F at 47"WC vacuum. As the blower is not capable of more than 47"WC vacuum with a single phase motor, a heat exchanger is not required for carbon treatment. A high temperature alarm switch has been included as a safety measure, both to protect the downstream carbon and to indicate a possible problem with the blower itself should the temperatures exceed 130F. Please contact **newterra** to discuss as appropriate.

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Water Storage Drum (Supplied Loose):

One (1) 55 G water storage drum
Level switch pre-installed

Vapor Phase Carbon Filtration (Provided Loose):

Two (2) **newterra** model DIS75V contactor vessels with:

- Dimensions – 24" diameter x 38" high
- Disposable vessel
- Pressure rating – 5 PSI
- 165 lbs of virgin, granular vapor phase carbon per vessel
- Pressure gauges (2, inlet of each vessel)
- Sample ports (3, inlet of first vessel, inlet of 2nd vessel, & discharge of 2nd vessel)
- Two (2) flex hoses (each 10' in length) with cam lock fittings
- Discharge stack to be 5' tall and terminate with "T" fitting
    - Discharge stack to be mounted directly on discharge of 2nd vessel
    - Bracing has not been provided for the discharge stack, and if bracing is required it is the responsibility of others.

Please note:

a) Carbon vessels have been provided based on the expected flow capabilities of the SVE blower. If contaminant information is known, **newterra** can provide modeling estimations of the required carbon change out frequency. Please contact **newterra** to discuss as appropriate.

Process Skids:

Both Skids MET US certified, built to NEC General Purpose standards, all wiring complete and all equipment pre-piped factory tested and mounted on skid

SVE Skid:
2' 10" x 3' 10" skid with the following standard features:

- Checker plate decking
    - Bottom of skid to be epoxy coated
    - Sides and top of skid to be painted with a urethane gloss enamel (**newterra** Blue)
- Forklift pockets
- ~~Lifting lugs~~
- ~~Stud sockets~~
- ~~Bolt down tabs~~

Process skid to contain the following:

- SVE Blower (Rotron)
- Sound enclosure around Rotron blower, including
    - Ventilation fan with and sound attenuating hood
    - Passive vent louvers with sound attenuating hood
    - High temperature ~~alarm~~ switch for fan activation

VLS Skid:
2' 10" x 4' skid with the following standard features:

- Checker plate decking
    - Bottom of skid to be epoxy coated

- Sides and top of skid to be painted with a urethane gloss enamel (**newterra** Blue)
- Forklift pockets
- ~~Lifting lugs~~
- ~~Stud sockets~~
- ~~Bolt down tabs~~

Process skid to contain the following:

- Vapor liquid separator
- VLS transfer pump

Please note:

a) The skids will not exceed 36" width at any point. No equipment will extend past the edges of the skid.
b) A sound enclosure has been provided around the Rotron blower. The enclosure will be designed to reduce noise levels from the blower to 75 dBA measured at 5' from the enclosure. Please note that nearby walls can reflect sound waves, resulting in an increased noise level. Please contact **newterra** to discuss as appropriate.
c) The sound enclosure provided will extend to the width of the skid (2'10"). In order to access the Rotron blower, access panels on the lengthwise side of the skid must be removed. Based on drawings provided, the alley is approximately 5' wide. With the skid centered in the alley, around 1' of space will be available on either side of the enclosure to access the Rotron blower. Please contact **newterra** to discuss as appropriate.
d) The equipment indicated between the VLS & the SVE blower (dilution line, valves, etc) will be pre-piped on either the inlet to the blower or the discharge of the VLS, as applicable. Piping will be required between the two skids, and that piping is the responsibility of others. Please contact **newterra** to discuss as appropriate.

Control System (Provided Loose):

PLC Series Direct Logic PLC based control panel with the following standard features:

- MET certified to the UL 508A standard
- AIC rating of 5000
- NEMA 3R lockable panel enclosure
- Inner swing panel
- Fused main disconnect
- Surge and lightning protection for control system
- Main power block
- Combination motor starters with overload and short circuit protection
- Branch circuit protection with circuit breakers for powered devices and control system power
- Direct Logic PLC based control system
- 24 VDC IS power supply
- Wired and installed
- Factory tested prior to shipping
- Panel stand included complete with anchoring points (to be secured at site by others)

Outside cover of inner swing panel to contain the following:

- HOA switches ~~contained within user interface display screen~~(physical)
- Red alarm indicator light
- User interface display screen
  - 7-day, 24 hour run time programming to be adjusted through display screen or offsite telemetry package.
- Alarm reset button
- Emergency stop button

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Please note:

a) The control panel has been provided loose for installation on site by others. If required, **newterra** can provide a control panel stand for a minor cost. Wiring between the junction boxes on the skids & the control panel is to be the responsibility of others. Please contact **newterra** to discuss as appropriate.

Remote Control and Telemetry:

newterra wireless remote access system for PLC based control systems

newterra Site Link Basic Wireless Service:

- P & ID user interface will display status of all inputs, outputs and alarms
  - Standard 20 digital inputs/16 digital outputs, expandable with digital/analog inputs and outputs
- P & ID user interface will allow for Hand/Off/Auto control of all motors, valves or other auxiliary outputs
  - Standard 16 digital outputs (expandable)
- Accessible from any PC/Mac, mobile phone, or wireless device with access to the Internet
  - Does not require installation of any software
  - Uses Internet Browser
- Two levels of access available (must be specified at time of order):
  - Full access includes
    - Remote reset of alarms
    - Remote shutdown and restart
  - Read only access includes
    - Viewing only of P & ID
    - Viewing of alarms
- Datalogging capabilities
  - Alarm history including data and time for each event
  - Motor run times
  - 3-month datalogging storage capacity on **newterra** Site Link Server
  - Datalogs in .csv format available for download from **newterra** Site Link Server 24/7
- Initial setup up by **newterra**
  - Hardware included
  - Annual service fee applies per Telemetry Services Agreement

newterra Site Link E-Monitor Service, Daily email status report

- Hardware included
- Annual service fee applies per Telemetry Services Agreement

newterra Site Link E-Alarm Service, Instant text message or email on alarm

- Accessible via **newterra** Website with Internet Explorer
- Hardware included
- Annual service fee applies per Telemetry Services Agreement

newterra Site Link Basic Wireless, Site Link E-Monitor, and Site Link E-Alarm are independent services; customer can select to use any single service or combination of services for the system. All services must be purchased separately from the equipment purchase; the **newterra** Telemetry Services Agreement must be completed in order to obtain the services. The **newterra** Telemetry Services Agreement is available for review upon request.

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Miscellaneous Items to be Supplied Loose:

- Five (5) sample port assemblies
- ~~One (1) high level alarm switch for installation in batch storage container~~
  - ~~Batch storage container provided by others~~

Please note:

a) Sample port assemblies have been provided for field installation by others. Each assembly includes one (1) ¼" ball valve and one (1) ¼" hose barb. Please contact **newterra** to discuss as appropriate.

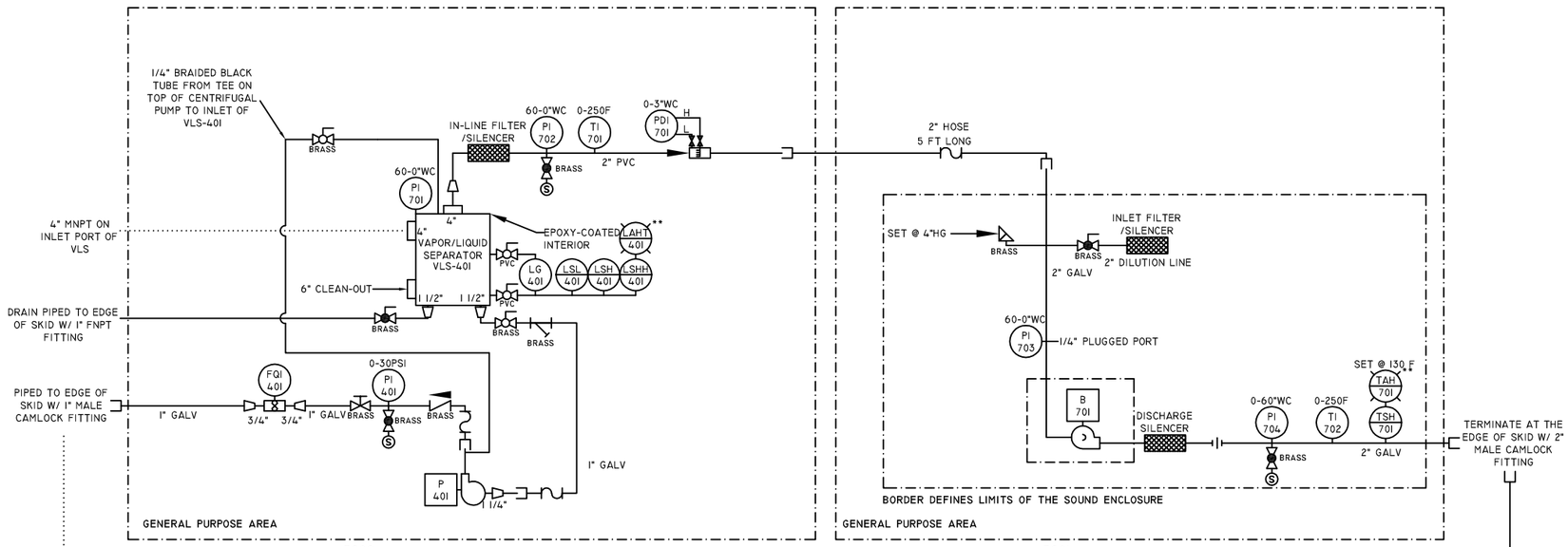
Operation and Maintenance Manual (Two Copies):

Operating instructions for all treatment system components
Copy of operating manual for each piece of equipment
Summary of system components
Summary of system operation principles
Summary of operation controls and failsafes
Summary of maintenance requirements for each piece of equipment

TRANSFER PUMP:
TAG = P-401
MAKE/MODEL = GOULDS IST
FLOWRATE & PRESSURE = 5 GPM @ 50' TDH
HORSEPOWER & MOTOR TYPE = 3/4, TEFC CL I DIV 2
VOLTAGE & PHASE = 120V/1P
HOUR METER/AMP METER = NO/NO
HAND-OFF-AUTO = YES (PHYSICAL)
LOCAL DISCONNECT = NO

SVE BLOWER:
TAG = B-701
MAKE/MODEL = ROTRON EN505AX58ML
FLOWRATE & VACUUM = 80 SCFM @ 47"WC
DISCHARGE PRESSURE = 27"WC
DISCHARGE TEMPERATURE = 122 F
HORSEPOWER & MOTOR TYPE = 2, EXP
VARIABLE FREQUENCY DRIVE = NO
VOLTAGE & PHASE = 120V/1P
HOUR METER/AMP METER = NO/NO
HAND-OFF-AUTO = YES (PHYSICAL)
LOCAL DISCONNECT = NO

VENTILATION FAN:
TAG = F-7901
MAKE/MODEL = CANARM 12"
FLOWRATE & PRESSURE = 1,390 CFM @ 0.25"WC
HORSEPOWER & MOTOR TYPE = 1/4 , GP
VOLTAGE & PHASE = 120V/1P



DESIGN NOTE:
Never use braided black hose with hose barbs and zip ties for pressure connection in liquid service. Use appropriate compression fittings.

BUILDING EQUIPMENT AND CONTROL PANEL

CONTROL PANEL

TO BE LOCATED ON BUILDING. PANEL TO BE A MINIMUM OF 36" FROM ANY HAZARDOUS PROCESS EQUIPMENT, AND A MINIMUM OF 36" ABOVE GRADE.

BORDER DEFINES LIMITS OF THE ENCLOSURE
GENERAL PURPOSE AREA
TSH 7901
F 7901

WIRING AND SPECIAL PROJECT NOTES

WIRING TO BE GENERAL PURPOSE, ACCORDING TO NEC FOR OUTDOORS.

Miscellaneous Items to be Supplied Loose:

- Eight (8) sample port assemblies for field installation by others
- Three (3) vacuum gauges (60-0"WC)
- Three (3) 4" PVC ball valves

NOTES
PIPING DETAILS:
- WATER FLOW METERS: PROVIDE 10 DIA. OF STRAIGHT PIPE BEFORE AND 5 DIA. OF STRAIGHT PIPE AFTER METERS. ENSURE THAT THROTTLING VALVES ARE NOT DIRECTLY IN LINE WITH METERS.
- AIR FLOW METERS: PROVIDE 8 DIA. OF STRAIGHT PIPE BEFORE AND 3 DIA. OF STRAIGHT PIPE AFTER METERS, AVOID TEES AND ELBOWS BEFORE AND AFTER METERS.
- MATERIALS OF VALVES AND FITTINGS TO BE THE SAME AS THE DESCRIPTION AT THE LINE. IF THERE IS A TRANSITION FROM PVC TO STEEL, THE VALVE SHOULD BE BRASS.
- THERE ARE NO SPECIAL PIPING REQUIREMENTS OTHER THAN WHAT IS EXPLAINED ON THE DIAGRAM.
- WHEN PVC HOSE IS SPECIFIED, ALWAYS USE VACUUM HOSE; USE GREEN HOSE FOR PRESSURES LESS THAN 60PSI; USE TANK TRUCK HOSE FOR PRESSURES BETWEEN 60PSI AND 150PSI.
- PVC PIPE MAY BE SUBSTITUTED WITH EQUAL-SIZED PVC HOSE WHERE A FLEXIBLE CONNECTION IS PREFERRED .

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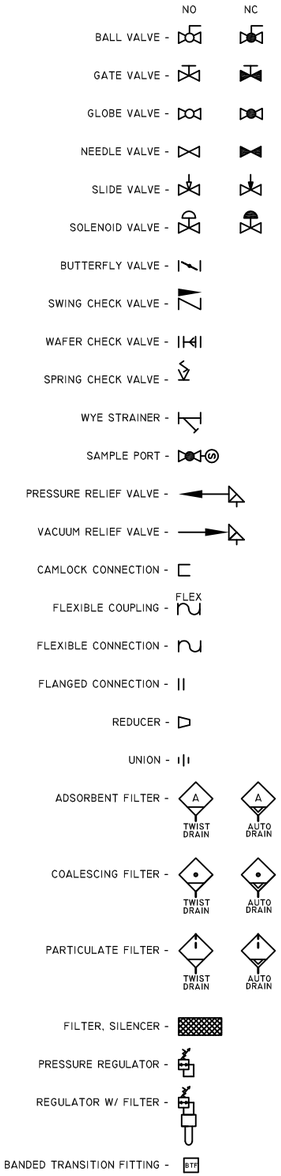
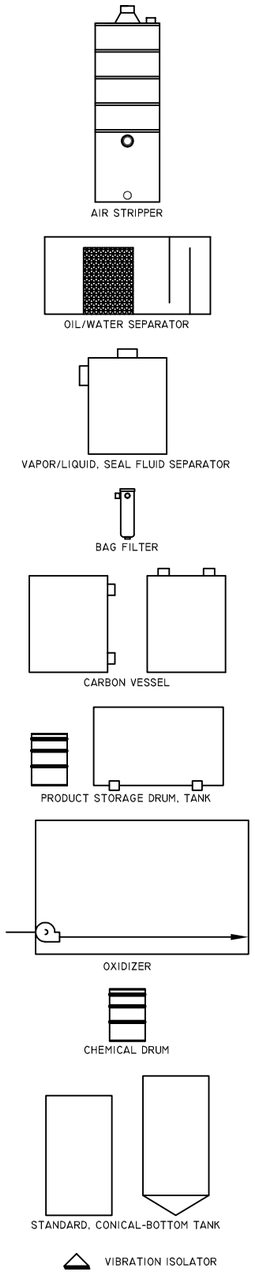
LEVEL	REVISION	DATE (mm/dd/yy)	BY
A1	FOR APPROVAL - REVISED	06/17/14	AM
A	FOR APPROVAL	06/09/14	AM

PROJECT NUMBER 202456
TITLE AND LOCATION P&ID Tacoma, Washington
CUSTOMER Aspect Consulting, LLC
DRAWN BY AM | DATE 06/09 | SHEET 1 | SHEETS 2

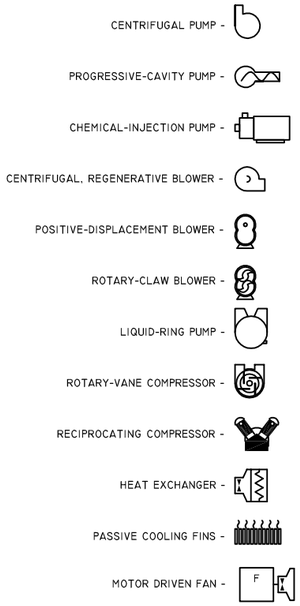
VALVES AND PIPING



EQUIPMENT



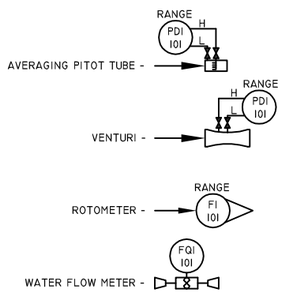
EQUIPMENT



EQUIPMENT

AS - AIR STRIPPER
BLD - BUILDING, TRAILER OR SKID
FLT - FILTER VESSEL
LPC - LIQUID-PHASE CARBON VESSEL
MFD - MANIFOLD
OWS - OIL/WATER SEPARATOR
OX - OXIDIZER
PST - PRODUCT STORAGE TANK
SOS - SEAL OIL SEPARATOR
SWS - SEAL WATER SEPARATOR
TNK - TANK
VLS - VAPOR/LIQUID SEPARATOR
VPC - VAPOR-PHASE CARBON VESSEL

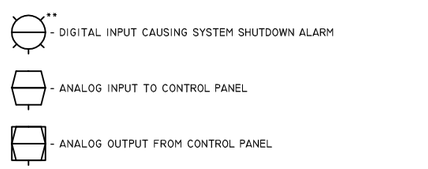
FLOW MEASUREMENT



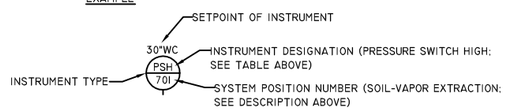
INSTRUMENT DESIGNATION

	INPUT	1ST MODIFIER	2ND MODIFIER	3RD MODIFIER	OUTPUT	1ST MODIFIER	
A			ALARM				A
B						BLOWER	B
C	CYCLE					COMPRESSOR	C
D		DIFFERENTIAL				AIR DRYER	D
E							E
F	FLOW					FAN	F
G	GAS (LEL)		GAUGE				G
H				HIGH	HAND	HEATER	H
I	CURRENT		INDICATOR				I
J							J
K							K
L	LEVEL			LOW			L
M					MOTORIZED		M
N							N
O							O
P	PRESSURE				PNEUMATIC	PUMP	P
Q		QUANTITY					Q
R							R
S	SPEED		SWITCH		SOLENOID		S
T	TEMPERATURE		TRANSMITTER				T
U							U
V						VALVE	V
W							W
X							X
Y							Y
Z	POSITION						Z

INSTRUMENT IDENTIFICATION



EXAMPLE



SYSTEM POSITION DESIGNATION

100 - VACUUM INLET MANIFOLD
300 - INLET HEAT EXCHANGER
400 - VAPOR/LIQUID SEPARATOR
500 - VAPOR/LIQUID SEPARATOR - 2
700 - SOIL-VAPOR EXTRACTION
1000 - LIQUID-RING PUMP
1300 - SVE HEAT EXCHANGER
1600 - VAPOR-PHASE CARBON
1900 - OXIDIZER
2200 - AIR SPARGE
2500 - SPARGE HEAT EXCHANGER
2800 - SPARGE OUTLET MANIFOLD
3100 - AIR COMPRESSOR
3400 - COMPRESSED-AIR OUTLET MANIFOLD
3700 - PNEUMATIC WELL PUMPS
4000 - SUBMERSIBLE WELL PUMPS
4300 - SURFACE-MOUNT WELL PUMPS
4600 - GROUNDWATER INLET MANIFOLD
4900 - OIL/WATER SEPARATOR
5200 - PRODUCT STORAGE TANK
5500 - INLET TANK
5800 - UPSTREAM BAG FILTER
6100 - CHEMICAL INJECTION
6400 - AIR STRIPPER
6700 - PRE-CARBON BAG FILTER
7000 - LIQUID-PHASE CARBON
7100 - PRE-MEDIA BAG FILTER
7200 - ACTIVATED ALUMINA
7300 - DISCHARGE TANK
7400 - POST-TREATMENT BAG FILTER
7600 - REINJECTION
7900 - BUILDING,TRAILER OR SKID
8200 - CONTROL PANEL
8500 - ELECTRICAL PARTS
9900 - EXTRAS

NOTES

PIPING DETAILS:
- WATER FLOW METERS: PROVIDE 10 DIA. OF STRAIGHT PIPE BEFORE AND 5 DIA. OF STRAIGHT PIPE AFTER METERS. ENSURE THAT THROTTLING VALVES ARE NOT DIRECTLY IN LINE WITH METERS.
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(800) 420-4056

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LEVEL	REVISION	DATE (mm/dd/yy)	BY
A	FOR APPROVAL	06/09/14	AM

PROJECT NUMBER: 202456
TITLE AND LOCATION: P&ID Tacoma, Washington
CUSTOMER: Aspect Consulting, LLC
DRAWN BY: AM | DATE: 06/09 | SHEET: 2 | SHEETS: 2

** CIVIL CONSTRUCTION NOTES **

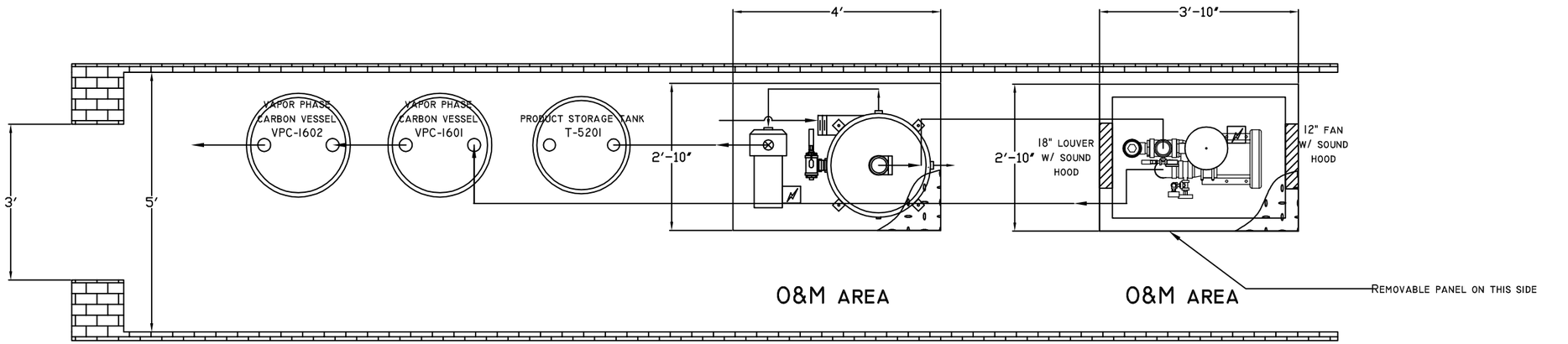
- 1" SOUND ATTENUATING INSULATION ON WALLS AND CEILING OF SOUND ENCLOSURE.
- INSTALL GRATING BETWEEN BUILDING FANS AND OUTSIDE LOUVERS.

**MECH./ELECT. ASS'Y NOTES **

- LOCATE COOLING THERMOSTAT IN THE WARMEST LOCATION AT CEILING LEVEL.
- PUT COW MATTING UNDER SVE BLOWER.
- NOISE LIMIT: 75 dB MAX AT 5 FT
- MAXIMUM WIDTH FOR SKID IS 34". THIS INCLUDES ALL EQUIPMENTS, PIPING AND TERMINATIONS AT THE EDGE OF SKIDS. SKIDS SHOULD GO THROUGH AN ALLEY 36" WIDE

*** COMMISSIONING NOTES ***

- FAN AND LOUVER HOODS NEED TO BE INSTALLED ON SITE. CANNOT SHIP WITH HOODS ATTACHED.
- NEWTERRA RECOMMENDS PAD BE AT LEAST 12" LARGER THAN ENCLOSURE IN ALL DIRECTIONS. LOCAL CODES MAY REQUIRE ALTERNATE DIMENSIONS.



** LABELS TO BE INSTALLED **

NEWTERRA STANDARD SYSTEM LABELS

- FLOW DIRECTION LABELS
- AIR LINE LABELS
- WATER LINE LABELS
- AIR/WATER LINE LABELS
- HOT SURFACE LABEL (LINES >= 140 DEGF)
- HEARING PROTECTION LABELS
- WARNING LABEL: THIS MACHINE IS AUTOMATICALLY CONTROLLED
- ARC FLASH WARNING LABEL

*** DIMENSION INFORMATION ***

DESCRIPTION	DIM (L X W X H)
SKID 7901	3' 10" X 2' 10"
SKID 7902	4' X 2' 10"

FLOW DIRECTION

ELECTRICAL CONNECTION

FLOW INTO THE PAGE

FLOW OUT OF THE PAGE

THIS AREA REPRESENTS SERVICE SPACE REQUIRED

NOTES

System Weight:
newterra can provide upon request an estimated weight of the system. Although every effort is made to ensure this estimate is representative of the final system weight, newterra cannot guarantee this weight and it is the responsibility of the client to ensure adequately sized equipment is utilized for offloading and final placement of the system. A final system weight will be available at time of loading at newterra and will be provided at time of shipment.

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LEVEL	REVISION	DATE (mm/dd/yy)	BY
AI	FOR APPROVAL - REVISED	06/17/14	AM
A	FOR APPROVAL	06/09/14	AM

PROJECT NUMBER 202456

TITLE AND LOCATION
SYSTEM LAYOUT
TACOMA, WASHINGTON

CUSTOMER
ASPECT CONSULTING, LLC

DRAWN BY	DATE	SHEET	SHEETS
AM	06/10	1	1

Project Electrical Load Calculations

Project Infortmaion												
Project Number		Project Name		System Voltage	115	Transformer Required?	No					
202456		Walker Chevrolet		Y or Δ ?	Δ	115V Single Phase						
Motors - 3ph @ Sys Volts							Three Phase Loads					
Device	HP	Amps		AWG	Class J	TM Breaker	L1	L2	L3			
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
			L1-L2-L3									
Misc - 3ph @ Sys Volts												
Device		Amps										
		0.00	L1-L2-L3									
		0.00	L1-L2-L3									
		0.00	L1-L2-L3									
Heaters - 3ph @ Sys Volts												
Device	Watts	Amps										
	0	0.00	L1-L2-L3									
	0	0.00	L1-L2-L3									
	0	0.00	L1-L2-L3									
	0	0.00	L1-L2-L3									
Heaters - 1ph @ Sys Volts												
Device	Watts	Amps										
	0	0.00	L1 - L2									
	0	0.00	L1 - L2									
	0	0.00	L1 - L2									
	0	0.00	L1 - L2									
Motors - 1ph @ 230										1Ph Tranformer Loads		3Ph
Device	HP	Amps								L1	L2	L3
	0	0.00	L1 - L3									
	0	0.00	L1 - L3									
	0	0.00	L1 - L3									
	0	0.00	L1 - L3									
	0	0.00	L1 - L3									
	0	0.00	L1 - L3									
Motors - 1ph @ 115												
Device	HP	Amps										
P-401	0.75	13.80	L1 - N				13.8					
B-701	2	24.00	L1 - N				24					
F-7901	0.25	5.80	L1 - N				5.8					
	0	0.00	L1 - N									
	0	0.00	L1 - N									
Misc - 1ph @ 115												
Device		Amps	On Lines									
GFI Recp		15.00	L1 - N				15					
heat trace		20.00	L1 - N				20					
Control Power		5.00	L1 - N				5					
			L2 - N									
			L1 - N									
			L2 - N									
			L1 - N									
			L1 - N									
Transformer												
Device		1 Ph kVA		3Ph kVA								
		0					0.0		0.0			
				0			0.0	0.0	0.0			
						Leg Totals (A)	83.60	0.00	0.00	0.00	0.00	0.00

Calculation and Selection			
Maximum Load Amps of the 3 Legs	83.60		
Disconnect with Full Safety Factor	104.50	Disconnect Selected for Use	100
Disconnect with Conservative Safety Factor	83.60	Fused Selected for Use	100

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202456 – Walker Chevrolet
Control Narrative – Revision (A1)

NOTE: Throughout this narrative, unless otherwise noted, shutdown refers to components controlled directly via the newterra control panel only and it should be noted that stand alone components that have their own control panel and Emergency Stop button will not shut down (such as rotary screw compressors, Oxidizers, oxygen/ ozone generators, roto-phase converters, fans, heaters etc).

System Start and Stop Logic

- The system will start when the start button is pressed on the HMI.
- The system will automatically restart after recovery from a power failure after a 30 second delay, unless the Start button is pressed first.
- To stop the system press the stop button on the HMI display.
- The system will shut down under some alarm conditions, see the modules below for these specific circumstances.
- All equipment will have to be put in "AUTO" in order to operate with the exception of heaters, auto-drain valves, building fans or self-governed equipment (such as screw compressors, air dryers, etc.).
- **Note:** when outputs are put in "HAND" mode the "AUTO" logic described below will be bypassed and the output will run regardless of inputs (unless the emergency stop button is activated). This is done for on-site testing and troubleshooting purposes. When a soft HOA switch (a software based toggle switch present in remote telemetry or HMI based systems) is used, a 2 minute safety timer is used on all pumps to prevent running them dry or excessive flooding due to operator error.

400 – Vapor Liquid Separator (VLS) Module

- VLS pump (P-401) is controlled by two level switches (LSH-401 & LSL-401). The pump will turn ON with LSH-401 and OFF with LSL-401.
- LSHH-401 will cause an alarm (LAHH-401) after being active for 5 seconds. This is a shutdown alarm that will turn the SVE blower OFF until LSL-401 has deactivated.
- When LSH-401 is active while LSL-401 is in-active OR LSHH-401 is active while LSH-401 is in-active an alarm shall occur (LAHL-401) after 5 seconds. This is a shutdown alarm. This alarm indicates a failure in the level switch assembly.

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700 –Soil Vapor Extraction Module

- SVE Blower (B-701) will start after the system has been running for 5 seconds to limit voltage drop due to several items starting all at once when the system is first started
- B-701 will run for as long as there is no LAHH-401 alarm in the VLS. If a high water level alarm occurs the SVE blower will remain off until the alarm has cleared.
- A high temperature alarm (TAH-701) triggered by TSH-701 will shut down the system.

5200 – Product Storage Tank Module

- A high high level alarm (LAHH-5201) will be triggered by LSHH-5201 being active for 5 seconds and will shut down the system to indicate the product storage tank is full and cannot accept any more.

7900 – Building Module

- The building fan (F-7901) will operate based on a manual set point on TSH-7901

8200 – Control Panel Module

- An emergency stop alarm (ESA-8201) will be triggered immediately by any emergency stop button in the system being pushed in and shut down all **newterra** controlled equipment in the system. **NOTE:** Some components are built by other manufacturers and are intended as stand-alone systems. The **newterra** emergency stop will not put these devices into an emergency shut down state and vice-versa. Please confirm with **newterra** the nature of components selected. The emergency stop button(s) will physically interrupt power to a master relay that governs control power to motor starters and other non-critical equipment. This is a fail-safe setup to prevent damage to the system or harm to operators.
- When a critical system shutdown alarm occurs the alarm relay (AR-8201) will activate. This is a courtesy relay providing two sets of contacts, a set of normally open dry contacts and a set of normally closed dry contacts for tying into external equipment if required.
- When an alarm occurs the alarm light (AL-8201) will light up solid.
- A panel overload alarm (OLA-8201) will be triggered by OL-8201 being activated and shut down the system. The starter responsible for the overload condition will need to be reset manually on-site.
- A first scan power fail alarm (FSPF-8201) will be triggered by the PLC to indicate that the PLC has recovered from a power failure. The alarm is a warning alarm only.
- A general PLC alarm (PLCA-8201) will be triggered by the PLC if it detects a critical internal fault. The alarm will shut down the system and will require **newterra** technical help to recover.
- A low PLC battery alarm will trigger an email (on systems equipped with E-Alarm) and/ or display on the HMI (if equipped) to indicate that the PLC battery is in need of replacement.

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System Input Summary

DEVICE TAG	DEVICE NAME	RANGE	STATE	TYPE
LSHH-401	LEVEL SWITCH HIGH-HIGH - VLS	N/A	N.C.	DIGITAL (PLC)
LSH-401	LEVEL SWITCH HIGH - VLS	N/A	N.O.	DIGITAL (PLC)
LSL-401	LEVEL SWITCH LOW - VLS	N/A	N.O.	DIGITAL (PLC)
TSH-701	TEMPERATURE SWITCH HIGH - SVE	25-225 °F	N.C.	DIGITAL (PLC)
LSHH-5201	LEVEL SWITCH HIGH-HIGH - PST	N/A	N.C.	DIGITAL (PLC)
TSH-7901	TEMPERATURE SWITCH HIGH - BLD	-30-100 °F	N.O.	DIRECT
KILL-8201	KILL SWITCH - PANEL	N/A	N.C.	DIGITAL (PLC)
OL-8201	OVERLOAD GENERAL - PANEL	NA	N.C.	DIGITAL (PLC)

DEVICE STATE: NORMALLY OPEN (N.O.) OR NORMALLY CLOSED (N.C.)

Vapor Liquid Separator

Module Code: 400

400-Drain

Reducer, Bushing, Galv, 1-1/2" x 1"	Part:	10014	
Hex	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0
Valve, Ball, Brass, 1", 150#	Part:	P1067	
NPT, Teflon seats, 600 PSI WOG	Qty:	1	
	Mfg:	Kitz	
None	Mfg Part:	601-1	Maint Code: 1

400-VLS

Nipple, Galv, 1" x Close	Part:	10216	
	Qty:	1	
	Mfg:		
None	Mfg Part:	GNS-1000	Maint Code: 0
Nipple, Galv, 1" x Close	Part:	10216	
	Qty:	2	
	Mfg:		
None	Mfg Part:	GNS-1000	Maint Code: 0
Cap, Band seal end, 6" 0706-028	Part:	10397	
	Qty:	1	
	Mfg:		
-	Mfg Part:	0706028	Maint Code: 0
Pipe, PVC 40 (Clear), 2"	Part:	10697	
10ft Length, 40-020CL	Qty:	3	
	Mfg:		
None	Mfg Part:	40-020CL	Maint Code: 0
Reducer, Bushing, PVC 80, 2" x 1", SxS, 837-249G	Part:	10899	
	Qty:	2	
	Mfg:		
None	Mfg Part:		Maint Code: 0
Reducer, Bushing, PVC 80, 2" x 1", SxF, 838-249	Part:	11080	
	Qty:	1	
	Mfg:		
None	Mfg Part:	838-249	Maint Code: 0
Plug, PVC 80, 1", MPT	Part:	12388	
850-010G	Qty:	1	
	Mfg:		
None	Mfg Part:	850-010	Maint Code: 0
Elbow, Street, 90deg, Galv, 1"	Part:	17518	
Street Elbow	Qty:	1	
	Mfg:		
None	Mfg Part:		Maint Code: 0
Elbow, Street, 90deg, Galv, 1"	Part:	17518	
Street Elbow	Qty:	2	
	Mfg:		
None	Mfg Part:		Maint Code: 0

Valve, Ball, PVC, 1", Soc, GF 161 375 019 -	Part:	20685	
375 Ball Valve PVC c/w FPM [Viton]	Qty:	2	
1/2-2 soc & trd ends included	Mfg:		
-	Mfg Part:	GF 161 375 019	Maint Code:
Union, PVC 80, 2", soc, 857-020	Part:	P1080	
	Qty:	1	
	Mfg:		
None	Mfg Part:		Maint Code: 0
Tee, PVC 80, 2", SxSxS, 801-020G	Part:	P1156	
	Qty:	2	
	Mfg:		
None	Mfg Part:	801-020	Maint Code: 0

FQI-401

Meter, Water, 3/4", US Gal, w/o pulse, MTH	Part:	10141	
US Gal, c/w couplings (20 gpm - 8 psi drop)	Qty:	1	
see notes for pressure drops	Mfg:	GWF	
---	Mfg Part:	MTH3/4 US Gals	Maint Code: 125

LSL/H/HH-401

Switch, Level, L312 3393-0001	Part:	22873	
3 position-6" for std VLD	Qty:	1	
Top switch: LSHH set at NC	Mfg:		
-	Mfg Part:	L312 3393-0001	Maint Code: 128

P-401

Pump, Centrifugal, Goulds, NPE, 1ST1D4E4W	Part:	11680	
3/4hp, 1ph, 115/230V, TEFC, 3500rpm, 60Hz, 2 pole	Qty:	1	
Class 1 Div 2	Mfg:	Goulds	
*******Discharge Pump*******	Mfg Part:	1ST1D4E4W	Maint Code: 160
Model: 1ST Flow Requirement: 5 GPM @ 50' TDH Hosepower: 3/4 Voltage: 120V/1ph Motor Type: TEFC Class 1 Div 2 Approval: UL/CSA RPM: 3500 Impeller: E			
Gauge, Pressure, 0-30psi, Indumart, P16T2-FG-30	Part:	16202	
SS, brass internals, Glyc. Filled, bottom mount	Qty:	1	
	Mfg:	Indumart	
---	Mfg Part:		Maint Code: 173

P401-Gauge

Nipple, Galv, 1/4xShort	Part:	10015	
	Qty:	1	
	Mfg:		
-	Mfg Part:		Maint Code: 0
Tee, Galv, 1/4"	Part:	10625	
	Qty:	1	
	Mfg:		
-	Mfg Part:	14GZT	Maint Code: 0

P401-Inlet

Reducer, Bushing, Galv, 1-1/2" x 1"	Part:	10014	
Hex	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0
Strainer, Wye, Brass, 1"	Part:	12078	
threaded	Qty:	1	
	Mfg:		
---	Mfg Part:	145T05	Maint Code: 108
Valve, Ball, Brass, 1", 150#	Part:	P1067	
NPT, Teflon seats, 600 PSI WOG	Qty:	1	
	Mfg:	Kitz	
---	Mfg Part:	601-1	Maint Code: 1

P401-Outlet

Reducer, Bushing, Galv, 1" x 3/4"	Part:	10146	
Hex	Qty:	2	
	Mfg:		
---	Mfg Part:	1X34GZB	Maint Code: 0
Coupling, Galv, 1"	Part:	10299	
	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0
Camlock Fitting, Aluminum, 1", Part "F"	Part:	10402	
Male Adapter x Male Thread Cam Lock Fitting	Qty:	1	
	Mfg:	Bayco Industries	
---	Mfg Part:	CGF-100-A1	Maint Code: 0
Valve, Check, Spring, Brass, 1"	Part:	10404	
	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0
Valve, Gate, Brass, 1"	Part:	P1216	
	Qty:	1	
	Mfg:		
---	Mfg Part:	514T05	Maint Code: 0

P401-Pipe

Valve, Ball, Brass, 1/4", 150#	Part:	10047	
NPT, Teflon seats, 600 PSI WOG	Qty:	1	
	Mfg:	Kitz	
---	Mfg Part:	601-1/4	Maint Code: 0
Camlock Fitting, Aluminum, 1", Part "F"	Part:	10402	
Male Adapter x Male Thread Cam Lock Fitting	Qty:	2	
	Mfg:	Bayco Industries	
---	Mfg Part:	CGF-100-A1	Maint Code: 0
Camlock Fitting, Aluminum, 1", Part "C"	Part:	10403	
Female Adapter x Hose Shank Cam Lock Fitting	Qty:	2	
	Mfg:	Bayco Industries	
---	Mfg Part:	CGC-100-A1	Maint Code: 0
Reducer, Bushing, Galv, 1" x 1/4"	Part:	10535	
Hex	Qty:	2	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0

Nipple, KC, Plated, 1"	Part:	11210	
	Qty:	2	
	Mfg:		
---	Mfg Part:	CNT-100-SP	Maint Code: 0
Hose, Suction, PVC, Green, 1", J100	Part:	12090	
Tigerflex or SATO, 85psi@70F, 60psi@100F	Qty:	4	
PVC,150F (min 100ft order)	Mfg:	Kuriyama	
---	Mfg Part:	SATO-100	Maint Code: 0
Reducer, Bushing, Galv, 1-1/4" x 1"	Part:	21421	
Hex	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code:
Tee, Galv, 1"	Part:	P1063	
	Qty:	2	
	Mfg:		
---	Mfg Part:	1GZT	Maint Code: 0

P401-SP

Valve, Ball, Brass, 1/4", 150#	Part:	10047	
NPT, Teflon seats, 600 PSI WOG	Qty:	1	
	Mfg:	Kitz	
-	Mfg Part:	601-1/4	Maint Code: 0
Nipple, Galv, 1/4xClose	Part:	10048	
	Qty:	1	
	Mfg:		
None	Mfg Part:	GNS-0200	Maint Code: 0
Hose Barb, Brass, 1/4" x 1/4", NPT x Hose, 125-4B	Part:	18070	
1	Qty:	1	
	Mfg:		
None	Mfg Part:	125-4B	Maint Code:

VLS-401

Vapor Liquid Separator, 45 Gallon, VLD400	Part:	10119	
Max Air Flow 500cfm, Max Water Flow 10gpm	Qty:	1	
1.5" Water Outlet !Requires Drum	Mfg:	Maple Leaf Environmental Equipment	
Standard Features: Baffle Side Cleanout Options: Threaded Inlet CW Epoxy Coated Interior 2" Sight Glass, for level switches in sight glass	Mfg Part:	VLD400	Maint Code: 143
Drum, Unpainted, Steel, 45 gal	Part:	13977	
2 hole lid, bottom 2" port	Qty:	1	
	Mfg:		
---	Mfg Part:	SOH00733	Maint Code: 0

Soil-Vapor Extraction

Module Code: 700

700-Dilution

Filter, Silencer, Solberg, FS-30P-200	Part:	M1096	
	Qty:	1	
	Mfg:	Solberg	
---	Mfg Part:	FS-30P-200	Maint Code: 172
Valve, Ball, Brass, 2", 150#	Part:	P1065	
NPT, Teflon seats, 600 PSI WOG	Qty:	1	
	Mfg:	Kitz	
---	Mfg Part:	601-2	Maint Code: 0

700-Gauges

Nipple, Galv, 1/4xShort	Part:	10015	
	Qty:	1	
	Mfg:		
-	Mfg Part:		Maint Code: 0
Elbow, 90deg, Galv, 1/4"	Part:	10092	
	Qty:	1	
	Mfg:		
None	Mfg Part:	14GZE9	Maint Code: 0
Tee, Galv, 1/2"	Part:	10210	
	Qty:	1	
	Mfg:		
None	Mfg Part:	12GZT	Maint Code: 0
Tee, Galv, 1/4"	Part:	10625	
	Qty:	1	
	Mfg:		
-	Mfg Part:	14GZT	Maint Code: 0
Tee, Galv, 1/4"	Part:	10625	
	Qty:	1	
	Mfg:		
-	Mfg Part:	14GZT	Maint Code: 0
Tee, Galv, 1/4"	Part:	10625	
	Qty:	1	
	Mfg:		
None	Mfg Part:	14GZT	Maint Code: 0
Tee, Galv, 1/4"	Part:	10625	
	Qty:	1	
	Mfg:		
-	Mfg Part:	14GZT	Maint Code: 0
Nipple, Galv, 1/2" x Short (1-1/2)	Part:	P1014	
	Qty:	1	
	Mfg:		
None	Mfg Part:	GNS-0415	Maint Code: 0
Reducer, Bushing, Galv, 1/2" x1/4"	Part:	P1018	
Hex	Qty:	1	
	Mfg:		
None	Mfg Part:	CIGB-0402	Maint Code: 0

700-Inlet

Filter, Inline, Solberg, CSL-851-200HC	Part:	10072	
Polyester element, npt fittings, air flow rate:100	Qty:	1	
	Mfg:	Solberg	
---	Mfg Part:	CSL-851-200HC	Maint Code: 115
Pipe, PVC 40, 2"	Part:	10154	
10ft Length, 40-020G	Qty:	3	
	Mfg:		
---	Mfg Part:	40-020 Cut in 10ft l	Maint Code: 0
Camlock Fitting, Aluminum, 2", Part "C"	Part:	10502	
Female Adapter x Hose Shank Cam Lock Fitting	Qty:	2	
	Mfg:	Bayco Industries	
-	Mfg Part:	BAL-200C	Maint Code: 0
Clamp, Hose, SS, 2", HAS32	Part:	10930	
	Qty:	4	
	Mfg:		
None	Mfg Part:	HAS32	Maint Code: 0
Hose, Suction, PVC, Green, 2", J200	Part:	12092	
TigerFlex or SATO, 65psi@70F, 40psi@100F	Qty:	5	
PVC,150F, (min 100ft order)	Mfg:	Kuriyama	
-	Mfg Part:	SATO-200	Maint Code: 0
Plug, Galv, 1/4", Square Drive	Part:	17575	
NPT	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0
Camlock Fitting, Aluminum, 2", Part "F"	Part:	M1272	
Male Adapter x Male Thread Cam Lock Fitting	Qty:	2	
	Mfg:	Bayco Industries	
-	Mfg Part:	CGF-200-A1	Maint Code: 0
Reducer, Bushing, Galv, 4" x 2"	Part:	P1023	
Hex	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0
Cross, Galv, 2" NPT	Part:	P1217	
	Qty:	1	
	Mfg:		
---	Mfg Part:	2GZCR	Maint Code: 0

700-Outlet

Silencer, Discharge, 2", Universal, URB2	Part:	11828	
	Qty:	1	
<130cfm	Mfg:	Universal Silencer	
---	Mfg Part:		Maint Code: 0
Coupling, GALV, 2"	Part:	25513-T	
	Qty:	1	
	Mfg:		
---	Mfg Part:	GMC02	Maint Code:
Union, Galv, 2"	Part:	P1093	
	Qty:	1	
	Mfg:		
---	Mfg Part:	2GZU	Maint Code: 1

700-Relief

Valve, Relief, Vacuum, Kunkle, 2", Set @ Custom, 215V-H	Part:	10732	
Max 426 scfm Custom Set Point:	Qty:	1	
	Mfg:	Kunkle	
Set @ 4" HG	Mfg Part:	215V-H	Maint Code: 104

700-SP

Valve, Ball, Brass, 1/4", 150#	Part:	10047	
NPT, Teflon seats, 600 PSI WOG	Qty:	2	
	Mfg:	Kitz	
-	Mfg Part:	601-1/4	Maint Code: 0
Nipple, Galv, 1/4xClose	Part:	10048	
	Qty:	2	
	Mfg:		
None	Mfg Part:	GNS-0200	Maint Code: 0
Hose Barb, Brass, 1/4" x 1/4", NPT x Hose, 125-4B	Part:	18070	
1	Qty:	1	
	Mfg:		
None	Mfg Part:	125-4B	Maint Code:

B-701

Blower, Rotron, 2hp, 1ph, XPF, EN505AX58ML	Part:	10357	
3600rpm, 120cfm@35"wc, UL/CSA	Qty:	1	
115/230V, 60	Mfg:	Rotron	
---	Mfg Part:	038177	Maint Code: 103

PDI-701

Gauge, Magnehelic, Bracket, A-368	Part:	12272	
	Qty:	1	
	Mfg:	Dwyer	
None	Mfg Part:	A-368	Maint Code: 0
Meter, Flow, Pitot Tube, 2"	Part:	12875	
Multi-Point Averaging	Qty:	1	
	Mfg:		
-	Mfg Part:	-	Maint Code: 126
Hose Barb, Brass, 1/4" x 1/4", NPT x Hose, 125-4B	Part:	18070	
1	Qty:	2	
	Mfg:		
None	Mfg Part:	125-4B	Maint Code:
Hose, 1/4" ID, 3/8" OD, 1/16" Wall, Black, Tubing	Part:	19400	
4	Qty:	4	
-75 to 275deg F	Mfg:		
None	Mfg Part:	51075K27	Maint Code:
Valve, Clamp-Style Pinch for Tubing Acetal	Part:	19402	
1/2" Max Tube OD, 12 Flow Positions	Qty:	2	
Sold only as a package of 10	Mfg:		
None	Mfg Part:	5031K12	Maint Code:
Hose Barb, Brass, 1/4" x 1/8", Male	Part:	19425	
	Qty:	2	
	Mfg:		
None	Mfg Part:	125-4A	Maint Code:

Compression Fitting, 3/8" x 1/4", Comp x F 66-6B	Part:	20882	
66-6B	Qty:	1	
	Mfg:		
None	Mfg Part:	66-6B	Maint Code:
Compression Fitting, Brass, 3/8" x 3/8", Comp x M 68-6C	Part:	20883	
68-6C	Qty:	1	
	Mfg:		
None	Mfg Part:	68-6C	Maint Code:
Gauge, Magnehelic, 0-3.0"wc, 2003	Part:	M1050	
	Qty:	1	
	Mfg:	Dwyer	
---	Mfg Part:	2003	Maint Code: 132

PI-701/703

Gauge, Vacuum, 60-0" wc, SS, 1/4", Dry, J60"-0WC	Part:	M1319	
2-1/2" Dial	Qty:	3	
	Mfg:		
---	Mfg Part:	P32T2-60vac	Maint Code: 176

PI-704

Gauge, Pressure, 0-60" wc , Dry, J60"-WC, SS	Part:	M1293	
2-1/2" Dial, 1/4" MNPT Connection	Qty:	1	
	Mfg:	McDaniel Controls, Inc.	
---	Mfg Part:	P32T2-60	Maint Code: 173

TI-701

Gauge, Temp, 0-250F, WL31205	Part:	M1267	
3"Dial,4"Stem,1/2"NPT	Qty:	1	
	Mfg:		
---	Mfg Part:	WL31205	Maint Code: 175

TI-702

Gauge, Temp, 0-250F, WL31205	Part:	M1267	
3"Dial,4"Stem,1/2"NPT	Qty:	1	
	Mfg:		
---	Mfg Part:	WL31205	Maint Code: 175

TSHH-701

Switch, Temperature, Probe, A19AAF-12C	Part:	15650	
25-225 deg F, 10 foot Capillary Tube	Qty:	1	
Use with WEL14A-602R (MLE # 15653)	Mfg:	Johnson Controls	
---	Mfg Part:	A19AAF-12C	Maint Code:
Switch, Temperature, Probe, WEL 14A-602R	Part:	15653	
Bulb, Well for Temperature Switch, Brass	Qty:	1	
	Mfg:	Johnson Controls	
---	Mfg Part:	WEL 14A-602R	Maint Code:

Vapor-Phase Carbon

Module Code: 1600

1600-Gauges

Tee, Galv, 1/4"	Part:	10625	
	Qty:	1	
	Mfg:		
-	Mfg Part:	14GZT	Maint Code: 0

1600-Hose

Camlock Fitting, Aluminum, 2", Part "C"	Part:	10502	
Female Adapter x Hose Shank Cam Lock Fitting	Qty:	4	
	Mfg:	Bayco Industries	
-	Mfg Part:	BAL-200C	Maint Code: 0
Clamp, Hose, SS, 2", HAS32	Part:	10930	
	Qty:	8	
	Mfg:		
None	Mfg Part:	HAS32	Maint Code: 0
Hose, Suction, PVC, Green, 2", J200	Part:	12092	
TigerFlex or SATO, 65psi@70F, 40psi@100F	Qty:	20	
PVC,150F, (min 100ft order)	Mfg:	Kuriyama	
-	Mfg Part:	SATO-200	Maint Code: 0
Camlock Fitting, Aluminum, 2", Part "F"	Part:	M1272	
Male Adapter x Male Thread Cam Lock Fitting	Qty:	4	
	Mfg:	Bayco Industries	
-	Mfg Part:	CGF-200-A1	Maint Code: 0

1600-Pipe

Tee, Galv, 2"	Part:	10136	
1	Qty:	4	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0
Reducer, Bushing, Galv, 2" x 1/4"	Part:	P1219	
Hex	Qty:	4	
	Mfg:		
---	Mfg Part:	2x14GZB	Maint Code: 0

1600-SP

Valve, Ball, Brass, 1/4", 150#	Part:	10047	
NPT, Teflon seats, 600 PSI WOG	Qty:	1	
	Mfg:	Kitz	
-	Mfg Part:	601-1/4	Maint Code: 0
Valve, Ball, Brass, 1/4", 150#	Part:	10047	
NPT, Teflon seats, 600 PSI WOG	Qty:	2	
	Mfg:	Kitz	
-	Mfg Part:	601-1/4	Maint Code: 0
Nipple, Galv, 1/4xClose	Part:	10048	
	Qty:	1	
	Mfg:		
None	Mfg Part:	GNS-0200	Maint Code: 0

Nipple, Galv, 1/4xClose	Part:	10048	
	Qty:	2	
	Mfg:		
None	Mfg Part:	GNS-0200	Maint Code: 0
Hose Barb, Brass, 1/4" x 1/4", NPT x Hose, 125-4B	Part:	18070	
1	Qty:	1	
	Mfg:		
None	Mfg Part:	125-4B	Maint Code:
Hose Barb, Brass, 1/4" x 1/4", NPT x Hose, 125-4B	Part:	18070	
1	Qty:	2	
	Mfg:		
None	Mfg Part:	125-4B	Maint Code:

1600-Stack

Pipe, PVC 40, 2"	Part:	10154	
10ft Length, 40-020G	Qty:	10	
	Mfg:		
None	Mfg Part:	40-020 Cut in 10ft l	Maint Code: 0
Nipple, Galv, 2" x Close	Part:	10222	
	Qty:	1	
	Mfg:		
None	Mfg Part:		Maint Code: 0
Tee, PVC 40, 2", SxSxS, 401-020G ***	Part:	P1157	
	Qty:	1	
	Mfg:		
None	Mfg Part:	401-020	Maint Code: 0
Elbow, 90deg, PVC 80, 2", SxF, 807-020	Part:	P1159	
	Qty:	1	
	Mfg:		
None	Mfg Part:	807-020	Maint Code: 0

PI-1601/1602

Gauge, Pressure, 0-60" wc , Dry, J60"-WC, SS	Part:	M1293	
2-1/2" Dial, 1/4" MNPT Connection	Qty:	2	
	Mfg:	McDaniel Controls, Inc.	
---	Mfg Part:	P32T2-60	Maint Code: 173

VPC-1601/1602

Filter, Carbon, Air, DIS-75VS	Part:	11289	
165 lbs Virgin Air Phase, Steel, 150cfm, ±5psig	Qty:	2	
Black	Mfg:		
---	Mfg Part:	DIS-75VS	Maint Code: 144

Product Storage Tank

Module Code: 5200

5200-Drain

Reducer, Bushing, Galv, 2" x 1"	Part:	P1020	
Hex	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0
Valve, Ball, Brass, 1", 150#	Part:	P1067	
NPT, Teflon seats, 600 PSI WOG	Qty:	1	
	Mfg:	Kitz	
---	Mfg Part:	601-1	Maint Code: 1

5200-Inlet

Elbow, 90deg, Galv, 1"	Part:	10290	
	Qty:	1	
	Mfg:		
---	Mfg Part:	MGE90-10	Maint Code:
Camlock Fitting, Aluminum, 1", Part "F"	Part:	10402	
Male Adapter x Male Thread Cam Lock Fitting	Qty:	1	
	Mfg:	Bayco Industries	
---	Mfg Part:	CGF-100-A1	Maint Code: 0
Reducer, Bushing, Galv, 2" x 1"	Part:	P1020	
Hex	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0

5200-Stack

Pipe, PVC 40, 2"	Part:	10154	
10ft Length, 40-020G	Qty:	2	
	Mfg:		
None	Mfg Part:	40-020 Cut in 10ft l	Maint Code: 0
Nipple, Galv, 2" x Close	Part:	10222	
	Qty:	1	
	Mfg:		
None	Mfg Part:		Maint Code: 0
Adapter, PVC 80, Female, 2", SxT, 835-020	Part:	P1085	
	Qty:	1	
	Mfg:		
---	Mfg Part:	835-020	Maint Code: 0
Tee, PVC 40, 2", SxSxS, 401-020G ***	Part:	P1157	
	Qty:	1	
	Mfg:		
None	Mfg Part:	401-020	Maint Code: 0

LSHH-5201

Strain Relief, Connector, PVC, 1/2"	Part:	16884	
TSRC10	Qty:	1	
	Mfg:		
---	Mfg Part:	TSRC10	Maint Code: 0

Switch, Level, Almeg, Vertical, ATB3-48SS	Part:	M1499	
1/4" NPT	Qty:	1	
	Mfg:	Almeg	
---	Mfg Part:	ATB3-48SS	Maint Code: 100

PST-5201

Drum, Lid, Black, Steel, 45 gal, 2 hole lid, bottom 2" port	Part:	20160	
Spare lid for SOH00733	Qty:	1	
	Mfg:		
---	Mfg Part:		Maint Code:

Drum, Black, Steel, 45 gal, 2 hole lid, bottom 2" port	Part:	M1137	
including palletization	Qty:	1	
	Mfg:		
---	Mfg Part:	---	Maint Code: 0

Building, Trailer or Skid

Module Code: 7900

7900-Enclosure

Duct, Custom, as detailed below:	Part:	23292	
	Qty:	1	
	Mfg:		
Sound enclosure, approximately 2' 10" W x 3' 10" L x 5' H	Mfg Part:		Maint Code:

7900-Manual

Manual, System, Hard Copy	Part:	17149	
	Qty:	2	
	Mfg:		
---	Mfg Part:		Maint Code: 0

7900-SoundFoam

Insulation, Sound, Foam, V100-Beige, 1"	Part:	19180	
	Qty:	85	
	Mfg:		
---	Mfg Part:		Maint Code:

7901-Hood

Insulation, Sound, Foam, V100-Beige, 1"	Part:	19180	
	Qty:	4	
	Mfg:		
None	Mfg Part:		Maint Code:

Insulation, Sound, Foam, V100-Beige, 1"	Part:	19180	
	Qty:	8	
	Mfg:		
None	Mfg Part:		Maint Code:

Hood, 15"	Part:	23989	
Fits 12" Fan & Louver	Qty:	1	
	Mfg:		
None	Mfg Part:		Maint Code:

Hood, 21"	Part:	24305	
Fits 18" Fan & Louver	Qty:	1	
	Mfg:		
None	Mfg Part:		Maint Code:

7901-Louver

Fan, Shutter, Backdraft damper, 18"x18"	Part:	23081	
Non-Motorized	Qty:	1	
	Mfg:	Canarm	
---	Mfg Part:	SR3218X18	Maint Code:

7901-Skid

Skid, Custom Size

Part: M1484
Qty: 1
Mfg: Maple Leaf Environmental Equipment

Model: Skid 2' 10" x 3' 10"
Working Length: 3' 10"
Working Width: 2' 8"
Bolt Down Tabs: N
Stud Sockets: N
Lifting Lugs: N
Fork Holes on the Width: N
Fork Holes on the Length: Y
Man Hole: N
Deck: Steel
Containment Lip: N
Angle Box: N

Mfg Part: Maint Code: 0

7902-Skid

Skid, Custom Size

Part: M1484
Qty: 1
Mfg: Maple Leaf Environmental Equipment

Model: Skid 2' 10" x 4'
Working Length: 4'
Working Width: 2' 8"
Bolt Down Tabs: N
Stud Sockets: N
Lifting Lugs: N
Fork Holes on the Width: N
Fork Holes on the Length: Y
Man Hole: N
Deck: Steel
Containment Lip: N
Angle Box: N

Mfg Part: Maint Code: 0

F-7901

Fan, Building, 12", 1/4hp, 1750rpm, 120V, 1ph, TEFC
CSA Approved, S12-E1

Part: M1072
Qty: 1
Mfg: Canarm

Mfg Part: SD120311 Maint Code: 118

TSH-7901

Switch, Temperature, Probe, A19ABC-24D
range -30/100F

Part: 15651
Qty: 1
Mfg: Johnson Controls

Mfg Part: A19ABC24D Maint Code:

Extras - Shipped Loose

Module Code: 9900

9900-SP

Valve, Ball, Brass, 1/4", 150#	Part:	10047	
NPT, Teflon seats, 600 PSI WOG	Qty:	8	
	Mfg:	Kitz	
-	Mfg Part:	601-1/4	Maint Code: 0
Nipple, Galv, 1/4xClose	Part:	10048	
	Qty:	8	
	Mfg:		
None	Mfg Part:	GNS-0200	Maint Code: 0
Hose Barb, Brass, 1/4" x 1/4", NPT x Hose, 125-4B	Part:	18070	
1	Qty:	8	
	Mfg:		
None	Mfg Part:	125-4B	Maint Code:

PI-101/103

Gauge, Vacuum, 60-0" wc, SS, 1/4", Dry, J60"-0WC	Part:	M1319	
2-1/2" Dial	Qty:	3	
	Mfg:		
None	Mfg Part:	P32T2-60vac	Maint Code: 176

Project Packing List

PMProjNum **202456**

Walker Chevrolet

PM_ShippingNotes:

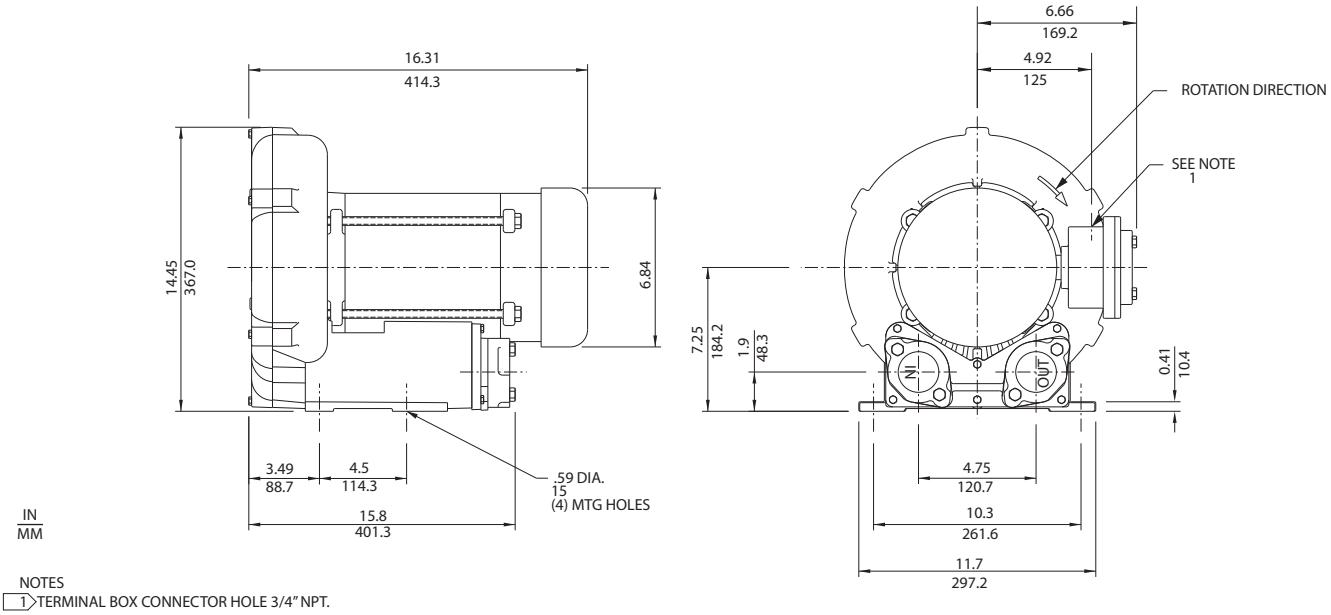
Tag	Part Number	Part Description	Req	PO #	EngMemo
			Rec	Line	
700	18660	Hose, Assembly, J200, 2"	1	-	
700-Inlet	ea	Green Hose	0		
	Type: G	- One (1) 5 ft long		0	
1600	18660	Hose, Assembly, J200, 2"	2	-	
1600-Hose	ea	Green Hose	0		
	Type: G	- One (1) 15 ft long - One (1) 5 ft long		0	
1600	24766	Stack, Assembly, PVC	1	-	
1600-Stack	ea		0		
	Type: G	10 ft above grade PVC stack including: - One (1) 2" Elbow, PVC - One (1) 2" Screened Tee. PVC - One (1) 2" Nipple, GALV		0	
1600	11289	Filter, Carbon, Air, DIS-75VS	2	---	
VPC-1601/	ea	165 lbs Virgin Air Phase, Steel, 150cfm, ±5psi	0		
	Type: I	Black ---		0	
5200	20160	Drum, Lid, Black, Steel, 45 gal, 2 hole lid, bott	1	---	
PST-5201	ea	Spare lid for SOH00733	0		
	Type: I	---		0	
7900	17149	Manual, System, Hard Copy	2	---	
7900-Manu	ea		0		
	Type: P	---		0	
7900	25371	Fan, Hood, Sound, Assembly, 12"	1	-	
7901-Hood	ea		0		
	Type: G	-		0	
7900	18608	Fan, Hood, Sound, Assembly, 18"	1	-	
7901-Hood	ea		0		
	Type: G	-		0	
7900	M1484	Skid, Custom Size	1	---	
7901-Skid	ea		0		
	Type: P	Model: Skid 2' 10" x 3' 10" Working Length: 3' 10" Working Width: 2' 8" Bolt Down Tabs: N Stud Sockets: N Lifting Lugs: N Fork Holes on the Width: N Fork Holes on the Length: Y Man Hole: N Deck: Steel Containment Lip: N Angle Box: N	202456-003	2	

Tag	Part Number	Part Description	Req	PO #	EngMemo
			Rec	Line	
7900	M1484	Skid, Custom Size	1		---
7902-Skid	ea		0		
Type: P		Model: Skid 2' 10" x 4' Working Length: 4' Working Width: 2' 8" Bolt Down Tabs: N Stud Sockets: N Lifting Lugs: N Fork Holes on the Width: N Fork Holes on the Length: Y Man Hole: N Deck: Steel Containment Lip: N Angle Box: N	202456-003	3	
9900	18682	Sample Port Assembly, 1/4"	8		-
9900-SP	ea		0		
Type: G		-		0	
9900	M1319	Gauge, Vacuum, 60-0" wc, SS, 1/4", Dry, J60'	3		Vacuum gauge - change tag
PI-101/103	ea	2-1/2" Dial	0		
Type: F		None		0	

EN 505 & CP 505

ROTRON®

2.0 / 2.5 HP Sealed Regenerative w/Explosion-Proof Motor



NOTES
1. TERMINAL BOX CONNECTOR HOLE 3/4" NPT.
2. DRAWING NOT TO SCALE, CONTACT FACTORY FOR SCALE CAD DRAWING.
3. CONTACT FACTORY FOR BLOWER MODEL LENGTHS NOT SHOWN.

		Part/ Model Number			
		EN505AX58ML	EN505AX72ML	CP505FS58MLR	CP505FS72MLR
Specification	Units	038177	038178	080655	038962
Motor Enclosure - Shaft Mtl.	-	Explosion-proof-CS	Explosion-proof-CS	Chem XP-SS	Chem XP-SS
Horsepower	-	2.0	2.0	2.0	2.0
Phase - Frequency	-	Single-60 hz	Three-60 hz	Single-60 hz	Three-60 hz
Voltage	AC	115/230	230/460	115/230	230/460
Motor Nameplate Amps	Amps (A)	22/11	5.8/2.9	22/11	5.8/2.9
Max. Blower Amps	Amps (A)	24/12	6.4/3.2	24/12	6.4/3.2
Inrush Amps	Amps (A)	112/56	56/28	112/56	56/28
Service Factor	-	1.0	1.0	1.0	1.0
Starter Size	-	1/0	0/0	1/0	0/0
Thermal Protection	-	Class B - Pilot Duty	Class B - Pilot Duty	Class B - Pilot Duty	Class B - Pilot Duty
XP Motor Class - Group	-	I-D, II-F&G	I-D, II-F&G	I-D, II-F&G	I-D, II-F&G
Shipping Weight	Lbs	92	84	92	84
	Kg	41.7	38.1	41.7	38.1

Voltage - ROTRON motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

Operating Temperatures - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

XP Motor Class - Group - See Explosive Atmosphere Classification Chart in Section I

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AMETEK® TECHNICAL & INDUSTRIAL PRODUCTS

Environmental / Chemical Processing Blowers

EN 505 & CP 505

ROTRON®

2.0 / 2.5 HP Sealed Regenerative w/Explosion-Proof Motor

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- Maximum flow: 150 SCFM
- Maximum pressure: 75 IWG
- Maximum vacuum: 70 IWG
- Standard motor: 2.0 HP, explosion-proof
- Cast aluminum blower housing, impeller , cover & manifold; cast iron flanges (threaded); teflon® lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

MOTOR OPTIONS

- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS

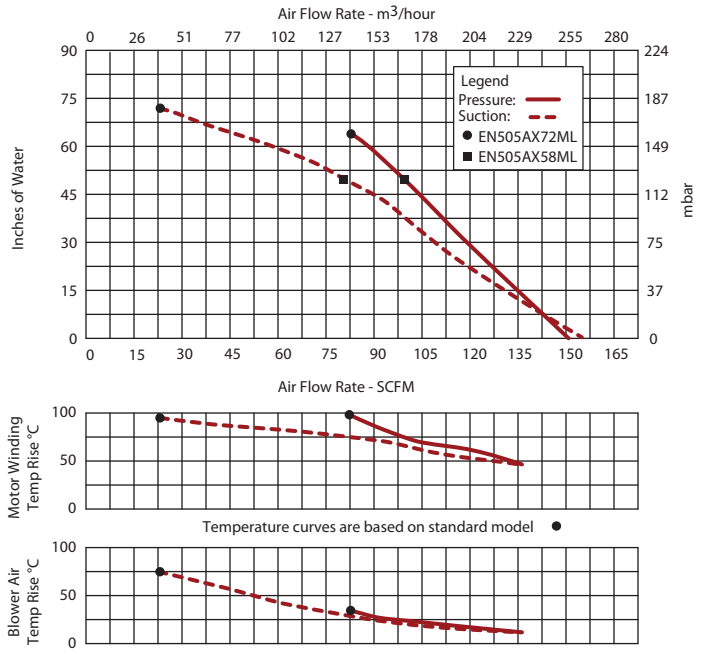
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES

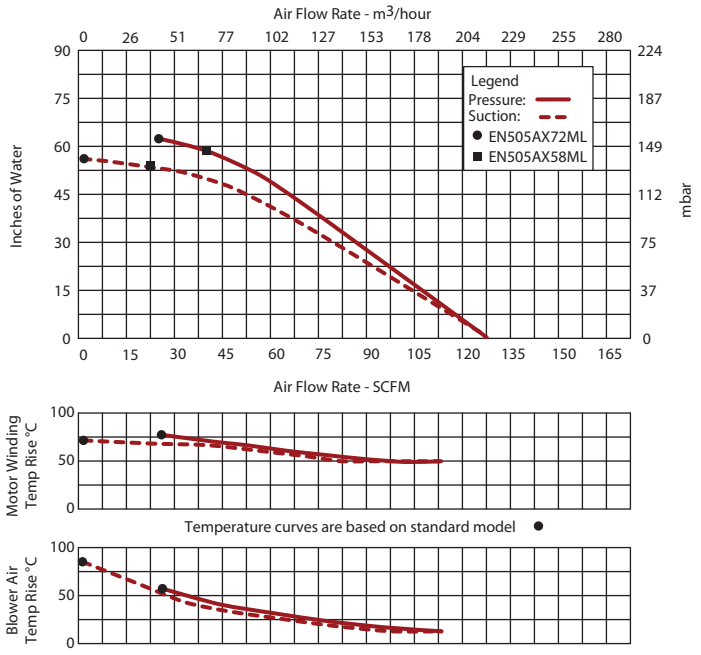
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

Blower Performance at Standard Conditions

60 Hz



50 Hz



This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

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TECHNICAL & INDUSTRIAL PRODUCTS

APPENDIX E

Photographic Documentation of SVE System

Photograph 1 – Soil vapor extraction (SVE) system installed in the 5-foot-wide alley on the north side of Morrell's Dry Cleaners.

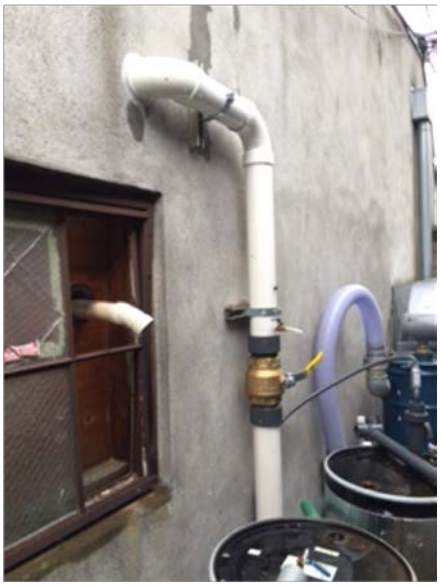
Photograph 2 – Manifold pipes, control valves, and vacuum gauges and sample ports for glacial till wells (VE-1/VE-2) on left, advance outwash wells (VE-3/VE-4) in middle, and SVE trench (VE-H) on right.

Photograph 3 – Sub-slab suction pit (VE-SS) riser outside of equipment area in Morrell's Dry Cleaners.

Photograph 4 – Notice and manometer for VE-SS in Morrell's Dry Cleaners.

Photograph 5 – VE-SS lateral pipe that connects to SVE system. This may be extended through ceiling and connected to radon fan after sufficient SVE treatment.

Photograph 6 – Lateral extension of VE-SS pipe through north sidewall of Morrell's Dry Cleaners.

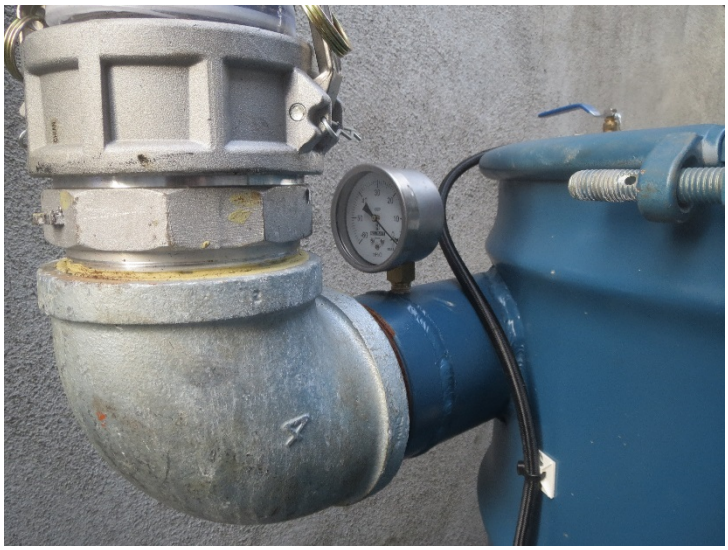


Photograph 7 – VE-SS connection to SVE system in the alley on north side of Morrell's Dry Cleaners.

Photograph 8 – VE-SS connection to the manifold line.

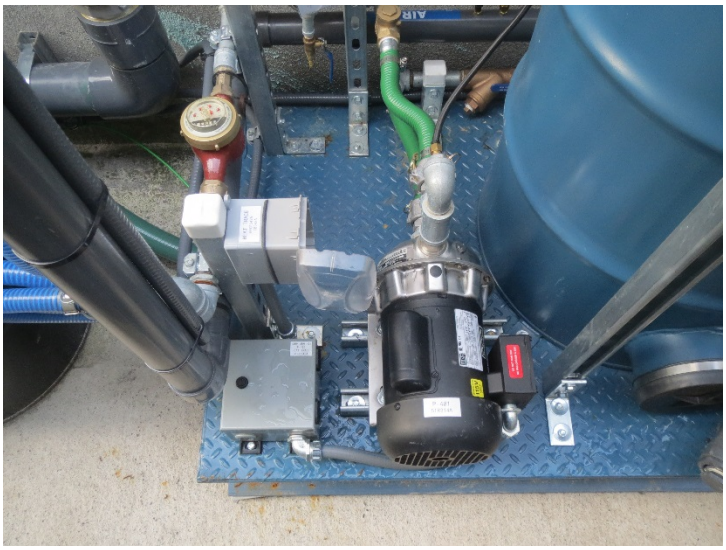
Photograph 9 – SVE system, including 2 GAC drums in foreground, water collection drum (3rd drum), vapor liquid separator (blue drum), and blower housing in back.

Photograph 10 – Sound proof enclosure that contains the 2-HP regenerative blower.



Photograph 11 – Vacuum pressure gauge on the influent line to the vapor-liquid separator.

Photograph 12 – Pitot tube flow meter on effluent line from the vapor liquid separator.



Photograph 13 – Water transfer pump for the vapor-liquid separator.

Photograph 14 – Site gauge on the vapor liquid separator.